# TAKE CARE OF YOURSELF TO TAKE CARE OF OTHERS IN TIMES OF PANDEMIC

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"To care for" means to treat, assist, take care of something or someone, taking responsibility, giving attention[1]. In Nursing, it gives meaning to the profession, considered one of the premises that accompany professionals from academic training, across the development of skills and competences throughout the career, appearing as both a subjective and objective feature.

Historically, Nursing has faced several challenges, from the period of Ancient Nursing based on practice to Modern Nursing based on science[2]. With the arrival of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), new challenges arise day after day, causing us to reflect and think.

In January 2020, the World Health Organization (WHO) declared an outbreak of the coronavirus disease 2019 (COVID-19), warning the world of the high risk of transmission across countries. In March of the same year, the outbreak was characterized as a pandemic, generating stress in the majority of the population, health professionals included[3]. There were several factors that contributed to putting the population in a scenario full of uncertainties amidst the pandemic and political-social issues[4]. Unfavorable working conditions, such as inadequate staffing for the high complexity of care for infected patients, inadequate remuneration, scarcity or low quality of personal protective equipment (PPE), and other situations in the daily work of Nursing professionals were intensified with the onset and spread of the pandemic. Such factors contribute to raising the level of mental and physical exhaustion, even causing organic changes in health professionals[5].

Recommendations have been developed, gathered and published to guide and support the population as well as frontline healthcare workers caring for COVID-19 patients[3].

Management and collective strategies such as therapeutic listening, psychological care, and support networks using digital tools have gained prominence in the management of psychological distress[6].

Self-care, meditation, self-knowledge and strategies for coping with the possibilities of illness were established and continue to be suggested and applied to minimize the consequences of this period. Therefore, they support health professionals and must be accessible.

Raising awareness about the need for self-care has already been considered an important matter, but, currently, it has become fundamental for survival. Despite the challenges experienced and overcome so far, we remain in a setting of uncertainty as to the end of the pandemic, as new variants emerge.

Self-care practices have become essential for coping with situations to which we are constantly exposed and can serve as protective measures to avoid mental and physical illnesses[7].

In addition to practices suggested and offered in support of health professionals, taking care of oneself is inherent to each person; it requires clarity of ideas and actions so that there are actual improvements in the quality of life. For this to happen, organized actions are necessary:

- Planning self-care time every day, so you can introduce healthier habits into your routine;
- Managing your time to achieve what can in fact improve your well-being;
- Developing your own menu with healthier foods that you like to eat;
- Being more selective with the information you receive;
- Setting aside quality time to do what you like or to do nothing;
- Practicing physical activities and going for walks, which contribute to maintaining physical and mental health;
- Caring for the quality of sleep, as a well-rested sleep calms the mind and renews energies;
- Being kind and prudent in the work environment creates mutual support between you and your peers;

- Perceiving conflicting situations, so you can assertively engage in the decision-making process;
- Keeping up-to-date on work processes to feel confident in the execution of tasks;
- Identifying signs of physical and/or mental illness and seek help.

"Take care of yourself: the principle of caring for yourself is the principle that underlies your need, commands your development and organizes your practice"[8].

In order to take care of others, one must assume the responsibility of taking care of oneself and, for this to happen, a process of personal transformation must be faced, consisting of a set of attitudes and practices of a subject towards themselves, in search of a more harmonious and healthy way of life. Acting consciously creates conscious, healthy and better results for the quality of life of those who care and are cared for.

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# PROCESSING TIME OF LOANER ITEMS FOR TOTAL HIP REPLACEMENT

*Intervalos de tempo para processamento de materiais consignados de prótese total de quadril*

*Intervalos de tiempo para el procesamiento de materiales consignados para prótesis total de cadera*

Thayse Rosa[1]*, Giovana Abrahão de Araújo Moriya[2,3]

**ABSTRACT: Objective:** To estimate the time intervals necessary to reprocess loaner items for total hip replacement in a sterile processing department of a private hospital in São Paulo (SP). **Method:** This is an exploratory, descriptive field study with a quantitative approach. The sample consisted of 41 processing cycles for loaner items. Intervals were recorded using a digital stopwatch, including the start and end times of each activity. Sample calculation was estimated with a 95% confidence interval. **Results:** Median total processing time was 10 hours, total effective time was 4.9 hours, and the interval between the end of reprocessing and the time of surgery was 4.7 hours in advance. One surgery was canceled due to delayed delivery of the item. **Conclusions:** This study measured the reprocessing times of loaner items, maintaining the methodological rigor at all stages, with estimates that respected the confidence interval, making this investigation reproducible. We suggest that professionals from other facilities perform these measurements to allow the construction of indicators that can help nurses in decision-making.
**Keywords:** Time and motion studies. Hip prosthesis. Time perception. Perioperative nursing.

**RESUMO: Objetivo:** Estimar os intervalos de tempo envolvidos no reprocessamento de materiais consignados temporários de prótese total de quadril em um centro de material e esterilização de um hospital privado de São Paulo (SP). **Método:** Estudo exploratório-descritivo, de campo, com abordagem quantitativa. A amostra foi composta de 41 processamentos de materiais consignados. Os intervalos de tempo foram registrados com auxílio de cronômetro digital, hora inicial e final de cada atividade. O cálculo amostral foi estimado com intervalo de confiança de 95%. **Resultados:** O tempo total do processamento teve mediana de 10 horas, o tempo efetivo total foi de 4,9 horas e o intervalo de tempo entre o fim do reprocessamento e o horário da cirurgia foi de 4,7 horas de antecedência. Houve cancelamento de uma cirurgia em virtude do atraso na entrega do material. **Conclusão:** Nesta pesquisa foram mensurados os tempos de reprocessamento de materiais consignados, sendo mantido o rigor metodológico em todas as etapas, com estimativas que respeitaram o intervalo de confiança, o que faz deste estudo passível de reprodução. Sugere-se que profissionais de outras instituições realizem tais mensurações, de modo que permitam a construção de indicadores, auxiliando enfermeiros na tomada de decisão.
**Palavras-chave:** Estudos de tempo e movimento. Prótese de quadril. Percepção do tempo. Enfermagem perioperatória.

**RESUMEN: Objetivo:** Estimar los intervalos de tiempo involucrados en el reprocesamiento de materiales consignados temporalmente para reemplazo total de cadera en un Centro de Material y Esterilización de un hospital privado de São Paulo. **Método:** Estudio de campo exploratorio-descriptivo con enfoque cuantitativo. La muestra consistió en 41 procesamientos de materiales consignados. Los intervalos de tiempo se registraron con la ayuda de un cronómetro digital, hora de inicio y finalización de cada actividad. El cálculo del tamaño de la muestra se estimó con un intervalo de confianza del 95%. **Resultados:** El tiempo total de procesamiento tuvo una mediana de 10 horas; el tiempo efectivo total fue de 4,9 horas y el intervalo de tiempo entre el final del reprocesamiento y el momento de la cirugía fue de 4,7 horas antes. Se canceló una cirugía debido al retraso en la entrega del material. **Conclusión:** En esta investigación se midieron los tiempos de reprocesamiento de los materiales consignados, manteniendo el rigor metodológico en todas las etapas, con estimaciones que respetaron el intervalo de confianza, haciendo este estudio susceptible de reproducción. Se sugiere que profesionales de otras instituciones realicen dichas mediciones, de manera que permitan la construcción de indicadores, ayudando a las enfermeras en la toma de decisiones.
**Palabras clave:** Estudios de tiempo y movimiento. Prótesis de cadera. Percepción del tiempo. Enfermería perioperatoria.

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## INTRODUCTION

In most facilities, dealing with loaner items is a daily struggle that can have strong negative effects on the productivity of the sterile processing department (SPD)[1].

Although Brazil does not have specific standards for managing loaner items, their processing is addressed in the Collegiate Board Resolution of the Brazilian Health Regulatory Agency (*Resolução da Diretoria Colegiada da Agência Nacional de Vigilância Sanitária* — RDC/Anvisa) no. 15/2012 on best practice requirements for processing healthcare products in the country[2]. The loan of surgical instruments is a common practice not only in Brazil but in many countries. Their high cost and the physical structure necessary to store these items make it impossible to maintain inventories. This logistics also involves some vendors that do not have an ideal inventory for distribution to all hospitals, with a high turnover in a short interval. As a result, this instrument is not always delivered with enough time for processing, directly affecting patient care, potentially risking the processing quality, and leading to delays or even suspensions of surgeries[3].

The loan process should consider the planning and provision of these items whenever they are requested by the medical teams during surgical scheduling. The main characteristic of loaner items is that they can be returned to vendors without any burden to the facility, paying source, or patient[4].

A critical item that needs to be loaned is the total hip replacement (THR) set, chosen for this study both for the complexity of its structural characteristic (cleaning difficulty, disassembly, access to residues, and the large number of boxes in a single surgery) and its increasing use. The number of THR surgeries has increased worldwide in the last decade due to demographic changes, including higher longevity, more sedentary lifestyle, and trauma (violence, car accidents)[5].

The lack or delayed provision of reprocessed loaner items for THR surgeries can directly impact the safety of patient care. This fact evidences the need for the development and execution of specific and well-designed processes and activities, ensuring that loaner items are sterile and complete at the time of surgery. SPD is responsible for determining the minimum time for item delivery so that reprocessing can be done in time for the surgery.

However, so far, no estimates have been made for the actual time intervals needed to process loaner items used in THR procedures.

## OBJECTIVES

- To estimate the time interval necessary to reprocess loaner items for THR procedures in an SPD of a private hospital in São Paulo (SP);
- To estimate individual time intervals (in hours) for each stage involved in processing loaner items for THR, from receipt to the assembly of the surgery cart.

## METHOD

This is an exploratory, descriptive field study with a quantitative approach. The feasibility of this research project was assessed by the Research Project Management System and the Research Ethics Committee of the facility under study.

Statisticians assisted the sample size calculation. The sample consisted of 41 processing cycles for THR loaner items. The processing time of loaner items for THR procedures was considered the dependent variable, while the complexity of the items (volume, weight, number of instruments, and boxes/baskets) was regarded as the independent variable.

Data collection had four steps:

1. Mapping all stages involved in the processing of loaner items for THR procedures;
2. Preparing and sending an invitation letter and informed consent form to judges and elaborating the instrument for validation;
3. Validation of the data collection instrument by selected judges with experience in the subject;
4. Data collection.

In order to reduce measurement bias and have better rigor/control and standardization, thus avoiding discrepancies among the examiners, data were collected exclusively by the first researcher. She contacted the department responsible for surgical scheduling daily to confirm the performance of elective surgeries in different shifts (morning, afternoon, and evening). The researcher arrived early at the site and directly observed the procedure, recording the initial time, the time spent on each activity, and the final time of the activities performed in the four reprocessing stages (receipt, cleaning, preparation, and sterilization) without influencing the processing. To that end, she used a digital stopwatch, pausing the timer if the processing was interrupted by any complication and starting it again when the activity was resumed.

All information was transcribed to a database. For data treatment and analysis, categorical variables were expressed as absolute frequencies and percentages, and numerical variables were described as mean and standard deviation (SD) or median and interquartile range, as well as minimum and maximum values. Estimates of total time intervals of the processing stages were presented as means followed by 95% confidence intervals (95%CI). Time interval estimates for idle items were expressed as medians followed by 95%CI. CIs for medians were calculated according to a method proposed in the literature[6]. Analyses were carried out using the SPSS software (SPSS Inc. Released 2008. SPSS Statistics for Windows, Version 17.0. Chicago: SPSS Inc.).

# RESULTS

## Advance delivery time

The advance time in which the six vendors delivered the items for processing in the facility was: 23 sets delivered 18 hours before surgery; 10 sets between 18 and 36 hours; 1 set between 37 and 47 hours; 4 sets between 48 and 71 hours; 3 sets over 72 hours.

## Examples of non-compliance

Figure 1 illustrates some non-compliance aspects regarding the cleaning and damage of the items received.

## Quantification of the items

Data from Table 1 show detailed descriptive analyses of information related to THR loaner items concerning: vendor, number of instruments, number of boxes, and number of baskets or trays.

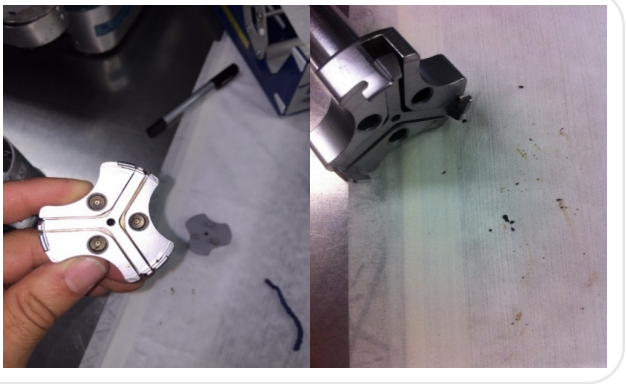

**Figure 1.** Item with residues received for total hip replacement surgery.

## Total time intervals

Table 2 presents descriptive analyses of time intervals.

## Item idle time

Table 3 brings descriptive analyses of idle time intervals.

**Table 1.** Vendor, number of instruments, and number of baskets or trays from the loaner sets for total hip replacement (n=41).

| Vendor that delivered the item | n (%) |
|---|---|
| A | 25 (61.0) |
| B | 09 (22.0) |
| C | 03 (7.3) |
| D | 02 (4.9) |
| E | 01 (2.4) |
| F | 01 (2.4) |
| **Total of instruments per processing cycle** | |
| Median | 150 |
| (interquartile range) | (106–254) |
| Minimum–maximum | 88–420 |
| **Number of boxes received** | |
| Median | 06 |
| (interquartile range) | (4–12) |
| Minimum–maximum | 4–19 |
| **Number of baskets or trays received** | |
| Median | 09 |
| (interquartile range) | (6–17) |
| Minimum–maximum | 6–24 |

**Table 2.** Total time intervals for each area involved in processing loaner items for total hip replacement (n=41).

| Time at each stage | Median | IQR | Minimum–maximum |
|---|---|---|---|
| Receipt (minutes) | 50 | (34–91) | 12–1,439 |
| Cleaning (minutes) | 85 | (76–108) | 73–405 |
| Cleaning (hours) | 1.4 | (1.3–1.8) | 1.2–6.8 |
| Preparation (minutes) | 135 | (79–211) | 46–693 |
| Preparation (hours) | 2.3 | (1.3–3.5) | 0.8–11.6 |
| Sterilization (minutes) | 131 | (115–154) | 79–340 |
| Sterilization (hours) | 2.2 | (1.9–2.6) | 1.3–5.7 |
| Processing (minutes) | 598 | (505–730) | 290–2,050 |
| Processing (hours) | 10.0 | (8.4–12.2) | 4.8–34.2 |

IQR: interquartile range.

## Comparison of processing time by vendor

The median effective processing time was 291 minutes (or 4.9 hours). Table 4 shows detailed descriptive analyses of the effective time spent on the processing stages of loaner items evaluated with a stopwatch for companies A and B, responsible for 83% of the sample.

**Table 3.** Item idle time between the stages involved in processing loaner items for total hip replacement (n=41).

| Item idle time (minutes) | Median | IQR | Minimum–maximum |
|---|---|---|---|
| Between receipt and cleaning | 01 | (0–13) | 0–539 |
| Between cleaning and preparation | 16 | (0–28) | 0–241 |
| Between preparation and sterilization | 22 | (1–59) | 0–166 |
| Between sterilization and time of surgery§ | 283 | (159–625) | -150–963 |
| Between sterilization and time of surgery (hours)§ | 4.7 | (2.7–10.4) | -2.5–16.1 |

§Negative item idle times represent processing delays regarding the scheduled time of surgery (processing ended after the scheduled time of surgery); IQR: interquartile range.

**Table 4.** Effective time intervals for each stage involved in processing loaner items for total hip replacement for companies A and B*.

| Effective time at each stage | Vendor | |
|---|---|---|
| | A (n=25) | B (n=9) |
| Receipt (minutes) | 27.7 (12.3) | 54.1 (17.2) |
| | 10.1–53.1 | 35.7–86.9 |
| Cleaning (minutes) | 79.4 (10.9) | 85.2 (8.7) |
| | 72.3–125.2 | 76.0–100.5 |
| Cleaning (hours) | 1.3 (0.2) | 1.4 (0.1) |
| | 1.2–2.1 | 1.3–1.7 |
| Preparation (minutes) | 66.2 (20.1) | 108.4 (26.8) |
| | 39.6–135.0 | 60.9–140.5 |
| Preparation (hours) | 1.1 (0.3) | 1.8 (0.4) |
| | 0.7–2.3 | 1.0–2.3 |
| Sterilization (minutes) | 104.9 (18.0) | 120.3 (17.4) |
| | 71.8–142.8 | 99.7–151.1 |
| Sterilization (hours) | 1.7 (0.3) | 2.0 (0.3) |
| | 1.2–2.4 | 1.7–2.5 |
| Processing (minutes) | 278.3 (33.1) | 368.1 (47.7) |
| | 231.2–367.2 | 295.5–441.9 |
| Processing (hours) | 4.6 (0.6) | 6.1 (0.8) |
| | 3.9–6.1 | 4.9–7.4 |

*Values expressed as mean (standard deviation), minimum and maximum values.

## DISCUSSION

Brazil has no definite recommendation for the minimum delivery time for loaner items to be timely processed. Nonetheless, Article 34 of Anvisa's RDC 15/2012 provides the following definition: "The professional in charge of the health service's SPD is responsible for: (...) III – Determining the time limit for the SPD to receive healthcare products that require processing before use and that do not belong to the health service" [2].

The International Association of Healthcare Central Service Materiel Management (IAHCSMM) recommends a two-day (48 hours) period before the time of surgery for known loaner boxes and three days (72 hours) for boxes processed for the first time[1]. In this study, the results showed that 56% of the 41 sets of loaner items were received by the facility less than 18 hours in advance of the scheduled time of surgery. Only 17% of the sample were delivered with an interval of over 48 hours and 7% over 72 hours. We underline that, in the last two cases, deliveries occurred on Fridays and on days that preceded holidays, with the surgical procedures scheduled for the next business day. Unfortunately, in the daily practice of hospitals worldwide, the delivery times pre-established by the facilities for loaner items are not always respected.

An article published in the journal of the Association of periOperative Registered Nurses demonstrates that this situation is experienced globally and not only in Brazil:

> Unfortunately, vendors frequently deliver loaner items to the health care facility just before the scheduled procedure; thus, loaner items may arrive at the user facility with insufficient time for them to be appropriately cleaned, inspected, inventoried, wrapped, sterilized, cooled, documented, and tracked to the patient according to published standards and recommended practices. This can result in staff members rushing to process the instrument trays, which often leads to missed steps or errors in reprocessing[7].

We highlight that RDC 15/2012 establishes that the facility is responsible for returning used loaner items clean[2].

However, aside from services that do not comply with this standard, Brazilian facilities show a large discrepancy regarding technological resources (automated washers versus manual cleaning).

Several non-compliance aspects were detected in the items delivered during this study, such as visible residues (Figure 1). These failures occur because, when loaner items are received, the concern is to check their type and quantity, while the cleaning quality is not often inspected.

Evidence of residues is often found during preparation, when the worker performs the cleaning inspection of the disassembled item with a magnifying glass and appropriate light. Another peculiarity of THR instrument loan sets that directly impacts their processing is the number of boxes and/or items that comprise them. The number of boxes in this study ranged from 4 to 19 for each THR set received (Table 1). We underline that each box had 1 to 3 baskets or trays that could be disassembled, that is, the boxes had different sizes. This diversity meant a variable number of trays in each box.

The median total processing time (Table 2) was 10 hours (approximately twice the effective time), considering the start of inspection until the item was ready for use. We emphasize that these values may change depending on the reality of each sector. By analyzing item idle times, we were able to identify when they occur, what the possible problems are, and correct them. Table 3 indicates that the longest idle time is between preparation and sterilization. This finding may be related to the loading of autoclaves to meet the daily demand. Table 3 also shows that the median interval between the end of processing and the scheduled surgery was 4.7 hours (not counting the total/effective processing time since the item was already available for use).

We highlight that two loan sets were ready after the scheduled time of surgery. In the first case, the processing ended two and a half hours after the schedule, and the surgery was canceled because there was not enough time to prepare the item, even though the company delivered it six hours before the scheduled time. The second loan set was delayed for 15 minutes, and the surgery was performed as planned.

The median effective processing time was 291 minutes (or 4.9 hours). Table 4 compared the effective time spent on each processing stage for companies A and B (83% of the sample), considering that their number of instruments and baskets is different, revealing that both companies affected these processing stages. This finding indicates important differences in the workload of professionals, in addition to increasing costs for the facility.

Challenges in the management of loaner items are a worldwide concern. Hospitals and official agencies in the United States and other countries have been discussing the issue in order to elaborate proposals for improvements and standardization of protocols. In Switzerland, documents relevant to the management of loaner items are often published by the Swiss Agency for Therapeutic Products (Swiss Medic)[8]. Australia has developed a guideline for the management of instrument loan sets, published by the state of Queensland[9], and also addresses the subject of loaner items in publications on the website of The Sterilizing Research and Advisory Council of Australia[10]. Besides the IAHCSMM, the World Health Organization also has recommendations for the management of loaner items, providing guidelines similar to those of the countries mentioned above[1,11]. Brazil is no different. Although we do not have specific standards for the management of loaner items, their processing is addressed in Anvisa's RDC 15/2012, which establishes best practice requirements for the processing of healthcare products[2].

Together with the legislation, these discussions serve as a foundation for safe practices, reducing the risks associated with failures in the management chain of these items and further strengthening the trust between hospital facilities and vendors of loaner items. This research sought to learn the processing time of THR loaner items. We found that this item is differentiated by weight, high load volume, and specificity regarding its compliance. These characteristics were crucial for better determining the minimum delivery time for vendors. We believe that these data can contribute to a safe practice, ensuring that the defined time interval does not overload the professionals processing the item, reducing the different risks for all parts that comprise the loan management chain and resulting in a safe practice both for the professionals involved and the patient undergoing surgical procedures.

## CONCLUSION

This study fulfilled its objectives by measuring the processing time intervals of loaner items for THR procedures in the SPD of a private hospital in São Paulo. The median total processing time was 10 hours. The intervals varied for each processing stage, from the receipt to the assembly of the surgery cart. The median total effective time was 291 minutes (or 4.9 hours). We also described the effective time of each processing stage for companies A and B and the number of THR loaner items. Even if the processing time changes,

depending on the nature of the item, the methodological rigor maintained through all stages — with time estimates that respected the CI — makes this study reproducible. Thus, each SPD can identify their processing time intervals according to their reality. Of note, we found no other studies with similar objectives in the national and international literature.

## FUNDING

None.

## CONFLICT OF INTERESTS

The authors declare there is no conflict of interests.

## AUTHORS' CONTRIBUTION

**GAAM:** Conceptualization, Methodology, Project management, Supervision, Writing — review & editing. **TR:** Conceptualization, Investigation, Validation, Writing — original draft, Writing — review & editing.

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# FACTORS RELATED TO QUALITY OF STEAM FOR STERILIZATION OF MEDICAL DEVICES

*Fatores relacionados à qualidade do vapor para esterilização de produtos para saúde*

*Factores relacionados con la calidad del vapor para la esterilización de productos sanitarios*

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**ABSTRACT: Objectives**: To identify and discuss the factors related to quality of steam and their relation to daily practices of the Central Sterile Supply Department (CSSD). **Method**: Documentary research based on the analysis of the normative theoretical framework about quality of steam for the sterilization of medical devices. **Results**: Factors that are directly related to quality of steam are: feedwater, steam contaminants, pipeline pressure fluctuations, non-condensable gases, steam dryness and superheating. **Conclusion**: Controlling factors that impact the success of steam sterilization is not an assignment for clinical engineering service only; it is a responsibility that should be shared with the manager of the CSSD. Safety in steam sterilization should not be reduced to monitoring of time, temperature or the result of physical, chemical and biological indicators, but include monitoring of the quality of steam, which is the sterilizing agent.

**Keywords:** Sterilization. Steam. Quality control. Quality management.

**RESUMO: Objetivos:** Identificar e discutir os fatores relacionados à qualidade do vapor e sua relação com as práticas do cotidiano do Centro de Material e Esterilização. **Método:** Pesquisa documental, construída com base na análise do referencial teórico normativo sobre a qualidade do vapor para esterilização de produtos para saúde. **Resultados:** Os fatores que estão diretamente relacionados à qualidade do vapor são: água de alimentação, contaminantes do vapor, flutuações de pressão na rede, gases não condensáveis, título e superaquecimento. **Conclusão:** O controle de fatores que impactam o sucesso de esterilização por vapor não é uma atribuição única da engenharia clínica, mas sim uma responsabilidade compartilhada com o gestor do centro de materiais. A segurança na esterilização pelo vapor não deve ser reduzida ao controle de tempo, à temperatura ou ao resultado de indicadores físicos, químicos e biológicos, mas incluir o controle da qualidade do vapor, que é o agente esterilizante.

**Palavras-chave:** Esterilização. Vapor. Controle de qualidade. Gestão da qualidade.

**RESUMEN: Objetivos:** Identificar y discutir los factores relacionados con la calidad del vapor y su relación con las prácticas cotidianas en el Centro de Material y Esterilización. **Método:** Investigación documental, construida a partir del análisis del marco teórico normativo sobre la calidad del vapor para esterilización de productos sanitarios. **Resultados:** Los factores que están directamente relacionados con la calidad del vapor son: agua de alimentación, contaminantes del vapor, fluctuaciones de presión en la red, gases no condensables, titulación y sobrecalentamiento. **Conclusión:** El control de los factores que impactan el éxito de la esterilización por vapor no es una tarea única de la ingeniería clínica, sino una responsabilidad compartida con el gerente del centro de materiales. La seguridad en la esterilización por vapor no debe reducirse al control del tiempo, la temperatura o el resultado de indicadores físicos, químicos y biológicos, sino que debe incluir el control de la calidad del vapor, que es el agente esterilizante.

**Palabras clave:** Esterilización. Vapor. Control de calidad. Gestión de la calidad.

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## INTRODUCTION

Sterilization using saturated steam under pressure is the method that brings together the greatest advantages for patients and healthcare services, as it does not leave toxic residues, has fast cycles, is compatible with different packages and has an excellent penetration into lumens[1]. During the cycle, the load is quickly heated by heat transfer promoted by the condensation of steam, when water changes from the gaseous to the liquid state, when it gets in contact with surfaces[2]. The direct contact of the steam with all surfaces is thus essential for the transfer of thermal energy, which promotes microbial inactivation[3].

The steam recommended for sterilization processes is saturated, in which there is a balance between condensation and evaporation[4]—that is, a maximum level of humidity—, but does not present the condensate, which is water in liquid state[3]. Therefore, not any steam is suitable for sterilization processes; for example, in the case of superheated steam, the temperature exceeds the boiling point at a certain pressure and the energy transfer by contact does not occur, since the steam is "dry" and the process becomes similar to sterilization in hot air sterilizers[5].

In practice, the quality of steam is essential to ensure the safety of sterilization processes. As an example, in situations where steam is superheated, *Bacillus subtilis* spores can be 2.5x more resistant than they would be in saturated steam conditions. However, only a 1.3x increase was observed in the resistance of *Geobacillus stearothermophilus* in superheated steam[6,7].

This shows the need for steam quality control in healthcare services, since cycles are monitored with biological indicators that use the *Geobacillus stearothermophilus* spore, which may not identify all changes in steam quality and provide a false sense of safety.

## OBJECTIVE

To identify and discuss factors related to the quality of steam and its relation to daily practice in the Central Sterile Supply Department (CSSD), supporting risk management.

## METHODS

This is a documentary research based on the analysis of normative theoretical references about the sterilization of medical devices, aimed to identify factors related to steam quality:

- Association for the Advancement of Medical Instrumentation, *ST79 Comprehensive guide to steam sterilization and sterility assurance in health care facilities*[8];
- Department of Health, United Kingdom. *Health Technical Memorandum 01-01: Management and decontamination of surgical instruments (medical devices) used in acute care. Part C: Steam sterilization*[9];
- European Committee for Standardization. *EN 285: Sterilization. Steam sterilizers. Large sterilizers*[4];
- *Brazilian Association of Technical Standards (ABNT). NBR ISO 17665-2: sterilization of health care devices – steam – Part 2: ABNT NBR ISO 17665-1 Application Guide*[10].

The documents were sent to selective reading to identify factors of interest for the objective of the study, to analytical reading to summarize the information needed by CSSD professionals, and, finally, to interpretive reading, when authors sought relationships between the scientific literature and daily practice[11].

## RESULTS

All information found is shown in Chart 1.

**Chart 1.** Factors related to the quality of steam, according to the documents analyzed.

| Document | Factors related |
|---|---|
| Association for the Advancement of Medical Instrumentation[8] | • Steam dryness*;<br>• Non-condensable gases;<br>• Superheating;<br>• Water contaminants;<br>• Various problems (e.g. obstructions and pressure variations in the pipeline). |
| Department of Health, United Kingdom[9] | • Steam dryness*;<br>• superheating;<br>• Non-condensable gases;<br>• Contaminants. |
| European Committee for Standardization[4] | • Non-condensable gases;<br>• Dryness value*;<br>• Superheating;<br>• Contaminants;<br>• Pressure fluctuations;<br>• Water for steam generation. |
| Brazilian Association of Technical Standards[10] | • Non-condensable gases;<br>• Dryness value;<br>• Superheating;<br>• Contaminants;<br>• Variations in steam pressure. |

*Variants of the term *dryness*. In this study, we chose to use the term "steam titration", commonly used in our field.

For discussion purposes, the factors identified were classified into five categories: feedwater and steam contaminants, pressure fluctuations, non-condensable gases (NcG), steam dryness and superheating.

# DISCUSSION

## Feedwater and Steam Contaminants

Contaminants can originate from water or steam contact with supply lines and materials, or during steam generation and transport[10]. These substances not only are related to changes in the steam dryness, but can also be toxic, corrosive and create a barrier between microorganisms and the sterilizing agent[10]. In practice, there are autoclaves that present with incrustations in the pipeline, in the steam generator and various stains and corrosion both in the chamber and instruments. The risks related to contaminated steam increase according to the length of the path that the steam must travel to reach the autoclave.

Since the level of contaminants in steam can be influenced by the quality of the feedwater[4,10], there are specific control recommendations, for example, the technical report nº 34 by the Association for the Advancement of Medical Instrumentation[12] and the standard EN285[4].

Steam contaminants and their reference values, such as silicates, iron, cadmium, phosphate and conductivity, can be found in NBR ISO 17665-2[10] and EN285[4] standards, which also describe the test and the sampling method of the condensate for analysis.

## Pressure Fluctuations

Some devices are fed with steam through an external source, for example, sterilizers that receives steam from a boiler. The recommendation in such cases is that the autoclave be designed to operate with pressure fluctuations of ±10% of the pressure measured from the inlet to the final pressure reduction valve, at most[4].

In practice, when the steam supply line also supplies other sectors, such as Nutrition and Diet Service and Laundry, the line pressure may fluctuate, affecting this requirement.

## Non-condensable Gases

Non-condensable gases (NcG) are those that "occupy space in the autoclave's inner chamber", competing with steam. Therefore, their presence is a potential failure, as they act as a thermal insulator, compromising the thermocoagulation of proteins and the inactivation of microorganisms[13,14]. The volume of NcG should not exceed 3.5% or 3.5 mL for every 100 mL of water[4].

Biological and chemical indicators do not specify the presence of less than 10% of NcG[14]. If small amounts (about 1% or more) are present in the chamber, the conditions required for the sterilization process can occur on directly exposed surfaces, but steam penetration into porous materials or narrow channels can be seriously reduced[15].

NcG can also lead to wet loads after the sterilization, which is considered inadmissible[8]. Several factors can contribute to the increase of NcG in the process:

- Presence of NCG in the steam-generation water—NcG dissolved in the water itself, such as $CO_2$ and $O_2$, and other water contaminants that can become NcG when heated—and interruption in water supply. In case of NcG from water, a degasser can be installed before the water enters the autoclave steam generator, so that the feedwater reaches specified tolerances[4];
- Inefficiency at the air removal stage: failure of the pressure measurement system, inadequate programming of the conditioning phase, e.g. inadequately reduced number of vacuum pulses to reduce total cycle time, performance variables in the vacuum pump due to wear or variation in the temperature of the water supply required for the pump to operate;
- NcG coming from the load itself: families of porous products or lumens (details of this variable can be consulted in ABNT NBR ISO 17665-3)[16]; indiscriminate use of the sterile barrier system, such as adding spunbond-meltblown-spunbond (SMS) sheets to packages, which results in a more challenging condition than used in performance qualification; presence of volatile chemical agents from the fabric washing process[4];
- Leakage failure in the steam generator or piping: when the steam is cooled, the volume decreases in such a way that a vacuum forms in the generator and the piping. Thus, if there are leaks or design flaws, there will be unwanted entry of air into the system;
- Chamber tightness failure: perforations caused by corrosion or loose connections, which can commonly occur after trepidation resulting from the operation of the autoclave. Both situations will allow air to enter when the autoclave is in vacuum;

- Failure to seal doors: failure in preventive maintenance, use of gaskets with mountings other than the specified by the manufacturer, mechanical failure in the gasket channel, failure in the autoclave gasket pressure adjustment with pressurized air.

The Bowie and Dick Test (BD) is one of the mostly used to verify the removal of air and NcG. The effectiveness of the BD built by the CSSD staff depends on the correct assembly and conditioning of the package, in accordance with specifications in technical standards[4,8].

The commercially available packages have different sensitivities, according to chemical indicators used[17]. In the last decade, electronic devices have been introduced to replace the BD penetration test. These devices are equivalent in performance to the original BD test and are currently available in compliance with the requirements of EN ISO 11140-4[18].

A study about the monitoring of steam penetration with the aid of an electronic device was carried out for a year and a half in three sterilizers. The conclusion was that the monitoring of steam penetration should be carried out every cycle and not just in the first cycle of the day[19]—which rationally is pertinent due to the randomness of a moment where failures can occur.

The differences between the temperature measured by the sensor positioned at the theoretically coldest point of the chamber (usually, the drain) and the temperature calculated based on chamber pressure may not be adequate to detect small volumes of air concentrated in lumens and internal spaces. Under such circumstances, air removal and steam penetration should be predicted by data obtained from a steam penetration test[10,20] such as the BD test.

In practice, each steam sterilization cycle should be considered a unique event. Therefore, European standards specify an automated control to detect failures at each cycle, thus reducing human errors[4]. Air detectors can be specified to control each cycle, as they are capable of detecting NcG and cancel cycles in which inadequate removal could compromise safety[4,17].

## Steam dryness

The steam dryness corresponds to the mass of the gas fraction in the saturated steam mass[4]. It is also referred to as "dryness factor"[1,8] and "dryness value"[10], being expressed, in general, as a percentage. For example, 95% means there is 5% of moisture in the steam.

Sterilization requires a continuous supply of steam, free from condensate and with a minimum dryness of 97[8], 95[4] or 95% to sterilize loads containing metal products and a minimum of 90% to sterilize loads containing textiles [10]. Therefore, there is no consensus on the aforementioned standards.

Excessive steam humidity can result in sterilization failure and wet loads, while low humidity can result in sterilization failures due to superheating[4]. Although necessary, accurate measurements of this variable are still difficult nowadays. The EN285 standard describes a test for this purpose, but it should not be considered the actual measurement of the steam moisture content, but a method to demonstrate that the quality of the steam is acceptable[4]. In practice, possible reasons for excessively wet steam can be: inadequate drainage and slope of drains and pipes, steam supply through pipes with stagnant flow and piping without proper insulation between the generator and the autoclave, which causes excessive condensation[9].

In autoclaves where wet steam becomes a persistent problem, two interrelated phenomena can be the cause. The first is called priming and occurs when the water level in the generator rises due to foam formation, resulting in water droplets and other impurities carried along with steam[21,22]. The second is foaming, which consists of the formation of bubbles (foam), due to the presence of contaminants in the generator[22]. Both priming and foaming can be caused by: inadequate treatment of the steam generator feedwater; exceeding water level in the steam generator; generator in need of internal cleaning; violent boiling of water inside the pipes due to small volumes and high amount of total dissolved solids (generally 2,000 ppm)[8,9].

## Superheated Steam

The microbicidal activity of steam is based on the temperature and duration of contact between water molecules and microorganisms[10]. In order for the steam to have a lethal action on microorganisms at the times and temperatures used in the CSSD, the ideal saturation condition must be present, but there is another physical condition of the water when it reaches the gaseous state that also does not allow the heat exchange to promote microbicidal action: superheated steam.

In this condition, steam has a lower density than saturated steam, reaching higher temperatures at the same pressure of the saturation condition. Then, the less efficient heat exchange between the superheated steam and the load is

called sensible heat, the same as in another sterilization technique: dry heat used in ovens. Compared to saturated steam, dry heat requires higher temperatures and contact time, in some cases ranging from 160 and 170°C for periods of 2 to 4 hours[23], or 170°C for 30 minutes[24,25]—predominantly used in industrial processes.

These conditions contradict the common sense that "the higher the temperature, the shorter the sterilization time", because the energy exchange in sensible heat has low efficiency compared to the latent heat of saturated steam. Therefore, if saturated steam turns into superheated steam, there will be no condensation in contact with the load, so the effectiveness of heat exchange is reduced.

In practice, superheated steam results in failures in the sterilization process, can damage materials such as rubbers, reduce the useful life of surgical instruments, cause burns, and damage the wrapping used as a sterile barrier[9], especially pouches, favoring the contamination of the load. As for the factors that can contribute to the steam becoming superheated, the following stand out:

- Storage of natural fiber fabrics, such as cotton, in places with relative humidity below 40%[10]. Recommendations are that fabrics that will be submitted to sterilization must be washed shortly before so that the fibers are rehydrated and, consequently, avoid steam superheating[8]. Additionally, manufacturers should be consulted regarding package sizes, dimensions and validated densities for sterilization with saturated steam[8]. In the case of boxes lined with cotton fields or other absorbent products, performance qualification is essential. Services that sterilize cotton fabrics can show dark stains on the fabric, which are similar to burns, especially on the package that is next to the steam inlet of the equipment's internal chamber. This event is potentially associated with superheating;
- Steam supply lines with excessive pressure reduction, by a valve or other devices restricting the flow of steam in the piping. When this factor is associated with high dryness values prior to pressure reduction, superheating can be significant[9]. This factor can be controlled through engineering devices such as pressure reduction stages along the steam supply line or at the autoclave steam inlet, in addition to controlling the steam transport speed in the supply lines so that it does not exceed 25 m/s[10], the latter being more difficult to scale and control.

In some circumstances, the autoclave detects this type of failure, and one may assess them by means of pressure and temperature values on the cycle tape printout, during the sterilization cycle or at the end of it. According to NBR ISO 17665-2, at a temperature of 134°C the absolute pressure must be 3,042 mBar[10], indicating a probable satisfactory quality of steam. In cases where the temperature displayed by the autoclave control is higher than the corresponding pressure indicated, the steam will potentially be superheated. For example: at 135°C, the corresponding pressure is 3,132 mBar (absolute); however, when there is superheating, the records show 3,132 mBar with incompatible temperatures, such as 133 or 136°C, even considering the uncertainties in the calibration of instruments. The autoclave will not always detect these failures, due to its dynamics of temperature monitoring in the drain, since this is a theoretically "cold" location that could lead to an underestimation of temperatures.

Steam superheating must not reach values above 25°C when compared to the value of boiling water at atmospheric pressure. An apparatus coupled to the steam supply pipeline is used for this measurement, promoting the compression of the steam extracted from the supply line and its expansion at atmospheric pressure to allow the temperature to be measured at that time.

As an example, the temperature of boiling water at sea level is 100°C. The steam will be considered superheated when its temperature is above 100°C, but it cannot exceed 125°C, which is the maximum value tolerated, according to the EN285 standard, under the conditions of the example shown[4]. It is important to emphasize that the temperatures used to exemplify are a parameter for evaluating the quality of steam and not the temperature used to promote microbial inactivation during sterilization. The method, construction and use of the measuring apparatus are described in detail in standard EN285[4].

## FINAL REMARKS

The analysis of the documents helped us to identify that the factors related to steam quality are: feedwater, steam contaminants, network pressure fluctuations, NcG, steam dryness and superheating. Assessing these factors led us to conclude that the safety of steam sterilization should not be reduced to time and temperature control due to the complexity and specificity of factors related to steam quality. Thus, it is recommended that CSSD managers, along with the clinical engineering service, aim to:

- ensure the acquisition of adequate and safe equipment for the CSSD, supported by regulations and technologies based on evidence that demonstrate the impact, effectiveness and safety of processes;
- ensure preventive and predictive maintenance, installation, operation and performance qualifications, as well as establish change control to guide requalification;
- undertake a water quality monitoring program for different uses at the CSSD, with a view to controlling adverse events, preserving equipment, and ensuring optimal operating conditions and steam quality;
- train and supervise CSSD personnel in the proper use of packaging systems and procedures for loading autoclaves;
- invest in staff training, especially for the decision-maker regarding load release, since potential failures can be identified in the printed physical indicator and in load-release devices, which constitute an important verification instrument;
- consider, in risk management, that not all failures in the sterilization process will be merely detected by chemical and biological indicators; therefore, the safety of the process must not be reduced to the results of these devices;
- establish criteria to support the choice of companies for the thermal qualification of autoclaves, considering the factors presented in this study, since there is no institution responsible for certifying the competence of these companies to date.

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None.

## CONFLICT OF INTERESTS

The authors declare there is no conflict of interests.

## AUTHORS' CONTRIBUTION

**RQO:** Conceptualization, Investigation, Writing — original draft, Writing — Review & editing. **SBR:** Conceptualization, Investigation, Writing — original draft, Writing — review & editing. **EAM:** Conceptualization, Investigation, Writing — original draft, Writing — Review & editing. **KUG:** Conceptualization, Investigation, Writing — original draft, Writing — Review & editing.

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# FACTORS THAT INFLUENCE THE ADHERENCE TO THE SURGICAL SAFETY CHECKLIST

*Fatores que influenciam a adesão à lista de verificação de segurança cirúrgica*

*Factores que influyen en la adhesión a la lista de control de seguridad quirúrgica*

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**ABSTRACT: Objective:** To identify the perception of professionals regarding the use of the Surgical Safety Checklist and map the factors that can enhance or weaken its completion and adherence. **Method:** Cross-sectional study with a mixed approach. Data collection was carried out by applying an interview with health professionals who work in a surgical center of a public hospital in the south of the country, from February to June 2019. **Results:** The following categories were listed: strengths and weaknesses in the application of the list; 96.6% strongly agreed that they felt safer to participate in procedures in which the checklist is applied and 90.2% agreed that it provides good communication. However, 39.9% disagreed that the entire team participates in its application and 69.9% agreed that the list is not always applied due to resistance or impracticality. **Conclusion:** The professionals recognize that the applicability of the list provides security for the surgical process, but one of the weaknesses was the low adherence of the team to carry out the proposed step by step.
**Keywords:** Patient safety. Perioperative care. Checklist.

**RESUMO: Objetivo:** Identificar a percepção dos profissionais em relação à utilização da Lista de Verificação de Segurança Cirúrgica e mapear os fatores que podem potencializar ou fragilizar o preenchimento e a adesão. **Método:** Estudo transversal, com abordagem mista. A coleta foi realizada pela aplicação de entrevista com os profissionais de saúde que atuam em um centro cirúrgico de um hospital público de município do Sul do país, no período de fevereiro a junho de 2019. **Resultados:** Elencaram-se as seguintes categorias: potencialidades e fragilidades na aplicação da lista; 96,6% concordaram totalmente que se sentiam mais seguros em participar de procedimentos em que o *checklist* é aplicado e 90,2% e concordaram que proporciona boa comunicação. Porém 39,9% discordam de que toda a equipe participe da aplicação e 69,9% concordam que nem sempre a lista é aplicada em função da resistência ou pouca praticidade. **Conclusão:** Os profissionais reconhecem que a aplicabilidade da lista proporciona segurança para o processo cirúrgico, porém uma das fragilidades foi a baixa adesão da equipe em realizar o passo a passo proposto.
**Palavras-chave:** Segurança do paciente. Assistência perioperatória. Lista de checagem.

**RESUMEN: Objetivo:** Identificar la percepción de los profesionales sobre el uso de la Lista de Verificación de Seguridad Quirúrgica (LVSQ) y mapear los factores que pueden mejorar o debilitar el llenado y la adherencia. **Método:** Estudio transversal con enfoque mixto. La recolección se realizó mediante la aplicación de una entrevista a profesionales de la salud que laboran en un centro quirúrgico de un hospital público de una ciudad del sur del país, de febrero a junio de 2019. **Resultados:** Se enumeraron las siguientes categorías: potenciales y debilidades en la aplicación de la LVSQ; El 96,6% está totalmente de acuerdo en que se siente más seguro al participar en los procedimientos donde se aplica la LVSQ y el 90,2% está de acuerdo en que proporciona una buena comunicación. Sin embargo, el 39,9% no está de acuerdo con que todo el equipo participe en la aplicación y el 69,9% está de acuerdo en que la LVSQ no siempre se aplica, por su resistencia o poca practicidad. **Conclusión:** Los profesionales reconocen que la aplicabilidad de la LVSQ brinda seguridad al proceso quirúrgico, pero una de las debilidades fue la baja adherencia del equipo en la realización del procedimiento paso a paso propuesto.
**Palabras clave:** Seguridad del paciente. Atención perioperativa. Lista de verificación.

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## INTRODUCTION

Incidents caused by care failures directly impact the quality of care and patient safety. A third of adverse events (AE) cause serious or permanent harm, increasing hospital stays, care costs, and exposing patients to new risks[1-3].

The Institute of Medicine (IOM) created, in 2001, six dimensions of quality of care, in which it recommends that patient care be safe, effective, patient-centered, timely, efficient, and equitable. One of the dimensions was patient safety[4]. Patient safety is understood as actions taken to minimize the risk of unnecessary harm to patients[5].

Considering the high rate of surgical AE, in 2007 and 2008, the World Alliance for Patient Safety, in partnership with the National Health Surveillance Agency (*Agência Nacional de Vigilância Sanitária* – ANVISA) and the Pan American Health Organization (PAHO), launched the Second Global Challenge, entitled "Safe Surgery Saves Lives", with the aim of improving quality standards in surgical care, stimulating the perception of professionals and involving the entire care team in this process[6].

The surgical center (SC) is considered a critical and restricted area, characterized as a complex sector, where there is a multidisciplinary team, equipment, materials, and different technologies, making it a tense environment that requires a high degree of concentration and, although professionals are attentive and responsible, human beings are prone to erros[7,8].

From January to December 2021, more than 180,000 incidents were reported by the Health Surveillance Notification System (*Sistema de Notificações em Vigilância Sanitária* – NOTIVISA). Of the AE reported, 895 were due to flaws during the surgical procedure, of which 4.80% were deaths[9].

With the Second Global Challenge, the Surgical Safety Checklist (SSC) was created, with the main objective of strengthening safety practices and enabling better communication and teamwork in the areas involved in the surgical process[6]. The use of SSC helps the SC care team, enabling comprehensive patient assessment and minimizing the risk of AE. Considering that there are many factors that can lead the team to errors, such as errors in the laterality of the procedure, forgetting of compresses or other surgical materials inside the surgical cavity, hypovolemia due to lack of preparation for the risk of blood loss, among other events that may compromise patient safety[10].

In a study carried out in 2017, with the objective of measuring adherence to the "Safe Surgeries Save Lives" program, from the perspective of 220 nurses from different regions of Brazil, the authors identified that adherence to the program's objectives was adequate, but there are still weaknesses, mainly in the prevention of "never events"[11].

According to another study carried out in a hospital in Minas Gerais, in 2019, which aimed to evaluate adherence to the safe surgery checklist in a medium-sized teaching hospital, it was found that of the 394 medical records evaluated, 90.72% had the checklist, however, no medical records were found with the checklist fully completed[12].

Considering the relevance of the topic, the following guiding question emerged for carrying out this research: how has the adherence to filling out and executing the SSC items been, from the perspective of health professionals involved in the surgical procedures of a large public hospital, in the city of Porto Alegre, state of Rio Grande do Sul?

Understanding what the barriers are to not using the SSC, as recommended, and what are the beneficial points for adherence can generate improvement actions and, therefore, improve the safety of the patient, the team and the institution, avoiding errors, in addition to determining actions aimed at patient safety in the surgical process.

## OBJECTIVES

- To identify the perception of health professionals working in the surgical center regarding the use of the Surgical Safety Checklist;
- To map the factors that can enhance or weaken the completion and adherence to the Surgical Safety Checklist.

## METHOD

Mixed cross-sectional study, with a quantitative-qualitative approach, carried out from February to June 2019, in a large public hospital located in the south of the country, in the city of Porto Alegre. The SSC was implemented at the institution in 2011.

The research was carried out in accordance with ethical principles and the project was approved by the Research Ethics Committee (CAAE 03162918.1.0000.5344 and

03161918.1.3001.5530). Data collection was carried out by the first researcher, after approval by the ethics and research committees of the institutions involved, proponent and co-participant (Protocols No. 3.111.178 and No. 3.120.060, respectively), followed by Resolution No. 466/2012 of the National Health Council[13].

Inclusion criteria were: health professionals (doctors, nurses, and nursing technicians) who work in the care of surgical patients in the SC participate in some stage of the SSC process, have worked at the institution for more than three months, and have consented to participate in the study by reading and signing the Informed Consent. Professionals who were on vacation, leave or away during the data collection period were excluded from the study.

All information and reports were kept anonymous, as well as the identification of each study participant.

Data were collected through the application of an *in loco* interview and during the interval between surgeries by the main researcher. For this, we used a questionnaire with questions created by the authors, structured and composed of four parts:

- Part 1: sociodemographic data and information on professional experience;
- Part 2: thirteen propositions about the SSC answered using a Likert scale. This scale was presented with five degrees of variation, with grade 1 – strongly disagree (SD) and the opposite extreme, grade 5 – strongly agree (SA); the intermediate point, grade 3 – neither agree nor disagree; and grades 2 and 4 – partially disagree and agree (PD and PA);
- Part 3: the participant was asked to assign a score from 0 to 10 regarding satisfaction with the application and compliance with the SSC by the team;
- Part 4: two open alternatives that constituted the qualitative data, with optional completion: What is your suggestion regarding the items that can be removed from the SSC or added to it? Space for comments that you deem relevant to the objectives of the work.

As for the quantitative data, the Excel® spreadsheet was used for storage and the Statistical Package for Social Sciences (SPSS), version 18.0 (SPSS Inc., USA) software for the analysis. Categorical variables were evaluated using absolute and percentage frequencies. For continuous variables, measurements of position (average, minimum, and maximum) and dispersion (standard deviation) were analyzed. To assess the qualitative data, content analysis was used, which involves three steps: pre-analysis, material exploration, and interpretation of results[14].

## RESULTS

Thirty health professionals participated, including 11 physicians (six anesthesiologists and five surgeons), five nurses and 14 nursing technicians (six surgical technicians and eight with basic training as nursing technicians).

Most participants were females (21/70.0%), aged between 25 and 60 years, mean of 38 years and standard deviation (SD) of 8.62.

The length of professional experience of 93.3% ranged between two and thirty years, with a mean of 12.7 years (SD = 8.2 years).

The team's responses regarding the SSC are presented in Table 1.

The results are presented according to the two categories of analysis emerging from the subjects' discourse: strengths and weaknesses identified in the SSC process. These findings were also related to the statements through the percentages with the Likert scale.

Understanding the reasons that may interfere and/or facilitate adherence to the SSC facilitates the development of strategies and actions to reduce risks. For this, it was necessary to understand and categorize the strengths and weaknesses of the SSC process. Therefore, the answers from parts 1 and 2 of the instrument were analyzed and divided into these two categories. Chart 1 shows the issues identified as potential.

It is also possible to perceive the weaknesses identified. It is believed that security-related issues go through several phases, and knowing them to act and propose improvements is essential to reduce errors. It is worth mentioning the issues listed in Chart 2 as weaknesses.

In part 3 of the instrument, the satisfaction of the team regarding the application and compliance with the SSC was questioned. The satisfaction rating scale ranged from 0 to 10, with 0 to 2 considered very dissatisfied, 3 and 4 dissatisfied, 5 and 6 indifferent, 7 and 8 satisfied, and 9 and 10 very satisfied. The average satisfaction score was 7.9, indicating that most professionals are satisfied with this process. However, attention is drawn to the fact that 26.6% (eight professionals) did not fill out this stage of the instrument (Figure 1).

**Table 1.** Professional's responses on factors that influence adherence to the Surgical Safety Checklist (n = 30).

| Statements | DT* | DP¨ | NC,ND& | CP+ | CT# |
|---|---|---|---|---|---|
| | n (%) | n (%) | n (%) | n (%) | n (%) |
| 1. The SSC (checklist) provides security in the surgical process. | 00 (0.0) | 00 (0.0) | 00 (0.0) | 02 (6.6) | 28 (93.3) |
| 2. The SSC provides good interpersonal team communication | 00 (0) | 01 (3.3) | 02 (6.6) | 08 (26.6) | 19 (63.3) |
| 3. The entire surgical team (doctors, anesthesiologist, and nursing team) actively participates in all stages of the SSC, duly fulfilling their role. | 05 (16.6) | 07 (23.3) | 04 (13.3) | 11 (36.6) | 03 (10.0) |
| 4. I feel safer to participate in a procedure in which the SSC is applied, in relation to one in which it is not applied. | 00 (0.0) | 00 (0.0) | 01 (3.3) | 02 (6.6) | 27 (90.0) |
| 5. I understand the importance of using the SSC and, for this reason, I comply with all the steps determined in the LVSC document. | 00 (0.0) | 00 (0.0) | 01 (3.3) | 03 (10.0) | 26 (86.6) |
| 6. The SSC is very extensive and time-consuming to apply. | 24 (80.0) | 03 (10.0) | 01 (3.3) | 02 (6.6) | 00 (0.0) |
| 7. The SSC is not always applied due to the lack of practicality and/or resistance of some team members. | 05 (16.6) | 02 (6.6) | 02 (6.6) | 08 (26.6) | 13 (43.3) |
| 8. The SSC items are sufficient to perform a safe surgery. | 03 (10.0) | 04 (13.3) | 00 (0.0) | 14 (46.6) | 09 (30.0) |
| 9. It is necessary to remove items from the SSC. | 23 (76.6) | 03 (10.0) | 02 (6.7) | 02 (6.6) | 00 (0.0) |
| 10. It is necessary to replace SSC items. | 16 (53.3) | 03 (10.0) | 03 (10.0) | 05 (16.6) | 03 (10.0) |
| 11. It is necessary to add SSC items. | 07 (23.3) | 01 (3.3) | 02 (6.6) | 07 (23.3) | 13 (43.3) |
| 12. We always paused before anesthetic induction and surgical incision to check for all the items needed for the procedure. | 10 (33.3) | 08 (26.6) | 04 (13.3) | 06 (20.0) | 02 (6.6) |
| 13. Correct application of the SSC reduces the risk of adverse events. | 00 (0.0) | 00 (0.0) | 00 (0.0) | 04 (13.3) | 26 (86.6) |

*Strongly disagree; ¨partially disagree; &neither agree nor disagree; +partially agree; #strongly agree.

**Chart 1.** Category 1: Potentialities identified in the SSC process, according to the statements raised in the data collection instrument.

| |
|---|
| (1) The SSC provides safety in the surgical process. |
| (2) The SSC provides good interpersonal team communication. |
| (4) I feel safer participating in a procedure in which the SSC is applied than in one in which it is not applied. |
| (5) I understand the importance of using the SSC and, for that reason, I comply with all the steps determined in the SSC document. |
| (6) The SSC is very extensive and time-consuming to apply. |
| (8) The SSC items are sufficient to perform a safe surgery. |
| (13) Correct application of the SSC reduces the risk of adverse events. |

**Chart 2.** Category 2: Weaknesses identified in the SSC process, according to the statements raised in the data collection instrument.

| |
|---|
| (3) The entire surgical team (doctors, anesthesiologist, and nursing team) actively participate in all stages of the SSC, duly fulfilling their role. |
| (7) The SSC is not always applied due to the impracticality and/or resistance of some team members. |
| (12) We always paused before anesthetic induction and surgical incision to check all the items needed for the procedure. |

In part 4 of the instrument, only 23.3% of the participants answered the two open alternatives, whose answers make up the discussion of this article. For this, participants were identified by letters and Arabic numbers, according to the group: N1, NT1, S1, A1, being N for nurse, NT for nursing technician, S for surgeon, and A for anesthesiologist. The sequence of numbers was defined according to the order in which the questionnaire was completed.

## DISCUSSION

The checklist is a tool with the purpose of reducing the rates of AE in surgical procedures[15]. Its use practically doubled the chance of users receiving surgical treatment with adequate standards of care[16].

In view of the data found in the literature, it was found that when participants answered about the fact that the SSC provides safety in the surgical process, 93.3% strongly agreed, which demonstrates that the multidisciplinary team understands the safe processes and that its proper application minimizes risks and possible surgical complications.

It also appears, in statement 13, with which 86.6% of the participants fully agreed and 13.3% partially agreed that the correct application of the SSC reduces the risks of AE, as observed below:

> *The nursing team has a good adherence to the completion of the checklist steps. I believe that the entire team (medical and nursing) understands the importance of risk mitigation that SSC can provide for a safe procedure* (N1).

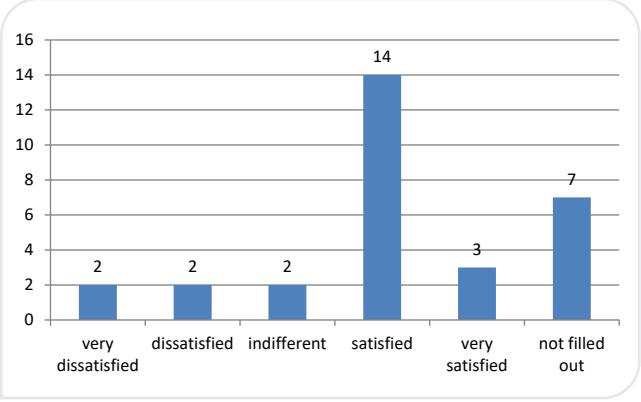


**Figure 1.** Satisfaction of study participants regarding the application and compliance with the SSC by the team.

A study carried out in Porto Alegre, Rio Grande do Sul, with nursing professionals from the SC of a private hospital, showed that these professionals perceive the importance of applying the checklist and correlate it with patient and worker safety[17]. This is also demonstrated in statement 4, with which 90.0% strongly agreed. As they stated, they feel safer to participate in procedures in which the SSC is applied compared to those whose application is not registered.

One of the goals recommended by the use of the SSC is to improve the interpersonal communication of the multidisciplinary team, in addition to reinforcing existing safety practices[8]. Regarding statement 2, 63.6% of the participants strongly agreed and 26.6% partially agreed with the fact that the SSC provides good team communication.

Interpersonal communication is always a point to be improved, and the checklist allows the entire team to participate actively, but communication processes are still a challenge in the health area. Although most understand that the list provides good communication, it is perceived as a point to improve, as this is a factor that weakens the communication process. The observation of a participant recorded below illustrates this reflection: *"There are still, better yet, there still needs to be improved — a lot — the interpersonal relationship of the team in relation to respect mainly"*. (A2)

Despite understanding it to be a potent point in the perception of their activities, the hierarchy of care exists and can interfere with patient care.

In statement 5, about the fulfillment of all the steps determined in the SSC document, 86.6% strongly agreed, followed by 10.0% who partially agreed. This was seen as a potentiality of the process. However, while this answer is a security element, when compared with the answers obtained in statement 3, 16.6% strongly disagreed and 23.3% partially disagreed. The perception of the team members regarding the systemic character points to the difficulty of the participants to understand their roles and the vision of the best practices to obtain the best results.

One of the greatest difficulties encountered is the resistance and lack of interest of the medical team in carrying out the checklist[17]. The result of question 3, discussed above, demonstrates that there is a weakness in the adherence of the entire team to the application of the SSC, and the greatest difficulty found for good performance is in the team itself. As evidenced in the following observation: *"The SSC is not being applied correctly;*

*surgical teams pay no attention; employees should do their part out loud"* (A5).

In view of this scenario, we identified a deficiency in the adherence of part of the team to the application of the checklist or in considering all the steps, which constitutes a gateway to failures and AE. This also impacts interpersonal relationships, which can cause friction and/or embarrassment for other team members. In statement 7, 43.3% of the participants strongly agree and 26.6% partially agree that the SSC is not always applied due to the little practicality and/or resistance of some team members.

The following comments illustrate some difficulties encountered by the team in active participation: *"We need to improve the awareness of care teams, who often go through, or would like to go over, this stage (of the SSC questionnaire), in a hurry to start the procedure"* (A3); *"We still have surgeons who refuse to respond to the checklist. There could be continuing education in loco to raise awareness of these"* (NT14); *"It would be interesting if the medical team were more participatory in relation to the checklist, as its importance is often not taken into account"* (NT5).

The comments expose a concern on the part of the team due to the lack of adherence or the fact that some team members do not consider the SSC to be a necessary and useful procedure.

In part 1 of the data collection instrument, in relation to the training of professionals for the use of the SSC, 72.7% of the physicians did not remember or responded that they did not train for the use of the SSC; in relation to the nursing team, 94.7% answered that they were trained to use the SSC. This data leads us to reflect on the need to carry out training periodically, including the medical team, so that there is better approval of the use of the checklist and that all of the team actively participate in its application and with the same level of understanding. It can be inferred that the little involvement or the lower adherence of the medical team in this process are due to their non-involvement in the care processes of the hospital under study.

In statement 12, 59.9% disagreed with the pause before anesthetic induction and the surgical incision to verify safety items, as recommended in best practices. The World Health Organization (WHO) recommends that, before anesthetic induction, the sign in be performed to verify the safety of the procedure[6]. At this stage, anesthesia and nursing professionals must be present. Prior to the incision, a time out must be performed for further safety checks. This step involves all team members.

These steps are not performed due to the lack of adherence to the application of the SSC by some members of the surgical team, and one of the factors found was the lack of training that, consequently, leads to a lack of understanding of the usefulness of the SSC.

Asked if they identified the need to add items to the SSC, 43.3% of the study participants fully agreed and 16.6% included, in part 4 of the instrument, the demarcation of laterality. According to the following comment, the institution's SSC follows the model recommended by the WHO: *"The SSC of this institution was recently reformulated, following the WHO model"* (N5).

However, in the instrument of the study institution, there is a field to describe the laterality of the procedure, but it does not specify whether the incision site is demarcated. In the SSC proposed by the WHO, there is a specific field to identify whether the demarcation was performed and another to confirm the surgical site with the patient. The WHO suggests that the SSC be adapted to the reality of each institution, and items can be added and/or modified, but it does not recommend removing the recommended items[6].

Between January and December 2021, 11 cases of procedures performed on the wrong side of the body and 28 cases on the wrong site were reported in Brazil[9]. These data point to risks for patient safety, demonstrating the need to maintain the items recommended by the WHO, such as the demarcation of laterality, which improves the visibility of the surgical team and ensures that the procedure is performed in the correct surgical site.

## FINAL CONSIDERATIONS

The present study made it possible to analyze the recognition of the applicability of SSC by professionals and the benefits involved in the safety of the surgical process. Although contradictory, one of the weaknesses was the low adherence of the team to the step-by-step checklist and the perception of nursing professionals that the medical team can be more proactive and participatory in this process. On the other hand, it was evidenced that most physicians did not receive training or do not remember being trained to use the SSC, affirming the importance of this training, unlike nursing professionals, who claim their participation in the training.

It is believed that having a permanent education plan for the entire multiprofessional team can sensitize them and promote their better integration and, in this way, bring benefits

to all professionals involved in the surgical process, whether in communication, in the organizational climate and more satisfaction regarding this process, impacting on patient safety. Although it is reported by all professionals that the team of surgeons is the one with the lowest adherence to SSC, they recognize that the checklist provides more security for the practice of procedures.

It was identified that some items need to be added to the SSC, such as the demarcation of laterality and confirmation with the patient of the surgical site. Both are present in the SSC proposed by the WHO, which allows a better visualization of the surgical site by the care team, minimizing the risk of the occurrence of never events.

We understand that there are limitations in this study due to the fact that few surgeons participated, which could lead us to other results. However, it was possible to identify some weaknesses, allowing the promotion of actions that improve the effectiveness of SSC and the adherence of all professionals, positively impacting the safety of surgical patients in the institution.

## FUNDING

None.

## CONFLICT OF INTERESTS

There are no conflicts of interests.

## AUTHOR'S CONTRIBUTIONS

**CCS:** Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Visualization, Writing — original draft, Writing — review & editing. **ADB:** Data curation, Formal Analysis, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing — review & editing. **ECMS:** Investigation, Resources. **TPPR:** Investigation, Resources.

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# INTRAOPERATIVE SURGICAL SMOKE: OCCUPATIONAL SAFETY MEASURES PROPOSED BY SPECIALIST NURSES

## *Fumaça cirúrgica no intraoperatório: medidas de segurança ocupacional propostas por enfermeiros especialistas*

## *Humo quirúrgico intraoperatorio: medidas de seguridad ocupacional propuestas por enfermeras especialistas*

Patrícia Treviso[1]*, Brenda Carvalho Peradotto[1], Juliana Vargas Campiol[1], Neide da Silva Knihs[2], Marcia Cristina de Oliveira Pereira[3], Giovana Abrahão de Araújo Moriya[4]

**ABSTRACT: Objective:** To describe measures proposed by nurses specialized in surgical center (SC) to reduce inhalation of electrocoagulation smoke in the intraoperative period and improve occupational safety. **Method:** This is a qualitative study based on data from a scientific meeting of SC specialists about the inhalation of electrocoagulation smoke. The meeting was held in São Paulo in 2019, lasted one hour, and was audio-recorded. The SC-specialist nurses who participated were randomly divided into four groups. The unavailability to participate in the entire meeting was considered an exclusion criterion. The data corpus consisted of: recording of the meeting and reports of the groups, followed by thematic analysis. **Results:** Twenty-one nurses, most of them women, from seven Brazilian states participated in the meeting. They suggested the following measures to decrease smoke inhalation and improve occupational safety: technology to reduce and/or suction smoke; surgical or N95 mask; room exhaust system; establishment of regulations; continuing education. **Conclusions:** Measures to reduce smoke inhalation and increase team safety in the intraoperative period include technologies to reduce smoke, use of personal protective equipment, establishment of regulations, and continuing education.

**Keywords:** Smoke. Electrocoagulation. Occupational health. Biomedical technology. Intraoperative period.

**RESUMO: Objetivo:** Descrever medidas propostas por enfermeiros especialistas em centro cirúrgico (CC) para reduzir a inalação de fumaça proveniente da eletrocoagulação no intraoperatório e melhorar a segurança ocupacional. **Método:** Estudo qualitativo, com dados oriundos de reunião científica com especialistas em CC realizada em 2019, em São Paulo, com duração de uma hora, gravada em áudio, acerca da inalação de fumaça oriunda da eletrocoagulação. Participaram enfermeiros especialistas em CC, divididos aleatoriamente em quatro grupos. Considerou-se a indisponibilidade para participar da reunião na íntegra um critério de exclusão. Compuseram o *corpus* de dados: gravação da reunião e registros dos grupos, e procedeu-se a análise temática. **Resultados:** Participaram 21 enfermeiros de sete estados brasileiros, a maioria mulheres. Foram apontadas medidas para diminuir a inalação de fumaça e melhorar segurança ocupacional: tecnologia para reduzir e/ou aspirar fumaça; máscara N95; sistema de exaustão de sala; estabelecimento de normativas; educação permanente. **Conclusão:** Medidas para reduzir a inalação de fumaça e aumentar a segurança da equipe no intraoperatório incluem tecnologias para reduzir a fumaça, uso de equipamentos de proteção individual, estabelecimento de normativas e educação permanente.

**Palavras-chave:** Fumaça. Eletrocoagulação. Saúde do trabalhador. Enfermagem perioperatória. Período intraoperatório.

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**RESUMEN: Objetivo:** Describir las medidas propuestas por enfermeros especialistas en el Quirófano (Q) para reducir la inhalación de humo intraoperatorio por electrocoagulación y mejorar la seguridad ocupacional. **Método:** Estudio cualitativo, con datos de una reunión científica con expertos en Q realizada en 2019, en São Paulo, de una hora, grabada en audio, sobre la inhalación de humo por electrocoagulación. Participaron enfermeros especialistas en Q, divididos aleatoriamente en cuatro grupos. La falta de disponibilidad para participar plenamente en la reunión se consideró un criterio de exclusión. Se compuso el corpus de datos: grabación de la reunión y actas de los grupos, y se realizó el análisis temático. **Resultados:** Participaron 21 enfermeras de siete estados brasileños, la mayoría mujeres. Se identificaron medidas para reducir la inhalación de humo y mejorar la seguridad ocupacional: tecnología para reducir y/o inhalar humo; mascarilla quirúrgica o N95; sistema de escape de la habitación; establecimiento de regulaciones; Educación permanente. **Conclusión:** Las medidas para reducir la inhalación de humo y aumentar la seguridad del equipo intraoperatorio incluyen tecnologías para reducir el humo, uso de equipo de protección personal, establecimiento de regulaciones y educación continua.

**Palabras clave:** Humo. Electrocoagulación. Salud laboral. Tecnología biomédica. Enfermería perioperatoria. Periodo intraoperatorio.

## INTRODUCTION

Surgical smoke originates from the use of electrosurgical equipment in tissue dissection and coagulation processes and may be toxic to the health team in the operating room (OR)[1]. Known to produce surgical smoke, the equipment used in the intraoperative period, including electrosurgical devices, laser ablation devices, electrocauteries, and ultrasonic devices, can raise the temperature of the tissue to the point of rupturing the cells and releasing particles into the environment[2].

This smoke consists of water vapor and chemical compounds, such as toluene, xylene, ethylbenzene, butyl acetate, acrylonitrile, 1,2-dichloroethane, phenol, chlorine, cyanide, hydrogen cyanide, carbon monoxide, and polycyclic aromatic hydrocarbons (PAH), which, in large part, have naphthalene, a possible human carcinogen[3-5]. Another element also present in surgical smoke is benzene, at a concentration hundreds of times higher than the exposure limit established by the National Institute for Occupational Safety and Health (NIOSH), a United States regulatory agency[6]. In addition to chemicals, biological elements such as viral deoxyribonucleic acid (DNA) components can also be identified in surgical smoke[7].

The size and morphology of smoke particles influence the effectiveness of protection measures and vary according to the tissue and type of incision[8]. The electrocauterization technique, for example, produces particles with a smaller mean aerodynamic size (0.07 µm), while laser tissue ablation creates larger particles (0.31 µm)[9].

The protection afforded by surgical masks only applies to particles larger than 0.9 µm[10]. The N95 mask, in turn, ensures that no particle greater than 0.3 µm is inhaled[11]. In addition, when used in the OR, some smoke evacuation systems remove particles larger than 0.12 µm from the environment, preventing the professionals from inhaling them[2,8].

Signs and symptoms related to smoke inhalation vary, but the most frequently reported by professionals working in the intraoperative period are: headache, lacrimation, cough, sore throat, unpleasant smell, nausea, drowsiness, dizziness, sneezing, and rhinitis[12,13]. However, there is a risk for more severe diseases, such as alveolar congestion, interstitial pneumonia, bronchiolitis, and emphysematous changes in the respiratory tract[1].

Discussions by nurses are extremely important to bring to light possible risks arising from exposure to surgical smoke since these professionals are involved in all surgical center (SC) processes and are responsible for managing the service, justifying the performance of this study.

Thus, the guiding question is: what measures should be taken to reduce the inhalation of electrocoagulation smoke in the intraoperative period and improve occupational safety?

## OBJECTIVE

To describe measures proposed by SC-specialist nurses to reduce inhalation of electrocoagulation smoke in the intraoperative period and improve occupational safety.

## METHOD

This is an exploratory, descriptive, qualitative study. Data were collected from a scientific meeting of SC specialists held during the 14th Congress of the Brazilian Association of Surgical Center, Anesthesia Recovery, and Sterile Processing Department Nurses (*Associação Brasileira de Enfermeiros de*

*Centro Cirúrgico, Recuperação Anestésica e Centro de Material e Esterilização* — SOBECC), in the city of São Paulo, in September 2019. The meeting lasted one hour and discussed the inhalation of electrocoagulation smoke in the intraoperative period.

SC-specialist nurses from several country regions were invited to participate in the study. Professionals attending the Congress were intentionally invited. The participants were informed of the purpose of the activity and how it would happen. Those who agreed to participate in the study signed an Informed Consent Form (ICF).

The inclusion criteria were: being a nurse, having experience in surgical nursing, and participating in the congress. The unavailability to participate in the entire scientific meeting was considered an exclusion criterion.

Participants were randomly divided into four groups — one group with six members and the remaining tables with five nurses each. Each group elected an interlocutor to moderate the discussion and a person responsible for recording the discussion. They received paper, pen, flip chart, and six numbered envelopes, each containing a question for the group to discuss sequentially.

The interlocutor was instructed to open an envelope at a time, starting the discussion on each question. One of the participants should make a brief report of the points discussed and the responses elicited. They were encouraged to discuss each question for 5 to 7 minutes.

The questions covered the following topics: risks associated with surgical smoke; professional categories exposed to it; exposure time; signs and symptoms related to inhalation of this type of smoke; measures to reduce smoke inhalation by the team; and measures to increase occupational safety connected to smoke.

After 35 minutes, each group presented the discussion results based on the questions using the flip chart. All interlocutors disclosed the answers from their groups. These answers were documented in the flip chart and audio-recorded. The general discussion was moderated by the main researcher and an assistant researcher.

At the end of the scientific meeting, the groups delivered the reports to the researchers. Together with the recording, which was later transcribed, these reports comprised the data corpus of this study. Next, we performed thematic data analysis.

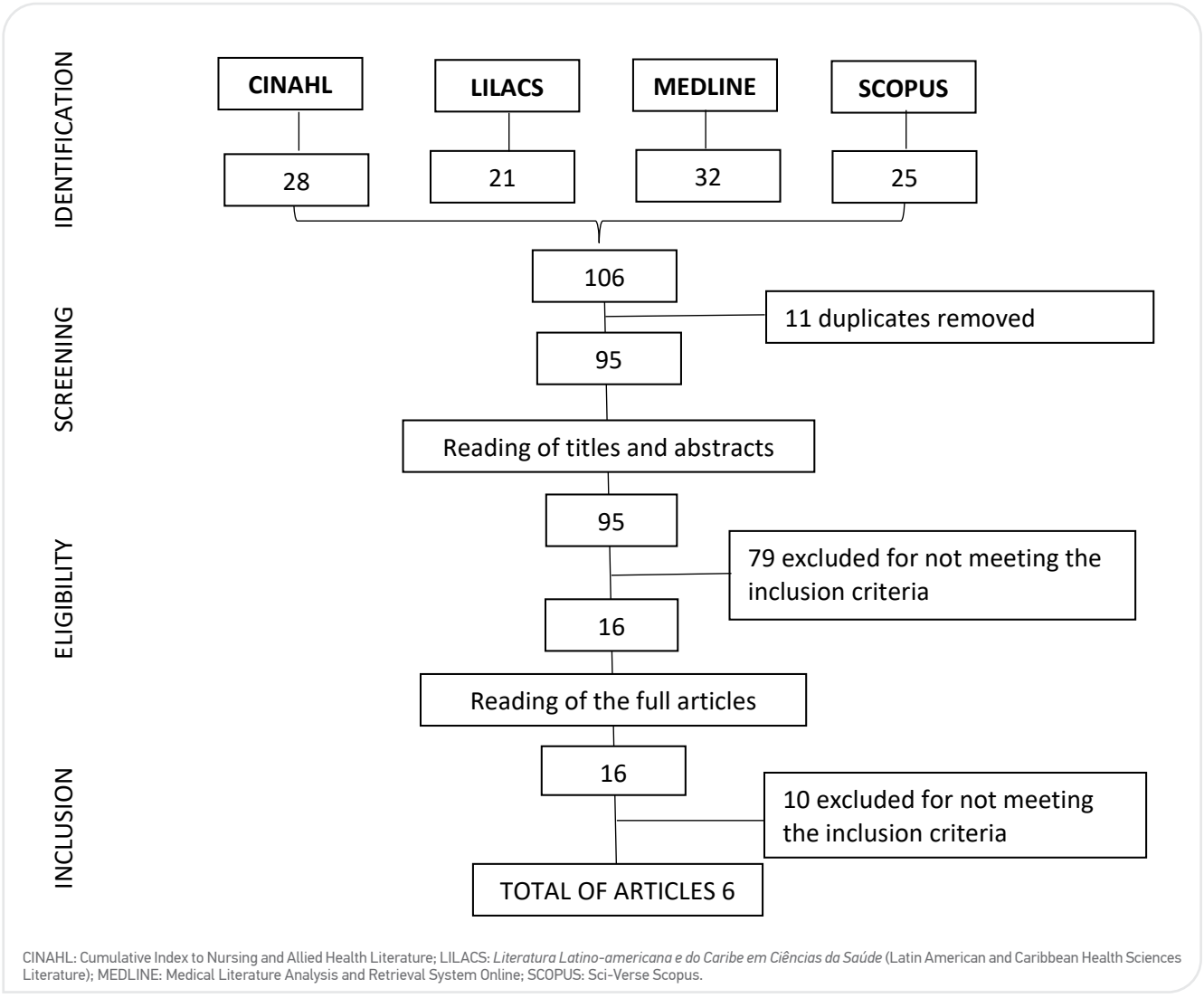
The study complied with Resolution no. 466/2012 of the Brazilian National Health Council. The Research Ethics Committee approved this project (Certificate of Presentation for Ethical Consideration/*Certificado de Apresentação para Apreciação Ética* — CAAE 33693320.6.0000.5308).

In order to strengthen the study, we also performed an integrative literature review. The six stages of the integrative review were followed: identifying the theme and selecting the research question, establishing the criteria for sample selection, defining the information to be extracted from the selected articles, assessing the studies included in the integrative review, analyzing the results, presenting and synthesizing the knowledge[14].

In the first stage, the research question was elaborated according to the Patient or Problem, Intervention, Comparison, and Outcomes (PICO) strategy, in which: (P) inhalation of electrocoagulation smoke by the surgical team; (I) intraoperative care; and (O) recommendations for occupational safety. In this case, comparison (C) was not used. Therefore, the following question was defined: based on scientific evidence, what are the recommendations for occupational safety regarding electrocoagulation smoke in the intraoperative period?

In the second stage, data were collected by consulting the databases: Medical Literature Analysis and Retrieval System Online (Medline), Latin American and Caribbean Health Sciences Literature (*Literatura Latino-americana e do Caribe em Ciências da Saúde* — LILACS), Sci-Verse Scopus (SCOPUS), and Cumulative Index to Nursing and Allied Health Literature (CINAHL). We included primary studies, with no language restriction, published in the past five years (2017–2021). Search strategies were based on the Health Sciences Descriptors (*Descritores em Ciências da Saúde* — DeCS) "electrosurgery", "plume", "surgery smoke" and the boolean operator "AND".

In the third stage, after identifying 106 studies, we used the Mendeley reference manager, removing 11 duplicates from the different databases. Next, two independent reviewers read the titles and abstracts, excluding those that did not meet the inclusion criteria or match the proposed theme. Sixteen studies were selected for full reading, a step performed by two independent reviewers to help validate the selection of articles for analysis. For this analysis, the reviewers considered the inclusion and exclusion criteria and the research question, resulting in six articles, which comprised the sample of this review. To better understand the selection of the material obtained, we used an adapted version of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) flowchart, as shown in Figure 1[15].




CINAHL: Cumulative Index to Nursing and Allied Health Literature; LILACS: *Literatura Latino-americana e do Caribe em Ciências da Saúde* (Latin American and Caribbean Health Sciences Literature); MEDLINE: Medical Literature Analysis and Retrieval System Online; SCOPUS: Sci-Verse Scopus.

**Figure 1.** Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews flowchart for the selection of articles comprising the sample.

In the fourth stage, evidence was extracted by analyzing, interpreting, and synthesizing the publications selected for the sample through the elaboration of a synoptic table consisting of title, year, objective, methodological design of the study, treatment evidence, and level of evidence. This step was also performed by two independent reviewers. The information collected comprised the data corpus of the research.

The quality of the articles was assessed based on the classification of the level of evidence, following recommendations from the Oxford Centre for Evidence-Based Medicine[16], which categorizes the studies into five levels:

I) systematic review of randomized trials;
II) randomized trial;
III) non-randomized cohort/follow-up studies;
IV) case studies or case-control studies;
V) expert opinion or opinion based on standards and legislation.

In the fifth stage, data were analyzed from the perspective of the thematic analysis, and three categories were established: "surgical smoke components"; "risks and effects of surgical smoke inhalation on human health"; and "occupational safety measures".

In the sixth stage, results were presented, and data were descriptively discussed, allowing us to identify the measures

to improve occupational safety related to electrocoagulation smoke in the intraoperative period.

## RESULTS

Twenty-one SC-specialist nurses from various country regions attended the meeting — one participant from each of the following states: Santa Catarina, Espírito Santo, Bahia, and Pará; three participants from Rio de Janeiro; four from Rio Grande do Sul; ten from São Paulo. The participants were mainly women (17/81.0%).

The measures described by the professionals to reduce inhalation of electrocoagulation smoke in the intraoperative period were: adopting technology to suction electrocautery smoke before it disperses in the OR, monitored by clinical engineering; using High-Efficiency Particulate Air (HEPA) filters in the OR; using masks for particle filtration. As for measures to increase the safety of professionals with respect to smoke inhalation, the specialists cited: continuing and permanent education; establishment of institutional policies; adoption of technologies that produce less smoke; use of microparticle filtration masks; disclosure of risks through scientific evidence; use of a smoke suction device; installation of an exhaust system; and elaboration of national regulations, aiming at greater safety concerning electrocoagulation smoke (Chart 1).

The presentation of articles included in the integrative review contains: authorship; year of publication and country; design and sample; interventions; outcomes; and level of evidence (Chart 2).

Based on the thematic analysis, data from the integrative review were organized into three categories (Chart 3).

## DISCUSSION

Half of the articles included in the integrative review were performed in Brazil, which shows the interest of Brazilian researchers in the impacts of surgical smoke[4,13,17]. However, according to the primary results of this study, discussions on this subject in health facilities are still incipient in our country. Out of the four groups of professionals, only one reported having, in one of the facilities, meetings on the subject and proposals to implement technology for smoke suction. That same hospital already uses suction in surgical

**Chart 1.** Questions and results of the scientific meeting held during the 14th Congress of the Brazilian Association of Surgical Center, Anesthesia Recovery, and Sterile Processing Department Nurses, in São Paulo, September 2019.

| Questions | Group 1 | Group 2 | Group 3 | Group 4 |
|---|---|---|---|---|
| 1. Does the facility where you work hold discussions about surgical smoke? | Incipient or non-existent. | There is no discussion on the subject; however, some surgeons have requested smoke suction equipment. | A hospital held meetings to implement smoke suction technology for a year (since 2018). The same professional mentions the availability of a high-frequency suction device for human papillomavirus (HPV) lesions in the hospital where they work. | This subject is not addressed in the facility. |
| 2. What are the risks of surgical smoke? | Microbiological risks. | Microbiological risks, mainly associated with HPV, the dispersion of cancer cells and chemotherapeutic agents in surgeries that involve intraoperative chemotherapy. | Risk of implications for the respiratory and cardiac systems of the professionals, upper airway irritation, eye irritation, cancer. | Nausea, vomiting, eye irritation. Little is known about the subject, making it difficult to establish a causal connection. |

Continue...

**Chart 1.** Continuation.

| Questions | Group 1 | Group 2 | Group 3 | Group 4 |
|---|---|---|---|---|
| 3. Which professionals inhale surgical smoke? | Professionals of the surgical team who stay in the OR, such as surgeons, the nursing team, anesthesiologists, and the patient. | Everyone in the operating room, especially those close to the surgical field, including the surgical team, surgical technologist, and anesthesiologist. | All professionals in the operating room, the patient, and the staff working close to the operating room. | Physicians, assistants, surgical technologists, circulating nurses, perfusionists in the operating room, as well as X-ray technicians and other people who provide support in the room. |
| 4. For how long does the team working in the operating room inhale the surgical smoke? | While they are working: 6 hours, 8 hours, 12 hours (depending on their shift). | During and after the use of the electric scalpel. It also depends on the type and specialty of the surgery, the length of the procedure, and how long the equipment was used. | From the moment the smoke-generating equipment starts being used to approximately 20 minutes after use. | It varies, depending on how long the technology is used. Some variables need to be considered for mapping the exposure, such as: complexity of each procedure, type of surgery, whether they are intracavitary or video-assisted surgeries. |
| 5. Has any professional ever mentioned discomfort or symptoms caused by surgical smoke inhalation? If so, what discomfort or symptom has been reported to you? | Yes. Frequent upper airways problems, such as airway irritation, odor-related discomfort. However, making a causal connection is difficult since we also have to consider the room temperature, the use of air conditioning, and the presence of suspended particles, in addition to smoke. | Yes. Discomfort related to the smell of electrocoagulation. Airway irritation. Eye burning. | Yes, both by professionals and students. Respiratory distress, aversion to the smell produced by electrocoagulation. | Yes. Cough, eye itching, runny nose, nausea, vomiting, odor-related discomfort. |
| 6. What measures could be taken to: a) reduce surgical smoke inhalation in the intraoperative period; b) increase the safety of the surgical team with respect to smoke inhalation in the intraoperative period? | a) invest in technology, improve the quality of the masks, invest in specific devices, such as smoke suction devices, smoke evacuation systems, High Efficiency Particulate Air (HEPA) filters; invest in education and awareness of the medical and nursing teams.<br>b) perform continuing education actions involving all professionals in the sector. | a) adhere to evidence-based best practices concerning the use of electrosurgical equipment.<br>b) establish institutional policies; use smoke suction devices; acquire new devices with complete sealing. | a) adopt technologies available in the market, from accessories to surgical smoke suction devices, with clinical engineering monitoring. Perform continuing education activities for the multidisciplinary team.<br>b) adopt technologies that produce less and/or no smoke; use microparticle filtration masks; raise awareness among the entire multidisciplinary team about the use of protective technologies. Disclose the risks through scientific evidence. | a) provide education linked to the patient's safety center; worker's health; independent commission of care-related infections. Since this is an occupational risk, there must be institutional concern. We lack national regulations and resolutions for more up-to-date practices on this subject.<br>b) use equipment such as smoke suction devices and room exhaust systems according to the current legislation. |

**Chart 2.** Summary of the articles included in the integrative review.

| Reference | Year and country | Design and sample | Interventions | Outcomes | Level of evidence |
|---|---|---|---|---|---|
| Okubo *et al.* (2017)[4] | 2019 Brazil | Quantitative cross-sectional study. n=50 | Collection of hydrocarbons through a suction pump and identification by liquid chromatography. | Detection of hydrocarbons and low correlation between the production of these compounds and the time of electrocautery use. | III |
| Casey *et al.* (2021)[8] | 2020 Ireland | Qualitative study. n=3 | Use of three different cutting methods to collect information about the aerosol produced in all three procedures. | Higher prevalence of carbon and oxygen molecules in the samples. | III |
| Stanganelli *et al.* (2019)[13] | 2019 Brazil | Cohort study. n=39 | Administration of a questionnaire about signs and symptoms that the literature relates to surgical smoke exposure. | The most prevalent symptoms were eye irritation, burning sensation in the pharynx, nausea, vomiting. | III |
| Claudio *et al.* (2017)[17] | 2017 Brazil | Cross-sectional study. n=50 | Gas collection by vacuum suction pump and gas chromatography reading. | Hydrocarbons detected in the air of operating rooms in 100% of surgeries. | III |
| Hu *et al.* (2021)[18] | 2020 China | Quantitative cross-sectional study. n=700 | Nasal swab collection from gynecologists to detect human papillomavirus (HPV). | The rate of HPV infection in the nasal epithelial cells of participants who performed electrosurgery was significantly higher than among those who did not. | III |
| Michaelis *et al.* (2020)[19] | 2020 Germany | Qualitative study. n=501 | Administration of a questionnaire on sociodemographic data and perceived dangers of surgical smoke according to health professionals. | Half of the surgeons classified the health risks related to surgical smoke without protective measures as high or very high. Nurses showed greater health concern than surgeons. Smoke risks: headache, rhinitis, asthma, pneumonia. | V |

**Chart 3.** Surgical smoke components, risks related to surgical smoke inhalation, and occupational safety measures.

| **Surgical smoke components** |
|---|
| Hydrocarbons[4,13,17] |
| Human papillomavirus (HPV)[18] |
| Biological material[8] |
| Carcinogenic material[17] |
| **Risks and effects of surgical smoke inhalation on human health** |
| Transmission of HPV deoxyribonucleic acid (DNA)[18] |
| Interstitial pneumonia[8] |
| Bronchiolar hypertrophy and hyperplasia[8] |
| Eye irritation[13] |
| Burning sensation in the pharynx[13] |
| Nausea and vomiting[13] |
| **Occupational safety measures** |
| Surgical and N95 masks[8,13,17-19] |
| Smoke suction devices[13,17,19] |

procedures for electrocauterization of human papillomavirus (HPV) lesions.

A study conducted in China showed that surgical smoke might carry biological material[1]. In another study published in 2020, nasal swab was collected from 700 gynecologists from 67 hospitals who performed electrosurgery, including loop electrosurgical excision procedures, aiming to identify whether these professionals were at risk of acquiring HPV DNA through surgical smoke. The rate of HPV infection in the nasal epithelial cells of the participants who performed electrosurgery was higher (8.96%) than in those who did not perform electrosurgery (1.73%), evidencing that gynecologists from the first group were at risk of HPV infection[18].

Participants of this study mentioned the following risks of surgical smoke inhalation: microbiological risks (HPV) due to cell dispersion through electrocoagulation smoke; risks to the respiratory and cardiac systems; eye irritation; nausea and vomiting. The integrative review also addresses these risks: eye irritation[13]; nausea and vomiting[13];

presence of biological material[8]; presence of carcinogenic material[17]; interstitial pneumonia[8]; bronchiolar hypertrophy and hyperplasia[8].

Of note, the specialist nurses from the four groups participating in this study mentioned that professionals working in the SC have complained of discomfort associated with smoke inhalation, such as: upper airway irritation, respiratory distress, runny nose, aversion to the smell produced by electrocoagulation, nausea, vomiting, coughing, and eye irritation. Nonetheless, we underline that two groups reported that these symptoms are not always associated with surgical smoke, making it difficult to make a causal connection. Group 1 declared that these symptoms are sometimes related to temperature, air conditioning use in the OR, and the possible presence of other particles in the environment. On the other hand, Group 4 pointed out that little is known about the subject.

Electrocoagulation smoke is produced when the equipment tip touches human tissue. Unless some suction and exhaust mechanism is used[19], this smoke is dispersed throughout the environment, posing risks related to the particulate matter and its chemical and biological composition[1,20].

The groups stated that all professionals in or near the OR, as well as the patient, are exposed to the risks of surgical smoke inhalation. In general, surgeons, anesthesiologists, surgical technologists, circulating nurses, and nurses are present in the OR[21]. However, other professionals may also be in the room, depending on the surgical procedure being performed or the need for support in the use of surgical technology. These professionals include clinical engineers, perfusionists, and X-ray technicians, who are also exposed to the risks of surgical smoke.

The measures suggested by the participants to reduce smoke inhalation in the intraoperative period are: adopting technology to suction electrocoagulation smoke; using HEPA filters; using facial masks with higher particle filtration; and complete sealing. Three articles[13,17,19] of the integrative review mentioned the use of smoke suction devices, and five articles[8,13,17-19] cited the use of surgical or N95 masks.

A study conducted in China in 2020 revealed that the detection rate of HPV particles in participants who used surgical masks (7.64%) was lower than in those who did not use protection (24.32%). Regarding the use of N95 masks, the detection of HPV particles was 0% compared to other types of masks (13.98%)[18].

Both measures — use of surgical or N95 mask and use of technology to suction smoke before it spreads in the OR — are considered crucial for the occupational safety of the professionals in the room, as well as for patient safety[1].

The study participants also suggested other measures aimed at occupational safety: investing in continuing education for the multidisciplinary team; establishing institutional policies; adopting technologies that produce less smoke; using technology for smoke suction; using microparticle filtration masks; installing an air exhaust system in the OR; raising awareness about the use of technologies among the multidisciplinary teams; performing research on the subject; disclosing the risks through scientific evidence; elaborating documents aimed at national regulations and resolutions for safer practice.

These results expand the knowledge of the subject investigated, providing elements for better safety for professionals working in the SC, especially in the OR. Since nurses work both in care and SC management, they need to know the risks and complications resulting from surgical smoke inhalation and propose, together with the multidisciplinary team, measures to reduce the exposure of professionals to smoke. They should also contribute to the elaboration of guiding documents and continuing education actions, aiming at the safety of those in the OR.

## Study limitations

The study was based on a strategy to raise awareness among nurses from several Brazilian states, seeking to discuss a current and relevant theme to the safety of the surgical team. However, as the groups consisted of professionals from different facilities and realities, we could not verify the specific reality of each facility, which would certainly enrich the study. This is, therefore, a suggestion for new investigations. We also stress the need for primary studies that analyze the Brazilian context.

# FINAL CONSIDERATIONS

Electrocoagulation smoke poses chemical and biological risks to professionals in the OR related to its inhalation during the intraoperative period. Exposed individuals may present symptoms such as upper airway irritation, cough, bronchiolitis, eye irritation or itching, nausea, and vomiting, among others.

The measures proposed by the participants to reduce surgical smoke inhalation and increase team safety in the intraoperative period include continuing education and the use of technologies such as: equipment with lower particle emission and with

a smoke suction device, microparticle filtration facial masks, room exhaust system, and elaboration and/or implementation of protocols aimed at greater safety of the professionals.

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None.

## CONFLICT OF INTERESTS

The authors declare there is no conflict of interests.

## AUTHORS' CONTRIBUTION

**PT:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project management, Resources, Supervision, Validation, Visualization, Writing — original draft, Writing — review & editing. **BCP:** Data curation, Formal analysis, Writing — original draft, Writing — review & editing. **JVC:** Data curation, Formal analysis, Writing — original draft, Writing — review & editing. **NSK:** Validation, Visualization, Writing — review & editing. **MCOP:** Conceptualization, Methodology, Validation, Visualization. **GAAM:** Conceptualization, Methodology, Validation, Visualization.

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# NURSING PROFESSIONALS WORKING IN THE SURGICAL CENTER EXPERIENCE MUSCULOSKELETAL PAIN

*Trabalhadores de enfermagem que atuam em centro cirúrgico sentem dor musculoesquelética*

*Trabajadores de enfermería que trabajan en centros quirúrgicos sienten dolor musculoesquelético*

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**ABSTRACT: Objective:** To assess the intensity of musculoskeletal pain and the affected anatomical regions reported by nursing professionals working in a hospital surgical center. **Method:** This is a quantitative, descriptive, cross-sectional study carried out with nursing professionals working in the surgical center of a general hospital. Data were collected between December 2019 and March 2020 by administering a sociodemographic, labor, and clinical questionnaire, the Nordic Musculoskeletal Questionnaire, and the Numeric Pain Rating Scale. **Results:** Twenty-five nursing professionals participated in the study. Most were women, aged 31 to 40 years, married, and with children. The anatomical regions most affected by musculoskeletal pain in the previous year were the low back, ankles and feet, shoulders, and neck; in the previous seven days, the lumbar region was responsible for the highest percentage of pain. Only a small part of workers declared not feeling pain in recent days. **Conclusions:** The pain reported by the participants compromises their work activities. Pain intensity reveals professional suffering, with the risk of chronicity and of triggering other diseases, even autoimmune ones.
**Keywords:** Nursing. Surgicenters. Pain. Musculoskeletal pain.

**RESUMO: Objetivo:** Avaliar a intensidade da dor musculoesquelética e as regiões anatômicas comprometidas referidas por profissionais de enfermagem atuantes em um centro cirúrgico hospitalar. **Método:** Estudo transversal, descritivo e quantitativo, desenvolvido com profissionais de enfermagem que atuam no centro cirúrgico de um hospital geral. A coleta de dados ocorreu entre dezembro de 2019 e março de 2020, mediante aplicação de questionário sociodemográfico, laboral e clínico, Questionário Nórdico de Sintomas Osteomusculares e Escala Numérica de Avaliação da Dor. **Resultados:** Participaram do estudo 25 profissionais de enfermagem. A maioria é mulher, na faixa etária de 31 a 40 anos, casada e com filhos. As regiões anatômicas mais acometidas pela dor musculoesquelética no último ano foram lombar, tornozelos e pés, ombros e pescoço, e, nos últimos sete dias, o maior percentual de dor foi na região lombar. Apenas pequena parcela dos trabalhadores referiu não sentir dor nos últimos dias. **Conclusão:** A dor referida pelos participantes compromete suas atividades laborais. A intensidade da dor expressa sofrimento profissional, com risco de cronificação e desencadeamento de outras patologias, até mesmo autoimunes.
**Palavras-chave:** Enfermagem. Centros cirúrgicos. Dor. Dor musculoesquelética.

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**RESUMEN: Objetivo:** Evaluar la intensidad del dolor musculoesquelético y regiones anatómicas comprometidas reportadas por profesionales de enfermería que laboran en el quirófano de un hospital. **Método:** Estudio transversal, descriptivo y cuantitativo, desarrollado con profesionales de enfermería que laboran en el quirófano de un hospital general. La recolección de datos se realizó entre diciembre de 2019 y marzo de 2020, mediante la aplicación del cuestionario sociodemográfico, laboral y clínico, Cuestionario Nórdico de Síntomas Musculoesqueléticos y Escala Numérica de Evaluación del Dolor. **Resultados:** Participaron del estudio veinticinco profesionales de enfermería. La mayoría son mujeres, de entre 31 y 40 años, casadas y con hijos. Las regiones anatómicas más afectadas por el dolor musculoesquelético en el último año fueron la zona lumbar, tobillos y pies, hombros y cuello y, en los últimos siete días, el mayor porcentaje de dolor fue en la región lumbar. Solo una pequeña parte de los trabajadores informó no haber sentido dolor en los últimos días. **Conclusión:** El dolor informado por los participantes compromete sus actividades laborales. La intensidad del dolor expresa sufrimiento profesional, con riesgo de cronicidad y desencadenamiento de otras patologías, incluidas las autoinmunes.

**Palabras clave:** Enfermería. Centros quirúrgicos. Dolor. Dolor musculoesquelético.

## INTRODUCTION

In 1700, the Italian physician Ramazzini carried out studies on occupational diseases and stated that inappropriate movements and postures during work could cause serious problems for the human body. Among occupational diseases, work-related musculoskeletal disorders stand out[1].

Work-related musculoskeletal disorders (WMSD) can be defined as dysfunctions that affect musculoskeletal structures caused by work overload, with symptoms such as localized pain, fatigue, functional loss, limb numbness, physical discomfort at the end of the working day, paralysis, paresthesia, and local edema[2]. In this context, inadequate physical effort during work activities can result in physical discomfort for nursing professionals[3].

Currently, the expression WMSD is also found in the literature as work-related musculoskeletal disorders (WMSD). WMSDs stand out for their magnitude and severity, making them a relevant public health problem, especially in industrialized countries since they affect workers' quality of life in different health areas[4]. In addition, they impair different levels of functional capacity, potentially leading to absenteeism, decreased productive capacity, work abandonment, limitation of professional activity, as well as high costs with treatments and compensations[5].

The health work environment is conducive to the development of WMSDs, given its many risk factors, including repetitive movements, stress, weight lifting, work overload, physical and genetic factors, and poor posture[6]. Continuous exposure to these factors can contribute to the emergence of mechanical tensions in muscles, ligaments, and joints, which can lead to pain in regions such as the neck, back, shoulders, and wrists[5].

Among health workers, nursing professionals are affected by WMSDs due to work overload and daily demands[7]. Studies have shown a significant incidence of musculoskeletal symptoms related to these professionals, with a rate ranging from 43 to 93%. The prevalence of these symptoms is usually caused by occupational stress[8]. In the hospital environment, nursing professionals are the ones who complain most about pain, as they often fail to care for their own health to prioritize patient care[9].

Some authors have described the prevalence and characteristics of muscle symptoms in nursing professionals. However, these studies have different results. In an investigation with 37 nursing professionals working in the surgical center (SC) of a federal hospital, the prevalence of musculoskeletal symptoms among the participants was 76.5% in the previous seven days and 83.3% in the previous 12 months. In this study, the lumbar region was the most affected (42.3%), followed by the dorsal one (30.8%)[10].

Nonetheless, another study assessing 52 nursing professionals working in the Sterile Processing Department (SPD) identified a prevalence of musculoskeletal symptoms of 60.8% in the previous seven days and 80.4% in the previous 12 months among the participants; low back pain was predominant in both cases. More than 90% of the interviewees reported pain and/or discomfort in some body part during their work[11].

The considerations above evidence the knowledge gap regarding research on pain among nursing professionals working in the hospital environment, particularly in the SC. Thus, this study proves to be relevant since health workers should acquire knowledge of this subject and engage — through dialogs, discussions, and reflections — in actions and interventions aimed at promoting health and preventing diseases in order to maintain a healthy personal and professional life.

## OBJECTIVE

To assess the intensity of musculoskeletal pain and the affected anatomical regions reported by nursing professionals working in a hospital SC.

## METHOD

This is a quantitative, descriptive, cross-sectional study developed with nursing professionals working in the SC of a philanthropic large general hospital located in the northwest region of the state of Rio Grande do Sul (RS).

This facility has 198 hospitalization beds and is considered a macro-regional reference in health. It serves a population of 1,282,927 people — equivalent to 12.9% of the RS population —, distributed in 125 municipalities[12]. The SC consists of six operating rooms equipped to treat adults, older adults, children, and newborns.

The target population of the study comprised 43 nursing professionals. The inclusion criteria were: being part of the nursing team, working in the SC of this facility, and signing the informed consent form (ICF). The study excluded nursing professionals on leave, including sick leave, and/or vacation during the data collection period and who did not sign the ICF.

Data were collected between December 2019 and March 2020 by administering the following instruments: sociodemographic, labor, and clinical questionnaire, Nordic Musculoskeletal Questionnaire (NMQ), and Numeric Pain Rating Scale.

The sociodemographic, labor, and clinical questionnaire was developed by the researchers and covered the following items: age group, sex, marital status, whether they had children and how many, professional category, undergraduate/graduate/specialization courses, time since graduation, management/coordination position, weekly workload, another employment relationship, and length of nursing experience.

The visual numeric scale used to assess pain intensity is a simple but effective instrument, ranging from 0 to 10, in which 0 represents "no pain" and 10 corresponds to "extreme pain" [13].

NMQ was developed by Kuourinka and collaborators in 1987 and translated into Portuguese in 2003 by Barros and Alexandre[14]. This instrument is used to standardize and measure reports of musculoskeletal symptoms and includes 36 multiple-choice and dichotomous questions regarding the presence of musculoskeletal symptoms in the 12 months and seven days prior to the interview[14].

For the analysis, data were initially entered into a database with independent double entry in Microsoft Office Excel®. After verification and correction of possible mistakes and/or inconsistencies, the data were transferred to the software Statistical Package for the Social Sciences (SPSS)®, version 22.0, and analyzed using descriptive and inferential statistical analysis.

Descriptive statistics were used to characterize the participants' sociodemographic, labor, and clinical data. Qualitative variables were expressed as relative and absolute frequency.

As for ethical aspects, this study is linked to the master's thesis entitled "Musculoskeletal pain, stress, burnout, and resilience in nursing professionals in the hospital environment", whose research project was approved by the hospital's Evaluation Committee and the university's Research Ethics Committee (REC), under the consolidated opinion no. 3,657,852. The study complied with all ethical-legal precepts involving research with human beings, as recommended by Resolution no. 466/2012 of the Brazilian National Health Council[15].

## RESULTS

Out of the 43 nursing professionals invited, six nurses and 19 nursing technicians participated in the study, totaling 25 participants. Table 1 presents their sociodemographic characteristics. The vast majority of participants were women (92%), aged 31–40 years (56%). With respect to marital status, 36% reported being married, and the same percentage declared being single; 68% reported having children, most of them with a single child (48%).

Table 2 describes the results of the participants' labor characteristics. The prevalent professional category was nursing technicians (76%), with a higher rate of individuals who graduated between one and five years earlier (32%); 36% of the sample had specializations, and 80% did not hold management positions. Concerning workload, most individuals worked 36 hours per week (80%), with exclusive employment relationship (88%). Regarding the length of nursing experience, almost half of the research participants had more than ten years of experience (48%), followed by those whose career span ranged from 5 to 10 years (28%).

Table 3 presents the results related to pain in different anatomical regions mentioned by the participants. As to pain in the previous year, the highest rates were in the upper

posterior chest and ankles/feet (36%), followed by the lumbosacral region, neck and shoulders, and deltoids (32%). Shoulder disorders (12%) were responsible for the highest rate of individuals prevented from performing normal activities in the previous year, followed by neck, upper posterior chest, wrists or hands, and ankles/feet (8%).

Most visits to health professionals in the previous 12 months were motivated by pain in the upper posterior chest and neck, followed by shoulders, wrists or hands, and ankles/feet.

When asked about pain in the previous seven days, most participants reported pain in the upper posterior chest (28%), followed by shoulders and ankles/feet (20%).

Next, Table 4 shows the intensity of musculoskeletal pain reported by the participants in the previous seven days, scored 0 to 10, in which 0 represents "no pain" and 10 corresponds to "extreme pain". The results indicate that 28% of workers declared no pain in the previous seven days; 16% experienced severe pain, with the same rate (7 and 8), respectively.

**Table 1.** Sociodemographic characteristics of nursing professionals working in the surgical center of a general hospital – April/2020 (n=25).

| Variable | Number | Percentage (%) |
|---|---|---|
| Sex | | |
| Female | 23 | 92 |
| Male | 02 | 8 |
| Age group (years) | | |
| 18 to 30 | 05 | 20 |
| 31 to 40 | 14 | 56 |
| 41 to 50 | 04 | 16 |
| Over 51 | 02 | 8 |
| Marital status | | |
| Married | 09 | 36 |
| Single | 09 | 36 |
| Domestic partnership | 07 | 28 |
| Children | | |
| Yes | 17 | 68 |
| No | 08 | 32 |
| Number of children | | |
| 0 | 08 | 32 |
| 1 | 12 | 48 |
| 2 | 04 | 16 |
| 3 | 01 | 4 |

## DISCUSSION

The nursing team working in the SC performs several activities that can trigger musculoskeletal pain, impairing their physical and mental health. This statement stems from the results of the present research, which has a predominance of women and shows how much pain they feel in different anatomical regions.

Similar results were found in a study[16] that sought to identify complaints related to physical discomfort due to SC ergonomic risks, its anatomical location, characterization,

**Table 2.** Labor characteristics of nursing professionals working in the surgical center of a general hospital – April/2020 (n=25).

| Variable | Number | Percentage (%) |
|---|---|---|
| Professional category | | |
| Nurse | 06 | 24 |
| Nursing technician | 19 | 76 |
| Specialization | | |
| Yes | 09 | 36 |
| No | 16 | 64 |
| Time since graduation (years) | | |
| 1 to 5 | 08 | 32 |
| 6 to 10 | 05 | 20 |
| 11 to 15 | 07 | 28 |
| Over 16 | 05 | 20 |
| Management position | | |
| Yes | 05 | 20 |
| No | 20 | 80 |
| Weekly workload (hours) | | |
| 30 | 01 | 4 |
| 36 | 20 | 80 |
| 40 | 02 | 8 |
| 44 | 02 | 8 |
| Another employment relationship | | |
| Yes | 03 | 12 |
| No | 22 | 88 |
| Length of nursing experience (years) | | |
| Less than 1 | 01 | 4 |
| 1 to 3 | 03 | 12 |
| 3 to 5 | 02 | 8 |
| 5 to 10 | 07 | 28 |
| Over 10 | 12 | 48 |

and correlation with the working environment. In that study[16], 77.27% of participants were women. Likewise, research[17] aimed at analyzing and comparing the professional satisfaction rate of nurses working in the SC identified a majority of females. Another investigation[18] assessed 340 nursing professionals working in the SC and/or SPD of 11 hospitals in the city of Londrina, Paraná; among them, 87.1% were women — a characteristic of the nursing field.

The fact that most participants are women, aged 31 to 40 years, can be one of the factors that partially explains pain complaints in many anatomical regions, combined, of course, with physical effort, and that requires knowledge of ergonomics. Similar to the present study, research conducted in a hospital in the northern region of Portugal[19] identified that 65.1% of the nurses, with a mean age of 40 years, had some complaint of musculoskeletal pain or discomfort. Another study[16] also found an increase in musculoskeletal pain complaints in nursing professionals, with a mean age between 26 and 35 years (36.6%).

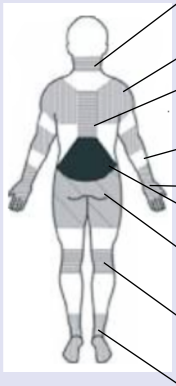
The present research shows that this team has expertise in SC nursing, an essential condition for performing high-quality activities, as this complex, specialized unit requires experience[20]. The longer career span was also identified in studies with SC professionals, who had a mean length of nursing experience of 8 years[17] and ranging from 10 to 20 years[10].

The intensity of the pain self-reported by the participants and the fact that they declared feeling pain in more than one anatomical region lead us to contemplate how much this pain can interfere in the daily work of these SC

**Table 4.** Intensity of musculoskeletal pain in the previous seven days, in which 0 represents "no pain" and 10 corresponds to "extreme pain", as reported by the nursing team working in the surgical center of a general hospital.

| Pain intensity | Number | Percentage (%) |
|---|---|---|
| 0 | 7 | 28 |
| 1 | 1 | 4 |
| 3 | 1 | 4 |
| 4 | 3 | 12 |
| 5 | 2 | 8 |
| 6 | 2 | 8 |
| 7 | 4 | 16 |
| 8 | 4 | 16 |
| 9 | 1 | 4 |

**Table 3.** Frequency of musculoskeletal symptoms per anatomical region reported by the nursing team working in the surgical center of a general hospital.

| Musculoskeletal symptoms | PDF | IAN | CAS | PR |
|---|---|---|---|---|
| Body part | n (%) | n (%) | n (%) | n (%) |
|  Neck | 08 (32) | 02 (8) | 03 (12) | 03 (12) |
| Shoulders | 08 (32) | 03 (12) | 02 (8) | 05 (20) |
| Upper posterior chest | 09 (36) | 02 (8) | 03 (12) | 07 (28) |
| Elbows | 02 (8) | - | - | 01 (4) |
| Wrists or hand | 04 (16) | 02 (8) | 02 (8) | 02 (8) |
| Lumbosacral | 08 (32) | 01 (4) | 01 (4) | 02 (8) |
| Hips/thighs | 03 (12) | - | - | - |
| Knees | 01 (4) | 01 (4) | - | 01 (4) |
| Ankles/feet | 09 (36) | 02 (8) | 02 (8) | 05 (20) |

PDF: experienced problems (such as pain, tingling/numbness) in the previous 12 months; IAN: was prevented from performing normal activities in the previous 12 months; CAS: visited a health care professional in the previous 12 months; PR: experienced some problem in the previous seven days.

professionals, including when it comes to the incidence of iatrogenesis and abstention, the safety of the team and the patient, and the damage to the facility's image. In addition, the pain reported by them can become chronic in the medium and long term, making their professional practice impossible. In the SC, professionals associate pain and/or physical discomfort with the tasks performed in the unit. Most of them have lived with pain and discomfort for a long time, making the situation worrying because, in the long term, these symptoms can worsen and become increasingly harmful to the worker[16].

Specifically concerning pain sites, in the present study, the participants reported more pain in the upper posterior chest and ankles/feet (36%) in the previous year, followed by the low back, neck, and shoulders (32%). Likewise, a study[16] with 22 nursing professionals found that most participants (68.18%) reported discomfort in the upper limbs, spine, or lower limbs, with the shoulders (18.91%), spine (18.91%), and legs (18.91%) as the most painful sites.

Most nursing professionals attributed the prevention from performing normal activities in the previous year to disorders in the shoulders, neck, upper posterior chest, wrists or hands, and ankles/feet. An investigation[21] revealed similar results, identifying that the leave taken by these professionals in the previous 12 months was related to pain in the low back, with a percentage of 34%, followed by the shoulder and neck, both with 31%. Study[22] with 90 nursing professionals from a public hospital providing secondary and tertiary care indicated that the risk factors predisposing to low back pain are associated with poor posture, carrying heavy equipment, performing repetitive movements, and continuing to work, even with pain.

In the present study, the highest response rates regarding the presence of pain in the previous seven days were in the posterior chest, shoulders, and ankles/feet, a result that, although in different percentages, suggests a change in the pain typology from acute to chronic. Research[23] with 42 nursing professionals showed that 71.4% of them reported musculoskeletal symptoms in the previous 12 months, while 31.0% declared experiencing muscular discomfort in the previous seven days. In this scenario, another factor deserving attention is the quantitative and qualitative distribution of nursing professionals in the SC, considering that the professional deficit, together with the unit's health care profile, may lead to work overload[24].

As for the intensity of pain reported by the participants in this research, the fact that only 28% did not mention any pain in the previous week is a finding that deserves attention, reflection, and discussions from managers and nurses of the unit, with the goal of implementing appropriate actions for pain treatment and management, as well as reviewing contributing and triggering factors for pain. The physical and mental suffering of SC nursing professionals due to their work activity interferes with their professional capacity and quality of life, making them susceptible to illnesses[25]. In this regard, it is up to the professionals to become aware of the prevention of ergonomic risks, adopt good postures, avoid carrying heavy objects, and practice physical activities to strengthen their body muscles since working in the SC requires physical strength, long periods of standing in the orthostatic position, and repetitive movements[25].

Based on the arguments above, the pain experienced by the nursing team working in the SC should be regularly assessed to prevent personal and organizational harm, mainly related to the quality and safety of patient care in the SC. Nursing is responsible for a significant number of SC workers, and the job characteristics of this unit favor the emergence of both physical and mental illnesses among these professionals[26]. Exposure to and handling of physical, chemical, biological, ergonomic, and psychosocial agents can damage the quality of productivity and care and compromise the workers' health[26].

The results of this research, together with our positions regarding research findings on the subject, show that the nursing team working in the SC presents signs of illness, especially concerning the persistence of musculoskeletal pain in different anatomical regions, which varies in intensity, can cause harm, and risks the safety of patients undergoing surgical procedures, with direct repercussions on care quality and the organization's image.

With respect to the limitations of this study, the number of participants and the fact that the investigation was conducted in a single hospital preclude us from making inferences and comparisons between facilities.

## FINAL CONSIDERATIONS

The assessment of the intensity and sites of musculoskeletal pain reported by nursing professionals working in an SC is important because it provides managers and workers with support for actions and interventions in order to improve knowledge about pain, ergonomics, precautions to prevent damage to the physical and mental health of

workers, as well as maintain the quality of care and of the organization as a whole.

The pain reported by the participants affects their work activities, and its intensity reveals the professional's suffering in their daily life, with risk of chronicity and of triggering other diseases, including autoimmune ones. We stress the risk of illnesses, which may make the professional nursing practice impossible in the SC.

We believe that this research contributes to reducing the evidence gap on the subject, more specifically, that related to the SC unit. We expect that the results can help broaden discussions and reflections, leading to changes in the attitude of both managers and health professionals from the unit.

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## CONFLICT OF INTERESTS

The authors declare there is no conflict of interests.

## AUTHORS' CONTRIBUTION

**CCS:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Supervision, Validation, Visualization, Writing — original draft, Writing — review & editing. **MBF:** Data curation, Formal analysis, Investigation, Validation, Visualization, Writing — original draft, Writing — review & editing. **LV:** Data curation, Formal analysis, Investigation, Validation, Visualization, Writing — original draft, Writing — review & editing. **PT:** Conceptualization, Data curation, Formal analysis, Methodology, Supervision, Validation, Visualization, Writing — original draft, Writing — review & editing. **CFC:** Conceptualization, Data curation, Formal analysis, Methodology, Software, Supervision, Validation, Visualization, Writing — original draft, Writing — review & editing. **EMFS:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Supervision Validation, Visualization, Writing — original draft, Writing — review & editing.

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# BEST PRACTICES FOR REPROCESSING HEALTH PRODUCTS

## *Melhores práticas de reprocessamento de produtos para saúde*

## *Mejores prácticas para reprocesar productos sanitarios*

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**ABSTRACT: Objective:** To know the scientific production on the practices for reprocessing hospital materials. **Method:** This is an integrative review, conducted in August and September 2019 in the following nursing databases: Latin American and Caribbean Health Sciences Literature, Cumulative Index to Nursing and Allied Health Literature, Medical Literature Analysis and Retrieval System Online, and Scientific Electronic Library Online. We used descriptors in Portuguese, Spanish, and English, with a five-year time frame. Results were presented in a table, and the corpus for analysis in categories, according to the deductive method. **Results:** We retrieved 1,207 articles and selected six of them based on the eligibility criteria. The most frequent designs were quantitative studies in Portuguese, and three thematic categories were identified: cleaning process of healthcare products; packaging and sterilization of healthcare products; storage of healthcare products. **Conclusions:** The main procedures performed at each stage of material reprocessing were determined and should be described in institutional protocols. We highlight the lack of research on the reprocessing of healthcare products with a higher level of evidence.
**Keywords:** Hospitals. Equipment and supplies, hospital. Sterilization.

**RESUMO: Objetivo:** Conhecer a produção científica sobre as práticas de reprocessamento de materiais hospitalares. **Método:** Revisão integrativa, realizada em agosto e setembro de 2019 nas bases de dados da enfermagem, Literatura Latino-americana e do Caribe em Ciências da Saúde, Cumulative Index to Nursing and Allied Health Literature, Medical Literature Analysis and Retrieval System Online *e* Scientific Electronic Library Online. Utilizaram-se descritores em português, espanhol e inglês, com recorte temporal de cinco anos. Os resultados foram apresentados em quadro, e o *corpus* de análise em categorias, conforme o método dedutivo. **Resultados:** Foram identificados 1.207 artigos e selecionados seis deles em conformidade com os critérios de elegibilidade. Os delineamentos mais frequentes eram estudos quantitativos, no idioma português, configurando três categorias temáticas: processo de limpeza dos produtos para saúde; acondicionamento e esterilização dos produtos para saúde; armazenamento dos produtos para saúde. **Conclusão:** Foram evidenciados os principais procedimentos realizados em cada etapa do reprocessamento de materiais, que deve ser descrita em protocolos institucionais. Destaca-se a lacuna de pesquisas com nível de evidência, voltadas para o reprocessamento de produtos para saúde.
**Palavras-chave:** Hospitais. Equipamentos e provisões hospitalares. Esterilização.

**RESUMEN: Objetivo:** Conocer la producción científica sobre las prácticas de reprocesamiento de materiales hospitalarios. **Método:** Revisión integrativa, realizada de agosto a septiembre de 2019, en bases de datos especializadas en Enfermería, Literatura Latinoamericana y Caribeña en Ciencias de la Salud, *Cumulative Index to Nursing and Allied*, *Medical Literature Analysis and Retrieval System Online* y *Scientific Electronic Library Online*. Se utilizaron descriptores en portugués, español e inglés, con un marco de tiempo de cinco años. Los resultados se presentaron en una tabla y el corpus de análisis en categorías, según el método deductivo. **Resultados:** Se identificaron 1.207 artículos y se seleccionaron seis de ellos, de acuerdo con los criterios de elegibilidad. Los diseños más frecuentes fueron estudios cuantitativos, en portugués, configurando tres categorías temáticas: proceso de limpieza de productos sanitarios; envasado y esterilización de productos sanitarios; almacenamiento de productos sanitarios. **Conclusión:** Se destacaron los principales procedimientos realizados en cada etapa del reprocesamiento del material, los cuales deben ser descritos en los protocolos institucionales. Se destaca la brecha en la investigación con nivel de evidencia, enfocada al reprocesamiento de productos sanitarios.
**Palabras clave:** Hospitales. Equipos y suministros de hospitales. Esterilización.

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## INTRODUCTION

The Sterile Processing Department (SPD) is responsible for processing healthcare products (HP), a complex and essential activity performed following sequential stages that require operational and technological capability[1]. SPD is an important sector of health facilities, associated with the quality of the services provided and patient safety[2], although, in many circumstances, its real value is not recognized.

Sterilization acts directly in the battle against healthcare-associated infections and therefore affects the quality of care and the safety of patients and professionals. Any failure during the reprocessing of HPs might compromise their sterility and lead to adverse events during and after hospitalization[2,3].

Thus, the reprocessing of HPs consists of a systematic and methodological set of actions taken to ensure these products are suitable for safe use. Reprocessing steps include: pre-cleaning, reception, cleaning, drying, evaluation of the integrity and functionality of the instrument, preparation/packaging, disinfection or sterilization, storage, and distribution to the consumer units[4,5].

To guarantee quality in all stages, the SPD must have a proper infrastructure in line with the current legislation and best scientific practices. Therefore, these steps must be strictly followed to ensure a contaminant-free HP[6].

In Brazil, the Collegiate Board Resolution No. 15/2012 established the requirements for best HP processing practices and highlighted the need for an operational quality management system to document and control the processes. In addition, it discusses the validation of each reprocessing step, demanding their description in the Standard Operating Procedures, manuals, and protocols since they classify, standardize, and validate the work processes[7].

From this perspective, the need to analyze and compile scientific production in this context becomes clear so that sterilization practices can be based on the best evidence, given the lack of a high level of evidence in this area.

## OBJECTIVE

To know the scientific production on the practices for reprocessing hospital HPs.

## METHOD

This is an integrative review developed in five stages: establishing the problem; selecting the sample and defining the inclusion criteria; characterizing the studies; analyzing the results; presenting and discussing the findings[8].

The guiding research question was structured based on the issue presented: What is the scientific evidence for best practices related to reprocessing hospital HPs in the SPD?

Searches were carried out in August and September 2019 in journals indexed in the electronic resources: Nursing Database (*Base de Dados em Enfermagem* — BDEnf), Latin American and Caribbean Health Sciences Literature (*Literatura Latino-Americana e do Caribe em Ciências da Saúde* — LILACS), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Medical Literature Analysis and Retrieval System Online (PubMed/MEDLINE), and Scientific Electronic Library Online (SciELO), through search strategies structured specifically for each database, with the help of a librarian specialized in this type of research.

In order to define the search strategy, we used keywords in English, Portuguese, and Spanish: Equipment and Supplies, Hospital OR Equipment and Supplies, Hospital OR Hospital Equipment and Supplies OR Hospital Supplies OR Hospital Supply OR Hospital Equipment OR Materials Management, Hospital OR Materials Management, Hospital OR Hospital Material Management OR Storeroom OR Storerooms OR Materials AND Sterilization.

The inclusion criteria consisted of original articles in English, Spanish, and Portuguese. The exclusion criteria were editorials, dissertations, theses, opinion articles, experience reports, and comments. The filters used were: articles with their full text available for free; written in English, Spanish, and Portuguese; published in prior five years (between January 2014 and July 2019).

In the first step of the eligibility process, the references were retrieved with only their titles and abstracts. The second step involved reading the studies in full. The third consisted of a new reading and justification for the selection of the articles comprising the sample.

In the inclusion stage, one of the researchers compiled the articles in sequential order in a Microsoft Word document. The topics of interest recorded were: author, study title, database, year of publication, objective, methods, and results.

The investigation of the most frequent themes of the articles included in this review was based on the analysis of

deductive content, starting with predefined categories, in line with the steps of the HP reprocessing procedure.

We underline that copyright principles have been respected throughout the process.

## RESULTS

A total of 1,207 articles were identified, of which 1,172 comprised the corpus of analysis after the removal of 35 duplicates. Six articles met the criteria for data selection, extraction, and summarization, comprising the study sample. Figure 1 shows the steps of the article selection process. Chart 1 summarizes the six articles selected for the corpus for analysis of this review.

Regarding language, four articles were published in Portuguese (Brazil), one in English (India), and one in Spanish (Spain). The year with the most publications was 2017, with three articles. The quantitative method was the most used (five studies).

With respect to the subjects of the studies, two articles addressed aspects related to cleaning; two investigated packaging and the sterilization process; two focused on HP storage.

## DISCUSSION

Investigation of the most frequent themes of the articles included in this review was based on the structuring of three

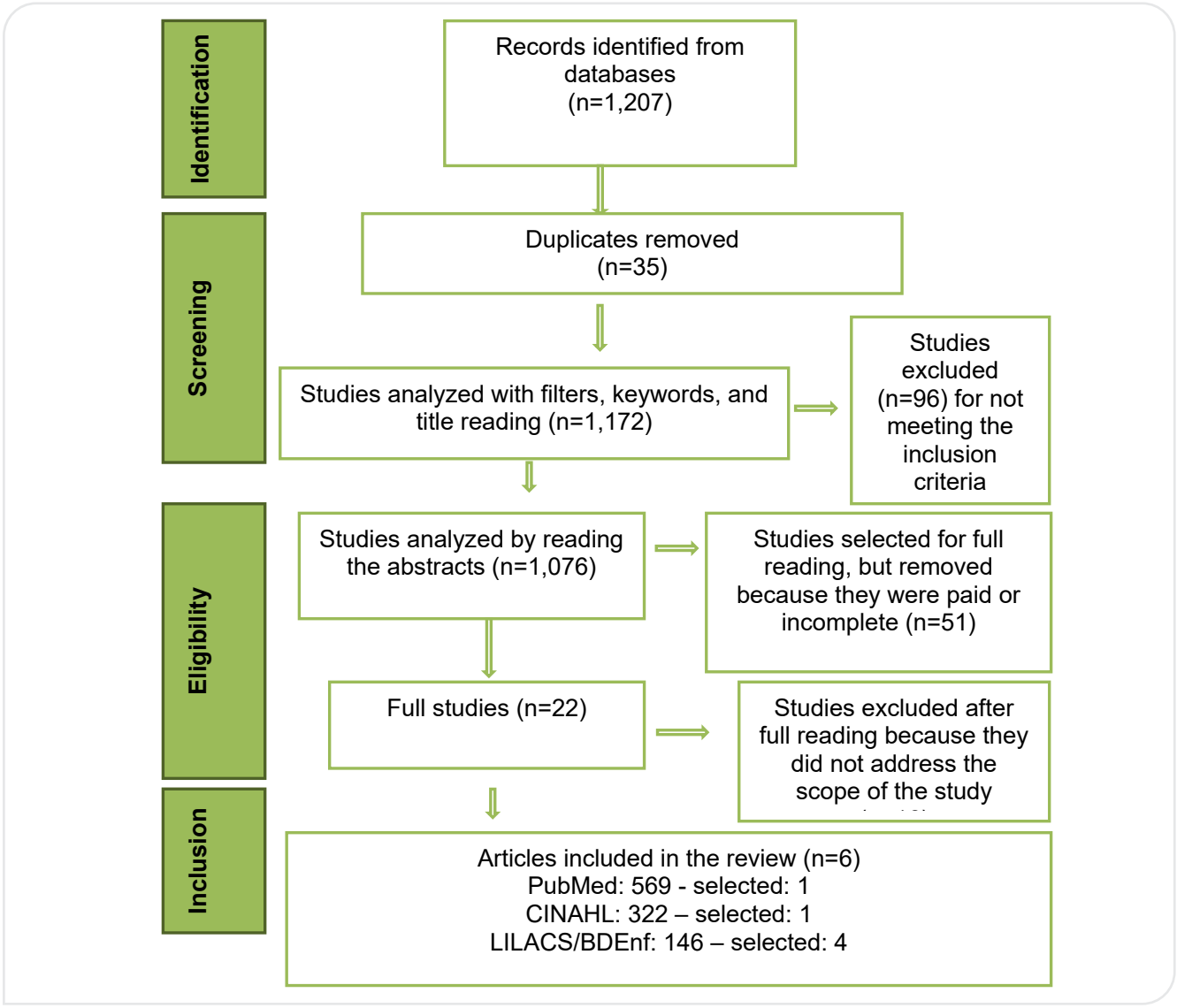


**Figure 1.** Steps of each process and selection of articles that comprised the sample.

**Chart 1.** Article characterization according to authors, title, journal, year of publication, database, objective, method, and results.

| Authors and title | Journal, year, and database | Objective | Method | Results |
|---|---|---|---|---|
| Madeira et al.[2] Processing of health products in material and sterilization centers | Revista SOBECC; 2015 LILACS/ BDEnf | To analyze the processing of health products in Material and Sterilization Centers (MSC) in Health Care Establishments of the city of Teresina – PI. | Cross-sectional observational study. | For the proper processing of healthcare products, the sector should have: a clean and bright environment, unidirectional product flow, and autoclave chamber filled with 80% load. Inadequacies identified: lack of identification label on packages, no use of Bowie & Dick or class V or VI chemical indicators, no monitoring of physical and biological parameters, and no documentation archive. |
| Alvim et al.[3] Monitoring of health products cleaning with adenosine triphosphate testing | Revista SOBECC; 2019 LILACS/ BDEnf | Evaluating the cleaning quality of health products by using the surface adenosine triphosphate (ATP) test in a Central Sterile Services Department. | Quantitative, descriptive, cross-sectional study. | Adenosine triphosphate tests are not specific enough to ensure the quality of the cleaning of healthcare products, but they suggest the lack of residues in all instruments. |
| Mussel et al.[5] Storage of health products in hospital sterilization centers | Revista Enfermagem em Foco; 2017 LILACS/ BDEnf | Describe storage conditions for sterile products in Sterilized Material Centers of large hospitals. | Quantitative descriptive study. | Packaging of healthcare products is made in closed cabinets (60%), with a washable surface (100%), and humidity and temperature control. All sterile processing departments reported controlling the expiration date of products, and 80% of them transported materials in exclusive carts. 30% of the facilities did not have an exclusive physical area for sterile products. |
| Díaz et al.[9] Validation of manual and automated washing procedures for surgical instruments prior to sterilization | Metas de Enfermería; 2018 CINAHL | To validate the manual and automated cleaning process of surgical instruments prior to sterilization in the sterilization unit of a university hospital. | Quantitative, descriptive, cross-sectional, prospective study. | 134 residual control tests were performed in automated washing; 56% were valid, while 44% of controls had visible remains of residual contamination, mainly due to mechanical problems during the procedure. A total of 85 protein tests were analyzed to validate manual cleaning. No protein was detected in the material before sterilization in 88.3% of cases. |
| Mendonça et al.[17] Quality indicators of health product processing in steam autoclaves | Revista de Enfermagem UFPE Online; 2017 LILACS-BDEnf | To analyze quality indicators of health product processing using saturated steam under pressure in Material Sterilization Centers. | Quantitative descriptive study. | Most (83.3%) of the six hospitals in the study performed annual reviews of the standards and operational routines of each stage of healthcare product processing and had appropriate physical space for cleaning, preparation, and storage, as well as a physical barrier between areas. The findings evidence the need to invest in aspects related to the improvement of processing for health. |
| Basu[18] Reason behind wet pack after steam sterilization and its consequences: an overview from Central Sterile Supply Department of a cancer center in eastern India | Science; 2017 PubMed | To analyze the reasons that cause wet packs after sterilization and its consequences. | Qualitative descriptive study | The causes identified for wet packs are: poor quality of the packaging material and of the steam, improper packaging and autoclave loading technique. Measures to prevent wet packs include: using good-quality water (steam), periodically performing autoclave maintenance, avoiding overloading the sterilizer, allowing enough time to cool the material after sterilization, using good-quality packages, maintaining adequate temperature and humidity during and after the process. |

categories: cleaning process of HPs, packaging and sterilization of HPs, and storage of HPs.

## Category 1: cleaning process of health products

This category covers aspects related to the cleaning process, which includes manual and automated cleaning steps, followed by tests to validate these steps, with chemical surface tests[3,9].

Cleaning consists of removing organic and inorganic residues from the HP surface, dents, joints, lumens, and other internal spaces to maximize the reduction of microbial load. It can be done manually with water, standard detergents, and cleaning supplies suitable for the material. Automated cleaning, such as high-pressure cleaning, washer disinfectors, or ultrasonic cleaners, provides agility, standardization, monitoring, and process validation, in addition to decreasing the workers' exposure to biological risks. However, we emphasize that these devices and materials should be cleaned beforehand to reduce organic and inorganic matter as much as possible[1,10,11].

When workers do not pay attention to the importance of the cleaning process, doing it ineffectively, the residues that cumulate on the materials are not entirely removed and may form barriers or biofilms that protect the microorganisms[12]. Moreover, all stages of this process are influenced by the use of appropriate accessories, the action of detergents, water quality, work environment, trained staff, and evidence-based protocols[13].

This aspect leads us to reflect on the matter and raises concerns over the adequate pre-wash of HPs since this process is crucial for the effectiveness of the others.

From this perspective, the articles listed in this review recommend using the adenosine triphosphate (ATP) protein test[3]. Protein tests allow the effective validation of the cleaning process, both manual and automated, because they determine the levels of organic matter in HPs and assess parameters beyond visual cleaning, ensuring safety to the process[14]. After this validation and the implementation of corrective measures, we can achieve excellence in HP reprocessing[9].

Yet, the Brazilian legislation does not specify the best chemical test for cleaning validation. Some investigations indicate that the ATP-bioluminescence assay can be an effective method for cleaning validation, providing fast and objective results[15,16].

In one of the studies in this review, relative light unit values were below 204 RLU when considering all instruments (cannulated or not) and 250 RLU in cannulated instruments[3]. Corroborating this finding, a study pointed out that ATP concentrations below 500 RLU are acceptable for characterization of clean surfaces[16].

Of note, the proper cleaning process validated through ATP testing is extremely important for reducing adverse events. ATP is considered a strong control variable for cleaning monitoring, capable of confirming instrument decontamination, and is regarded as a best practice that should be disseminated among health services[6].

Therefore, cleaning and its validation steps should follow protocols based on scientific studies with a high level of evidence[3].

## Category 2: packaging and sterilization of health products

After the cleaning and inspection processes, HPs must be adequately packed to be effectively sterilized. Thus, this category covers aspects related to these steps and lists processes relevant to the implementation of best reprocessing practices. One of these processes is validating the sterilization, particularly regarding wet packs and the appropriate ways of preventing this condition, in addition to the adoption of quality indicators[5,17,18].

After cleaning, the HP should be inspected to detect organic and inorganic matter, which interferes with sterilizing agents and causes adverse events in patients. To that end, the use of magnifying lenses is recommended to assist in the examination[1].

The HP must then be dry for packaging and placed in validated and standardized packages. In turn, the receptacle must ensure integrity, resistance, safety, and atoxicity, allow thermal sealing, impermeability, and compatibility with the sterilization method, and guarantee sterility. These packages must follow the standards recommended by regulatory bodies and have product identification labels in the external area[2]. The available barriers that meet these criteria include: Spunbond Meltblown Spunbond (SMS), medical paper, Tyvek, and metal boxes, trays, and containers[1,19].

Next, the product is sterilized to destroy micro-organisms in such a way that they are no longer detectable in the standard culture medium, that is, the probability of survival of these micro-organisms must be less than 1:1,000,000[1].

Several sterilization methods are available, depending on the HP. For critical heat-resistant HPs, the ideal method is autoclave (pressurized saturated steam). In the case of heat-sensitive items, the process is more complex[4].

The control of the sterilization process relies on the type and safety of the equipment, the nature of the product to be sterilized, packaging compatible with the sterilization method, the sterilization method itself, proper loading and unloading. Preventive maintenance and performance assessment should be done and documented every year in all SPD machinery[20].

Tests to validate sterilization must be performed according to load release monitoring methods by process indicators such as chemical, biological, and physical controls. Chemical indicators, like Bowie & Dick (class II indicator), should be used to check the vacuum pump (air removal) in the first cycle of the day. Class V and VI chemical indicators are part of routine monitoring for sterilization cycle validation and load release. Biological tests are performed in the first load of the day and in implant loads. Physical tests are generated by the autoclave. These parameters should be manually or digitally controlled and archived for five years[1,2,7].

Using autoclave tape (class I indicator) externally in all packages is also recommended, as it differentiates processed from unprocessed products, with the advantages of having low cost and allowing immediate reading[1,21].

We underline that any residual moisture inside or outside a sterile material results in wet packs. This residual moisture can create a potential route for micro-organisms to move from the external to the internal environment and possibly contaminate products after sterilization. One of its causes is the poor quality of packaging materials (materials must be packed in such a way that steam and air can circulate in the package but be impervious to bacteria). Large extensions of rigid HPs, low load distribution, and poor packaging techniques should be avoided[18].

The following factors must also be assessed: autoclave steam quality, water quality, sterilization cycle duration, autoclave vacuum pump, faulty planning, poor sterilizer conditions, drying time, vacuum pump operation, vacuum drain cleanliness, presence of leaks, and quality of the generator/boiler. Lack of preventive sterilizer maintenance and inadequate inventory management system also compromise the effective sterilization process[18].

We also stress the importance of the proper HP organization in the autoclave, placing: concave-convex instruments in the vertical or inclined position; products like jugs and buckets with the opening facing down; packages inside the autoclave in the vertical position, with space between them; larger packages on the bottom of the chamber and smaller ones on the top. We should also pay attention not to use more than 80% of the autoclave capacity and properly record the temperature, pressure, and time parameters of all autoclave cycles[17].

## Category 3: storage of health products

After sterilization, one of the last steps of HP processing is storage. Proper storage is associated with related care to avoid non-conformities linked to environment and ambiance and is especially covered in two articles of this review[1,5].

The entire HP sterility may be compromised if the storage does not ensure its maintenance with actions like: storage in drawers, package stacking, package folds, non-restricted location, excessive handling, inefficient cleaning of the site, lack of temperature and humidity control, poor product distribution, lack of donning and/or inadequate donning, lack of air conditioning, presence of sunlight, among others[1,7,22]. Therefore, the following aspects are imperative to maintain optimum storage conditions for the sterile product: organization, cleaning, and humidity and temperature control of the environment[23,24].

Storage site dimensions should be based on the number of beds in the facility. The site must be centralized, exclusive, and restricted. The minimum distance recommended from the storage shelves is 45 cm to the ceiling, 20 cm to the floor, 5 cm to the wall, and 60 cm between shelves[5,7].

The storage site should be cleaned with sponges and 70% alcohol at least once a week or whenever it is dirty. A specific cart is also required to transport the sterile HP in order to preserve its sterility[5].

Another important aspect is the sudden variation in relative humidity and temperature, which may influence the preservation of packages, interfering with their resistance. The literature disagrees when it comes to temperature and humidity ranges, for instance: temperature from 18 to 25°C and humidity between 30 and 60%[1]; temperature between 18 and 24°C and humidity below 70%[19]; temperature up to 24°C and humidity between 30 and 70%[22]. Adjustments and adaptations are allowed according to regional climate differences and the storage site infrastructure.

The limitations of the study include not having articles about validation methods for automated cleaning equipment and on the use of detergents in the cleaning process of HPs.

As for nursing contributions, this research discusses best practices in HP sterilization processes and can serve

as a guide for the work of nursing professionals on their SPD routine.

## CONCLUSION

The study reached the objective of knowing the scientific production on the practice for reprocessing hospital HPs. In the cleaning process, we identified the ATP protein test as a validation method for both manual and automated cleaning. In the packaging and sterilization process, we discussed the importance of visually inspecting the materials during cleaning and encasing them in validated packages. In sterilization, we explored the proper loading, using chemical, physical, and biological indicators to validate the sterilization cycle. In addition, the wet pack, which represents a contamination risk, should have its cause identified and fixed. In the storage process, we highlighted the importance of adequate infrastructure and safe handling of sterile materials, as well as of keeping the humidity and temperature of the site within safe parameters. These steps should be described in institutional protocols.

This study detected a gap in validation methods for automated cleaning equipment (ultrasonic cleaners and washer disinfectors), its validation tests, and the use of detergents. We concluded that we lack research with a high level of evidence aimed at HP processing.

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None.

## CONFLICT OF INTERESTS

The authors declare there is no conflict of interests.

## AUTHORS' CONTRIBUTION

**ABC:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Visualization, Writing — original draft, Writing — review & editing. **JBRG:** Conceptualization, Formal analysis, Investigation, Methodology, Project management, Supervision, Validation, Visualization, Writing — original draft, Writing — review & editing. **LFS:** Validation, Visualization, Writing — original draft, Writing — review & editing. **LNA:** Validation, Visualization, Writing — original draft, Writing — review & editing. **AGA:** Validation, Visualization, Writing — original draft, Writing — review & editing. **RW:** Validation, Visualization, Writing — original draft, Writing — review & editing.

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# PRE- AND POSTOPERATIVE NURSING VISITS: COMPREHENSIVE REVIEW

## *Visitas de enfermagem pré e pós-operatórias: revisão integrativa*

## *Visitas de enfermería pre y postoperatorias: revisión integrativa*

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**ABSTRACT: Objective:** To analyze the scientific production about pre- and postoperative nursing visits. **Method:** Comprehensive review with searches in the Virtual Health Library, Web of Science, SCOPUS, LILACS, CINAHL, PubMed and SciELO databases. The research question was: "what is the focus of scientific articles that discuss pre- and postoperative nursing visits?". **Results:** Nine recently published articles were identified, three of which were in international journals and six in Brazilian ones. Eight articles focused on the preoperative visit and only one on the postoperative visit. Most studies were classified as having a low level of evidence and two as having a moderate level. **Conclusion:** Studies on nursing visits are more focused on preoperative visits, finding that they reduce the anxiety of surgical patients and emphasizing that, when not performed, they directly worsen the quality of nursing care. Difficulties in making nursing visits are found in some services, either due to the high demand for care and administrative activities or due to the lack of knowledge of nurses and human resources.
**Keywords:** Perioperative nursing. Nursing care. Perioperative period. Perioperative care. Nursing process.

**RESUMO: Objetivo:** Analisar a produção científica acerca das visitas de Enfermagem pré e pós-operatórias. **Método:** Revisão integrativa, com buscas nas bases de dados da Biblioteca Virtual em Saúde, Web of Science, SCOPUS, LILACS, CINAHL, PubMed e SciELO. A pergunta de pesquisa foi: "qual é o enfoque dos artigos científicos que discutem sobre as visitas de Enfermagem pré e pós-operatórias?". **Resultados:** Identificaram-se nove artigos de publicações recentes, sendo três produzidos e publicados em periódicos internacionais e seis em nacionais. Oito artigos enfocaram a visita pré-operatória e apenas um a pós-operatória. A maioria dos estudos foi classificada com fraco nível de evidência e dois com moderada. **Conclusão:** A produção científica direciona-se mais para as visitas de Enfermagem no pré-operatório, afirmando que essas diminuem a ansiedade dos pacientes cirúrgicos e ressaltando que, quando não realizadas, interferem diretamente na qualidade da assistência de Enfermagem. Encontram-se, em alguns serviços, dificuldades para a realização das visitas de Enfermagem, seja pela alta demanda de atividades assistenciais e administrativas, seja pela falta de conhecimento dos enfermeiros e de recursos humanos.
**Palavras-chave:** Enfermagem perioperatória. Cuidados de enfermagem. Período perioperatório. Assistência perioperatória. Processo de enfermagem.

**RESUMEN: Objetivo:** Analizar la producción científica sobre las visitas de enfermería pre y postoperatorias. **Método:** Revisión integradora, con búsquedas en las bases de datos Biblioteca Virtual en Salud, Web of Science, SCOPUS, LILACS, CINAHL, PubMed, SciELO. La pregunta de investigación fue: ¿Cuál es el enfoque de los artículos científicos que discuten las visitas de enfermería pre y posoperatorias? **Resultados:** Se identificaron nueve artículos de publicaciones recientes, tres de los cuales fueron producidos y publicados en revistas internacionales y seis nacionales. Ocho artículos se centraron en la visita preoperatoria y solo uno en la visita posoperatoria. La mayoría de los estudios se clasificaron como con un nivel de evidencia débil y dos como moderados. **Conclusión:** La producción científica está más dirigida a las visitas de enfermería en el período preoperatorio y afirman que esto reduce la ansiedad de los pacientes quirúrgicos y, cuando no se realiza, interfiere directamente con la calidad de los cuidados de enfermería. En algunos servicios se encuentran dificultades para realizar las visitas de enfermería, debido a la alta demanda de actividades asistenciales y administrativas, el desconocimiento de las enfermeras y la falta de recursos humanos.
**Palabras clave:** Enfermería perioperatoria. Atención de enfermería. Periodo perioperatorio. Atención perioperativa. Proceso de enfermería.

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## INTRODUCTION

Resolution No. 358 of the Federal Nursing Council of Brazil (COFEn), published in 2009, considers that the Systematization of Nursing Care (SAE) structures professional work in terms of method, personnel and instruments, making the Nursing Process (NP) possible[1]. This resolution determines that all Brazilian environments, whether public or private, that provide professional nursing care must carry out the NP in a deliberate and systematic way, and it is up to the nurse to carry it out and evaluate it[1].

SAE enables nurses to put their technical-scientific and humanistic knowledge into practice, contributing to the quality of nursing care[2]. Likewise, perioperative nurses perform NP through the Systematization of Perioperative Nursing Care (SAEP), seeking to satisfy the needs of the surgical patient. Based on comprehensive, continuous, participatory, individualized, documented and evaluated care throughout the perioperative period, SAEP covers the immediate preoperative period (24 hours before surgery), intraoperative and immediate postoperative period (24 hours after surgery)[2].

SAEP is divided into five phases: preoperative nursing visit; perioperative care planning; implementation of care; assessment of care, postoperative nursing visit; and reformulation of the care to be planned[2]. Its implementation allows the perioperative nurse to get closer to the patient, developing an individualized care plan based on scientific knowledge[3].

The preoperative nursing visit aims to help the patient (and their family) to understand and prepare for the anesthetic-surgical treatment, identifying and analyzing individual needs, reducing anxiety, contributing to their recovery[2,4]. Adequate preparation of the patient for the anesthetic-surgical procedure is essential for the success of the procedure and for a quick return to daily activities[5]. During the visit, the nurse performs a general physical examination of the patient, advising them on fasting, removal of dental prostheses, contact lenses, jewelry and nail polish, prior body/oral hygiene and the surgical environment, given that this is a closed, complex unit, with several specificities, unlike other hospital environments, where the patient will be distant and isolated from their companion[2]. The Surgical Center (SC) has a large technological and bureaucratic apparatus, in which care often ends up being more mechanical and less humanized, so the nursing team must be careful so that the patient is not just one more client to be treated[6]. The information provided by the perioperative nurse to the patients must be transmitted in a clear and objective way, according to their level of education and cognitive understanding, as well as that of their family members/companions, making sure that their doubts have been clarified[7].

Dialogue and listening positively influence the perception that patients have in relation to the care provided in the SC, in addition to humanized, holistic and safe care[8].

The World Health Organization (WHO) defines patient education as a learning experience, which aims to support people and communities in improving their health, expanding their knowledge and influencing their attitudes[9]. Technological resources can be used for health education that facilitate the understanding of care learning[10]. The technologies used are varied, and hypermedia and games, serial albums and booklets, and even printed materials can be used[11].

For the education of the surgical patient in the preoperative period, pictures of the various places where the patient will go during the perioperative period can be used, such as: ward, SC and postanesthesia care unit (PACU)[7]. The use of this resource facilitates the teaching-learning process in preoperative guidelines, helping to stimulate self-care and reduce anxiety. Audiovisual education performed individually in the preoperative period reduces the level of anxiety and positively affects vital signs, reducing postoperative complications[7,12]. This benefit can also be achieved with the use of videos[13]. Therefore, patient education reduces anxiety and depression, consequently reducing the intensity of pain in the postoperative period[14], as this period encompasses several factors (psychological, physical and emotional) that can influence recovery[15].

The postoperative nursing visit must be performed by the perioperative nurse to assess the care provided and verify the results of care for the evolution of the patients, allowing the elaboration of a care plan until discharge[2]. In Brazil, most hospital SCs still do not adopt a formal care model to guide nurses' actions, so the care provided does not follow a pre-established plan[16]. Generally, perioperative nursing care is performed in an organized manner, but it is not documented, making it difficult to assure its continuity and not giving visibility to the work performed by the nursing team[16].

The implementation of PACU within the SC is often hampered by the lack of human resources, lack of understanding of the importance that nurses have in patient care and nurses' knowledge about the physical examination. Even so, most nurses are committed to the realization of the PACU[17].

## OBJECTIVE

To analyze the scientific production in pre- and postoperative nursing visits.

## METHOD

This was a comprehensive literature review, a method used in evidence-based practice and widely applied in the field of nursing[18]. The purpose of this method is to achieve an in-depth understanding of a given subject on the basis of previous studies[19].

This study included six steps:

1. identification of the subject and elaboration of the research question;
2. establishment of the inclusion and exclusion criteria;
3. identification of the selected studies;
4. classification of the selected studies;
5. analysis and interpretation of the results;
6. presentation of the results[20].

The guiding question of the defined research was: "what is the focus of the scientific articles that discuss pre- and postoperative nursing visits?".

The inclusion criteria were: scientific articles published in the last 10 years, in Portuguese, English or Spanish, with an approach on pre- and postoperative nursing visits. Articles that did not address pre- and postoperative nursing visits, letters, dissertations and theses were considered exclusion criteria.

The electronic databases used were: PubMed, CINAHL, LILACS, SciELO, Web of Science and SCOPUS. The searches were carried out in January 2021, using a controlled descriptor (nursing), available in Descriptors in Health Sciences (DeCS/MeSH), and uncontrolled descriptors (perioperative nursing visit, preoperative nursing visit, postoperative nursing visit, nursing visit, perioperative visit, preoperative visit and postoperative visit). They were combined with each other, using the Boolean operators AND and OR, as shown in Chart 1.

To select the articles that met the inclusion criteria, the repeated articles were initially excluded; later, the selection was carried out by reading the title, after reading the abstract and, finally, reading the article in full. Initially, 209 articles were selected, and articles were excluded in the following order: 42 for being repeated, 129 after reading the title; 22 after reading the abstract and 7 after reading the article in full. Therefore, the final selection sample consisted of nine articles. The summary of the searches in the databases for the selection of articles is described in Chart 2.

The Rating System for the Hierarchy of Evidence for Intervention/Treatment Questions scale was used to classify the level of evidence (LE):

I. systematic review or meta-analysis of randomized clinical trials;
II. randomized clinical trials;
III. nonrandomized clinical trials;
IV. case-control and cohort studies;
V. systematic reviews of descriptive and qualitative studies;
VI. descriptive or qualitative studies;
VII. opinion of authorities and/or specialist reports[21].

**Chart 1.** Search terms used according to databases.

| Database | Search term |
|---|---|
| PubMed | *("perioperative nursing visit" OR "preoperative nursing visit" OR "postoperative nursing visit" OR "nursing visit" OR "perioperative visit" OR "preoperative visit" OR "postoperative visit") AND nursing* |
| CINAHL | *("perioperative nursing visit" OR "preoperative nursing visit" OR "postoperative nursing visit" OR "nursing visit" OR "perioperative visit" OR "preoperative visit" OR "postoperative visit") AND nursing* |
| LILACS | *("perioperative nursing visit" OR "preoperative nursing visit" OR "postoperative nursing visit" OR "nursing visit" OR "perioperative visit" OR "preoperative visit" OR "postoperative visit") AND nursing* |
| SciELO | *("perioperative nursing visit" OR "preoperative nursing visit" OR "postoperative nursing visit" OR "nursing visit" OR "perioperative visit" OR "preoperative visit" OR "postoperative visit") AND nursing* |
| Web of Science | *("perioperative nursing visit" OR "preoperative nursing visit" OR "postoperative nursing visit" OR "nursing visit" OR "perioperative visit" OR "preoperative visit" OR "postoperative visit") AND nursing* |
| SCOPUS | *("perioperative nursing visit" OR "preoperative nursing visit" OR "postoperative nursing visit" OR "nursing visit" OR "perioperative visit" OR "preoperative visit" OR "postoperative visit") AND nursing* |

**Chart 2.** Overview of database searches.

| Database | Articles identified in the search | Repeated | Excluded after reading the title | Excluded after reading the abstract | Excluded after reading the whole paper | Selected articles |
|---|---|---|---|---|---|---|
| Web of Science | 19 | 0 | 14 | 3 | 1 | 1 |
| SCOPUS | 51 | 14 | 29 | 7 | 1 | 0 |
| LILACS | 18 | 0 | 8 | 2 | 3 | 5 |
| CINAHL | 15 | 5 | 8 | 0 | 0 | 2 |
| PubMed | 100 | 18 | 69 | 10 | 2 | 1 |
| SCIELO | 6 | 5 | 1 | 0 | 0 | 0 |
| TOTAL | 209 | 42 | 129 | 22 | 7 | 09 |

## RESULTS

Regarding the characteristics of the nine articles analyzed, it was found that the publications were relatively recent, with three articles in 2014, two in 2013, two in 2020, and only one in 2016 and 2018. Three articles were published in international journals and six in national journals: Medicine Journal; Scandinavian Journal of Caring Sciences; Journal of Caring Sciences; Revista de Enfermagem da Universidade Federal de Santa Maria (UFSM. Nursing Journal of the Federal University of Santa Maria); Revista da Sociedade de Cardiologia do Estado de São Paulo (SOCESP); Journal of the Society of Cardiology of the State of São Paulo; Revista da Associação Brasileira de Enfermeiros de Centro Cirúrgico, Recuperação Anestésica e Centro de Material e Esterilização (SOBECC, Journal of the Brazilian Association of Surgical Center Nurses, Anesthetic Recovery and Material and Sterilization Center); Revista de Pesquisa Cuidado é Fundamental Online (Research Journal Care is Essential Online); Revista Brasileira de Enfermagem (REBEn, Brazilian Journal of Nursing); and Revista de Enfermagem da Universidade Federal de Pernambuco (UFPE, Nursing Journal of the Federal University of Pernambuco Online) (Chart 3).

As can be seen in Chart 3, most studies (5) exhibited LE VI, while the others showed LEs II (1), III (1), V (1) and VII (1).

## DISCUSSION

Of the nine articles analyzed, eight[22-25,27-30] focused on the nurse's visit in the preoperative period and one[26] in the postoperative period.

In relation to the preoperative period, anxiety is a nursing diagnosis frequently identified in the preoperative period of surgical patients[25]. Most studies have shown that the preoperative nursing visit is effective in reducing the anxiety of surgical patients[2-25,27,28,30]. Studies[23,25] state that during the nurse's visit, based on health education, it is possible to resolve the patient's doubts and acquire information about the anesthetic-surgical procedure, reducing stress and the level of anxiety, making the process more tranquil. The nurse has the role of welcoming and bonding with the patient, experiencing a positive interaction, based on active listening and dialogue during the visit[23].

It is observed in the preoperative visit[22-24,27-29] that, in addition to the improvement in the quality of care offered in the operative preparation, the reduction of anxious symptoms has been shown to be beneficial in the prevention of complications for the surgical patient. Thus, the preoperative visit can offer a better surgical experience also in the postoperative period, especially in the short term[22,28].

Two articles[26,27] highlight the importance of the visit as a step in the PACU, for the nursing work process and qualification of care, allowing more scientific assistance, guaranteeing universality of language, control of records and better patient assessment[26,27]. The preoperative visit is an activity included in the PACU, and when not performed, it weakens the process, directly interfering with the quality of nursing care[22].

In the context of pediatrics, one article[30] focused on the importance of offering toys to children and providing parents with detailed information about their children's treatment during the preoperative visit. These measures reduce the anxiety of children undergoing surgery and are effective for better understanding by parents during the treatment process[30].

There was a lack of studies related to the postoperative nursing visit. Only one study[26] considered this attribution to

**Chart 3.** Summary of the articles selected as the study sample.

| Authors<br>Year of publication<br>Site of study | Objective | Method<br>Level of evidence | Conclusion of articles |
|---|---|---|---|
| Xu et al.[22]<br>2020<br>China | To investigate the influence of nursing visits against preoperative anxiety and postoperative complications in patients submitted to laparoscopic cholecystectomy. | Randomized clinical trial<br>LE II | The preoperative nursing visit can decrease anxiety and postoperative complications in patients submitted to Videolaparoscopic choleocystectomy. |
| D'Eça Jr. et al.[23]<br>2020<br>Brazil | To evaluate the quality of the data from the checklist of the preoperative nursing visit in a university hospital in northeastern Brazil. | Cross-sectional<br>LE VI | The quality of the data on the preoperative visit checklist is satisfactory, as incompleteness is low and the information is robust and reliable. |
| Ribeiro and Silva.[24]<br>2018<br>Brazil | To discuss through the literature about anxiety in the preoperative period of cardiac surgeries and the importance of nursing in this process. | Review of the literature<br>LE VI | The preoperative nursing visit is fundamental for the collection of data on the surgical patient, as it enables the detection and resolution of problems or alterations related to the biopsychosocial and spiritual aspects that may interfere directly with the expected result. |
| Gonçalves and Medeiros[25]<br>2016<br>Brazil | To identify if the preoperative visit could minimize the anxiety level experienced by surgical patients. | Exploratory, prospective, descriptive<br>LE VI | The preoperative nursing visit contributed to a decrease in the level of anxiety. |
| Xavier et al.[26]<br>2014<br>Brazil | To evaluate the quality of nursing care provided to the patient in the intraoperative period. | Quantitative, descriptive<br>LE VI | The postoperative visit instrument was effective in assessing the quality of nursing care provided in the intraoperative period. |
| Amorim et al.[27]<br>2014<br>Brazil | To understand the meanings of the therapeutic interpersonal relationship between nurses and patients, from the adoption of the Transpersonal Care Theory, on the preoperative nursing visit after the experiencing the surgical process. | Qualitative study<br>LE VI | The postoperative visit is effective for assessing the quality of nursing care provided in the intraoperative period. |
| Sadati et al.[28]<br>2013<br>Iran | To investigate the effects of preoperative nursing visits on anxiety and postoperative complications in candidates for laparoscopic cholecystectomy. | Prospective, semi-experimental, randomized clinical trial<br>LE III | The study showed that preoperative nursing visits can decrease the level of preoperative anxiety and postoperative complications. |
| Bosco et al.[29]<br>2013<br>Brazil | To report the experience of nursing residents in performing the preoperative visit. | Descriptive study, experience report type<br>LE VII | The nursing visits provide the resident with the opportunity to deepen the studies about surgical and anesthetic types and perioperative care, besides stimulating and facilitating contact with the patient/family. The preoperative visit is increasingly necessary in hospital practice, and the nursing professional needs to be able to perform it. |
| Ghabeli et al.[30]<br>2014<br>Iran | To determine the effect of toys and visits on reducing the anxiety of children before surgery and of their mothers and on the satisfaction with the treatment process. | Quasi-experimental post-test study with a control group.<br>LE V | Providing toys for children and informing parents about medical information have a great effect on reducing anxiety in children and family members and increase maternal satisfaction with the treatment process. |

assess the quality of care provided to patients in the intraoperative period.

In some services, there are difficulties in carrying out nursing visits, mainly due to the nurses' lack of knowledge or limited personnel and material resources, in addition to the high demand for care and administrative activities[27]. Continuous training and efforts by the SC management team are necessary so that the quality of care is not impaired[23].

Most studies (5) showed LE VI, while the others had LEs II (1), III (1), V (1) and VII (1).

As limitations of the study, the search of the databases resulted in most of the articles being national and there were few articles that addressed the topic of postoperative nursing visits.

This study contributes to the areas of nursing and health, by providing relevant information about the importance of pre- and postoperative nursing visits for patients and/or their families and encourages perioperative nursing to invest in this practice.

## FINAL CONSIDERATIONS

This review made it possible to know and analyze the focus of selected scientific articles that addressed pre- and postoperative nursing visits. The low number of studies on this topic is noteworthy, as some research shows that when the preoperative visit is not performed the quality of nursing care decreases. This fact can be explained by the difficulty that some services have in carrying out visits, the high demand for care and administrative activities from nurses, as well as the lack of knowledge and human resources.

It was evidenced that the preoperative nursing visit reduces the anxiety of surgical patients, based on health education, allowing the nurse to clarify the doubts of patients and their families/companions about the anesthetic-surgical procedure, providing better experience for the patient and even preventing postoperative complications.

Few publications on postoperative nursing visits were identified, and this step is very important to assess the quality of care patients are provided during the operation. Thus, it is evident that there is a need for perioperative nursing to invest in this theme.

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## CONFLICT OF INTERESTS

The authors declare there is no conflict of interests.

## AUTHORS' CONTRIBUTIONS

**CDC:** Conceptualization, Data curation, Formal Analysis, Methodology, Project administration, Writing — original draft, Writing — review & editing. **BRA:** Conceptualization, Data curation, Formal Analysis, Methodology, Writing — original draft, Writing — review & editing. **AFF:** Conceptualization, Data curation, Formal Analysis, Methodology, Writing — original draft, Writing — review & editing. **ASL:** Conceptualization, Data curation, Formal Analysis, Methodology, Writing — original draft, Writing — review & editing. **RCAC:** Conceptualization, Formal Analysis, Methodology, Writing — review & editing, Supervision.

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# NURSING CARE RECOMMENDATIONS FOR ROBOTIC CANCER SURGERIES: SCOPING REVIEW

*Recomendações de enfermagem para o cuidado em cirurgias oncológicas robóticas: revisão de escopo*

*Recomendaciones de enfermería para la atención en cirugía robótica oncológica: revisión del alcance*

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**ABSTRACT: Objective:** To identify and map perioperative nursing care for patients submitted to robotic cancer surgeries. **Method:** This is a scoping review based on recommendations from the Joanna Briggs Institute, held between October and December 2020 in the following databases: Virtual Health Library (VHL), Cumulative Index to Nursing and Allied Health Literature (CINAHL), National Library of Medicine (PubMed), and Scopus. The study time frame spans from 2010 to 2020. **Results:** We identified 84 publications and included eight in the sample. The results indicated the importance of preoperative nursing evaluation and clarification of surgery side effects. Recommendations for the intraoperative period included recording the nursing process, preventing perioperative hypothermia and positioning injuries, as well as continuing education for the team. The findings evidenced the role of nursing in pelvic floor dysfunctions and in identifying deficits in self-care and sexuality, especially in the postoperative period of patients submitted to prostatectomies. **Conclusions:** The recommendations identified can minimize the negative impacts of cancer surgeries and, consequently, improve perioperative nursing care.
**Keywords:** Robotic surgical procedures. Nursing care. Oncology nursing. Perioperative nursing.

**RESUMO: Objetivo:** Identificar e mapear os cuidados de enfermagem no período perioperatório para com o paciente submetido a cirurgias oncológicas robóticas. **Método:** Revisão de escopo, com base nas recomendações do Joanna Briggs Institute, realizada entre outubro e dezembro de 2020 nas bases de dados Biblioteca Virtual em Saúde (BVS), *Cumulative Index to Nursing and Allied Health Literature* (CINAHL), *National Library of Medicine* (PubMed) e Scopus. A delimitação temporal dos estudos foi de 2010 a 2020. **Resultados:** Foram identificadas 84 publicações, tendo-se incluído oito na amostra. Os resultados apontaram a importância da avaliação de enfermagem pré-operatória e do esclarecimento dos efeitos colaterais da cirurgia. No transoperatório, houve recomendações acerca do registro do processo de enfermagem, da prevenção da hipotermia perioperatória e de lesões relativas ao posicionamento, bem como da educação continuada da equipe. Os achados evidenciaram o papel da enfermagem nas disfunções do assoalho pélvico e na identificação de déficits no autocuidado e no domínio sexual, especialmente no pós-operatório de pacientes submetidos a prostatectomias. **Conclusão:** As recomendações identificadas são capazes de minimizar os impactos negativos das cirurgias oncológicas e, consequentemente, melhorar a assistência de enfermagem perioperatória.
**Palavras-chave:** Procedimentos cirúrgicos robóticos. Cuidados de enfermagem. Enfermagem oncológica. Enfermagem perioperatória.

**RESUMEN: Objetivo:** Identificar y mapear los cuidados de enfermería en el período perioperatorio de los pacientes sometidos a cirugía robótica oncológica. **Método:** Revisión del alcance, en base a las recomendaciones del Instituto Joanna Briggs, realizada entre octubre y diciembre de 2020, en las bases de datos Biblioteca Virtual en Salud (BVS), CINAHL, PubMed y Scopus. La delimitación temporal de los estudios fue de 2010 a 2020. **Resultados:** Se identificaron 84 publicaciones, incluidas ocho en la muestra. Los resultados mostraron la importancia de la evaluación de enfermería preoperatoria y el esclarecimiento de los efectos secundarios de la cirugía. Durante el transoperatorio, hubo recomendaciones en cuanto al registro del proceso de enfermería, prevención de hipotermia perioperatoria y lesiones relacionadas con el posicionamiento, así como la educación continua del equipo. Los hallazgos evidenciaron el papel de la enfermería en los trastornos del suelo pélvico y en la identificación de déficits en el autocuidado y en el dominio sexual, especialmente en el postoperatorio de pacientes sometidas a prostatectomías. **Conclusión:** Las recomendaciones identificadas son capaces de minimizar los impactos negativos de las cirugías oncológicas y, en consecuencia, mejorar la atención de enfermería perioperatoria.
**Palabras clave:** Procedimientos quirúrgicos robotizados. Atención de enfermería. Enfermería oncológica. Enfermería perioperatoria.

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## INTRODUCTION

During cancer treatment, approximately 80% of patients undergo some surgical procedure[1], whose history is marked by interventions considered invasive and mutilating. Therefore, in addition to the cancer disease process, patients need to deal with the negative effects of surgery on quality of life (QoL)[2].

In this scenario, even if the main objective of health interventions is to improve QoL, biological heterogeneity and cancer adaptability make it virtually impossible to put an end to oncologic surgeries[3]. Thus, the advent of the laparoscopic technique can be considered a historical landmark because it has made the procedures less aggressive and enabled the emergence of robotic surgery, which consists of performing the surgical procedure through a robot whose movements are controlled by the surgeon[3,4].

In order to overcome the limitations of its precursor, robotic surgery offers a series of benefits to surgeons. Among them, we can mention the three-dimensional view of the operative field, greater motion accuracy, reduced tremors, in addition to ergonomic advantages[4,5]. As for patients, it allows smaller incisions, blood loss, and postoperative pain, reducing length of stay[6]. Regarding QoL, the literature does not show significant score differences from the laparoscopic technique but highlights that cancer patients submitted to robotic surgery resume their daily activities faster and have better functional, social, and emotional performance[7].

However, the high cost of materials and specialized professionals is an important obstacle for the implementation of the technology, given the funding difficulty of the Brazilian health system. At the same time, the decrease in length of stay provided by robotic surgery can make it economically feasible for public health systems[4,8].

A literature review published in 2019 identified that nursing plays an essential role in care at all stages of robotic surgeries[9]. In the preoperative period, it is responsible for the patient's admission, preparation of the operating room and the robotic system, patient positioning, prevention of injuries related to the procedure, and attachment of the robotic interface to the patient. In the intraoperative period, we highlight the completion and standardization of checklists and the organization of the flow of professionals within the operating room. After the procedure, besides the care provided in hospitalization units, the importance of guiding patients and their families stands out.

Therefore, nursing professionals should be constantly updated on technological innovations that impact their practice. Nevertheless, although the role of the nursing team in robotic surgeries is described in the literature[9], scientific publications still focus on the medical area, evidenced by the scarcity of reviews and studies available to outline care recommendations for the performance of nursing work. Thus, the present study has as its guiding question: which nursing care activities should be performed in the perioperative period for patients submitted to robotic cancer surgeries?

## OBJECTIVE

To identify and map perioperative nursing care for patients submitted to robotic cancer surgeries.

## METHOD

This is a scoping review based on the method proposed by the Joanna Briggs Institute, which establishes five steps:

1. identification of the research question;
2. identification of relevant studies;
3. selection of studies for review;
4. data analysis;
5. collection, summarization, and report of results[10].

This modality of review aims to map the main available evidence and gaps in the literature, providing a basis for future research[11].

The research question was elaborated using the PCC acronym[10], in which: P (population) refers to cancer patients; C (concept) corresponds to nursing care; C (context) indicates robotic surgery. As a result, the following question was formulated: what are the nursing care recommendations for cancer patients submitted to robotic surgeries?

Searches were carried out between October and December 2020 in the databases: Virtual Health Library (VHL), Cumulative Index to Nursing and Allied Health Literature (CINAHL), National Library of Medicine (PubMed), and Scopus. Search strategies were constructed using selected keywords from the Health Sciences Descriptors (*Descritores em Ciências da Saúde* — DeCS) and Medical Subject Headings (MeSH), as shown in Chart 1.

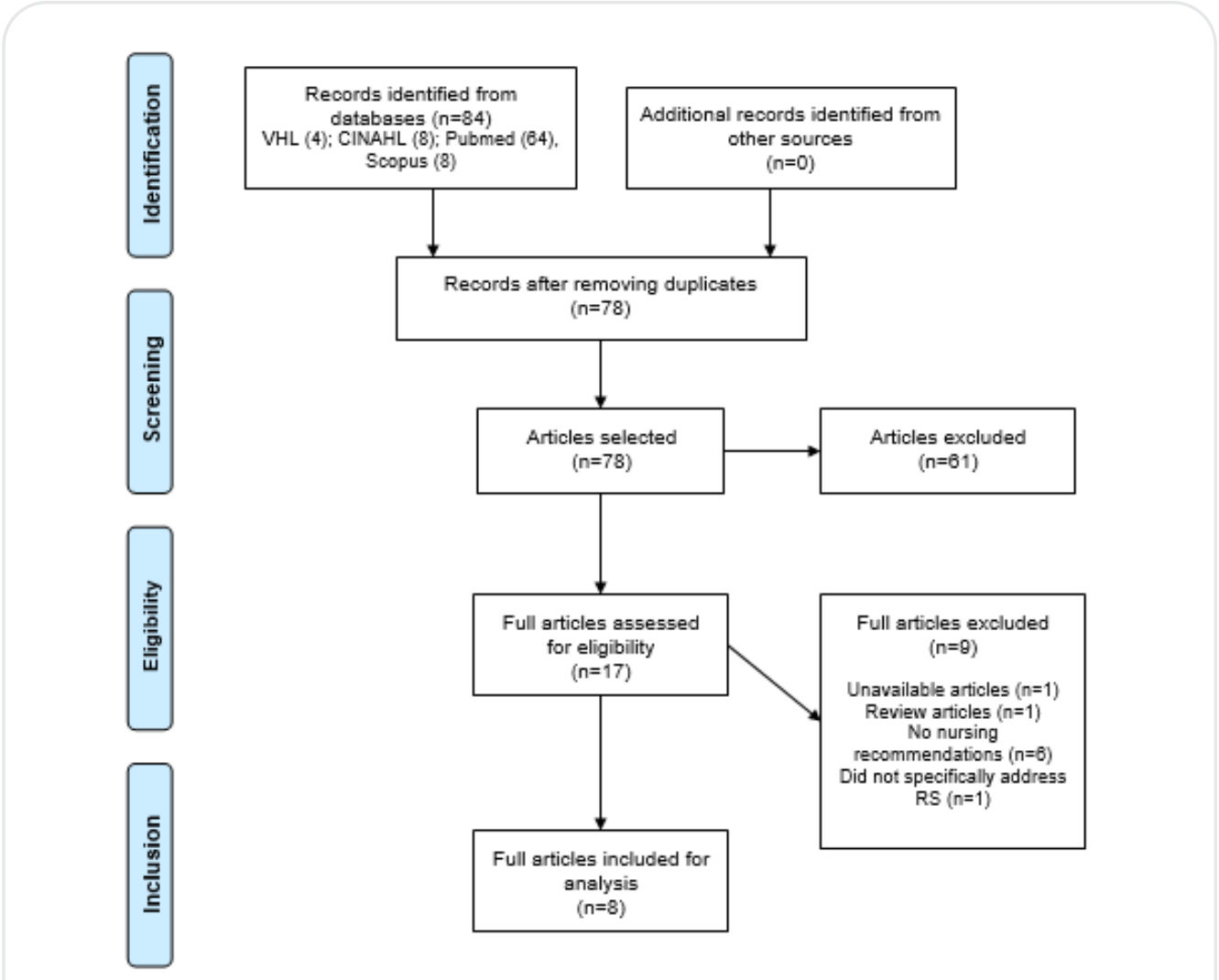
The inclusion criteria used were: full articles available online in Portuguese, English, Spanish, or Italian,

published between 2010 and 2020. This time frame was chosen because the number of robotic surgeries performed worldwide increased exponentially from 2010 onward[4]. As exclusion criteria, we defined: studies that addressed robotic surgeries outside the cancer context or conducted in animals, conference abstracts and annals, letters to the editor, review studies, reflections, and free communications.

**Chart 1.** Database search strategies.

| Database | Search strategy |
|---|---|
| PubMed | (robotics) AND (nursing care) AND (neoplasms) AND (oncology surgery) |
| CINAHL | (robotics) AND ((nursing care) OR (oncology nursing)) AND ((neoplasms) OR (surgical oncology)) |
| VHL and Scopus | (robotics) AND ((nursing care) OR (oncology nursing)) AND ((oncology) OR (oncology surgery)) |

PubMed: United States National Library of Medicine; CINAHL: Cumulative Index to Nursing and Allied Health Literature; VHL: Virtual Health Library.




VHL: Virtual Health Library; CINAHL: Cumulative Index to Nursing and Allied Health Literature; PubMed: United States National Library of Medicine; RS: robotic surgery.

Source: adapted from Moher et al.[13].

**Figure 1.** Flowchart of article selection.

Initially, two independent researchers read the title, abstract, and full articles to verify if they met the eligibility criteria. A third researcher analyzed any inconsistencies.

The level of evidence of the recommendations in the articles was classified according to Stillwell et al.[12] as:

- systematic reviews and meta-analyses;

**Chart 2.** Characterization of the studies selected to compose the sample.

| ID | Authors/ journal/study site/year | Language | Authors' background | Objective | Sample | Method | Level of evidence |
|---|---|---|---|---|---|---|---|
| A1 | Wang et al.[14], Support Care Cancer, China, 2018. | English | Nursing, Medicine, Chemistry | To explore the effects of continuing nursing care intervention on postoperative urinary control and QoL among patients with prostate cancer submitted to robotic prostatectomy. | 74 patients, 37 in the control group and 37 in the intervention group | Randomized clinical trial | II |
| A2 | Sayılan and Özbaş[15], Am J Mens Health, Turkey, 2018. | English | Nursing | To determine the effect of pelvic floor muscle exercise training administered to patients who underwent robotic radical prostatectomy on urinary incontinence (UI) problems. | 60 patients, 30 in the control group and 30 in the intervention group | Randomized clinical trial | II |
| A3 | Johansson and Von Vogelsang[16], J Clin Nurs, Sweden, 2019. | English | Nursing | To describe extremity symptoms reported by patients with bladder cancer after robot-assisted laparoscopic cystectomy. | 94 patients | Prospective longitudinal study | V |
| A4 | Dowrick et al.[17], Appl Nurs Res, Australia, 2018. | English | Nursing and Medicine | To investigate whether there are any differences in prostate cancer-specific QoL measures between partnered and unpartnered men at baseline and 12 months after robot-assisted radical prostatectomy. | 540 patients | Longitudinal cohort study | IV |
| A5 | Luo et al.[18], Clinics, China, 2020. | English | Nursing and Medicine | To investigate the efficacy of fluid warming in older adult patients submitted to robot-assisted laparoscopic radical cystectomy. | 108 patients with bladder cancer, 53 in the intervention group and 55 in the control group | Randomized clinical trial | II |
| A6 | Waller and Pattison[19], J Clin Nurs, United Kingdom, 2013. | English | Nursing | To understand the experience of men regaining urinary continence following robot-assisted radical prostatectomy. | 7 patients | Qualitative phenomenological study | V |
| A7 | Ângelo et al.[20], Rev. SOBECC, Brazil, 2020. | Portuguese | Nursing and Medicine | To report the experience of the first six cases of pediatric robotic surgery and the work of nurses specialized in robotic surgery in a cancer facility. | - | Experience report | VI |
| A8 | Mangham[21], J Perioper Pract, United Kingdom, 2016. | English | Nursing | To report the experience of patient positioning in robotic laparoscopic surgeries for gynecologic and urologic oncology. | - | Experience report | VI |

QoL: quality of life.

- randomized trials;
- non-randomized control trials;
- cohort and case-control studies;
- qualitative and descriptive studies obtained systematically;
- expert opinions.

In the stage of collection, summarization, and report of results, the researchers elaborated and used a specific organization instrument. It contained the following items: title, year of publication, study site, language, objective, method, level of evidence, nursing recommendations, and conclusion.

## RESULTS

The initial search identified 84 publications. After the exclusion of six duplicates and another 70 articles that did not meet the inclusion criteria for not specifically addressing robotic surgeries and/or offering nursing recommendations, the final sample comprised eight articles. The selection process (Figure 1) followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA Scr) flowchart.

Regarding the characteristics of the selected studies, four had their samples composed of patients diagnosed with prostate cancer, two with bladder cancer, and two with no tumor specification. The articles identified were published from 2013 to 2020, with 2018 having the largest number of studies (three). With respect to the level of evidence, three studies presented level II, one showed level IV, two had level V, and another two were classified as level VI.

As for study site, China and the United Kingdom stood out, with two works each. Six articles were published in international journals and two in Brazilian journals — one in oncology and three in nursing.

All papers had the participation of nurses. Four studies had physicians among the authors, and one had the participation of a chemist. Chart 2 presents the results.

Chart 3 describes the main nursing care recommendations for patients submitted to robotic cancer surgeries.

## DISCUSSION

Despite the high cost associated with robotic surgery, its demand in the cancer context is on the rise worldwide[4,22]. This review had a predominance of observational studies and experience reports, suggesting the need for research with higher levels of evidence, such as randomized clinical trials. However, in addition to funding, they require more collaboration from participants and from support and logistics services[23].

**Chart 3.** Summary of nursing care recommendations for robotic cancer surgeries.

| Operative period | Focus | Nursing recommendations | Articles |
|---|---|---|---|
| Preoperative | Patient | Clarify doubts about possible complications and side effects of surgery. | A6 |
| | Patient | Encourage the practice of pelvic floor strengthening exercises to prevent urinary incontinence after prostatectomy. | A3, A8 |
| | Nursing team | Assess the risk of skin and peripheral nerve lesions. | A1, A2 |
| Intraoperative | Nursing team | Frequent monitoring of body temperature. | A5 |
| | Nursing team | Infusion of warm fluids (between 37 and 41°C) to prevent perioperative hypothermia. | A5 |
| | Nursing team | Use cushions and other devices to help patient positioning and protect bony prominences. | A3, A7 |
| | Surgical team | Use the smallest Trendelenburg angle possible. | A3, A7 |
| | Nursing team | Redouble attention to avoid traction injuries during docking and undocking. | A7 |
| | Nursing team | Record the nursing process. | A3, A8 |
| | Surgical team | Perform realistic simulations with the surgical team before implementing changes related to patient safety. | A7, A8 |
| | Surgical team | Continuing education for the surgical team. | A7, A8 |
| Postoperative | Patient | Encourage and periodically monitor the practice of pelvic floor strengthening exercises to prevent urinary incontinence after prostatectomy. | A1, A2 |
| | Nursing team | Pay attention to deficits in sexuality, self-esteem, and self-care in patients submitted to prostatectomy and refer them to specialized professionals. | A4 |

These publications are mostly from international journals, especially from developed countries, with a prevalence of the English language. The adoption of technology by health facilities depends on several factors, such as cost, ease of use, and compatibility with existing systems — significant limitations for the implementation of robotic surgery in underdeveloped countries[8].

We found one Brazilian study carried out in a reference cancer center in the Southeast region. Although the number of robotic systems in Brazil has increased significantly in recent years, the technology is still incipient in the country and mostly found in large urban centers, like São Paulo and Rio de Janeiro[24].

We also underline that most articles are related to prostate and bladder tumors. Prostate cancer is the second most common in men, while bladder cancer is the ninth most frequent worldwide (without gender distinction); for both, the main treatment is surgery[25,26].

According to a 2018 mapping, urology is the specialty that most performs robotic surgeries globally, followed by general surgery and gynecology[24]. Despite the lack of definitive proof of the superiority of robotic surgery over laparoscopic surgery, the literature shows that its use by these specialties is particularly associated with the improvement in cosmetic results, the overcoming of ergonomic limitations, as well as the reduction in postoperative pain[27,28].

Preoperative recommendations evidence the importance of informing possible complications and side effects of robotic surgery to reduce anxiety[19]. Studies indicate that the nursing visit also elucidates doubts, promotes self-care, helps patients and families deal with possible changes in body image and functionality[29], and humanizes the surgical process[30,31].

Adequate patient positioning is one of the main indicators of perioperative care quality[29]. The long duration — compared to conventional surgery —, the positioning, and other specificities of robotic surgery favor the development of iatrogenesis[20]. In this sense, the elaboration of protocols[21] and the adoption of scales[16,20] for risk assessment of skin and peripheral nerve lesions may help nurses identify predisposing factors and implement preventive measures[32].

During robotic surgery, one of the main concerns is perioperative hypothermia[18]. The reduction in body temperature during surgical procedures is influenced by the type of anesthesia, environmental factors, age, weight, and comorbidities. Estimates indicate that 70% of patients are hypothermic when admitted to the post-anesthesia care unit, which may lead to complications[33]. A systematic review[34] concluded that the infusion of fluids at temperatures between 37 and 41°C is more effective in preventing perioperative hypothermia than at room temperature, in addition to reducing tremors in the immediate postoperative period.

The use of pneumoperitoneum and the Trendelenburg (or reverse Trendelenburg) position, which causes numerous physiological changes, are also particular characteristics of robotic surgical systems[35]. Thus, we emphasize the challenge of using the smallest possible Trendelenburg angle to favor the surgeon's view with minimum clinical damage to the patient[36].

Moreover, certain parts of robotic surgery pose a greater risk of positioning injuries, such as docking (moving the robot to the operating table and attaching it to the patient) and undocking (removing the robot from the patient and moving it away from the operating table)[37]. In addition to identifying predisposing factors and adopting risk stratification scales[38], the use of adhesives in pressure areas in long surgeries, as well as the standardization of the positioning and transfer process, can reduce the rates of skin lesions[32,39].

The findings of this review also highlight the importance of nursing team records[16,21]. Documenting the nursing process adds scientific credibility to the profession and improves the quality of care; however, it requires support and reorganization by health facilities[40].

Another aspect found in the publications relates to the effective adherence to patient safety protocols — although they should be shared with the entire surgical team, this is not the reality in health facilities[20,21]. Realistic simulations with the teams before implementing these changes, as well as continuing education actions and on-the-spot guidance, can help minimize this issue[41].

Regarding the postoperative period, the articles offer recommendations mostly for prostatectomies[14,15,17]. Despite the advances in the surgical technique, post-prostatectomy urinary incontinence (UI) still has a high incidence and negatively impacts QoL. A retrospective study showed that 78.77% of men submitted to robotic prostatectomy recover urinary continence within one year of the procedure; nonetheless, this period may be prolonged depending on age, nerve preservation, and pelvic lymph node dissection[42].

Pelvic floor exercises before the surgical procedure and during hospital stay produce significant results in urinary continence recovery up to six months after the surgical procedure[14,19]. Investing in self-care education for patients allows the reconstruction of professional practice and contributes to the quality of care[43].

Pelvic floor dysfunctions are an important area of the nurse's work. In addition to having the potential to cure or alleviate the symptoms of all types of UI and a good cost-benefit ratio, the nurse collaborates to the dissemination of evidence-based practice and to professional recognition[38,44].

Another recurrent impact of robotic prostatectomies is the deficit in sexuality, self-esteem, and self-care, which requires careful attention from the nursing team, as well as the referral to specialized professionals. The literature also recommends performing psychoeducational actions and clarifying doubts from the patient and their sexual partner[45].

The search strategy may be considered a limitation of the present study, as it did not include uncontrolled terms and restricted the time frame to articles published after 2010, which might have excluded some evidence available on the subject.

## CONCLUSION

The recommendations identified contribute to evidence-based practice by suggesting strategies that can minimize the negative impacts of cancer surgery and, consequently, improve perioperative nursing care and the patient's QoL.

Among them, we highlight the importance of the preoperative nursing visit and of recording the nursing process, as well preventing perioperative hypothermia and patient positioning injuries. Some studies have shown the role of nursing in identifying deficits in self-care and sexuality of patients submitted to prostatectomies, in health education, in addition to the relevance of the professional performance when it comes to pelvic floor dysfunctions and continuing education.

The expressive number of articles aimed at medical practice and the low level of evidence of some publications included in the sample also stand out since research on this subject is still incipient. We found no recommendations regarding the preparation of the operating room — an important task of the nursing team —, and those related to the postoperative period were restricted to prostatectomies.

This study encourages the reflection on the importance of the nursing team in robotic surgeries, as they participate in all stages of surgical procedures and cancer treatment. The results can substantiate evidence-based practice and, consequently, contribute to improving cancer care. We recommend the performance of new studies on the subject in order to address other interventions that may impact the nursing practice in robotic cancer surgeries.

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## CONFLICT OF INTERESTS

There is no conflict of interests.

## AUTHORS' CONTRIBUTION

**MNS:** Conceptualization, Methodology, Formal Analysis, Validation, Visualization, Writing — original draft, Writing — review & editing. **ABS:** Formal Analysis, Validation. **ACOM:** Writing — original draft, Writing — review & editing. **DLZS:** Writing — original draft, Writing — review & editing. **FMDM:** Methodology, Writing — original draft, Writing — review & editing. **LPK:** Conceptualization, Methodology, Project administration, Writing — original draft, Writing — review & editing.

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## Where it reads:

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## It should read:

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