

Cross-mapping of interventions applied to nursing diagnosis: risk of perioperative hypothermia

Mapeamento cruzado das intervenções aplicadas ao diagnóstico de enfermagem: risco de hipotermia perioperatória

Mapeo cruzado de intervenciones aplicadas al diagnóstico de enfermería: riesgo de hipotermia perioperatoria

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ABSTRACT: Objective: To map and validate the interventions/activities applied to patients with a nursing diagnosis of risk of perioperative hypothermia. **Method:** This is a methodological study focusing on the construction and validation of specific nursing activities/interventions for the NANDA-I risk diagnosis of perioperative hypothermia, carried out from August 2020 to September 2021. The process had three steps: search of activities in the literature, cross-mapping with interventions/activities of the Nursing Interventions Classification (NIC) and validation by specialists, considering items with content validity index >0.79 as valid. **Results:** Twelve articles were listed after literature review, which generated 57 activities grouped into active and passive heating methods, in addition to monitoring measures; as for nursing interventions, 3 interventions in NIC were mapped, encompassing 96 activities. Through cross-mapping, 17 nursing activities to be proposed for the perioperative period could be created, 15 of which were validated by 8 specialists. **Conclusion:** Fifteen interventions/activities arising from the diagnosis of risk of hypothermia were mapped and validated for application in the perioperative period, in order to favor quality of care. **Keywords:** Surgicenters. Hypothermia. Perioperative nursing. Nursing process. Postoperative complications.

RESUMO: Objetivo: Mapear e validar as intervenções/atividades aplicadas ao paciente com diagnóstico de enfermagem de risco de hipotermia perioperatória. **Método:** Trata-se de estudo metodológico, com foco na construção e na validação de atividades/intervenções de enfermagem específicas para o diagnóstico de risco de hipotermia perioperatória da NANDA-I, realizado de agosto de 2020 a setembro de 2021. O processo envolveu três etapas: levantamento das atividades na literatura, mapeamento cruzado com as intervenções/atividades da Classificação das intervenções de enfermagem (NIC) e validação por especialistas, considerando válidos os itens com índice de validade de conteúdo >0,79. **Resultados:** Na revisão de literatura, foram elencados 12 artigos, que geraram 57 atividades, agrupadas em métodos ativos e passivos de aquecimento, além de medidas de monitoramento; em relação às intervenções de enfermagem, na NIC, foram mapeadas 3 intervenções, englobando 96 atividades. Por meio do mapeamento cruzado, foi possível construir 17 atividades de enfermagem a serem propostas para o perioperatório, sendo 15 validadas pelos 8 especialistas. **Conclusão:** Foram mapeadas e validadas 15 intervenções/atividades advindas do diagnóstico risco de hipotermia para serem desenvolvidas no período perioperatório, a fim de favorecer a qualidade assistencial. **Palavras-chave:** Centros cirúrgicos. Hipotermia. Enfermagem perioperatória. Processo de enfermagem. Complicações pós-operatórias.

RESUMEN: Objetivo: Mapear y validar las intervenciones/actividades aplicadas a pacientes con diagnóstico de enfermería de Riesgo de Hipotermia Perioperatoria. **Método:** Se trata de un estudio metodológico, con foco en la construcción y validación de actividades/intervenciones de enfermería específicas para el diagnóstico de Riesgo de Hipotermia Perioperatoria de la NANDA-I, realizado de agosto de 2020 a septiembre de 2021. El proceso involucró tres etapas: levantamiento de actividades en la literatura, mapeo cruzado con intervenciones/actividades de la Clasificación Internacional de Intervenciones de Enfermería y validación por especialistas, considerando ítems válidos con índice de validez de contenido >0,79. **Resultados:** En la revisión de la literatura, se enumeraron 12 artículos, que generaron 57 actividades, agrupadas en métodos de calentamiento activo y pasivo, y medidas de seguimiento; en relación a las intervenciones de enfermería en la Clasificación Internacional, fueron mapeadas 03 intervenciones que abarcan 96 actividades. A través del mapeo cruzado, fue posible construir 17 actividades de enfermería a ser propuestas para el período perioperatorio, 15 de las cuales fueron validadas por los 8 especialistas. **Conclusión:** 15 intervenciones/actividades derivadas del diagnóstico Riesgo de hipotermia fueron mapeadas y validadas para ser desarrolladas en el perioperatorio con el fin de favorecer la calidad de la atención. **Palabras clave:** Centros quirúrgicos. Hipotermia. Enfermería perioperatoria. Proceso de enfermería. Complicaciones posoperatorias.

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INTRODUCTION

Hypothermia is defined as body temperature below normal parameters due to failure in thermoregulation, one of the most prevalent conditions in surgical patients^{1,2}. It can be classified as unintentional and therapeutic based on causal process. Unintentional hypothermia is an adverse event that can occur very often to patients undergoing surgical procedures, either due to direct action of anesthetics in the central thermoregulatory system, reduction of the patient's metabolism, or exposure to low temperatures in surgical environment. Therapeutic hypothermia, on the other hand, is known by the surgical staff, which establishes it as a treatment strategy^{3,4}.

Patients undergoing general anesthesia, whether intravenous, inhalational or combined, are more likely to have temperature disturbances due to a reduction in core temperature that impacts homeostasis. In addition, there are intrinsic factors that influence the control of body temperature such as age extremes, low Body Mass Index (BMI) and being a female^{2,5}.

The taxonomy North American Nursing Diagnosis Association International, Inc (NANDA-I) presents clinical judgments related to hypothermia associated with surgical patients, in which the following stand out: risk of hypothermia; risk of perioperative hypothermia, and ineffective thermoregulation¹. Conceptually, the risk of hypothermia in surgical patients is the susceptibility to an inadvertent drop in core body temperature below and which may compromise their health¹. In didactic terms, hypothermia is classified as mild (34 to 36°C), moderate (30 to 34°C) and severe (less than 30°C)^{3,4}.

Unintentional hypothermia can cause increased anxiety and stress, development of infection, prolonged postoperative period, increased mortality and other events, which, in general, increase health costs⁶⁻⁹. Furthermore, it is an important factor related to clotting disorders due to platelet dysfunction and inactivation of clotting factors^{7,8}.

In view of the possible adverse events associated with lack of temperature control, nursing care must be evidence-based, so that the basic human need of temperature regulation is achieved^{7,10}. For the planning of interventions and activities proposed for risk of hypothermia, knowing the methods of monitoring temperature, pre-warming and active and passive warming of a patient is necessary^{7,11-13}.

Thus, the relevance of using taxonomies that standardize nursing interventions is undoubted, as it helps to measure results, strengthen the quality of care and institute effective patient safety measures^{3,12}. Studies that incorporate the standard nomenclature to the Brazilian reality, including to actions of nursing prescriptions, are therefore needed¹⁴.

OBJECTIVE

To map and validate interventions/activities applied to patients with a nursing diagnosis of risk for perioperative hypothermia.

METHOD

This is a methodological study focusing on the creation and validation of nursing interventions for the NANDA-I risk diagnosis of perioperative hypothermia, carried out from August 2020 to September 2021. The creation and validation process involved three steps: search of activities in the literature, cross-mapping with NIC¹³ activities, and content validation by experts.

For the literature search, an integrative review was carried out in the Virtual Health Library (VHL), the Latin American and Caribbean Health Sciences databases (LILACS), Nursing Database (BDENF), Scientific Electronic Library Online (SciELO), and PUBMED in the Medical Literature Analysis and Retrieval System (MED-LINE), with view to answering the following guiding question: What are the nursing interventions for hypothermia control in surgical patients?

For the search, the following keywords registered in the Health Sciences Descriptors (DECs) and in MESH were used: operating room, hypothermia, perioperative nursing, nursing process, and postoperative complications. As a search strategy, descriptors were associated using the Boolean operator "AND" as follows: nursing AND nursing care AND hypothermia; perioperative nursing AND nursing process; hypothermia AND postoperative complications. In total, three search engines were used.

The inclusion criteria were articles addressing surgical procedures, risk of hypothermia and nursing interventions; the theme of the study was also considered, within a time frame from January 2011 to 2021, written in English, Portuguese and Spanish. Therefore, theses, dissertations, monographs and other review studies without meta-analysis or texts with themes other than the established were excluded.

The search and selection of articles were carried out independently by two researchers. After surveying the articles through the search engines and using the established criteria, articles that did not meet the criteria and duplicates were excluded. The title was evaluated, as well as abstracts and full texts. When there was disagreement about a particular article, the researchers would discuss based on the defined criteria to reach a consensus on the inclusion or exclusion of the studies.

After the selection process, 12 eligible articles were gathered for analysis and data extraction, as described in Figure 1.

In this process, nursing interventions relating to the diagnosis studied were also sought in the NIC. The activities were grouped into a single list in order to standardize activities' name for a cross-mapping with those listed in the NIC.

The Content Validity Index (CVI) was then used, in which each item was scored according to a Likert scale, considering the degree of importance for the care planning as:

- 1 = adequate;
- 2 = needs adjustment;
- 3 = inadequate.

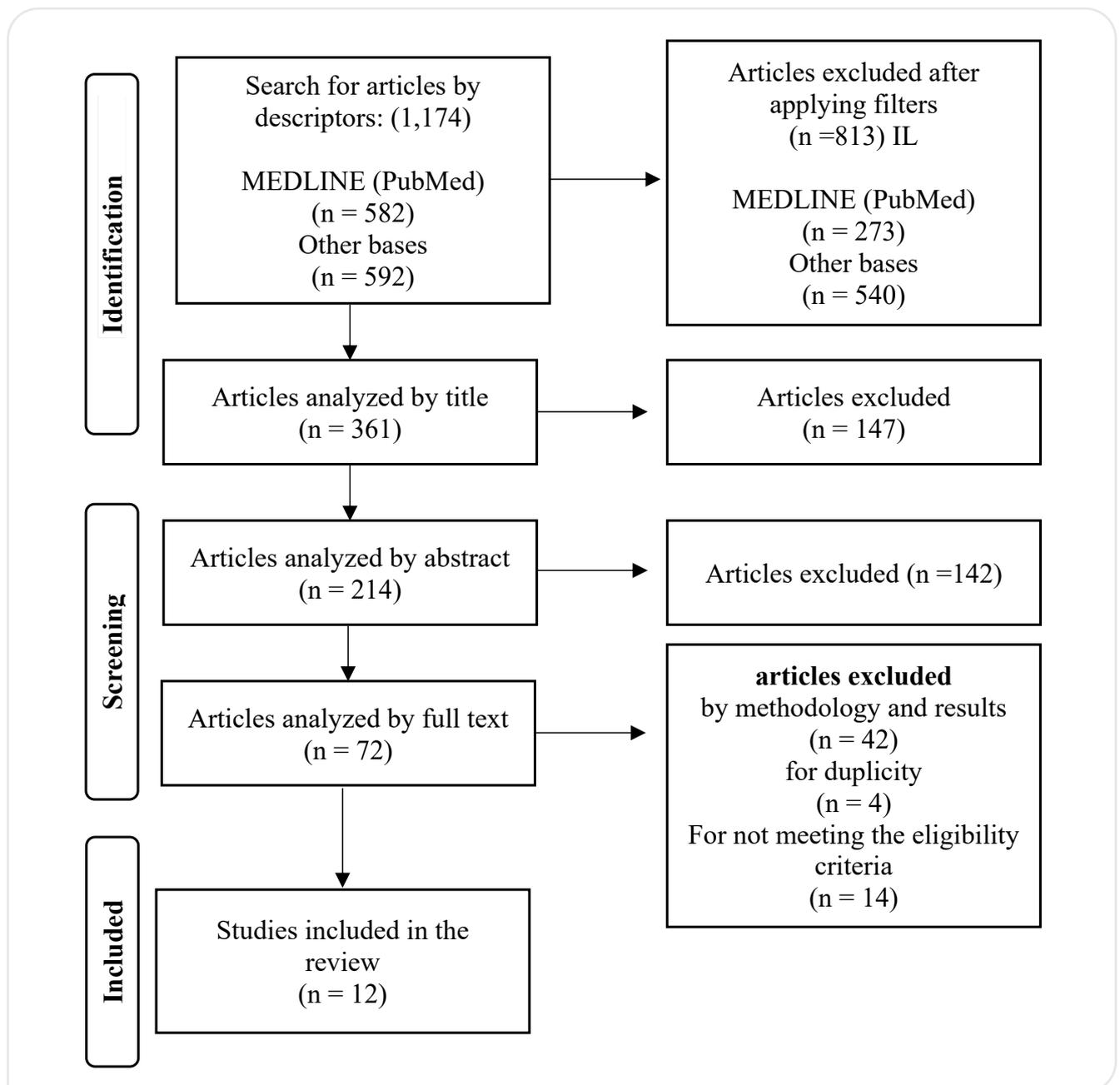


Figure 1. Study selection flowchart. Vitória (ES), Brazil, 2022.

To calculate the CVI, the following formula was applied: $CVI = \Sigma \text{“1” scores} / \Sigma \text{ scores}$. The experts evaluated each activity for the attributes of understanding, organization, objectivity and relevance. Items evaluated with a CVI lower than 0.8 in all items were disregarded¹⁵. If an item were classified as “inadequate” or “needs adjustment”, the researcher should suggest improvements and propose new activities. Items with $CVI > 0.79$ in only one of the domains were discussed by researchers so that adjustments could be made.

The search for specialists was based on analyzing their Lattes curricula and electronic form invitation. In order to be a specialist in this study, the professional should be a nurse with a *stricto sensu* postgraduate degree, experience in surgical center or in research in the area. Eighteen professionals were invited, but only eight agreed to participate.

After the final version was obtained, it was sent for grammar review, with view to cohesion, coherence and adequacy to the Brazilian Portuguese language.

This study was approved by the Research Ethics Committee of the institution, opinion 4.136.350/2020 and CAAE: 32064720.8.000.5060.

RESULTS

Twelve articles were selected in the content survey. They had been mostly published in 2019, in English, and jointly authored with nurses. After analysis, the data were organized in a table, highlighting the nursing activities, as Chart 1 shows^{5,6,8-10,12,16-21}.

From the literature review, 45 nursing interventions were listed and could be grouped, in general, into active and passive heating methods, with emphasis on forced air heating, use of blankets and cotton sheets, thermal mattress, infusion of heated solutions (intravenous and for cavity) and thermal blanket, in addition to temperature and other vital signs monitoring measures.

Based on the nursing diagnosis of risk of perioperative hypothermia and the NANDA/NIC connection, specific interventions were listed: regulation of perioperative temperature; hypothermia treatment and temperature regulation, totaling 96 activities.

In the cross-mapping, the nursing activities described in specific NIC interventions were associated with those found in the literature review. After this process, a list of activities

was assembled, privileging the language standardized in the NIC. In cases where the activity described in the NIC was limited or unclear, it was decided to use the description as found in the literature review in order to expand its applicability and understanding. The activities listed in Chart 2 are only the mapped ones.

After mapping and associating the activities linked to nursing interventions in the NIC and found in the literature, they were assessed by specialists with regard to understanding, organization, objectivity and pertinence for diagnosing the risk of perioperative hypothermia. This phase was necessary, as some activities were not described in the NIC. Eight specialists participated in this study, most of them being females (75%) with more than five years of experience in surgical care and a doctorate degree. The content validity index is shown in Table 1.

Activities classified as $CVI < 0.8$ were excluded. Regarding the activity, hot or cold solutions were provided, as appropriate. Most specialists questioned the use of the cold solutions; however, it is not, nor would be, recommended in a hypothermia situation, but because it is among temperature regulation interventions, it is classified as one of the activities that would fit hyperthermia. However, when considering the list for hypothermia, the activity would just be “Provide warm irrigating solutions as appropriate”. Regarding medical factors, the experts reported that this activity should be classified as clinical, not medical, factor.

DISCUSSION

Treatment of hypothermia is defined as preventing heat loss, rewarming, and monitoring patients whose peak body temperature is abnormally low as a result of uninduced circumstances¹³. The first pillar of this process is understanding the elements that support this judgment, highlighting associated conditions and risk factors^{5,6}.

In agreement with the validated activities, preheating, monitoring of vital signs, temperature control in the operating room and removal of wet and/or cold clothes stand out, which corroborates other studies regarding interventions for risk of perioperative hypothermia^{6,9,12,16}.

For this, it is essential to monitor temperature in the perioperative period, with view to early detection of risk of hypothermia, and to facilitate thermal control during the surgical procedure and in the immediate postoperative

Chart 1. Distribution of studies according to authors, year of publication, title, journal and activities carried out by the nursing team. Vitória (ES), Brazil, 2022.

Author	Year	Title	Journal	Interventions/activities
Gabriel et al. ¹⁶	2019	Prevention of inadvertent perioperative hypothermia – guideline compliance in German hospitals	German Medical Science	<ul style="list-style-type: none"> - Temperature measurement; - Active heating methods: <ul style="list-style-type: none"> - Forced air heating; - Thermal mattress.
Mendonça et al. ⁶	2019	Risk factors for postoperative hypothermia in the post-anesthetic care unit: a prospective prognostic pilot study	Brazilian Journal of Anesthesiology	<ul style="list-style-type: none"> Active heating methods: <ul style="list-style-type: none"> - Forced air heating; - Mattress heating; - Warmed serum.
Roth et al. ⁹	2019	Induction techniques that reduce redistribution hypothermia: a prospective, randomized, controlled, single blind effectiveness study	BMC Anesthesiology	<ul style="list-style-type: none"> - Verification of vital signs; - Cotton blanket; - Heated venous infusion; - Forced air heating; - Forced air heating + cotton blanket; - Inhalation induction with sevoflurane, phenylephrine and intravenous induction with propofol.
Souza et al. ¹²	2019	Cuidados de enfermagem no período intraoperatório para manutenção da temperatura corporal	Revista SOBECC	<ul style="list-style-type: none"> - Assessment of vital signs; - heated infusion intravenously; - heated infusion by cavity washing; <ul style="list-style-type: none"> - Cotton surgical drape; - Surgical drape + cotton sheet; - Bandaging of lower limbs with orthopedic cotton + cotton surgical drape.
Vural et al. ⁸	2018	Investigation of inadvertent hypothermia incidence and risk factors	Turkish Journal Of Surgery	<ul style="list-style-type: none"> - Temperature monitoring; - Application of heating method.
Ribeiro et al. ¹⁰	2017	Atitudes dos enfermeiros de centro cirúrgico diante da sistematização da assistência de enfermagem perioperatória	Revista SOBECC	<ul style="list-style-type: none"> - Passive method; - Active methods.
John et al. ⁵	2016	Comparison of resistive heating and forced-air warming to prevent inadvertent perioperative hypothermia	British Journal of Anaesthesia	<ul style="list-style-type: none"> - Temperature measurement; - Forced air; - Resistive heating.
Park et al. ¹⁷	2015	Clinical considerations in the use of forced-air warming blankets during orthognathic surgery to avoid postanesthetics shivering	Journal of Dental Anesthesia and Pain Medicine	<ul style="list-style-type: none"> - Assessment of vital signs; - Circulating water mattress; - Heating blanket + circulating water mattress.
Perl et al. ¹⁸	2014	Efficacy of a novel prewarming system in the prevention of perioperative hypothermia. A prospective, randomized, multicenter study	Minerva Anestesiologica	<ul style="list-style-type: none"> - Mistral-Air™ Premium Warming Suit; - Forced air heating; - Passive method.
Moysés et al. ¹⁹	2014	Hypothermia prevention during surgery: comparison between thermal mattress and thermal blanket	Revista da Escola de Enfermagem da USP	<ul style="list-style-type: none"> - Temperature monitoring; - Thermal mattress; - Thermal blanket.
Mattia et al. ²⁰	2012	Hipotermia em pacientes no período perioperatório	Revista da Escola de Enfermagem da USP	<ul style="list-style-type: none"> - Temperature control; Heating methods; - Heated venous infusion; - Thermal blanket; - Thermal mattress; - Common blanket; - Bandaging of the lower limbs with orthopedic cotton.
Klein et al. ²¹	2011	Nursing records in the perioperative period	Revista de Enfermagem UFPE On Line	<ul style="list-style-type: none"> - Heated venous infusion; - Thermal blanket; - Thermal mattress; - Common blanket.

Chart 2. Interventions for the nursing diagnosis of perioperative hypothermia, Vitória (ES), Brazil, 2022.

NIC intervention	Activities proposed in the NIC	Care identified in the literature
Perioperative temperature regulation (3,902) Treatment of hypothermia (3,800)	<ul style="list-style-type: none"> - Apply active external rewarming (for example, warm blanket positioned in the trunk region close to the extremities); - Install and regulate active heating device (e.g. heated air); - Apply active internal reheat or "central reheat" (e.g. heated EV fluids, heated humidified oxygen); - Provide hot or cold irrigating solutions, as appropriate; - Monitor the temperature of irrigating solutions; - Warming or cooling IV fluids, as appropriate; - Discontinue active heating activities (e.g. air heating) when appropriate; - Provide or assist in the provision of humidified and heated anesthetic gases, as appropriate; - Provide warmed intraperitoneal gases (e.g. carbon dioxide) for laparoscopy. 	<ul style="list-style-type: none"> - Apply active heating methods (e.g. forced air, resistive heating, heated infusion, thermal blanket, thermal mattress, circulating water mattress, heating blanket associated with circulating water mattress); - Heated anesthetic gases.
Perioperative temperature regulation (3,902) hypothermia treatment (3,800)	<ul style="list-style-type: none"> - Apply passive rewarming methods (e.g. blanket and warm clothes). 	<ul style="list-style-type: none"> - Apply passive heating methods (e.g., surgical drape, ordinary blanket, lower limb bandage with orthopedic cotton, lower limb bandage with orthopedic cotton associated with surgical cotton drape, surgical cotton drape associated with cotton sheet).
Perioperative temperature regulation (3,902) hypothermia treatment (3,800)	<ul style="list-style-type: none"> - Identify the patient's risk factors for body temperature abnormalities (e.g., major general or regional anesthesia, age, major trauma); - Identify medical, environmental and other factors that may lead to hypothermia (e.g. immersion in ice water, illness, traumatic injury); - Provide interference-free communication about the patient's risk of temperature abnormalities. 	<ul style="list-style-type: none"> - Identify risk factors (e.g. age, BMI, type of anesthesia, diabetes, hypertension, ASA level, length of surgery).
Perioperative temperature regulation (3,902) hypothermia treatment (3,800)	<ul style="list-style-type: none"> - Monitor vital signs, including core body temperature; - Monitor skin color, skin temperature, skin moisture. 	<ul style="list-style-type: none"> - Monitor vital signs (temperature, blood pressure, heart rate and oxygen saturation).
Perioperative temperature regulation (3,902) hypothermia treatment (3,800) Temperature regulation (3,900)	<ul style="list-style-type: none"> - Ensure adequate body temperature until the patient is awake; - Monitor the patient's temperature using appropriate devices and reference sites; - Initiate and maintain continuous temperature monitoring as appropriate; - Monitor and report signs and symptoms of hypothermia and hyperthermia. 	<ul style="list-style-type: none"> - Monitor patient's temperature.
Perioperative temperature regulation (3,902) hypothermia treatment (3,800)	<ul style="list-style-type: none"> - Adjust the ambient temperature to minimize the risk of hypothermia (i.e., in addition to air heating, when large surface areas are exposed, keep the ambient temperature above 73.4°F, or 23°C); - Remove the patient from cold environments; - Remove the patient's wet and cold clothes. 	<ul style="list-style-type: none"> - Monitor the temperature of the surgical room.
Perioperative temperature regulation (3,902) hypothermia treatment (3,800)	<ul style="list-style-type: none"> - Pre-warm the patient with an active warming method (e.g. forced air) for at least 15 minutes before starting anesthesia, as appropriate; - Minimize patient exposure during surgical preparation and procedure, when possible. 	<ul style="list-style-type: none"> - Pre-warm the patient 30 minutes before procedure.

NIC: Nursing Interventions Classification

Table 1. Content validity index of nursing activities after cross-mapping with nursing diagnosis of perioperative hypothermia. Vitória (ES), 2022 (n=8).

Nursing activity	CVI*
Apply active heating methods	1
Install and regulate active heating device	1
Apply active internal reheat or "central reheat"	1
Adjust room temperature to minimize risk of hypothermia	0.83
Apply passive heating methods	1
Provide interference-free communication about the patient's risk of temperature abnormalities	1
Identify patient risk factors for body temperature abnormalities	1
Stop active heating activities (e.g. air heating) when appropriate	1
Identify medical, environmental, and other factors that may trigger hypothermia	0.66
Monitor vital signs	1
Monitor the temperature of the surgical environment	0.83
Monitor patient temperature using appropriate measurement devices and locations	0.83
Minimize patient exposure during surgical preparation and procedure when possible	1
Pre-warm the patient for 30 minutes before the procedure	0.83
Remove patient's wet and cold clothing	1
Provide heated or cold irrigating solutions as appropriate	0.16
Ensure adequate body temperature until patient is awake	1

CVI: content validity index. *CVI values were the same for the four attributes evaluated (understanding, organization, objectivity, and relevance).

period. In addition, thermal comfort has a direct impact on the postoperative period, reducing the possibility of pathophysiological sequelae²².

There is also the planning of active and passive heating methods. According to the recommendations of the National Institute for Health and Clinical Excellence (NICE) and the American Society of Peri Anesthesia Nurses (ASPAN), passive methods are not very effective, as they reduce heat loss in only 30% of patients, so they must be associated with active heating methods^{12,23}.

As for active methods, some are more effective than others. In a meta-analysis, the forced air system was proven superior to passive heating methods and the thermal mattress, but there were no significant differences between the resistive heating blanket, the radiant heating system, and clothing with hot water circulation²⁴. Another study also did not report significant differences between forced air and polymer mattresses, but the latter is known to transfer less heat than forced air to take longer to bring the temperature to normal levels⁵. When comparing the thermal mattress, the thermal blanket and heated infusion, there was no statistically significant difference as well¹¹.

The forced air system is NICE' gold standard, as there is evidence that it allows patients to spend less time in the

post-anesthesia care unit, minimizes costs, maintains better temperature control, and have flexible use in heating places, offering more thermal comfort than other methods—which makes it a reference^{6,24}.

Preheating is another important approach that must be performed at least 30 minutes before the surgical procedure. Such activity avoids the initial drop in temperature and reduces hypothermia in anesthetic recovery, while forced air alone fails to prevent the initial drop in temperature^{23,24}. Absence of preheating and ineffective temperature monitoring result in a significant difference in negative outcomes between hypothermic and normothermic patients in the postoperative period^{2,4,23}.

However, even with all these means and care provided, the percentage of patients who may have the chance to have hypothermia in the perioperative period is high, especially in the intraoperative and immediate postoperative periods, whether mild or moderate. The fact is that temperature control methods reduce the rate of hypothermia and, consequently, some complications in the postoperative period^{4,23,25}.

Thus, the fundamental role of nurses in all perioperative phases is highlighted, as they contribute to the set of actions, from the identification and naming of problems to the implementation and evaluation of instituted actions.

Thus, it is their responsibility to plan effective interventions to prevent and treat hypothermia, as well as to develop protocols for care management^{5,10,26}.

Thus, the use of the Nursing Process through standardized language promotes interdisciplinary and better multi-professional communication, and ensures patient safety. The use of standardization of mapped interventions improves decision-making on the care to be provided, reducing time and optimizing the care process¹⁰.

The interventions/activities listed here can guide the planning of actions to be implemented in the perioperative period to mitigate vulnerability to hypothermia, expanding the visibility of perioperative nursing care and improving care quality.

CONCLUSION

This study allowed to map and validate 15 activities for the nursing diagnosis of risk of perioperative hypothermia, namely: active heating methods, adjustment of the room temperature to minimize the risk of hypothermia, communication without interference about the risk of temperature abnormalities, monitoring of vital signs, prewarming patients for 30 minutes before the procedure, and infusing of warmed solutions. This care can be established and implemented

in the practice of perioperative nursing to reduce the risk of hypothermia, as well as the consequences of this event.

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CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest.

AUTHORS' CONTRIBUTIONS

BHF: project administration, formal analysis, conceptualization, data curation, investigation, methodology, resources, writing – original draft, writing – review & editing, supervision, validation, visualization. TMO: project administration, investigation, methodology, resources, writing – original draft, writing – review & editing, visualization. ALA: writing – original draft, writing – review & editing, visualization. ABL: project administration, formal analysis, conceptualization, data curation, investigation, methodology, resources, writing – review & editing, validation, visualization.

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