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EXPERIENCE REPORT

Process modeling: technological innovation to control the risk for perioperative positioning injury

Modelagem de processos: inovação tecnológica para controle do risco de lesão por posicionamento perioperatório

Modelado de procesos: innovación tecnológica para controlar el riesgo de lesión por posicionamiento perioperatorio

Ana Luzia Rodrigues[I]
ORCID: 0000-0002-5876-8763

Fernanda Broering Gomes Torres[I]
ORCID: 0000-0002-1163-3781

Eduardo Alves Portela Santos[I]
ORCID: 0000-0003-3075-9184

Marcia Regina Cubas[I]
ORCID: 0000-0002-2484-9354

[I]*Pontifícia Universidade Católica do Paraná. Curitiba, Paraná, Brazil.*

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Corresponding author:
Ana Luzia Rodrigues
E-mail: analuzia64@hotmail.com

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ABSTRACT

Objectives: to report the construction of a process model to support the decision making of operating room nurses to control the risk for perioperative positioning injury. **Methods:** experience report on a process model that helps nurses with decision making regarding clients at risk for perioperative positioning injury. By following the steps, it was possible to identify intrinsic and extrinsic variables of the literature and of the workflows of teams involved in the positioning of the client for surgery. The Business Process Model and Notation, the Bizagi Modeler software and terms from the International Classification for Nursing Practice were used in the model. **Results:** the experience allowed the observation of the knowledge integration between different areas, which enabled the process modeling and its validation. **Conclusions:** process modeling is an innovative option for the development of support systems for clinical nursing decisions.

Descriptors: Operating Room Nursing; Workflow; Nursing Process; Biomedical Technology; Decision Making.

RESUMO

Objetivos: relatar a construção de um modelo de processos para dar suporte à tomada de decisão do enfermeiro de centro cirúrgico para controle do risco de lesão por posicionamento perioperatório. **Métodos:** relato de experiência sobre a modelagem de um processo que auxilia o enfermeiro a tomar decisões sobre o cliente com risco de lesão por posicionamento perioperatório. As etapas percorridas permitiram identificar as variáveis intrínsecas e extrínsecas da literatura e dos fluxos de trabalho das equipes envolvidas no posicionamento do cliente para cirurgia. Na modelagem, utilizaram-se a notação *Business Process Model and Notation*, o *software* Bizagi Modeler e termos da Classificação Internacional para a Prática de Enfermagem. **Resultados:** a experiência permitiu observar a integração de saberes entre distintas áreas, o que viabilizou a modelagem do processo e sua validação. **Conclusões:** a modelagem de processos é uma opção inovadora para desenvolvimento de sistemas de apoio às decisões clínicas da enfermagem.

Descritores: Enfermagem de Centro Cirúrgico; Fluxo de Trabalho; Processo de Enfermagem; Tecnologia Biomédica; Tomada de Decisões.

RESUMEN

Objetivos: informar la construcción de un modelo de proceso que apoye la toma de decisiones de los enfermeros de quirófano para controlar el riesgo de lesión por posicionamiento perioperatorio. **Métodos:** informe de experiencia sobre el modelo de un proceso que ayuda al enfermero a tomar decisiones sobre el cliente en riesgo de lesión por posicionamiento perioperatorio. Los pasos seguidos permitieron identificar las variables intrínsecas y extrínsecas de la literatura y de los flujos de trabajo de los equipos involucrados en el posicionamiento del cliente para la cirugía. En el modelo, se utilizaron el Modelo de Procesos de Negocio y Notación, el software Bizagi Modeler y los términos de la Clasificación Internacional para la Práctica de Enfermería. **Resultados:** la experiencia permitió observar la integración del conocimiento entre diferentes áreas, lo que posibilitó el modelado del proceso y su validación. **Conclusiones:** el modelado de procesos es una opción innovadora para el desarrollo de sistemas de apoyo a las decisiones clínicas de enfermería.

Descriptores: Enfermería de Quirófano; Flujo de Trabajo; Proceso de Enfermería; Tecnología Biomédica; Toma de Decisiones.

INTRODUCTION

The perioperative positioning of the client promotes access to the surgery site and preserves the biological functions. However, prolonged stay in the same position associated with constant body pressure, poses risks of temporary or permanent complications, such as skin and tissue injuries[1]. In a study on the topic, 77% of clients had pressure injuries resulting from positioning[1].

To prevent such complications, the perioperative team is responsible for safe and quality planning in which the client's individuality is considered. Nurses must practice their knowledge based on stages of the Nursing Process (NP), a technological instrument with five distinct stages, although interdependent and interrelated, namely: history, diagnosis, planning, implementation and evaluation[2].

For representation, standardization and documentation of the structuring elements of the practice - nursing diagnoses, outcomes and interventions - the International Council of Nurses developed the International Classification for Nursing Practice (ICNP®). Regarding the risks related to the positioning of the client in the Operating Room (OR), the ICNP® contains the nursing diagnosis "risk for perioperative positioning injury"[3], which guides decisions about nursing care for the control of potential positioning injuries.

Decision-making on the planning of perioperative care is influenced by the knowledge of intrinsic and extrinsic variables to the client, financial and normative aspects of the institution[4], as well as the nurse's expertise that comes from knowledge acquired in previous experiences, values, beliefs and technical skills on the topic[5].

The OR is a complex environment, in which variables can have different analyzes, imply in ambiguities and consequently, imprecise operational activities. Nurses must make efficient decisions using different knowledge of the context where they are inserted. For this, the timely access to sources of specific knowledge and/or specialists on the subject is essential, and in that sense, the use of mechanisms can support their decision making.

Process modeling stands out among the decision-making support mechanisms in the face of scenarios such as the OR, with flexible options of sequences of activities. This is a consolidated technique in other areas of knowledge, such as engineering[6] and the industry[7], and applied in an innovative way in nursing. It is a grouping of activities that shows the correlations between processes, people and information, and allows the improvement of results, elimination or simplification of procedures[8].

The modeling is developed based on a set of symbols and standard rules, such as the Business Process Model and Notation (BPMN)[9], and has the aid of computational tools, such as the Bizagi Modeler software.

In view of the above, a model of processes was built in an innovative way to support the decision making of OR nurses in the control of the risk for perioperative positioning injury.

OBJECTIVES

To report the construction of a process model to support the decision making of OR nurses to control the risk for perioperative positioning injury.

METHODS

This is an experience report on the construction of a process model to support the decision making of the operating room nurse to control the risk for perioperative positioning injury. It was conducted in the period from 2016 to 2020. The experience of modeling a process on the perioperative positioning of the client began with an interdisciplinary analysis on the theme through a partnership between researchers in the field of nursing and production and systems engineering. The mechanism adopted for the development of the final product was the process modeling technique, which is deemed capable of supporting nurses' decision making.

For the construction of the model, it was necessary to identify the intrinsic and extrinsic variables related to the risk for perioperative positioning injury. Such identification occurred through an integrative literature review and observation of the workflows of the teams involved in positioning the client for surgery. The observations occurred in three medium-sized hospitals in the southern region of Brazil; a university hospital with emphasis on trauma and emergency; a private hospital with emphasis on elective surgeries; and a public/private hospital where elective and emergency procedures are performed.

To ensure that the sample represented the surgical specialties and the risk variables of perioperative positioning, eight procedures from different specialties were selected in each hospital, based on the surgical agenda. The observed workflows followed the inclusion criteria: clients aged over 18 years; Body Mass Index (BMI) between 18.5 and 29.9 for adults, and between 22 and 27 and greater than 27 for older adults; duration of surgery between two and five hours, with general and/or local anesthesia. Obstetric surgeries were excluded because these have specific characteristics and in the ORs observed, they are not routine situations.

To model the process, the BPMN notation was used together with the Bizagi Modeler software (version 3.4.0.062/2019), a free tool that allows to design, diagram, document and publish the processes using the BPMN standard. The computational language characterized by the symbology (Figure 1) used for this modeling allowed the computational interpretation and representation of the process and consequently, the expansion of the application through the interoperability provided.

The start and the end of a process are represented by circles. The arrows represent the sequence flow and the rectangles with rounded edges, the tasks. Subprocesses have a [+] symbol at the bottom of the rectangle, implying the understanding that this activity contains a set of tasks.

Gateways, pictured as diamond shapes, are elements that create the division of the flow and represent the convergence or divergence of the continuity of a flow at the moment a decision is made. The parallel gateway is used when several activities occur in parallel; an inclusive gateway is used when, at a point in the flow, one or more paths among several available are activated; the exclusive gateway represents a decision point where only one path out of the many possible ones can be chosen.

Terms of the ICNP® 2017 were used to standardize the language of the texts inserted in the model[3]. In addition, the use

of nursing terminology promotes security in communication and continuity in the care provided.

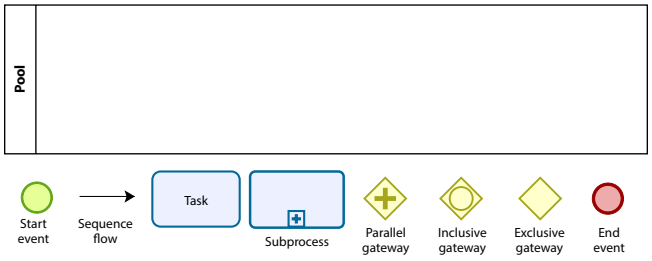


Figure 1 – Symbols for the model: pool and basic elements of Business Process Model and Notation, Curitiba, Paraná, Brazil, 2020

The model was built purposefully linking steps 1, 2 and 3 with stage I of the Nursing Process - nursing history, while step 4 was related to stages III and IV - nursing planning and implementation, for which the nursing diagnosis selected was "risk for perioperative positioning injury"[3], frequently identified in surgical clients.

In order to constitute a guide with a robust theoretical basis, the decision points and rules of the model were adjusted in scientific evidence and in orientations, recommendations and guidelines of scientific associations in the area about possible complications related to the positioning of the client for surgery.

In order to validate the constructed model, OR nurses analyzed case studies to answer items in a questionnaire on decision making for planning interventions for surgical clients in view of the diagnosis "risk for perioperative positioning injury". The responses were analyzed regarding concordance by calculating the Content Validity Index (CVI)[10], and those with overall CVI ≥ 0.80 were considered valid.

RESULTS

This process model experience demonstrated that the integration of knowledge between researchers from different areas about the same phenomenon allows sharing resources used in a different specialty, showing that the knowledge is complementary.

The analysis of the variables identified in the literature and those observed in the workflows of surgical specialties: cardiac; general; gynecological; otorhinolaryngology; orthopedics; urology; vascular and neurosurgery allowed the construction of the model with a macro process (Figure 2) structured in four steps including the following subprocesses: (i) consult the surgical schedule; (ii) consult the client's medical record; (iii) perform a physical examination; (iv) determine positioning devices and position the client.

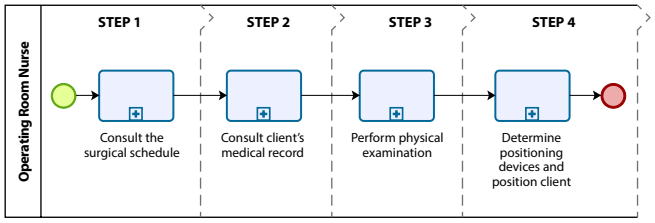
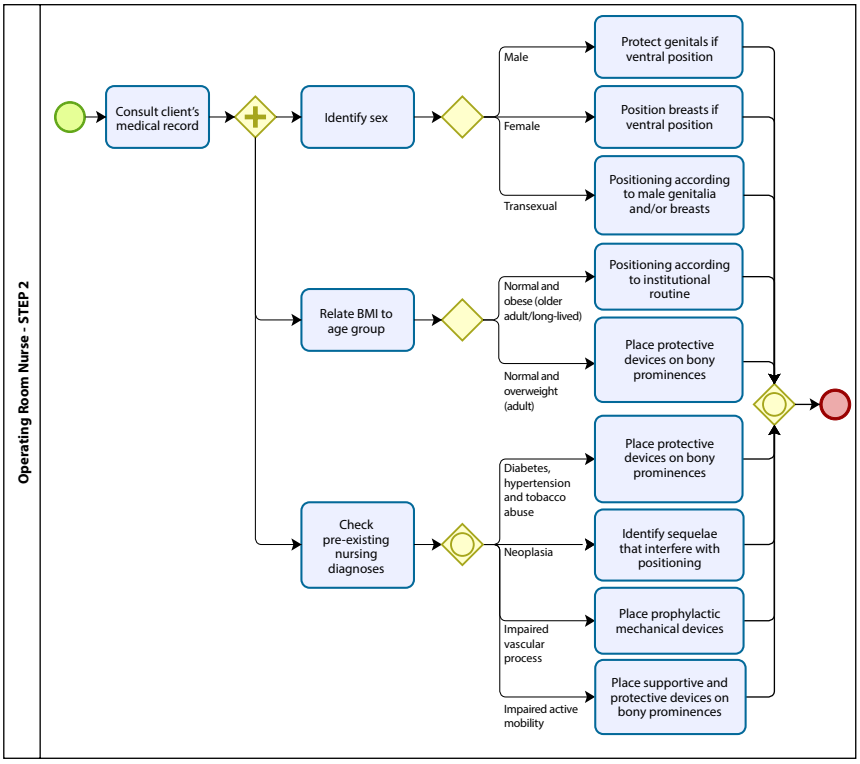


Figure 2 – Steps 1 to 4 of the macro process for perioperative positioning of the client, Curitiba, Paraná, Brazil, 2020

As a model is structured by macro and subprocesses, both the whole and the details can be observed, demonstrating the workflows of sequential and interdependent activities. Such structuring is important to carry out each step in the positioning of the client, which provides nurses with a comprehensive and at the same time specific view of the variables related to perioperative positioning, in addition to being aligned with the stages of the Nursing Process.

In order that nurses understand and integrate innovations in the health care process, they must be able to expose themselves to technological content. Usually, greater interest is given to hard technologies of the operating room, such as the operation of a mechanical ventilator or a multiparametric monitor. However, neglecting light-hard technologies, such as the symbology of computational language, may imply deficiency or underuse of technological resources.



BMI – body mass index.

Figure 3 – Step 2: "consult the client's medical record" subprocess, Curitiba, Paraná, Brazil, 2020

When using the model, the aim is that OR nurses integrate and analyze several variables in a single moment, systematically controlling the risks of complications for the client. The visual

aspect of the model (Figure 3) highlights decision points and rules, which facilitates the team's understanding of the sequence and routing of activities. For example, in surgical procedures that require the client's ventral position, the positioning of breasts is pertinent if a female client whereas in the case of a male client, it is pertinent to position the external genitalia. Although such positioning seems intuitive, it does not always happen, resulting in skin and/or tissue injuries of clients. Management activities are also enhanced by using the model, which enables to prioritize and allocate resources in response to the identified needs.

Upon completion of the model construction, it was validated by six OR nurses regarding the aid in decision making for planning interventions for clients with a nursing diagnosis "risk for perioperative positioning injury". Given the intentional choice of professionals working in ORs of the study site for more than a year, and the item and overall CVI scores in the three case studies not showing a significant difference, the sample could be considered representative of local issues related to typologies of ORs.

Ethical aspects

The project was approved by the Research Ethics Committee of the *Pontificia Universidade Católica do Paraná*, under number 2,809,970. The institutions authorized the observation of workflows.

CONCLUSIONS

Decision making requires the use of complex knowledge and it is not always possible to access sources of information at the time and in the environment where such decisions are made. The technological innovation - process model - reported in this article is a support system for nurses' decision making aimed at offering quality and efficiency to the execution of the Nursing Process.

During the development of the model, the challenges imposed by the need to translate knowledge between areas - nursing and production and systems engineering - were overcome, thereby consolidating the idea that knowledge is complemented by interdisciplinarity.

When organizing the variables used, the impact and dimension of nursing care directed to the surgical client at the moment of perioperative positioning, and the relevance and pertinence of guiding the assistance in the Nursing Process were evidenced.

In conclusion, the use of process modeling appears as an innovative option to develop support systems for clinical nursing decisions.

Study limitations

Indirectly, nurses' unfamiliarity with process modeling and the BPMN language was identified, which may have impacted on the few suggestions offered at the time of validation.

Contributions to the area

The model guides the nurse to control the risk of specific injury and generates positive developments for direct care to the OR client. From an organizational point of view, it contributes to the nurse's proactive performance. Decision making is sustained when this professional anticipates for the perioperative team the material and human needs that impact the surgical act and prioritizes the choice of devices used in positioning, especially in situations with scarce resources.

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