Computerized nursing process: methodology to establish associations between clinical assessment, diagnosis, interventions, and outcomes

PROCESSO DE ENFERMAGEM INFORMATIZADO: METODOLOGIA PARA ASSOCIAÇÃO DA AVALIAÇÃO CLÍNICA, DIAGNÓSTICOS, INTERVENÇÕES E RESULTADOS

PROCESO DE ENFERMERÍA INFORMATIZADO: METODOLOGÍA PARA ASOCIACIÓN DE LA EVALUACIÓN CLÍNICA, DIAGNÓSTICOS, INTERVENCIONES Y RESULTADOS

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ABSTRACT

The Nursing Process is a technology of care that guides the sequence of clinical reasoning and improves the quality of care. This article discusses the development of a computerized nursing process (CNP) for the intensive care unit. The study was conducted in three main steps: discussion and understanding of the International Standards Organization's standard 18.104; an evaluation of the theoretical expertise of International Classification for Nursing Practice - ICNP® 1.0; and the association of patient information with diagnoses and nursing interventions. The knowledge base was organized according to ICNP® Version 1.0. The result was a restructuring of the CNP that documents the clinical practice of nursing and provides support for decision making based on the association between clinical assessments, diagnoses and interventions. The success of this technology lies in its achievement of the integration of research, professional practice and teaching. The methodology establishes associations between clinical evaluations, diagnoses, interventions and the results of the ICNP ® 1.0 with ISO 18.104.

DESCRIPTORS

Nursing informatics
Nursing process
Terminology
Classification
Intensive Care Units

RESUMO

O Processo de Enfermagem é uma tecnologia do cuidado que orienta a sequência do raciocínio clínico e melhora a qualidade do cuidado. Este artigo trata-se do relato do desenvolvimento de um Processo de Enfermagem Informatizado (PEI) para Unidade de Terapia Intensiva. O presente estudo foi desenvolvido em três principais etapas: discussão e compreensão da norma International Organization for Standard 18.104; aprofundamento teórico sobre a CIPE® 1.0; associação das informações aos diagnósticos e intervenções de Enfermagem. A base do conhecimento foi organizada segundo a CIPE® Versão 1.0. O resultado foi a reestruturação do PEI a partir da associação das avaliações clínicas aos diagnósticos e intervenções que permitem documentar a prática clínica de enfermagem, além de fornecerem apoio para a tomada de decisão. As etapas metodológicas empregadas permitiram fazer a associação entre a avaliação clínica, os diagnósticos, as intervenções e os resultados da CIPE® 1.0 com a ISO 18.104.

DESCRITORES

Informática em enfermagem
Processos de enfermagem
Terminologia
Classificação
Unidades de Terapia Intensiva

RESUMEN

El Proceso de Enfermería es una tecnología que orienta la secuencia del razonamiento clínico y mejora la calidad del cuidado. Este artículo relata el desarrollo de un Proceso de Enfermería Informatizado (PEI) para Unidad de Terapia Intensiva. El estudio se desarrolló en tres etapas principales: discusión y comprensión de la norma International Organization for Standardization 18.104; profundización teórica de la CIPE® 1.0; asociación de las informaciones a los diagnósticos e intervenciones de Enfermería. La base del conocimiento se organizó según CIPE® 1.0. El resultado fue la reestructuración del PEI a partir de la asociación de las evaluaciones clínicas a los diagnósticos e intervenciones que permite documentar la práctica clínica de enfermería, además de brindar respaldo para la toma de decisiones. Las etapas metodológicas empleadas permitieron hacer la asociación entre la evaluación clínica, los diagnósticos, las intervenciones y los resultados de la CIPE® 1.0 con la ISO 18.104.

DESCRIPTORES

Informática aplicada a la enfermería
Procesos de enfermería
Terminología
Clasificación
Unidades de Terapia Intensiva

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INTRODUCTION

Nursing care, especially in an intensive care context, is complex, comprehensive, and challenging. In intensive care units (ICUs), nurses are exposed to difficult clinical situations that require attention and control, and nurses must work with various technological innovations that need to be integrated in a consistent, correct, and safe system of care. From this perspective, it is evident that nurses should target their activities toward the development of competence and skills for making safe decisions that are free from unnecessary risk and based on scientific evidence[1-3].

Among the various technologies in the ICU environment, the nursing process (NP) stands out as a care technology that guides the sequence of logical reasoning and improves the quality of care through the systematic clinical assessments, diagnoses, interventions, and outcomes of nursing. The NP is a tool that should be used by nurses to demonstrate the thought process and judgments they develop during the course of care. It integrates, organizes, and ensures the continuity of information, enabling nursing staff to evaluate their efficiency and effectiveness and to modify their performance according to patient recovery results. The NP also serves as a permanent foundation for education, research, and management in nursing[1-2,4-5].

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However, the volume of information in the ICU is substantial and can be described as heterogeneous, complex, and unstructured. Information is central to the care process, and access to information empowers nurses with evidence to support their contributions to patient outcomes. Therefore, a connection is proposed between access to essential information through the NP and the results and safety of the patient[6-7]. In this context, information technology and communication (ITC) have been used to support the development of the NP, integrating it into a logical structure of data, information, and knowledge for decision making in nursing care[7].

Information technologies and communication, coupled with the nursing process in the ICU, can promote improvements in the quality of direct care, patient results, and nursing practice by reducing the time spent on clinical records and documentation[3]. ITC can also foster the development of critical thinking and investigative reasoning among nurses; ITC approaches these professionals with care by promoting clinical discussion among peers, using multidisciplinary teams, and fostering the continuous search for information and scientific evidence[3:8-9].

Therefore, it is well known that the main objective in nursing informatics is to specify the requirements of the clinical information system and to incorporate the needs of nurses into the processing of information to support clinical nursing practice. This information system is necessary to integrate people, information, processes, and computing resources with a common goal of maximizing the technological capabilities and the benefits to the individuals involved in the system[6-7,10].

To integrate information related to the nursing process, several nursing terminologies have been developed and studied in recent years, especially for the International Classification for Nursing Practice (ICNP®). In Version 1.0 of the ICNP®, which was structured for computerization, there is a model with seven axes that establish nursing diagnoses, nursing interventions, and nursing care outcomes according to the priority health needs of the patient[11].

Based on these considerations, five studies conducted since 1999 have sought to develop and evaluate computerized NP in the ICU in accordance with the ICNP®[1-2,12-15]. Early studies adopted the ICNP® Beta 2 Version. In each study, the NP was evaluated, and new modifications were implemented[12-13]. In 2006, a proposed structure was reached that included the informational needs of nursing care in the ICU using ICNP® Version 1.0. The results indicated that the computerized system employs ergonomic criteria and content, and the system interface, content, and data security were rated as *Very Good* by the study participants. This study concluded that the web-based computerized system (fixed system), based on ICNP® Version 1.0, is an information system structure that promotes the organization, control, and logical visualization of nurses' clinical reasoning during patient care using ICU computer resources[1].

In 2008, continuing the studies initiated in 1999, another study further developed the structure of the information system and implemented NP on a personal digital assistant (PDA) mobile device that was integrated with the previously developed web-based computerized system. This study aimed to assess, using input from nurses in two general ICUs, the criteria of ergonomics, content, and usability of computerized NP on a mobile device, which was developed according to ICNP® Version 1.0. The results indicated that the mobile computerized NP system exceeded the established criteria (on a scale of 1–5) for content, technical organization, and interface related to ergonomics (mean 4.51; ± 0.24) and usability (mean 4.65, ± 0.25); the ratings were considered *excellent* by the evaluators. It was concluded that this computerized system for the PDA environment was a coherent, effective, and consistent system because, in addition to allowing the integration of research, teaching, and professional practice, it allowed nurses to more closely address patients' bedside care[14-15].

It is worth restating that the development and implementation of this technological product—the nursing process system—is the most complete and only computerized system designed in Brazil using ICNP® version 1.0. It is also

noteworthy that this technological product closed the cycle, and it is possible to conclude from the positive evaluation by the professionals involved that both the fixed system (Web-based)[1] and the mobile system (PDA)[14] are accessible and applicable for the implementation of a computerized NP in the ICU. It should also be noted that some recommendations were suggested for future work, including the resizing of data and information in the NP web-based and mobile device-based systems.

The aim of the present study was to examine the relationship between the data and information in the nursing process, which were computerized according to ICNP® Version 1.0, and to establish associations between detailed clinical evaluations of each human system and diagnoses, interventions, and patient outcomes.

METHODS

This is both a study of a technological product and a methodological study[16]. The study was conducted as part of a course (*Linked Research Project: Association - Diagnosis and Intervention of ICNP® 1.0 on computerized systems for ICU and Emergency*) in the Graduate Nursing Program, Federal University of Santa Catherine (PEN / UFSC), during the second half of 2010. The participating researchers were a teacher and six students, for a total of seven researchers. The participants in the course were also the study evaluators, as they are specialists in ICU and emergency room nursing and have been developing research activities with ICNP® Version 1.0 through the Clinical Research, Technology, and Informatics in Health and Nursing Group (GIATE / PEN / UFSC) since 2003.

This study was submitted to the Ethics Committee of the Universidade Federal de Santa Catarina and was approved without restrictions by members of the entity (protocol # 947/10).

The study was conducted between March and September 2010 and comprised the following steps:

Step 1: discussion and understanding of the application of the International Standards Organization (ISO) standard 18.104 for Brazilian nursing. This standard includes the reference terminology model for diagnoses and nursing actions, thus making the standard a tool that facilitates the mapping of various terminologies and promoting the integration of information systems and electronic medical records[17].

Step 2: discussion and theoretical expansion of the ICNP® version 1.0, which was conducted by relating it to the practice of intensive care nursing. The historical evolution of this classification of nursing was addressed, from the alpha version to the most current version, 2.0. In addition, studies on computerized NP that began in 1999[1-2,12-15] using this classification system were discussed.

Step 3: presentation of the current structure of computerized NP according to ICNP® version 1.0. The system is available at http://www.nfrinfor.ufsc.br and http://www.nfrinfor.ufsc.br/movel for both web and mobile devices, and it can be accessed using a login name and password provided by the computer system administrators.

In the current structure, after registering a new patient and/or selecting a previously registered patient, the identity screen opens, and users can perform a clinical evaluation to record the following data: vital signs (invasive or noninvasive), numeric pain scale, pulse oximetry, capnography, height, weight, subjective data from the patient and/or family, and links to hydroelectrolytic/blood/fluid balance.

After registration of the data mentioned above, the nurse initiates the clinical assessment of the following patient systems: respiratory, cardiovascular, neurological, musculoskeletal, gastrointestinal, renal, integumentary, reproductive (male and female), and biopsychosocial. Laboratory test results are also recorded. Data for the clinical assessments are as comprehensive and detailed as possible to ensure that the electronic record is complete and provides all information essential to the achievement of nursing care. In the current system, nurses must select each clinical evaluation and, based on each evaluation, select the respective diagnoses, as shown in Figure 1.

From the selection of nursing diagnoses submitted concerning the patient, the nurse selects the necessary interventions, as explained in Figure 2. Importantly, at this stage, the system is restructured so that nursing diagnoses are specific to the clinical evaluation and not just to the patient systems evaluated.

Step 4: association/linkage of data and information with diagnoses and nursing interventions, according to ICNP® version 1.0. Data from the clinical assessments, diagnoses, interventions, and outcomes of nursing for each system were printed out. This step was performed at biweekly meetings and was considered to be more complex because it required the nurses to integrate theory and practice and to develop clinical reasoning and clinical judgment based on the numerous possible associations that could be established in accordance with each clinical condition presented by the patient. This step also required conducting a comprehensive and thorough review of the data, diagnoses and interventions listed in the computerized NP.

The methodology used for the association/linkage of data involved the grouping of possible clinical situations (three or four situations) in increasing order of complexity for each patient system. From the collation of data from the clinical evaluation, we selected a list of specific diagnoses for each situation, as well as a group of nursing interventions for the diagnoses presented.

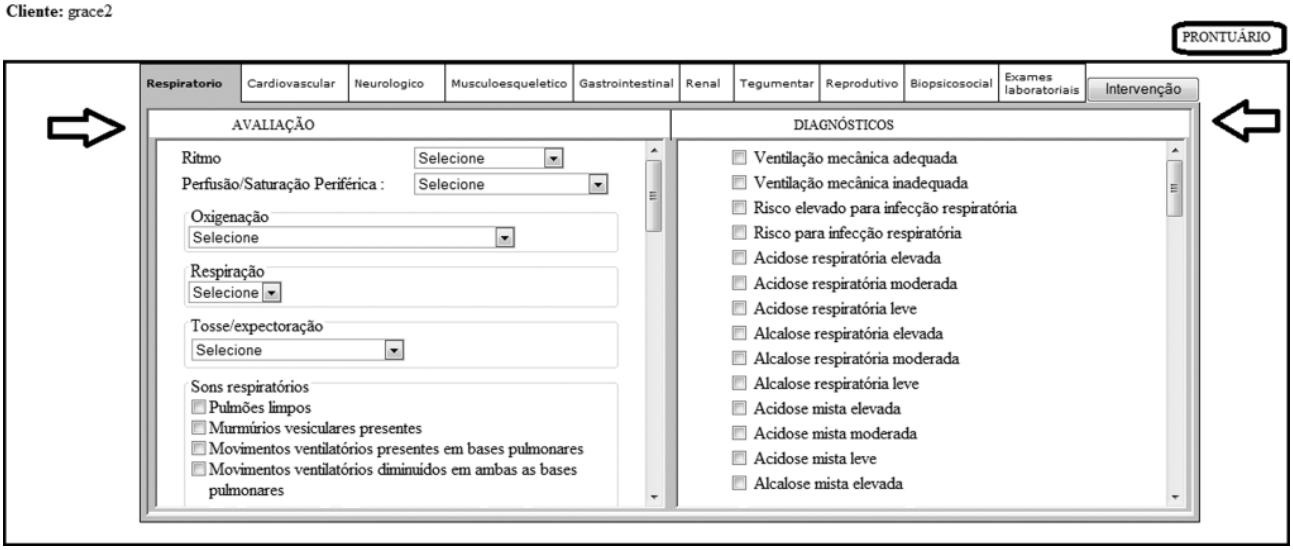

Figure 1 - Screenshot of the nursing respiratory clinical evaluation and diagnosis from the ICNP® 1.0 computerized NP - Florianópolis, 2011

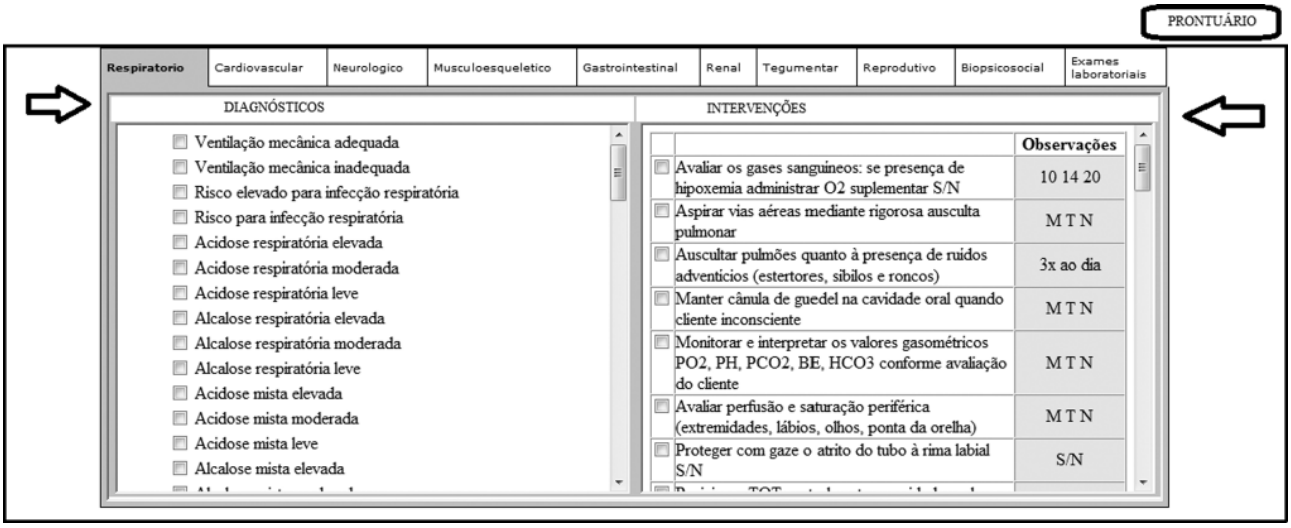

Figure 2 - Screen showing nursing diagnoses and interventions from the ICNP® 1.0 computerized NP - Florianópolis, 2011

At this stage, the musculoskeletal, cutaneous, biopsychosocial, gastrointestinal, male reproductive, and female reproductive systems presented three clinical situations, and the respiratory, cardiovascular, neurological, and renal systems presented four clinical situations.

Step 5: A general meeting was conducted to review associations and enter data into a spreadsheet using Excel® software.

Step 6: The previous structure of the NP was changed to a new computerized structure based on the associations/linkages established by the nurses. This step was performed in collaboration with a systems programmer specializing in computer science.

RESULTS

The results are presented in Table 1. The results address two clinical situations that were selected for the respiratory system to perform the association/linkage of data based on clinical evaluations, diagnostics, and nursing interventions using ICNP® version 1.0.

The association/linkage of data from the clinical assessments, diagnoses and nursing interventions was performed using the steps described above.

The first and second stages addressed the theoretical expansion and discussion of ISO 18.104 and ICNP® version 1.0. ISO 18.104, developed in 2003, accommodates the various terminologies and classifications currently used by nurses to document patient data. This standard constitutes a reference terminology that represents the concepts that facilitate the mapping of nursing terms to other health terminologies, promotes the integration of information systems, and enables comparative research and analysis to improve results and strengthen the body of nursing knowledge[17].

Table 1 – Association of the data from nursing clinical evaluations, diagnoses, and interventions: clinical situation 3 and 4, respiratory system

Computerized Nursing Process as per CIPE® version 1.0 Clinical situation 3 - Respiratory System			
Clinical evaluation Situation 3	**Clinical evaluation Situation 4**	**Nursing diagnoses**	**Nursing Interventions**
• ***Rhythm:*** → Irregular Surface → Irregular Deep • ***Peripheral Perfusion/ Saturation:*** → Acyanotic → Cyanosis of extremities → Widespread cyanosis • ***Oxygenation:*** →Continuous macronebulization → OTT TQT mechanical ventilation • ***Mode:*** → Intermittent SIMV + PS, OS; CPAP, continuous CPAP • ***Breathing:*** → Dyspnea or apnea • ***Cough / Sputum:*** →Productive with expectoration • ***Lung Sounds:*** → All of the sounds of Clinical Situation 2, except for: clear lungs and vesicular breath sounds in lung bases. → Snoring or diffuse rhonchi → Wheezing → Rales/crackles or diffuse rales/crackles • ***Oral Aspiration:*** → Small amount of drooling → Abundant drooling → Bloody secretion → Thick whitish secretion • ***Nasotracheal aspiration:*** → Purulent secretion → Bloody s secretion • ***Chest X-ray:*** → Mediastinal enlargement → Barotrauma → Air bronchograms → Lung condensed → Pleural effusion → Diffuse lung congestion → Lung congestion R and/or L → Fractured rib → R and /or L → Pneumothorax → R and /or L → Atelectasis → R and/ or L → Cardiomegaly → Artificial valve → Chest drain R and/ or L → Steel wires in the sternum → Strange body • ***Drains:*** → None → Chest R and/or L and/ or Mediastinum	• ***Rhythm*** → Irregular Deep • ***Peripheral Perfusion/ Saturation:*** → Acyanotic → Cyanosis of extremities →Widespread cyanosis • ***Oxygenation:*** → Mechanical ventilation for OTT TQT • ***Mode:*** → Controlled pressure → Controlled volume • ***Breathing:*** → Apnea • ***Cough/Sputum:*** → None → Dry → Productive with sputum • ***Lung Sounds:*** → All of the sounds of Clinical Situation 3 → Vesicular sounds in lung bases • ***Oral Aspiration:*** → Small amount of drooling → Bloody secretion → Whitish, thick secretion • ***Nasotracheal Suctioning:*** → Purulent secretion → Bloody secretion • ***OTT/TQT suction*** → No secretion → With secretion • ***Chest X-ray:*** → Mediastinal enlargement → Barotrauma → Air bronchograms → Mediastinum enlargement → Pleural effusion → Diffuse lung congestion → Pulmonary congestion → R and / or L → Rib fracture R and/ or L →Pneumothorax → R and/ or L →Atelectasis → R and / or L → Cardiomegaly → Artificial valve → Chest drain R and / or L → Steel wires in the sternum → Strange body • ***Drains:*** → None → Thorax R and/or L and/or Mediastinum	• Risk for respiratory infection • Mixed compensated alkalosis • Mixed alkalosis high / moderate/ mild • Mixed acidosis moderate / mild high / • Respiratory acidosis high / moderate • High respiratory alkalosis • Moderate respiratory alkalosis • Compensated alkalosis • Compensated acidosis • Inappropriate gasometry parameter • Inadequate gas exchange • Adequate airway clearance • Inappropriate airway clearance • Adequate, effective cough • Inadequate cough • Increased cough without sputum • Inadequate ventilatory response • Progressive hypoventilation • Inappropriate respiratory process • Inadequate tissue perfusion and saturation • Inadequate ventilatory response • Appropriate / inappropriate ventilatory weaning response • Hyperoxia through mechanical ventilation • Increased / decreased sputum • Adequate mechanical ventilation • Inadequate mechanical ventilation • High risk for respiratory infection • Increased dyspnea for small and medium efforts • Constant hyperventilation • Hyperventilation in progress • Constant hypoventilation • Hypoventilation in progress • High airway obstruction • High hypoxia • Potential for increased hypoxia • Increased thoracic bleeding • Decreased thoracic bleeding • Normal thoracic bleeding • Normal thoracic bleeding • Potential for thoracic bleeding • Increased lung congestion • Increased lung congestion – same level • Decreased lung congestion • Decreased lung congestions – same level • Severe lung congestion • Lung congestion in progress • Dependent on mechanical ventilation with adequate volume • Dependent on mechanical ventilation with pressure controlled • Increased nocturnal orthopnea • Increased continuous orthopnea • Serious suffocation • Fatigue in progress	• Aspirate airway through rigorous lung auscultation • Auscultation for the presence of adventitious noises (rales/crackles, wheezing and snoring) • Keep Guedel cannula in the oral cavity when patient is unconscious • Monitor and interpret blood gas values (PO2, pH, PCO2, BE, HCO3) according to patient assessment • Assess peripheral perfusion and saturation (extremities, lips, eyes, tips of the ears). • Position OTT centrally in the oral cavity with CUFF bifurcation at the labial rim • Evaluate OTT height in cm • Monitor CUFF pressure in 25 to 30 cmH2O • Examine vocal fremitus during chest examination • Measure the drainage volume of chest drains and/or mediastinum • Examine the characteristics of chest drainage and/or mediastinum • Observe signs of subcutaneous emphysema • Assess the chest for the presence of flail chest, tumor, lesion, asymmetry, etc. • Monitor peripheral oximetry and capnography. • Monitor arterial blood gases and oximetry during weaning from mechanical ventilation • Monitor signs of hypoxemia and hypercapnia (psychomotor agitation, cyanosis of the extremities, sweating, paleness, competition with ventilation machine) • Ensure alternative methods of communication between nurse, patient and family (provide material for writing cards, graphics, etc.) • Explain the patient's situation to the family at the time of the visit • Evaluate characteristics of lung secretion (volume, color, odor, concentration) • Assess ventilatory pattern in the mode of mechanical ventilation (sync, alarms, PEEP, PPI, FIO2, current volume, condensed in the circuit, circuit-level, etc.) • Monitor presence of tube obstruction through changes in breathing pattern (psychomotor agitation, cyanosis of the extremities, sweating, pallor, tachycardia, decreased O2 saturation) • Keep the head aligned with the body, avoiding kinks in the tube and connections • Increase FIO2 to 100% for 3 minutes before and after aspiration • Adjust gradually, decreasing PEEP every 2 cm3 H2O during the expiratory period, up to 5 cm3 H2O, before disconnecting the patient from the mechanical ventilator • Set mechanical ventilator parameters for patient-assisted aspiration • Adjust gradually, increasing PEEP every 2 cm3 H2O, during the expiratory period until earlier prescribed level, after OTT aspiration. • Evaluate secretion characteristics at each suction • Drain water condensed in the circuitry of the ventilator. • Replace OTT filter. • Evaluate the radiological findings. • Evaluate reflexes for proper breathing (cough, vomiting and swallowing). • Position patient in semi-fowler bed. • Monitor respiratory pattern after extubation with O2 catheter ventilation or macronebulization • Administer sedatives and muscle relaxants according to medical prescription and watch for side effects. • Install closed suction system when PEEP above 10 in mechanically ventilated patients. • Replace closed suction system • Aspirate oral and nasal cavity when necessary and before measuring CUFF pressure.

This reference terminology discusses a model for the development of diagnoses and nursing actions. According to ISO 18.104, the nursing diagnosis is considered to be a judgment in a focus or a judgment in a particular dimension of a focus. In other words, the combination of a descriptor for a focus and a descriptor for a judgment is mandatory to satisfy the definition of a nursing diagnosis. Nursing actions are conceptualized as a process during which a service is intentionally applied to a care recipient; the process is often represented in compound expressions of verbs or verbal expressions that can be qualified by time. Therefore, it appears that this terminology model was developed to be a common basis for the recording, analysis, and transfer of nursing data[17].

In 1989, the ICNP® developed from of a recognized need for nurses to describe the phenomena, interventions, and respective results presented by patients for whom these professionals are responsible. In its original form, the ICNP® aimed to provide a tool for describing and documenting the clinical practice of nursing by using the instrument as a basis for clinical decision making and by providing nursing with a vocabulary and a classification system that can be used with computerized information systems[11].

In this context, several studies, meetings, and conferences have been conducted in various parts of the world to improve this classification system. In 1996, the ICNP® Alpha version was published, followed by ICNP® Beta in 1999, ICNP® Beta 2 in 2001, and finally, in 2005, ICNP® version 1.0. In 2006, ICNP® Version 1.0 was translated into Portuguese through the efforts of the Portuguese Association of Nurses, and in 2007, this classification was translated into Brazilian Portuguese[11]. In 2008, ICNP® version 1.1 was published, and in July 2009, ICNP® version 2.0 was launched.

In essence, the components of the ICNP® are the elements of nursing practice that address what nurses do to meet certain human needs and produce certain outcomes (diagnoses, interventions, and nursing outcomes). It is a unified language that expresses the elements of nursing practice and that enables 1) comparisons between clinical settings, patient populations, geographic areas and times; 2) the identification of multidisciplinary nursing teams; 3) the differentiation of practice by levels of preparation and experience in nursing; and 4) establishment of the correlations between nursing activities and health outcomes[11].

It is noteworthy that ICNP® Version 1.0 reflects the major reformulations pointed out by nurses, providing a more robust and technologically more accessible classification system for these professionals. ICNP® Version 1.0 allowed nurses to systematically document their practices using diagnoses, interventions, and nursing outcomes in different population contexts[11].

The third stage of this study was performed by presenting the current structure of the computerized NP according to ICNP® Version 1.0 in a web environment[1]. This step allowed nursing students to review all the work performed to date as well as understand how the data from clinical assessments, diagnoses, interventions, and outcomes (explained in the form of change of a specific diagnosis) are structured in the computerized platform.

The fourth and fifth steps involved building a methodology for conducting the association/ joint data/diagnoses/ nursing interventions according to ICNP® Version 1.0 by exploring possible clinical situations for every system that are presented by patients in ICU scenarios.

In the completion of these steps, the nurses' clinical reasoning and clinical judgment were key factors in matching the clinical situations with their diagnoses and nursing interventions.

DISCUSSION

Here, we present the contributions of ICNP® Version 1.0, applied to the computerized nursing process, both to the organization and development of nurses' clinical reasoning in the care of ICU patients and to the nurses' health knowledge.

Clinical reasoning is conceptualized as a thought process that guides practice; it is a dynamic process composed of a sequence of thoughts by nurses that are used to make decisions about their actions[18] and to apply clinical judgment to the clinical situation presented by each patient[19]. This is divided into procedural reasoning, meaning how; interactive reasoning, which focuses on the patient as an individual with unique perspectives; and conditional reasoning, which involves multidimensional, complex forms of thinking and requires experience. These three forms of reasoning are integrated in practice and are developed progressively along with knowledge and experience. They also combine with narrative reasoning, which drives others and involves the stories created by professionals about patients and, ultimately, pragmatic reasoning, which involves the environment, the patient's social support, professional knowledge and skills, and professional values[20].

Clinical judgment includes the process of analysis and complex decision making about the patient's condition, family, and contextual situation (which all affect the responses provided by the patient or family) by using data and knowledge to interpret these factors[19,21]. In this manner, the nursing diagnosis is understood to be a clinical judgment about the responses, family or community, and existing or potential problems and life situations of the patient. These nursing diagnoses provide a basis for indicating the goals and nursing interventions that are required to achieve the results that are expected of nurses[19].

The computerized NP and the proposed methodology allowed us to understand ICNP® version 1.0, and the reference terminology provided a basis for the clinical reasoning of ICU nurses. The field experts indicated that they were able to systematize clinical situations with different degrees

of complexity and to establish logical diagnoses and nursing interventions using ICNP® Version 1.0 by integrating data, information, and knowledge.

The methodology used for data association provided an effective approach to clinical situations in which a patient presents a condition with increasing levels of complexity. At the first level, the patient had spontaneous respiration or used an oxygen catheter, exhibited lung sounds with or without minor changes, and underwent an X-ray examination appropriate to the clinical situation. At the last level, the patient had a high degree of respiratory complications that required mechanical ventilation using pressure- or volume-controlled methods, and the patient also had significant changes in respiratory sounds, X-rays, and blood gasometry.

CONCLUSION

A restructuring of the computerized nursing process according to ICNP® Version 1.0, based on the associations between clinical evaluations, diagnoses, and interventions, permits documentation of the clinical practice of nursing in the ICU environment. It is noteworthy that this computerized system is a permanent space where information and knowledge can be stored. The system allows nurses to establish dialogue among peers and on multidisciplinary teams, to enhance reasoning and clinical judgment, and to promote safe clinical decision making that reflects safety improvements in ICU nursing practices.

The warning systems that are currently programmed in the computerized NP—for example, the same nursing diagnosis for more than 3 days, the potential for pressure ulcers, and vasoactive drugs at dosage α and β adrenergic—allow nurses to prevent damage and adverse events specific to these situations in order to promote safe clinical decision-making by the nurse.

We stress the applicability of the computerized NP only to the emergency and ICU environments. However, the structured database allows the extension of the system to other scenarios of professional practice. The data currently stored will allow future studies to measure the main outcomes of nursing interventions in different clinical situations of patients, and the current data will facilitate integration with different hospital information systems, continuous upgrading, and the construction of quality indicators for patient safety.

The use of the worldwide classification system, the ICNP®, has enabled the organization and development of clinical reasoning for nurses who care for patients admitted to the intensive care unit through the establishment of a concrete association between the clinical evaluations, diagnoses, interventions, and outcomes of nursing.

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