Software programs developed to operationalize the nursing process in health services: scoping review

Abstract

Objective: To map the software programs developed to operationalize the nursing process in patient care in health services. Methods: This is a scoping review developed within the recommendations of the Joanna Briggs Institute and PRISMA Extension for Scoping Reviews. A search was carried out in seven databases, a library, eight databases and an academic search engine with no time limit. Results: 19,645 studies were found, of them were included 35. 51% addressed Nursing Theory and 20% of the studies covered the entire nursing process. In addition, 82% used the Nursing Process in a fragmented way. The highlighted target audience for which the software programs were developed: adults (26; 74.2%), and the hospital service (33; 94%). Conclusion: It was understood through this study that Brazilian nursing seeks systems that can provide subsidies regarding the application of knowledge in nursing care and process.

Descriptors: Nursing process; Nursing records; Nursing informatics; Software; Nursing.

What is already known on this?

In the literature there are isolated publications of software development to operationalize the nursing process, so there is no compiled with the information of these technological productions.

What this study adds?

The study points to a mapping of technological development research as support at various levels of complexity, and may help to incorporate software programs into various health services.

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INTRODUCTION

The Nursing Process (NP) consists of a methodological instrument originated to support care practice and support nurse decision-making, and its function is to direct, structure and document care, assisting nurses in the perception of individuals’ health problems, in the planning and implementation of their actions and in the evaluation of results, thus favoring a safer care process.(1)

In this sense, the NP is organized into five interrelated stages: Nursing Data Collection or Nursing History; Nursing Diagnosis (ND); Nursing Planning; Nursing Implementation and Evaluation. Theoretical support is needed to guide data collection, the establishment of nursing diagnoses and the planning of actions or interventions, as well as to provide the basis for the evaluation of the nursing outcomes achieved.(2)

The first stage of the NP is to investigate personal, family or human collective information to obtain a relationship with the health-disease process in which the person is. The second stage is to interpret and group the collected data, this results in the decision making of the ND. The third stage determines the results expected to be achieved and nursing interventions that will be carried out for the benefit of the clients, identified in the ND stage. In the fourth stage, the determined actions or interventions are implemented. Finally, the process of change in the persons’ responses in the health and disease process is evaluated, which determines whether the nursing actions or interventions achieved the expected result, when verifying the need for changes or adaptations in the stages of the NP.(2)

Several Nursing Classification Systems are used during these phases of the NP, the best known are: Nanda - International (NANDA-I), Nursing Outcomes Classification (NOC), Nursing Interventions Classification (NIC), Clinical Care Classification System (CCC) and the International Classification for Nursing Practice (ICNP®).(3)

Despite the importance of the NP, there are still some managerial, institutional and material obstacles found in the daily applicability of the NP, such as: excess work of the nurses, consequently the lack of time; lack of knowledge; inadequate theoretical framework; non-computerization of the nursing history; lack of computers; non-compliance with nursing prescriptions; non-use of diagnostic taxonomy; incomplete stages of the NP.(4)

Thus, the initiatives that propose to add elements of technology, information and communication to the NP, enhance research, teaching, individualization of care, assist in decision making and generate indicators for evaluating the care provided to the patients, thus providing rapid, systemic and quality care.(5)

Therefore, software programs, which consist of the grouping of data and interpreted instructions that will be processed by an internal electronic system and aim to simplify the working mechanism, are accurate and complete ways to standardize information, having the potential to speed up the collection and recording, store and retrieve data and eliminate redundancies.(6)
The use of software programs has direct implications for nursing, since it is considered an innovative, interesting, useful and simple technology to use. There are several advantages of its applicability in care practice, such as: the product can be suitable for the operation of the institution; reduction of the time of elaboration of nursing diagnoses; assistance in the management of care; strengthens evidence-based practice, by consolidating nursing as a science; and can assist both nursing professionals and students in the development of clinical judgment and the diagnostic reasoning process.\(^7\)\(^-\)\(^8\)

In view of the above, elements that facilitate the incorporation of NP, such as software programs, become a crucial point for the health field, and should be seen as an effective strategy that facilitates work during care practices. In this context, it is necessary to know scientific productions of the literature in relation to the use of software programs in the NP.\(^7\)

Thus, the study aimed to map software programs developed to operationalize the nursing process in patients’ care in health services, through the guiding research question: ‘What software programs have been developed to operationalize the nursing process in patient care in health services?’\(^7\)

**METHODS**

This is a scoping review developed based on the recommendations of the Joanna Briggs Institute and PRISMA Extension for Scoping Reviews (PRISMA-Scr).\(^9\)\(^-\)\(^10\) The study was developed in five stages: 1) identification of the research question; 2) identification of relevant studies; 3) selection of studies; 4) data extraction, separation, summarization and reporting of results; 5) communication of results.\(^11\)\(^-\)\(^12\)

Initially, a preliminary search was carried out during June 2020 to verify if there was a scoping review on the subject in the Open Science Framework and Cumulative Index to Nursing and Allied Health Literature (CINAHL) and it was found that there was no published study. After that, a protocol was built as recommended by the Joanna Briggs Institute (JBI) manual\(^9\) being adapted, which included the following items: reviewers; title; mnemonic Population, Concept and Context (PCC); objective; research question; inclusion and exclusion criteria; search strategy; databases, data extraction (title, author(s), year of publication, database/library/database/academic searcher, type of study (article, dissertation and thesis), country of origin, place of study, objective(s), desktop or mobile ELEFANTE, nursing classification system, nursing theory, patient, health service, main findings). After the preparation of said protocol, it was registered as suggested in (PRISMA-Scr)\(^10\) under no. https://osf.io/3w6fu.

The Participant, Concept and Context (PCC) mnemonic was applied to construct the research question, in which the Participant corresponds to ”patient”, the Concept to ”software programs to operationalize the nursing process” and the Context to the ”health services”.

The study was guided by the following question: "What software programs have been developed to operationalize the nursing process in patient care in health services?". Then, the following inclusion criteria were stipulated: articles from primary and secondary studies, dissertations and theses available in full, without time limitation, published in any language, and that address software programs developed to operationalize the nursing process in patient care for the various health services. Reflections, editorials and abstracts published in annals of scientific events were excluded. Following the recommendations of the Joanna Briggs Institute manual\(^9\), for the choice of descriptors, a search was carried out in the CINAHL, US National Library of Medicine (PubMed) databases, then an analysis of the words in the text contained in the title and abstract and the index terms used to describe the study was carried out. Thus, the following search strategy was defined: (patients OR clients) AND (ELEFANTE OR “nursing informatics” OR “medical informatics” OR “electronic health records” OR “information technology”) AND (“nursing process” OR “systematization of nursing care”) AND (“health services” OR “patient care services”).

A search was carried out from August to September 2020 in the following data sources: CINAHL, PubMed, Web of Science, Scopus, Scientific Electronic Library Online (SciELO), Latin American and Caribbean Literature in Health Sciences (LILACS), Nursing Database (BDENF), Spanish Bibliographic Index of Health Sciences (IBECS), Catalog of Theses and Dissertations of the Coordination for the Improvement of Higher Education Personnel (CAPES), DART-Europe, Electronic Theses Online Service (EThOs), South African National ETDOld Portal, Theses Canada, Open Access Scientific Repository of Portugal (RCAAP), Cyberesis, Trove, Digitala Vetenskapliga Arkivet (DiVA), New Zealand theses, Google Scholar.
Data sources were accessed through the CAPES Journal Portal from the Federated Academic Community through access from the Federal University of Rio Grande do Norte, with the exception of data sources (DART-Europe, Electronic Theses Online Service (EThOS), South African National ETD Portal, Theses Canada, Open Access Scientific Repository of Portugal (RCAAP), Cybertesis, Trove, Digitala Vetenskapliga Arkivet (DiVA), New Zealand theses, Google Scholar) that were accessed directly on their own websites.

The search was carried out independently by two authors, and the initial screening of the materials was standardized, carried out by reading the title and abstract, then the duplicates were excluded, then the selected ones were read in full, after said reading, the studies relevant to the aforementioned adopted criteria were included. Subsequently, there was double confirmation of the articles selected by a third author.

Data were extracted according to the protocol, inserted in a spreadsheet in Microsoft Excel, analyzed using descriptive statistics using absolute and relative frequency and relevant literature.

RESULTS

The searches in the databases totaled 19,645 studies, of which 263 publications were pre-selected by reading the title and abstract. After full reading, 151 studies were included by eligibility criteria. According to the inclusion criteria, the publications that fit the research totaled a sample of 35 studies (Figure 1).

Figure 1. Flowchart of selection of studies adapted from PRISMA-ScR and JBI recommendations. Natal, RN, Brazil, 2021.

![Flowchart of selection of studies adapted from PRISMA-ScR and JBI recommendations.](image)

Source: research data, 2021.

Regarding the characterization of the studies, of the search locations, the CAPES Catalog of Theses and Dissertations was where the scientific publications selected in this scoping review were concentrated (51.4%), followed by Google Scholar (17.1%), BDENF (11.5%), CINAHL (11.5%), LILACS (5.7%) and PubMed (2.8%).

Regarding the year of publications, there is a highlight for the year 2018, with 7 studies (20%); followed by 2015 (6; 17%); 2016 (4; 11.5%); the years 2013, 2002 and 2008 obtained 3 studies each (8.5%); 2019 and 2012 (2; 5.7%) each; the other years presented 1 study 2017, 2014, 2010, 2009, 2005, (1; 2.8%) each.
Regarding the type of study, 16 were articles (45.7%) and 19 were concentrated in Graduate Programs (54.3%), of which 14 were dissertations (73.7%) and 5 were theses (26.3%). The methodological design of technological production was the most addressed (22; 62.9%). The country of origin where the studies were most concentrated was Brazil (34; 97.1%), with the southeast region being the most covered (14; 40%) with the municipalities of São Paulo, Ribeirão Preto, Belo Horizonte and Viçosa (Box 1).

**Box 1.** Characterization of the studies. Natal, RN, Brazil, 2021.
Regarding the results obtained from the selected publications, of the 35 studies, 18 addressed the Nursing Theory of Basic Human Needs, by Wanda Horta (51%), being the only theory covered in the selected studies.

Regarding the NP, seven studies covered the entire process (20%), in which the interaction NANDA-I, NOC, NIC was used as a nursing classification. Twenty-nine (29) used NP in a fragmented manner. Eleven (11) addressed only the nursing diagnoses phase of the NP (31.4%), using the NANDA-I and/or ICNP taxonomies, 14 addressed nursing diagnoses and interventions using NANDA-I and NIC or ICNP (40%), one addressed only nursing outcomes, using NOC (2.8%) and two did not specify taxonomies (5.7%).

The type of ELEFANTE was also evidenced, 26 for desktop (74%) and nine for mobile (26%). The target audience for which the software programs were developed is adults (26; 74.2%), followed by newborns (7; 20%), postpartum women (1; 2.8%) and children and adolescents (1; 2.8%). In addition, the health service that appeared most in the sample was hospital (33; 94%), followed by Family Health Strategy (1; 2.8%) and outpatient (1; 2.8%). The studies focused mainly on patients hospitalized from the medical clinic to the Intensive Care Unit (ICU) (Box 2).

<table>
<thead>
<tr>
<th>First Author</th>
<th>Desktop or mobile</th>
<th>Nursing Classification</th>
<th>Nursing Theory</th>
<th>Target audience</th>
<th>Health Care Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moura13</td>
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<td>Did not address</td>
<td>Adults</td>
<td>Hospital</td>
</tr>
<tr>
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<td>Desktop</td>
<td>ICNP</td>
<td>BNT</td>
<td>Children and adolescents</td>
<td>Hospital</td>
</tr>
<tr>
<td>Santos15</td>
<td>Mobile</td>
<td>NANDA-I</td>
<td>BNT</td>
<td>Newborns</td>
<td>Hospital</td>
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<td>ICNP</td>
<td>Did not address</td>
<td>Adults</td>
<td>Primary Healthcare</td>
</tr>
<tr>
<td>Menezes17</td>
<td>Desktop</td>
<td>NANDA-I; NOC; NIC</td>
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<td>Adults</td>
<td>Hospital</td>
</tr>
<tr>
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<td>Desktop</td>
<td>ICNP</td>
<td>BNT</td>
<td>Adults and children</td>
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<tr>
<td>Sperandio19</td>
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<tr>
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<td>BNT</td>
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<tr>
<td>Silva Júnior21</td>
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<tr>
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<tr>
<td>Güterres24</td>
<td>Desktop</td>
<td>NOC</td>
<td>Did not address</td>
<td>Adults</td>
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</table>

Box 2. Results obtained from the selected publications. Natal, RN, Brazil, 2021.

Source: research data, 2021.
In the present study, 22 (61%) studies aimed at software development were found, of which 14 (39%) demonstrated the applicability of software programs to the NP. Only two studies reported some kind of difficulty during software handling. All studies pointed out the potential of using software programs as a system that supports nursing care and increases the quality of service.

**DISCUSSION**

Based on the research results, it was analyzed that all studies presented software development based on NCS. Most software programs took a comprehensive approach, integrating patient data collection, nursing diagnoses, and the implementation of nursing care. These systems automate the generation of nursing diagnoses and the definition of interventions based on Nanda, NIC or ICNP taxonomies. This results in the formulation of personalized therapeutic plans for each patient and standardization of language in electronic records, improving the efficiency of the electronic nursing record and evidence-based practice.

From the intensification of technology in the twentieth century, worldwide health services try to follow the advancement of computerized processes, automating their operational, managerial or care systems, to increase the quality of medical care, increasing the efficiency and security of patient data, in addition to technologically supporting all procedures in the health area.47
Therefore, the development of software programs for this purpose becomes increasingly necessary in the health field. It was observed that the productions selected for the study were carried out from 2002 to 2019, especially in 2018. This demonstrates that the creation of software programs aimed at nursing care followed the evolution of computerized systems.\(^{(48)}\)

Implementing the NP in software programs is considered a strategy to favor the incorporation of this methodological instrument in health services, since it can provide support for the practice of Nursing Care Systematization (NCS), at all stages of the NP, providing information at the appropriate time for clinical decision-making, in addition to making the practice more agile and simplified.\(^{(6)}\)

The main means for which the software programs were developed in this study were Desktop and then Mobile. These means facilitate the operationalization of the stages of the NP, and proved to be adequate, providing assistance planning in a reduced time, standardizing language in the records, reducing the physical space occupied by the records.\(^{(58)}\)

This study demonstrated that a greater number of productions found for the final sample were concentrated in the Graduate Nursing Programs in Brazil, demonstrating that the development of software programs offers the possibility of progress in the scientific area, consequently theses and dissertations are considered important sources in this line of research.\(^{(49)}\) For this reason, most of the selected studies were found in the CAPES repository, which deals with master's and PhD publications.

Still on the types of study, a greater number of master dissertations were observed when compared to PhD theses, this is due to the fact that Brazil has 57 Graduate Nursing programs, 37 master's and PhD degrees, 2 professional master's and PhD degrees, 16 academic master's degrees, 22 professional master's degrees and 2 PhD degrees. Regarding the courses, there are 117, 52 master's degrees, 39 PhDs, 24 professional master's degrees and 2 professional PhDs.\(^{(52)}\)

Regarding the methodologies of the analyzed researches, there was an emphasis on the studies of technological production with the objective of software development. The methodological design of technological production is the product of applied and experimental research, which aims to generate knowledge associated with practical applicability, resulting in new technologies.\(^{(51)}\)

Brazil, predominantly in the south and southeast, stands out for the number of publications on the construction and applicability of the software programs selected in the study, demonstrating growth and dissemination of the commitment of Brazilian nursing.\(^{(7)}\) However, it is noteworthy that the finding means that Brazilians describe more the methodological stages of software development, not meaning a predominance of the production of software technologies.\(^{(52)}\)

When analyzing the selected studies, the following Nursing Classification Systems stood out: NANDA-I, NOC, NIC and ICNP, in the production of software programs. These systems qualify the NP, enable the unification of a language related to clinical nursing care, facilitating the sharing of information in the fields of nursing practice and records.\(^{(14)}\)

The NANDA-I taxonomy facilitates the incorporation of the ND stage organized into domains and classes, using a multiaxial structure for diagnostic concepts, serving as a systematic guide that presents defining characteristics and related factors of each ND. ICNP is also used in the ND stage, and in the nursing outcomes (NO) stage, nursing interventions (NI), aiming to homogenize existing vocabularies and terminologies that contribute to nursing practice.\(^{(53-54)}\)

The NOC taxonomy contains expected results for NANDA nursing diagnoses, with the objective of measuring the development of these standardized results for the evaluation of health care and the NIC aims to build a standardized language for the development of actions to be performed by the nursing team with regard to the treatments and conducts provided.\(^{(55-56)}\)

In this context, communication technologies in nursing, such as taxonomies, have been used as support for the development of NP, based on the logic of data, information and knowledge for decision-making in nursing care, integrating its stages.\(^{(57)}\)

Nursing Theories also establish scientific bases for nursing care, addressing the theoretical phenomena that constitute a domain of interest in the practice of the profession. They describe key ideas of the essence of nursing, events, people or objects, which are interrelated, with the main objective of defining, characterizing and understanding the nurse-patient interaction, taking into account all intrinsic and extrinsic factors.\(^{(58)}\)

Wanda Horta's Theory of Basic Human Needs, which was the most addressed in the studies, consists of holistic principles, which are interrelated with the environment and the person. In which biological, psychosocial and psycho-spiritual needs are guided, according to this theory, if it is healthy and...
disease is avoided if the needs are fully met.\textsuperscript{(59)} The software programs that addressed nursing theories articulated the stages of the system to basic human needs.

It is of paramount importance that the concepts of nursing theories are articulated to clinical practice; however, it was found that most of the selected studies did not cover these theories, and thus there is a need to encourage the development of these technologies in an associated way that address the care and management dimension of nursing, and measure/describe the impact of the nursing process.\textsuperscript{(7)}

It is possible to attribute the non-use of theories to some complex factors, such as: the fact that nursing throughout the historical process describes its procedures based on the experience of clinical practice, lacking evidence-based practice, and it was only in the 1950s and 1960s that there was a greater dedication to reflect more deeply on the profession, its object of work and the theoretical framework for the domain of care, when, then, the nursing theories themselves began to be elaborated, consequently, consolidating themselves as a science in the health area.\textsuperscript{(60)} Or also, because theories comprise complex and multifaceted phenomena, which may represent subjectivity of interpretation on the part of developers, making it difficult to interface theory with software programs.

In addition, the Federal Council of Nursing states that the NP must be supported by a theoretical support that guides its stages. Since nursing theories represent one of the elements that make up the specific language of the profession and assist nurses in obtaining data related to the patient's needs, they are strictly necessary.\textsuperscript{(2)}

It was observed that the software programs addressed in the study were mainly aimed at the medium and high levels of complexity, in ICUs or hospitalization units of medical clinic, whose largest target audiences were neonates and adults. This fact may be due to the fact that approximately one quarter of hospitalizations performed in SUS refer to delivery, pregnancy and puerperium care, in addition to hospitalizations due to perinatal conditions.\textsuperscript{(61)} From this scenario, it is possible to analyze that increasingly technological advances enable the survival of newborns.\textsuperscript{(62)}

Software programs aimed at adults should be commonly applied, since the distribution of the population residing in the country with the age group of 20 to 59 years is the largest and also the second age group to which it is most interned, behind only the population over 60 years old.\textsuperscript{(61)}

In addition, patients admitted to intensive care units are commonly exposed to a high risk of being affected by adverse events due to the use of vasopressors, the high number of invasive interventions, due to the serious state of health, so monitoring care outcomes becomes even more necessary in sectors such as ICUs.\textsuperscript{(63)}

It was noticed, through these studies, that the health area has ensured an accelerated process of transformation and technological innovation in recent times, enabling considerable changes in the provision of care. Health informatics in the use of software is an articulation of concepts and ways of managing information, thus subsidizing health care.\textsuperscript{(64)}

In general, all studies highlighted the potential of using software programs in care practice, to standardize records, favoring the objectivity of clinical data, brought support for decision making, brings agility in developing and documenting NCS, generates indicators and facilitates the execution and accuracy of evidence-based NP.\textsuperscript{(19)} Only 2 studies reported difficulty in handling the software programs, which was solved after training.

In fact, nurses demand many bureaucratic activities, for this reason, informatics becomes an essential ally when compared to manual processes, as it is able to optimize time during management activities, as well as in care practice, which, with the articulation of software programs, in addition to improving them, improves care.\textsuperscript{(7)}

As limitations, it should be noted that the scoping review included only studies that were available in full, which may limit the inclusion of some relevant research on the subject.

\textbf{CONCLUSION}

This study allowed mapping the software programs available to operationalize the nursing process, and may encourage the development of new technologies to promote technological innovation in nursing, as well as disseminate its use in various health services.

After analyzing the profile of the proposed software programs, there was a need to build new systems aimed at the target audience of the older adults and adolescents, in addition to the gap in the incorporation of nursing theories in some software programs. It is imperative to recognize the importance of these theories in the context of the nursing process, which play a fundamental role in strengthening the
scientific and philosophical basis that guides the clinical practice of the profession. The construction of systems that incorporate theories, or innovation of existing systems, is essential to obtain more grounded software programs in the nursing area. Additional research is suggested to provide more robust data on the implementation and impact of these software programs on the nursing process.

CONTRIBUTIONS
Contributed to the conception or design of the study/research: Nascimento RCA, Aquino BCOS, Feijão AR. Contributed to data collection: Nascimento RCA, Aquino BCOS, Oliveira DN. Contributed to the analysis and/or interpretation of data: Nascimento RCA, Aquino BCOS, Oliveira DN, Feijão AR. Contributed to article writing or critical review: Nascimento RCA, Aquino BCOS, Oliveira DN, Feijão AR. Final approval of the version to be published: Nascimento RCA, Aquino BCOS, Oliveira DN, Feijão AR.

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