Technologies used to support the nursing process: scoping review

Abstract

Objective: To identify and map the technologies used to support the nursing process.

Methods: This is a scoping review carried out in November and December 2019, in 15 national and international databases. Data for analysis were extracted from indicators for a spreadsheet of Microsoft Excell 2010®.

Results: The study sample consisted of 14 studies, published mainly in 2017 and from Brazil. The technologies developed are mainly software, aimed at teaching and as target audience professionals who already work in health care.

Conclusion: The research points out that the insertion of technologies to support the nursing process is growing and is mainly focused on teaching, with the purpose of strengthening nursing training.

Keywords
Nursing process; Diagnosis, nursing; Education, nursing; Health services; Technology; Educational technology; Teaching materials

Resumen

Objetivo: Identificar e mapear las tecnologías utilizadas para apoyar el proceso de enfermería.

Métodos: Se trata de una scoping review, realizada en noviembre y diciembre de 2019, en 15 bases de datos nacionales e internacionales. Los datos para el análisis fueron extraídos de indicadores para una planilla de Microsoft Excel 2010®.

Resultados: La muestra del estudio se compuso por 14 estudios, publicados principalmente en el año de 2017 y de Brasil. Las tecnologías desarrolladas son principalmente software, destinados para el aprendizaje y como público destinatario a profesionales que ya trabajan en la atención de salud.

Conclusión: El estudio apunta que la inserción de tecnologías para apoyar el proceso de enfermería crece y está voltado principalmente a la enseñanza, con la finalidad de fortalecer la formación de los enfermeros.

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Conclusión: El estudio indica que la incorporación de tecnologías para apoyar el proceso de enfermería está creciendo y se orienta principalmente a la enseñanza, con la finalidad de fortalecer la formación de los enfermeros.
Introduction

The systematization of nursing care (SNC) is characterized as a foundation for nursing practice because it scientifically guides nurses’ performance in the care context and is carried out through a nursing process (NP).\(^{(1,2)}\)

NP consists of a technology structured in five stages: nursing history, nursing diagnoses, nursing interventions, nursing outcomes, and assessment. The stages demand that nurses have theoretical and practical knowledge, be able to infer analyzes and, thus, be able to develop clinical reasoning.\(^{(1,2)}\)

In this sense, NP is a dynamic and systematized activity in order to offer quality care to patients, which can be considered the main methodological model for the development of nursing actions.\(^{(3-5)}\)

However, for NP to be effective, there are obstacles in this process, as elucidated in research carried out in Egypt\(^{(4)}\) and in Iran\(^{(6)}\) that pointed out among the main obstacles: training process of nurses, absence of practical experience, work overload, absence of inputs for NP registration, and ineffective management process.

In the meantime, there is a need for strategies that can support NP in different areas, from educational to assistance. Among them, the use of technological resources stands out, since there are numerous advantages of using these tools for nursing, such as optimizing care in a resolutive and responsible manner with the help of standardized language and dynamic access by the nursing team.\(^{(7,8)}\)

The efficiency of technologies to support NP can be exemplified in a study\(^{(9)}\) carried out in a Neonatal Intensive Care Unit, in which, using a software, nurses’ adherence rate to NP increased by 100% when compared to the moment before the implementation of this feature.

In this regard, it becomes relevant to investigate the technologies developed and used to support NP, in order to elucidate which tools are available and how they can contribute to teaching and/or nursing practice.

Therefore, the study had as a guiding question: what technologies are used to support the nursing process in teaching and health services?

It aimed to identify and map the technologies used to support NP.

Methods

This is a scoping review with a research protocol registered in the Open Science Framework (https://osf.io/c2s38/), under DOI identification: 10.17605/OSF.IO/C2S38, developed and structured based on PRISMA-ScR10\(^{(10)}\) and Joanna Briggs Institute, Reviewers Manual recommendations,\(^{(11)}\) according to the theoretical framework grounded by Arksey and O’Malley.\(^{(12)}\)

This investigation is based on an exploratory review that proposes to map, in scientific production, relevant studies in a given area. It is described in five stages: research question identification; relevant study identification; study selection; data analysis; data synthesis and presentation.\(^{(11)}\)

The research question, the objective of the study and the descriptors of agreement were elucidated by the mnemonic combination PCC: P (Population) - Educational care technologies; C (Concept) - Nursing process; C (Context) 1– Teaching; Context 2 - Health Services. It presented the following guiding question: what technologies are used to support NP in teaching and health services?

The second stage included two subdivisions: one corresponded to the selection of descriptors in published research and available in the National Library of Medicine (PubMed) and Cumulative Index to Nursing and Allied Health Literature (CINAHL) databases, as highlighted in the manual.\(^{(10)}\) In the other, the descriptors indexed in the controlled vocabulary of the Medical Subject Heading Terms (MeSH) were Educational Technology, Technology, Nursing Process, and Teaching and Health Services.

In the first study search, crosses were applied: Technology AND nursing process AND Teaching and then Technology AND nursing process AND Health Services to select the largest number of studies in PubMed and CINAHL, in order to identify the most used keywords in published studies.
After selecting descriptors and equivalences, an electronic search of the studies was carried out in the PubMed, CINAHL, Web of Science, SCOPUS, COCHRANE and LILACS databases. These were searched on the CAPES Journal Portal, based on identification through the Federated Academic Community (CAFe – Comunidade Acadêmica Federada), as a way to standardize the collection on these bases, in November and December 2019.

For gray literature (dissertations and theses) the Theses and Dissertations Catalog of the Coordination for the Improvement of Higher Education Personnel (CAPES - Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) was used; Europe E-theses Portal (DART); Electronic Theses Online Service (EthOS); Portuguese Open Access Scientific Repository (RCAAP - Repositório Científico de Acesso Aberto de Portugal); National Theses and Dissertations (ETD Portal); Theses Canada; The National Library of Australia’s Trove (TROVE); Academic Archive Online (DIVA); Latin American theses and dissertations.

In article selection, the Boolean operators AND and OR were used, as described in the strategy: Technology OR (technological development OR software applications) AND educational technology OR (instructional technology) AND nursing process OR (nursing diagnosis) AND teaching OR (nursing education OR teaching materials) AND health services.

As each database has its search properties, the strategy used was adapted; however, the similarities in the descriptor combinations were maintained.

Refinement of the studies found was based on publications that answer the objective of the study and available in full and free of charge in electronic media.

Time limit has not been defined. Editorials, experience reports, theoretical essays, reflection studies, books and other reviews as well as research that did not appear in full were excluded.

The final sample was reached based on reading the materials in full, which were analyzed using data collection indicators such as year of publication, country of origin, objective of the study, methodological design, level of evidence, types of technologies (software, games, virtual learning environment (VLE), virtual learning object (VLO), booklets etc.); scope of use of technology (teaching, assistance and/or management), target audience of the technology and type of taxonomy for the employed NP (ICNP/NANDA, NIC, NOC).

The results were entered into electronic spreadsheets available in Microsoft Excel 2010 and analyzed using descriptive statistics.

It is noteworthy that the study was carried out with data in the public domain, so a Research Ethics Committee approval was not necessary.

Results

From analysis of the 1,938,412 studies identified, only 14 (100.0%) dealt with the theme and corresponded to the final sample. Study selection was presented in the flowchart below (Figure 1).

With regard to country of origin, Brazil stood out with 13 (92.9%) studies and Iran with only one (7.1%). As for year of publication, 2017 stood out with four (28.6%) publications, followed by 2016, with three (21.5%). The years 2012 and 2019 obtained only two (14.3%) studies each, while in...
2013, 2015 and 2018, they presented the lowest quantity with only one (7.1%) production each.

The main findings, type of study, level of evidence, scope of use of technologies and the target audience are presented below (Chart 1).

Regarding the taxonomy applied by the technologies, there was a predominance of the International Classification for Nursing Practice (ICNP), present in seven (50.0%) studies. The following is a synthesis of objectives related to technologies for NP support and the taxonomies used (Chart 2). It is noteworthy that there was no study from grey literature to make up the final sample.

**Chart 1.** Summary table of the technologies used to support the nursing process, type of study, level of evidence, scope of technologies used and target audience (n = 14)

<table>
<thead>
<tr>
<th>Collection indicators</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of technologies used</strong></td>
<td>Software - 8 (57.1%)</td>
</tr>
<tr>
<td></td>
<td>Mobile application - 1 (7.1%)</td>
</tr>
<tr>
<td></td>
<td>VLE - 4 (28.6%)</td>
</tr>
<tr>
<td></td>
<td>VLO - 1 (7.1%)</td>
</tr>
<tr>
<td><strong>Type of study</strong></td>
<td>Methodological - 7 (50.0%)</td>
</tr>
<tr>
<td></td>
<td>Descriptive-exploratory - 1 (7.1%)</td>
</tr>
<tr>
<td></td>
<td>Descriptive - 2 (14.3%)</td>
</tr>
<tr>
<td></td>
<td>Descriptive-cross-sectional - 1 (7.1%)</td>
</tr>
<tr>
<td><strong>Level of evidence</strong></td>
<td>Level II - 1 (7.7%)</td>
</tr>
<tr>
<td></td>
<td>Level IV - 4 (28.6%)</td>
</tr>
<tr>
<td></td>
<td>Level V - 8 (57.1%)</td>
</tr>
<tr>
<td><strong>Scope of use of technology</strong></td>
<td>Education - 8 (57.1%)</td>
</tr>
<tr>
<td></td>
<td>Assistance - 6 (42.9%)</td>
</tr>
<tr>
<td><strong>Target audience</strong></td>
<td>Professionals - 6 (42.9%)</td>
</tr>
<tr>
<td></td>
<td>Undergraduate students – 4 (28.6%)</td>
</tr>
<tr>
<td></td>
<td>Both target audiences - 4 (28.6%)</td>
</tr>
</tbody>
</table>

**Chart 2.** Objectives and taxonomies used by technologies developed to support the nursing process (n=14)

<table>
<thead>
<tr>
<th>Studies Found</th>
<th>Study objectives found</th>
<th>Taxonomy used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lotfi M, Zamanzadeh V, Valizadeh L, Khajehgooodari M, Ebrahimipour Rezaei M, Khalilzad MA(12)</td>
<td>To investigate the strategies for NP implementation in clinical practice and implementation rate assessment of this process in clinical contexts of low-income countries.</td>
<td>ICNP</td>
</tr>
<tr>
<td>Netto NP, Vieira CM, Nascimento MN, Bezerra AM, Quirino GS, Felix ND(13)</td>
<td>To develop a mobile application for teaching ICNP.</td>
<td>ICNP</td>
</tr>
<tr>
<td>Silva Jr MG, Aranjo EC, Moraes CR, Gonçalves LH(15)</td>
<td>To describe the development of a prototype software to apply NP in medical clinic units of a general hospital and assess its usefulness.</td>
<td>NANDA, NIC, NOC</td>
</tr>
<tr>
<td>Lima JJ, Vieira LG, Nunes MM(17)</td>
<td>To build a mobile technology to assist nurses in data collection, diagnostic reasoning and identification of possible interventions in neonates.</td>
<td>NANDA, NIC, NOC</td>
</tr>
<tr>
<td>Melo EC, Enders BC, Basto ML(18)</td>
<td>To describe the stages of construction and transition carried out in the development of a VLE (Plataforma PEnsinar®) aimed at teaching NP and Nanda International Classification, NIC, NOC, and ICNP®.</td>
<td>ICNP and NANDA, NIC, NOC</td>
</tr>
<tr>
<td>Salvador PT, Marmo CM, Vitor AF, Ferreira Júnior MA, Fernandes MI, Martins JC, et al(19)</td>
<td>To describe the content validity process of a VLO to support the teaching of SNC to nursing technicians.</td>
<td>NANDA, NIC, NOC</td>
</tr>
<tr>
<td>Avelino CC, Costa LC, Buchiorm SM, Nogueira DA, Goiáse SL(20)</td>
<td>To assess the teaching-learning of undergraduates and nursing professionals about ICNP® through a course on the Moodle Platform.</td>
<td>ICNP</td>
</tr>
<tr>
<td>Almeida SR, Dal Sasso GT, Barra DC(21)</td>
<td>To analyze the ergonomics and usability criteria of computerized NP from ICNP, in an Intensive Care Unit, according to the International Organization for Standardization (ISO) standards.</td>
<td>Inter-American Export Promotion Center</td>
</tr>
<tr>
<td>Avelino CC, Borges FR, Inagaki CM, Nery MA, Goiáse SL(21)</td>
<td>To develop and assess a course on the Moodle Platform on nursing diagnoses, interventions, and outcomes, according to ICNP.</td>
<td>ICNP</td>
</tr>
<tr>
<td>Rezende LC, Santos SR, Medeiros AL(22)</td>
<td>To assess a prototype for mobile device that allows the recording of data for SNC in Neonatal Intensive Care Units.</td>
<td>ICNP</td>
</tr>
<tr>
<td>Dal Sasso GT, Barra DC, Paese F, de Almeida SR, Rios GC, Marinho MM, et al(23)</td>
<td>To perform articulation of data and information of the computerized NP according to ICNP®, version 1.0 associating the detailed clinical assessment of each human system with the respective diagnoses, interventions, and outcomes of a client.</td>
<td>ICNP</td>
</tr>
<tr>
<td>Jensen R, de Moraes Lopes MH, Silveira PS, Ortega NR(24)</td>
<td>To describe the development and assessment of software that verifies the accuracy of diagnoses made by nursing students.</td>
<td>NANDA, NIC, NOC</td>
</tr>
<tr>
<td>Goyatá SL, Chaves EC, Andrade MB, Pereira RJ, Brito TB(25)</td>
<td>To assess the virtual environment use as a teaching and learning strategy of the course Basic Foundation of Nursing I, in particular of the NP given to students.</td>
<td>NANDA, NIC, NOC</td>
</tr>
<tr>
<td>Lira AL, Lopes MV(26)</td>
<td>To assess a VLO developed to mediate the teaching of nursing diagnostic reasoning and be applied to the intergenerational system by undergraduate students in nursing.</td>
<td>NANDA, NIC, NOC</td>
</tr>
</tbody>
</table>

**Discussion**

Research from analysis of results showed that most of them were developed in Brazil. This is related to the current search of Brazilian nursing for the execution of systematic and qualified care, as well as the publication of Resolution 358 of 2009 from the Federal Nursing Council (COFEN - Conselho Federal de Enfermagem), which makes nursing performance mandatory through NP in health services, whether public or private.(2)

Furthermore, the growing Brazilian production on NP is pointed out by studies.(13,27) They elucidate that countries of lower socioeconomic status currently stand out for the constant search for strategies for inserting NP in practice, being encouraged
both by nursing organizations worldwide, as well as
developed countries, for example, the United States
of America (USA) in which NP has been used effec-
tively since 1950.\textsuperscript{(1,28)}

The period of publication of the findings was
also analyzed, these were predominantly in 2017.
This fact is related to the insertion of technologies
increasingly present in nursing, initially motivat-
ed by organizations such as the American Nurses
Association (ANA) in the early 21\textsuperscript{st} century, who
formalized guidelines for the insertion of these con-
tents in the training of nurses, whether in under-
graduate or graduate courses.\textsuperscript{(29)}

Subsequently, at the end of the first decade of
this century, strategies were developed for training
nurses in the field of information technology based
on teaching models, such as the Nursing Informatics
Education Model (NIEM) and the Technology
Informatics Guiding Education Reform (TIGER).
NIEM condenses three dimensions of learning
about computing, information technology and
nursing, with the purpose of producing technolog-
ical resources. TIGER provides training on the use
and handling of these built tools.\textsuperscript{(29,30)}

Therefore, it is noted that the period in which
the studies were published is in line with the growth
of worldwide strategies for training nurses in com-
puter science and as a consequence in promoting
the development of technologies.\textsuperscript{(29,30)}

Regarding the type of study approached, there
was an emphasis on the methodological. This data
indicates that the technologies to support NP are
mainly derived from construction and validation
studies. Thus, these tools are in a broad technolog-
ical development process, as well as validation by
specialists when considering validation studies.\textsuperscript{(31)}

In this sense, with regard to the predominance
of methodological studies, it is identified that they
are studies with a low level of evidence, as they come
from the opinion of experts. Thus, it is important
for researchers to use experimental research with the
purpose of verifying, in addition to construction
and validation, the effectiveness of technologies de-
veloped in research.\textsuperscript{(31,32)}

With regard to the type of technology presented,
there was a prevalence of software, which is charac-
terized by the grouping of logical information, pro-
cessed by algorithms that result in a program.\textsuperscript{(33)}

VLEs were also important technologies eluci-
dated in the research analyzed, given that this re-
source seeks to strengthen the teaching-learning
process, since they consist of a platform where
professors can provide didactic materials, perform
activities and/or assessments; moreover, they favor
communication/interaction between students and
professors and allow the learner to actively seek to
build their knowledge.\textsuperscript{(34)}

In relation to the target audience, most technol-
ogies were developed for nursing professionals, with
the purpose of subsidizing the practice based on NP
by favoring the structuring of care, a personalized
and qualified nursing assistance.\textsuperscript{(8,35)}

That said, the improvements resulting from
the computerization of NP are described by nurses
in a study\textsuperscript{(35)} carried out in southern Brazil. These
professionals point out that the insertion of this re-
source made it possible to structure a care plan in a
logical manner, reducing the time used to perform
the NP steps and a greater visibility of the role of
nursing.

In this way, the construction of tools to sup-
port NP must be based on specific taxonomies.
Among them, ICNP stood out, this fact is related to
Brazil’s contributions to this taxonomy since 1995
through the Brazilian Nursing Association (ABEn
– Associação Brasileira de Enfermagem), with the
purpose of assisting in the development of a project
aimed at incorporating care practices in collective
health.\textsuperscript{(19)}

Thus, research involving ICNP has spread
widely in the country mainly due to the project
International Classification of Nursing Practice
in Collective Health (CIPESC - Classificação
Internacional da Prática de Enfermagem em Saúde
Coletiva), which motivated research and the con-
struction of strategies for ICNP implementation.\textsuperscript{(19)}

As for the objectives elucidated by the select-
ed studies, most seek to report the construction of
technologies or assess tools developed to support
NP; this refers that the research intends to gener-
ate innovations for the nursing practice in order to
strengthen the insertion of NP.\textsuperscript{(30)}
Therefore, it is clear that the technologies to support NP are undergoing a wide development process in the Brazilian reality, with the purpose of strengthening the implementation of this technology in the care context of nurses and thus enhancing their assistance by making it qualified, effective and valued.

Conclusion

It is concluded that the technologies used to support NP were mainly software and a VLE, which indicates an increasing computerization of current nursing and the transition to the use of digital resources for both teaching and care. The study contributes to generate the mapping of information about strategies to support the nursing process, so that it becomes feasible that nurses can visualize strategies to implement the nursing process in their work environment. That said, it is clear that the review has limitations, as it does not allow the effectiveness of the findings to be assessed; therefore, the development of experimental studies becomes pertinent, so that in this way it can verify whether the nursing process is enhanced with the help of these devices.

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