Review Article

Technologies used to support the nursing process: scoping review

Tecnologias utilizadas para apoio ao processo de enfermagem: revisão de escopo

Tecnologías utilizadas para apoyar el proceso de enfermería: revisión de alcance

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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.

Resumo

Objetivo: Identificar e mapear as tecnologias utilizadas para apoio ao processo de enfermagem.

Métodos: Trata-se de uma *scoping review,* realizada em Novembro e Dezembro de 2019, em 15 bases de dados nacionais e internacionais. Os dados para análise foram extraídos a partir de indicadores para uma planilha do *Microsoft Excell* 2010®.

Resultados: A amostra do estudo foi composta por 14 estudos, publicados principalmente no ano de 2017 e oriundos do Brasil. As tecnologias desenvolvidas são principalmente *software,* voltados para o ensino e como público alvo profissionais que já atuam na assistência à saúde.

Conclusão: A pesquisa aponta que a inserção de tecnologias para apoio ao processo de enfermagem é crescente e está voltado principalmente para o ensino, com a finalidade de fortalecer a formação dos enfermeiros.

Resumen

Objetivo: Identificar y 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 a partir de indicadores a una planilla de *Microsoft Excel* 2010®.

Resultados: La muestra estuvo compuesta por 14 estudios, publicados principalmente en 2017 y oriundos de Brasil. La principal tecnología desarrollada es *software*, utilizados para la enseñanza, cuyo público destinatario son profesionales que ya actúan en la atención a la salud.

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.

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Conflicts of interest: nothing to declare.

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 Trobe (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,[11] 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).

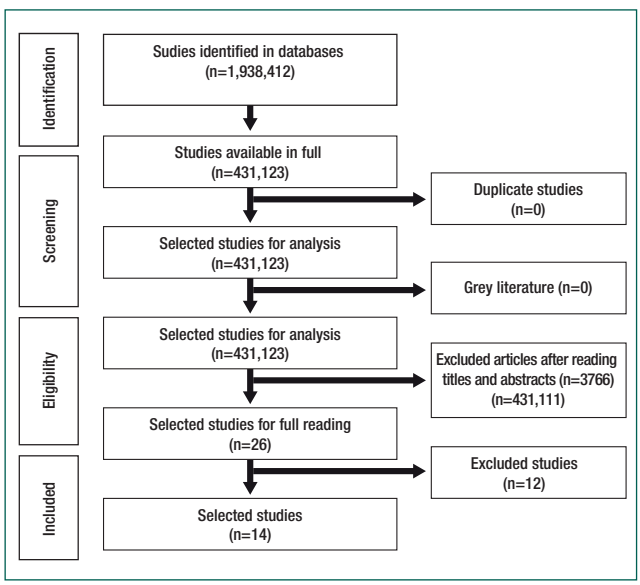

Figure 1. Study selection steps (n = 14)

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)

Collection indicators	Main findings
Type of technologies used	Software - 8 (57.1%) Mobile application - 1 (7.1%) VLE - 4 (28.6%) VLO - 1 (7.1%)
Type of study	Methodological -7 (50.0%) Descriptive-exploratory - 1 (7.1%) Quasi-experimental - 1 (7.1%) Integrative review - 1 (7.1%) Descriptive - 2 (14.3%) Descriptive-cross-sectional - 1 (7.1%) Undefined - 1 (7.1%)
Level of evidence	Level II - 1 (7.7%) Level IV - 4 (30.8%) Level V - 8 (61.5%)
Scope of use of technology	Education - 8 (57.1%) Assistance - 6 (42.9%)
Target audience	Professionals - 6 (42.9%) Undergraduate students– 4 (28.6%) Both target audiences - 4 (28.6%)

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

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

Studies Found	Study objectives found	Taxonomy used
Lotfi M, Zamanzadeh V, Valizadeh L, Khajehgoodari M, Ebrahimpour Rezaei M, Khalilzad MA[13]	To investigate the strategies for NP implementation in clinical practice and implementation rate assessment of this process in clinical contexts of low-income countries.	ICNP
Mota NP, Vieira CM, Nascimento MN, Bezerra AM, Quirino GS, Félix ND[14]	To develop a mobile application for teaching ICNP.	ICNP
Silva Jr MG, Araújo EC, Moraes CR, Gonçalves LH[15]	To describe the development of a prototype software to apply NP in medical clinic units of a general hospital and assess its usefulness.	NANDA, NIC, NOC
Lima JJ, Vieira LG, Nunes MM[16]	To build a mobile technology to assist nurses in data collection, diagnostic reasoning and identification of possible interventions in neonates.	NANDA, NIC, NOC
Melo EC, Enders BC, Basto ML[17]	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®.	ICNP and NANDA, NIC, NOC
Salvador PT, Mariz CM, Vítor AF, Ferreira Júnior MA, Fernandes MI, Martins JC, et al[18]	To describe the content validation process of a VLO to support the teaching of SNC to nursing technicians.	NANDA, NIC, NOC
Avelino CC, Costa LC, Buchhorn SM, Nogueira DA, Goyatá SL[19]	To assess the teaching-learning of undergraduates and nursing professionals about ICNP® through a course on the Moodle Platform.	ICNP
Almeida SR, Dal Sasso GT, Barra DC[20]	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.	Inter-American Export Promotion Center
Avelino CC, Borges FR, Inagaki CM, Nery MA, Goyatá SL[21]	To develop and assess a course on the Moodle Platform on nursing diagnoses, interventions, and outcomes, according to ICNP.	ICNP
Rezende LC, Santos SR, Medeiros AL[22]	To assess a prototype for mobile device that allows the recording of data for SNC in Neonatal Intensive Care Units.	ICNP
Dal Sasso GT, Barra DC, Paese F, de Almeida SR, Rios GC, Marinho MM, et al[23]	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.	ICNP
Jensen R, de Moraes Lopes MH, Silveira PS, Ortega NR[24]	To describe the development and assessment of software that verifies the accuracy of diagnoses made by nursing students.	NANDA, NIC, NOC
Goyatá SL, Chaves EC, Andrade MB, Pereira RJ, Brito TB[25]	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.	NANDA, NIC, NOC
Lira AL, Lopes MV[26]	To assess a VLO developed to mediate the teaching of nursing diagnostic reasoning and be applied to the integumentary system by undergraduate students in nursing.	NANDA, NIC, NOC

both by nursing organizations worldwide, as well as developed countries, for example, the United States of America (USA) in which NP has been used effectively since 1950.[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 motivated by organizations such as the American Nurses Association (ANA) in the early 21st century, who formalized guidelines for the insertion of these contents in the training of nurses, whether in undergraduate or graduate courses.[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 technological resources. TIGER provides training on the use and handling of these built tools.[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 computer science and as a consequence in promoting the development of technologies.[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 technological development process, as well as validation by specialists when considering validation studies.[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 developed in research.[31,32]

With regard to the type of technology presented, there was a prevalence of software, which is characterized by the grouping of logical information, processed by algorithms that result in a program.[33]

VLEs were also important technologies elucidated in the research analyzed, given that this resource 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.[34]

In relation to the target audience, most technologies 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.[8,35]

That said, the improvements resulting from the computerization of NP are described by nurses in a study[35] carried out in southern Brazil. These professionals point out that the insertion of this resource 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 support 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.[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 construction of strategies for ICNP implementation.[19]

As for the objectives elucidated by the selected studies, most seek to report the construction of technologies or assess tools developed to support NP; this refers that the research intends to generate innovations for the nursing practice in order to strengthen the insertion of NP.[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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