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REVIEW PROTOCOL

Nursing technologies in the digital health ecosystem: scoping review protocol

Tecnologias de enfermagem no ecossistema de saúde digital: protocolo de scoping review

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ABSTRACT

Objective: To map the scientific evidence related to the technologies that compose the digital health ecosystem in nursing. **Method:** The JBI methodology will be used. The search will include databases such as MEDLINE, Web of Science, Embase, SCOPUS, and ERIC, as well as manual reference searches and grey literature in repositories. Studies with various methodological designs, both primary and secondary, as well as grey literature, will be included. Editorials, conference abstracts, preliminary notes, research projects, and protocols will be excluded. Two reviewers will participate in the paired search, with blind selection of the evidence. In cases of disagreements, a third reviewer will be contacted. Decisions will follow a selection flow according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA). Data will be analyzed through tabular representation, diagrams, and illustrations. Registered in the Open Science Framework (https://osf.io/26hg3).
Descriptors: Digital Technology; Health Strategies; Ecosystem; Teaching Materials.

RESUMO

Objetivo: Mapear as evidências científicas relacionadas às tecnologias que compõem o ecossistema de saúde digital na enfermagem. **Método**: Será utilizada a metodologia do JBI. A busca incluirá as bases MEDLINE, Web of Science, Embase, SCOPUS e ERIC, além da busca manual por referências e a literatura cinzenta em repositórios. Serão incluídos estudos com diferentes delineamentos metodológicos, tanto primários quanto secundários, bem como a literatura cinzenta. Serão excluídos estudos editoriais, resumos em anais, notas prévias, projetos e protocolos de pesquisa. Dois revisores participarão da busca pareada, com seleção cega das evidências. Quando houver discordâncias no processo, um terceiro revisor será contatado. As decisões seguirão um fluxo de seleção conforme o *Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews* (PRISMA). Os dados serão analisados por meio de representação tabular, diagramas e ilustrações. Registro no *Open Science Framework* (https://osf.io/26hg3).
Descritores: Tecnologia Digital; Estratégias de Saúde; Ecossistema; Materiais de Ensino.

INTRODUCTION

Digital Health is a topic of international priority. In Brazil, initiatives by the Ministry of Science and Technology have made this theme a priority program coordinated by the National Network for Teaching and Research (RNP). This project aims to advance the conception of digital health and promote the development of Information and Communication Technologies (ICT) and Advanced Internet, with one of its pillars being Technological Development and Evaluation[1]. In this context, digital health becomes a highly complex field, arising from the integration of various social actors, healthcare organizations, and human resources[2]. Within this scope, there are digital ecosystems and sub-ecosystems.

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A digital ecosystem is the purpose of technological innovation that fosters integration between the environment and connectivity, establishing an open, dynamic, and global reinvention network, supported by specific regulations[2]. On the other hand, a digital health innovation ecosystem refers to an interconnected, interrelated, and interdependent network, including stakeholders in the healthcare sector, healthcare institutions, and digital health devices situated in a digital environment. These ecosystems demonstrate successful, proven, and effective practices; this strategy is implemented through information and communication technologies to monitor and improve the population's health conditions, empowering individuals and promoting health for themselves and others[3]. These practices are already being implemented in various countries.

In Africa, the process of including digital ecosystems has enabled access to the internet, as well as mobile and fixed broadband subscriptions. However, the high cost of technology hampers equitable access, especially when combined with the high burden of chronic non-communicable diseases, infectious and parasitic diseases, leading to epidemics and putting many countries at risk[4]. Nonetheless, the mapping of digital health is not yet widely discussed in the scientific literature.

A review study conducted in Australia showed that the understanding of digital health ecosystems is focused on the use/usability of technology, the consumer/user relationship, health care, information and data, and technology itself[5]. Thus, understanding the network of digital health ecosystems in a given country can facilitate care promotion mechanisms, beyond the programs offered by the healthcare system. Therefore, tools in healthcare are needed that focus on this activity, with an emphasis on accessible real-time technological availability for the community. In this study, health technology is understood as a means or instrument that addresses the needs (object) of a population, aiming at the improvement, balance, or restoration of its health-disease process. These outcomes are the direct impacts of technology[6]. To this end, technologies for informational and communication access, such as radio and newspapers, are categorized as Information and Communication Technologies (ICT), or those that involve the use of digital devices connected to the internet, known as Digital Information and Communication Technologies (DICT). In this sense, the development of a DICT can enhance clinical health conditions by facilitating care and improving the means of preventing health problems[7].

In Brazil, the use of a health ecosystem involves the production of knowledge through assistive, educational, or management technologies. In this regard, nursing plays a privileged role in contributing to the health sector by providing TDIC outputs that impact health practice (training, managerial assistance, or clinical reasoning) or assist patients (promotion, prevention, and rehabilitation) and their health conditions[8–10]. Nursing relies on practical-technological models for developing health technologies[11].

Therefore, due to the relevance of the topic and recognizing the gap in knowledge regarding digital health ecosystems in nursing, there is a need for a coalition between these technologies to support technological development in the field[12]. As a starting point for this process and critical-theoretical deepening, it is pertinent to conduct a literature review.

After conducting a search in the Medical Literature Analysis and Retrieval System Online (MEDLINE), Open Science Framework (OSF), Joanna Briggs Institute (JBI) Evidence Synthesis, and the Cochrane Database of Systematic Reviews, no ongoing or completed reviews were found regarding the formation of a digital health ecosystem in nursing. The aim of this review is to map the scientific evidence related to the technologies that make up the digital health ecosystem in nursing.

METHOD

Study design

This is a scoping review that will be developed according to the evidence synthesis manual published by JBI[13-15] and guided by the recommendations of the PRISMA-ScR checklist[16], along with the updates for transparency and methodological rigor in PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)[17]. The protocol has been registered in the Open Science Framework (https://osf.io/26hg3).

Study stages

The review will be conducted through nine sequential stages, which are: (1) Delimitation of the purpose and research question; (2) Development and agreement on the inclusion criteria based on the purpose and question; (3) Description of a structured methodology that includes evidence of the information, data collection, and its presentation; (4) Data mapping; (5) Evidence selection; (6) Evidence extraction; (7) Evidence analysis; (8) Presentation of results; and (9) Summary of indicators, conclusions, and reiteration of findings[13].

Research question
The research question was formulated based on the PCC strategy, recommended for formulating the research question[13], with "P" representing the population - Digital technologies, "C" representing the concept - Digital health ecosystems, and the second "C" representing the context - Nursing. The guiding research question established was: What technologies make up the digital health ecosystem in nursing? The following specific questions will be addressed:
a) Definition of the digital health ecosystem and the contents of each subsystem;
b) Strategies for delivering digital health materials;
c) Theories and theoretical frameworks used;
d) Results of the strategies and their application in the short, medium, and long term.

Eligibility criteria

Population
Digital technologies will be included from various perspectives of care (software, pamphlets, mobile applications, serial albums, educational games, cordel, etc), provided they were created to function, a priori, in the digital environment. Studies that only present publications in digital format, but where the technology was not previously made available, will be excluded.

Concept
The concept addressed will be digital health with a focus on the formation of a health ecosystem. This includes instructional strategies, audiovisual materials, illustrative, didactic-scientific, and training materials, in addition to evaluation strategies. The study will encompass the digital ecosystem as the context where technologies were built and operationalized by nursing.
Digital health is understood in different contexts and from various perspectives, where its application occurs through communication and/or information technologies, as well as services (such as telehealth) used in the provision of care. However, studies involving PowerPoint technologies, simulations, or virtual reality used exclusively for teaching purposes in learning environments (laboratories and classrooms) will be excluded, unless their productions are available. Technologies that deal exclusively with medical knowledge (such as tomography, in vitro fertilization, etc) will also be excluded.

Context
Studies conducted in various healthcare settings (outpatient, home care, hospital) will be included, with no restrictions regarding geographical location or social, ethnic, or gender factors. However, the service provided must align with the perspective of nursing care/assistance.

Types of Evidence
In the transition from the 1990s to the 2000s, the World Wide Web presented a large volume of health-related information. At the time, several publications from the Journal of the American Medical Association (JAMA) alerted the scientific community about the need to evaluate and standardize the health content disseminated on the internet. However, it was only in 2002 that the Web began to feature research on healthcare, becoming a vehicle for the dissemination of this type of knowledge02 is established as the temporal cutoff for this study. Studies with various methodological designs, both primary and secondary (quantitative, qualitative, and mixed), will be included. Quantitative studies with any experimental design (clinical trials, controlled or uncontrolled studies, experimental or quasi-experimental, observational, cohort, case-control, cross-sectional, descriptive, and methodological studies) will be considered. Qualitative studies with phenomenological designs, grounded theory, descriptive studies, and theoretical works with care products will also be included. Studies that address the study's objectives in depth will be selected, and their references will be examined to find additional relevant studies. Systematic reviews will also be considered in this scoping review. Editorials, abstracts in proceedings, preliminary notes, research projects, and protocols will be excluded. Research studies that do not meet the study's objectives will be excluded after the selection process, as outlined by JBI.

Information sources
The information sources for this study will include the following databases: Latin American and Caribbean Literature in Health Sciences (LILACS); MEDLINE via EBSCO Information Services; Web of Science (WoS); Embase via Elsevier; Cumulative Index to Nursing and Allied Health Literature (CINAHL); and SCOPUS via the CAPES journal portal. For grey literature, the following sources will be utilized: CAPES Theses and Dissertations Catalog, Brazilian Digital Library of Theses and Dissertations, WHO Library Database, medRxiv and OpenGrey.

Search strategies

The search strategy was developed based on a preliminary search in MEDLINE and SCOPUS to identify the most relevant descriptors and keywords for the research topic. The terms found in titles and descriptors were combined with other pertinent terms and tested. The search will be conducted based on the PCC elements, using terms from the Health Sciences Descriptors (DeCS) or Medical Subject Headings (MeSH), along with the Boolean operators AND and OR. The final search strategy will be selected based on the tests conducted on the PubMed portal, considering the strategy that results in the largest number of relevant studies for the proposed review topic (Figure 1). The strategy and search terms will be adapted according to each database.

Search	***Query***	***Records retrieved***
#1	*("technology"[MeSH Terms] OR "Digital Technology"[MeSH Terms] OR "Digital Electronics"[Title/Abstract] OR "Digital Technologies"[Title/Abstract] OR "electronics digital"[Title/Abstract] OR "technology digital"[Title/Abstract] OR "Biomedical Technology"[MeSH Terms] OR "biomedical technolog*"[Title/Abstract] OR "technology for health"[Title/Abstract] OR "Health Care Technology"[Title/Abstract] OR "Educational Technology"[MeSH Terms] OR "educational technolog*"[Title/Abstract] OR "Instructional Technologies"[Title/Abstract] OR "Care technology"[Title/Abstract] OR "Self-Help Devices"[MeSH Terms] OR "assistive device*"[Title/Abstract] OR "assistive technolog*"[Title/Abstract] OR "Information Technology"[MeSH Terms] OR "Hypermedia"[MeSH Terms] OR "software"[Title/Abstract] OR "educational software"[Title/Abstract] OR "application"[Title/Abstract] OR "evaluation instrument"[Title/Abstract] OR "evaluation protocol"[Title/Abstract] OR "evaluation protocols"[Title/Abstract] OR "protocols"[Title/Abstract] OR "care protocol"[Title/Abstract] OR "learning materials"[Title/Abstract] OR "learning materials"[Title/Abstract] OR "OVA"[Title/Abstract] OR "educational game"[Title/Abstract] OR "manual"[Title/Abstract] OR "playbook"[Title/Abstract] OR "playbooks"[Title/Abstract] OR "diagnosis"[Title/Abstract] OR "diagnostics"[Title/Abstract] OR "intervention"[Title/Abstract] OR "interventions"[Title/Abstract] OR "Multimedia"[MeSH Terms] OR "Multimedium"[Title/Abstract] OR "e-book"[Title/Abstract])*	4,943,640
#2	*("Digital Health Strategy"[Title/Abstract] OR "Ecosystem"[MeSH Terms] OR "Teaching Materials"[MeSH Terms])*	418,243
#2	*("nursing"[MeSH Terms] OR "Nursings"[Title/Abstract] OR "Nursing Care"[MeSH Terms] OR "care nursing"[Title/Abstract] OR "management nursing care"[Title/Abstract] OR "Nursing Care Management"[Title/Abstract] OR "health knowledge, attitudes, practice"[MeSH Terms] OR "knowledge attitudes practice"[Title/Abstract])*	419,473
#4	#1 AND #2 AND #3	3.862
	Limited year 2002	2,538

Figure 1 - Complete strategy in PubMed. Salvador, BA, Brazil, 2023

Study selection

The study selection process will follow an adapted model based on the JBI guidelines[13]. The search results will be exported to the Rayyan reference manager, developed by the Qatar Computing Research Institute (QCRI)[18]. The selection process will involve two independent researchers; in case of disagreement, a third researcher will resolve the conflict. Duplicate records will be considered only once with the help of Mendeley software.

Rayyan will assist in identifying studies by title/abstract and full text, according to the eligibility criteria. The selection will occur in two stages[14]: the first stage involves screening by title/abstract, and the second stage involves reading the full text and verifying the references. The reasons for exclusion will be listed in an appendix of the final report and summarized for presentation in the synthesis[17].

Data extraction

Data extraction will be carried out through the screening of the full text of the included articles. The data from these articles will be extracted by reading the full text and organized into a Goo-

gle spreadsheet, accessible to two reviewers. For each record, the following information will be evaluated: bibliographic details (authors, year of publication, journal, title, study country, adopted method, study design, and sample), population (digital care/assistance materials in nursing, definition of digital ecosystem, theoretical framework, material delivery strategies, theoretical models, and temporal applicability), and context (environment/application setting). Additionally, the key conclusions will be summarized (Figure 2). The draft of the data collection tool will be reviewed and updated as necessary. Whenever applicable, study authors will be contacted to request additional information not included in the publication.

Title Authors Year Journal Country	Design Sample	Material used	Concept covered	Theoretical framework Temporal applicability	Delivery strategy	Scenario Environment	Conclusion

Figure 2 - Data extraction instrument for the review. Salvador, BA, Brazil, 2023

PRESENTATION OF RESULTS

The results will be presented using the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flowchart[19] and mapped in the form of tables/diagrams. These results will be accompanied by a narrative synthesis of the data, which will be constructed based on thematic categories emerging from the analysis of the selected texts. Additionally, the construction of the ecosystem model, as well as the interpretation of the findings, will be guided by the praxeological-technological model[10]. The studies will be classified according to their levels of evidence and recommendation, following the Joanna Briggs Institute[20].

CONFLICT OF INTERESTS

The authors have declared that there is no conflict of interests.

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Data analysis and interpretation: Cruz Neto J, Joaquim JS, Salbego C, Sousa AR
Writing and/or critical review of the intellectual content: Cruz Neto J, Muniz VO, Joaquim JS, Salbego C, Vale PRLF, Sousa AR
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