

Nursing Technologies in Brazil: A Review

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ABSTRACT

Introduction: The production of new technologies enables greater speed and promotes new processes and the integration of information. In nursing, it becomes an important resource, as it is conceived from the practice of human care combined with scientific knowledge.

Objective: To identify technological productions in articles published in electronic format between the years 1990 and 2019.

Method: Review study with analysis of 29 issues and 149 online editions of the Brazilian Journal of Nursing published from January 1990 to July 2019.

Results: Total of 4,525 publications were identified and, after applying the inclusion and exclusion criteria, 46 articles were included in the analysis. Of these articles, 10 contained "information technologies" and 36 "other technologies".

Conclusion: Nurses establish partnerships and, based on the needs to provide good care of the human being, produce technologies for the care process, education and research itself.

INTRODUCTION

Technology in the historical process of mankind stands out for its great scientific discoveries, assisting in human development as well as in its relationship with nature, in the way of living in society, in the way of working, in the rhythms of life and, also, in health systems [1,2].

The information incorporated into the institutions provides speed and trustworthiness. Technology, in the organizational context, is an effective resource to enable an integrated information process [2].

In the Brazilian scenario of constant changes and innovations in the health area, computer technologies have helped to monitor epidemiological and demographic changes, enabling better directions in terms of access to health services with regard to increased costs and consequently, in terms of improved efficiency of public health policies [3].

In Health, Information Technology (IT) has a major relevance in clinical practice, promoting the improvement of the quality of care services. Nursing has a relevant prominence in this process, as it employs IT in teaching, management, research and also as an instrument for systematizing the care provided by nurses [4].

Networking allows nurses to become protagonists in the innovative creation of new processes and products, collaborating with other professionals, demonstrating the art and science of nursing, and stimulating changes in different professional spheres [5,6].

The Brazilian Journal of Nursing (Revista Brasileira de Enfermagem - REBEn) is a national reference for nursing. Thus, the study of technological productions contained in articles published in electronic format between the years 1990 and 2019 also results in an incentive for nurses to document what they create or to contribute with ideas for the creation of technologies.

METHODS

The development of this review study followed the steps recommended by the Cochrane Institute, namely, the formulation of the question, screening and selection of studies, critical evaluation of studies, data collection, analysis and presentation of data, interpretation of data and improvement and updating of the review [7].

To guide the actions, the following question was investigated: what types of technological productions are described in articles published in REBEn in electronic format between the years 1990 and 2019?

Descriptors found in the Health Sciences Descriptors (DeCS) platform were used to search for articles. They were the following: "Scientific and Technological Activities"; "Scientific Production Indicators"; "Product Production"; "Clean Technology"; "Self-help equipment"; "Technology"; "Evaluation of Biomedical Technology"; "Appropriate Technology"; "Intermediate Technology"; "High Cost Technology"; "Technology transfer"; "Low Cost Technology"; "Beside Automated Assistance Systems"; "Multimedia"; "Biomedical Technology"; "Health Science, Technology and Innovation Management"; "Science and Technology Information Networks"; "Ibero-American and Inter-American Science and Technology Indicators Network"; "Product Technology"; "Information Technology".

The selection of articles occurred using the REBEn database on the journal's webpage in Scientific Electronic Library Online (SciELO). All were original articles available in full, published in the Portuguese language. Publications of essays, theses, dissertations, experience reports, editorials, chronicles, letters, interviews, reports, papers without co-authorship or authorship of nurses, and papers that did not address the production of technologies in research were excluded.

The time frame for the study was between January 1990 and July 2019, corresponding to the period when electronic access was implemented. Collection was carried out in the months of August and September 2019. The date stipulated to begin the study is justified by the fact that from the 1990s onwards, there was an expansion of new health technologies, mainly computerization, aiming to meet the needs of users, health professionals and managers [8,9].

After the insertion of the articles selected in the first stage, they were all inserted in an electronic spreadsheet and structured as follows: order number, year of publication, database, edition, methodological follow-up, authors, title, abstract, Digital Object Identifier (DOI), and language.

The selection and analysis of articles took place after evaluation through the reading of abstracts, with exclusion of articles that did not meet the objectives of the study. The selected articles were placed in another spreadsheet with the following variables: order number, year/region, title, intervention, dimensions in nursing practice, methodology, applied technology, whether it was associated with information technology, and whether it was registered.

In the final characterization of the studies, the following items were defined: order number, author(s), article, year of publication, type of technology, professionals, City\State\Country, and intellectual ownership.

In the final process of selection and organization of articles, they were included in two separate tables, defined as "information technologies" and "other technologies".

The criteria for the dimensions of technologies in nursing practice were defined as follows: assistive technology, professional training technology, management technology, and technology for health education. The results are presented using descriptive statistics.

RESULTS AND DISCUSSION

This 29 issues containing 149 online editions were sought, resulting in 4,525 publications.

The stages of the process were developed and the results were reconciled between the independent researchers and the Cohen's Kappa Coefficient was applied, obtaining a result of 0.82.

The body of the study comprises 46 articles, which were organized in two different tables: the first with the technologies defined as information technologies, with a total of 10 publications; and the second comprising 36 publications classified as other technologies.

Of the 10 articles selected as ITs, the following types of technologies were identified: 4 (40%) assistance, 3 (30%) professional training, 2 (20%) health education, and 1 (10%) management.

Of the 36 articles classified as other technologies, 30 addressed instrument validation, three translation and adaptation, and three creation of technology for process evaluation. They were classified in the following areas: 20 (56%) assistance, 8 (23%) health education, 6 (17%) management, and 2 (4%) professional training (Figure 1).

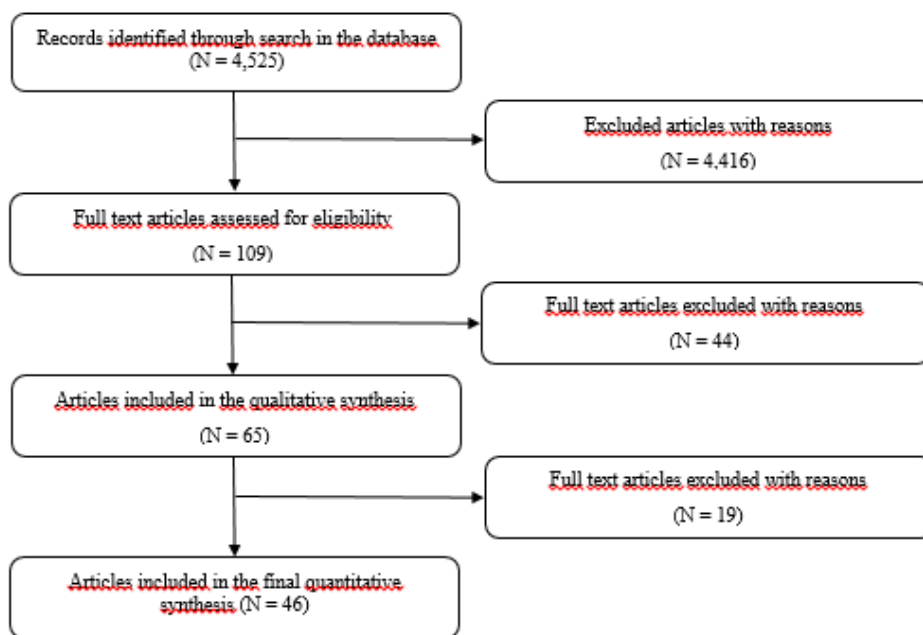


Figure 1. Diagram of the selection of the review texts. Florianópolis, Santa Catarina, Brazil, 2019.

The South, Southeast and Northeast regions had the same number of articles addressing information technologies, with three publications produced in each region (33% each), while the North region had one article (1%).

As for other technologies, the Southeast region was the one with the highest number of articles, with 16 publications (44%), followed by the Northeast with 13 (37%) and the South with four (11%).

An IT article was carried out with international partnership [10], with Coimbra - Portugal. Regarding the articles described in Tables 1 and 2, three were carried out with international participation, namely, with collaboration from Bogotá - Colombia, Coimbra - Portugal and Wisconsin - United States of America [11-13]. As for the types of technology, there were three aimed at professional training and one at assistance.

Five publications [14-18] did not provided a detailed description of the authorship or assistance from IT professionals in the creation of the project and its development.

No mention was made in any of the 46 articles regarding patent registration or intellectual ownership of the technologies presented.

Table 1. Articles selected and classified as information technologies. Florianopolis, SC, Brazil (2019).

Nº	Author(s)	Article	Year of publication	Type of technology	Professionals	City\State \country	Intellectual ownership
1	Lunardi Filho; Mazada; Lunardi	To develop a computer system to make nursing prescription feasible and operational.	1995	Assistive technology	Nurse administrator, Academic in Administration, Data processing technician	Rio Grande\ Rio Grande do Sul	No
2	Dias; Cassiani	Education without distance: use of WebCT as a support tool for teaching Intravenous Therapy in Nursing Undergraduate Course.	2003	Professional training technology	Nurses	Cascavel\ Paraná	No
3	Lopes; Higa	Development of a specialized system for identifying nursing diagnoses related to urinary elimination.	2005	Management technology	Nurses Statistician	Campinas\ Sro Paulo	No
4	Prado; Vaz; Almeida	Theory of meaningful learning: preparation and evaluation of a virtual class on the Moodle platform.	2011	Professional training technology	Nurses	Sro Paulo\ Sro Paulo	No
5	Barra et al.	Wiki technology assessment: tool to access information on mechanical ventilation in Intensive Care.	2012	Assistive technology	Nurses	Florianopolis \ Santa Catarina	No
6	Seixas et al.	Virtual learning environment: structuring a script for an online course.	2012	Professional training technology	Nurses	Sro Paulo \SP Coimbra \Portugal	No
7	Bfio et al.	Assessment of accessibility of assisted technology for deaf people.	2016	Health education technology	Nurses	Fortaleza\ Cearó	No
8	Carvalho et al.	Construction of assisted technology as an online course for blind people about hypertension.	2018	Assistive technology	Nurses	Joro Pessoa \ Parahba	No
9	Silva Jr et al.	Software for Systematization of Nursing Care in a hospitalization unit.	2018	Assistive technology	Nurses	Belém\Paró	No
10	Santana et al.	Nursing consultation software for hypertensive patients in the	2018	Health education technology	Nurses Web designer	Fortaleza\	No

		Family Health Strategy.					
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Table 2. Articles selected and classified as other technologies. Florianópolis, SC, Brazil (2019).

Nº	Author(s)	Article	Year of publication	Other Technologies	Professionals	City\State \Country	Intellectual ownership
1	Gonealves; Leite	Instrument for measuring attitudes towards the performance evaluation process.	2005	Management technology	Nurses	Sro Paulo\ Sro Paulo	No
2	CruZ et al.	Adaptation and validation of the instrument "Positions on nursing diagnosis" for the Portuguese language.	2006	Assistive technology	Nurses	Sro Paulo\ Sro Paulo	No
3	Higa; Lopes	Evaluation of a system specialized in nursing diagnosis related to urinary elimination.	2008	Assistive technology	Nurses	Campinas\ Sro Paulo	No
4	Ribeiro; Marin	Proposal for an instrument for assessing the health of institutionalized elderly people based on the concept of the Essential Nursing Data Set.	2009	Assistive technology	Nurses	Brashlia\ Distrito Federal	No
5	Fini; Cruz	Psychometric properties of the Dutch Fatigue Scale and Dutch Exertion Fatigue Scale: Brazilian version.	2010	Assistive technology	Nurses	Sro Paulo\ Sro Paulo	No
6	Barbosa; Bezerra	Validation of an educational video to promote attachment between HIV-positive mother and her child.	2011	Health education technology	Nurses	Fortaleza\ Cear6	No
7	Andrade; Chianca	Validation of nursing interventions for patients with spinal cord injury and impaired physical mobility.	2013	Assistive technology	Nurses	Belo Horizonte \ Minas Gerais	No
8	Pagliuca et al.	Validation of an instrument to assess the ability to measure blood pressure.	2014	Assistive technology	Nurses	Natal\RN	No
9	Tibbricio et al.	Validation of general guidelines for communication between nurses and blind patients.	2014	Assistive technology	Nurses Statistician	Sro Paulo\ Sro Paulo	No
10	Veras et al.	Risk classification in pediatrics: construction and validation of a guide for nurses	2015	Assistive technology	Nurses	Fortaleza\ Cear6	No
11	Toso et al.	Validation of newborn positioning protocol in Intensive Care Unit.	2015	Assistive technology	Nurses	Cascavel\ Paran6	No
12	Albuquerque et al.	Technology for self-care of sexual and reproductive health of women with an ostomy.	2016	Health education technology	Nurses	Recife\ Pernambuco	No
13	Miranda et al.	Translation and adaptation of a pediatric early warning score.	2016	Assistive technology	Nurses	Salvador\ Bahia	No

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14	Almeida et al.	Validation for the Portuguese language of the Debriefing Experience Scale.	2016	Professional training technology	Nurses	Ribeirro Preto \ Sro Paulo	No
15	Monteiro et al.	Clinical validation of the nursing diagnosis "Willingness for improved infant development".	2016	Assistive technology	Nurses	Fortaleza\ Cear6	No
16	Pereira; Puggina	Validation of self-assessment of communication skills and professionalism for nurses.	2017	Managemen t technology	Nurses	Sro Paulo\ Sro Paulo	No
17	Lins et al.	Validation of the adherence questionnaire for Brazilian chronic renal patients on hemodialysis.	2017	Assistive technology	Nurses	Rio de Janeiro \ Rio de Janeiro	No
18	Paim et al.	Validation of an instrument for nursing intervention for patients undergoing vasoactive therapy.	2017	Assistive technology	Nurses	Florianopolis\ Santa Catarina	No
19	Bellan et al.	Revalidation of a game for teaching the auscultatory measurement of blood pressure: pilot study.	2017	Health education technology	Nurses	Campinas\ Sro Paulo	No
20	Cordeiro et al.	Validation of an educational booklet on HIV/AIDS prevention in the elderly.	2017	Health education technology	Nurses	Fortaleza\ Cear6	No
21	Ramirez et al.	Spanish version of the scale of attitudes towards alcohol (SATA): content validation.	2017	Assistive technology	Nurses	Sro Paulo\SP Bogot6\ Colombia	No
22	Caldana; Gabriel	Evaluation of the Hospital Accreditation Program: face and content validation.	2017	Managemen t technology	Nurses	Ribeirro Preto \ Sro Paulo	No
23	Brasil G. B. et al.	Educational technology for people living with HIV: a validation study.	2018	Health education technology	Nurses	Belim\ Par6	No
24	Gomes et al.	Validation and reliability of Self-efficacy and their child's level of asthma control.	2018	Assistive technology	Nurses	Fortaleza\ Cear6	No
25	Pegoraro et al.	Validation of an instrument to evaluate a patient risk classification software.	2018	Managemen t technology	Nurses	Londrina\ Paran6	No
26	Dantas; Silva; Nybrega.	Validation of diagnoses, results and nursing interventions in the pediatric clinic.	2018	Managemen t technology	Nurses	Joro Pessoa\ Parana	No
27	Salvado et al.	Validation of a virtual learning object to support the teaching of the systematization of nursing care.	2018	Professional training technology	Nurses	Natal\ Rio Grande do Norte Coimbra\ Portugal	No
28	Siqueira; Vila; Weiss.	Cross-cultural adaptation of the Readiness For Hospital Discharge Scale - Adult Form.	2018	Assistive technology	Nurses	Goivnia\ Goibs Wisconsin\ United States of America	No

29	Nepomuceno et al.	Comparison of instruments to assess fatigue in patients with heart failure.	2018	Assistive technology	Nurses	Ribeirão Preto \ São Paulo	No
30	Rodrigues et al.	Head and neck cancer: validation of an instrument for data collection.	2018	Assistive technology	Nurses	Fortaleza \ Ceará	No
31	Sabino et al.	Validation of a booklet to promote maternal self-efficacy in preventing childhood diarrhea.	2018	Health education technology	Nurses	Florianópolis \ Santa Catarina	No
32	Araújo et al.	Clinical validation of falls prevention behavior in a hospital environment.	2018	Assistive technology	Nurses	Natal \ Rio Grande do Norte	No
33	Macedo; Bohomol.	Validation of a self-assessment instrument by the Patient Safety Centers.	2019	Management technology	Nurses	São Paulo \ São Paulo	No
34	Souza; Orlandi	Translation and cultural adaptation of the Patient Perceptions of Hemodialysis Scale in Brazil.	2019	Health education technology	Nurse and Gerontologist	São Carlos \ São Paulo	No
35	Silva et al.	Nursing diagnoses in a home program: cross-mapping and NANDA-I Taxonomy.	2019	Assistive technology	Nurses	Montes Claros \ Minas Gerais	No
36	Santiago; Moreira.	Validation of the content of a booklet on overweight for adults with hypertension.	2019	Health education technology	Nurses	Fortaleza \ Ceará	No

The creation and development of new technologies promote important changes, favoring organizational and professional performance, and consequently, services provided with quality and with better cost-benefit ratio ^[19-57].

The publications addressing information technologies during the studied period were few. The increase in the use of IT is desirable given the increased speed of the internet, social networks, opportunities in the human project, with a view to self-creating its own humanity ^[58].

In health, technology includes not only the sense of a palpable product, which acts as an instrument, that is, technology is not exclusively used to refer to materials, but it also represents values in its use, meeting the needs of health care ^[59].

Nurses have to seek solutions to meet the needs that include quality care and more resources. The creation of new technologies in nursing is aimed at solving nonconformities, incorporating agility and cost reduction, demonstrating the importance of empowering nurses in this process of creating and using technologies ^[60].

Computerized technologies allow efficient management, as for example, in bed management, account audits, internal communication with support areas and clinical information of patients for the entire care team. Thus, computerization is a foundation in the management process, with an impact on different actions ^[61].

Technologies can assist in teaching-learning, assistance and management actions. In this way, technologies are important in the execution of the professional prerogatives of nursing, providing support in health care actions ^[5].

The studies classified in the present study as assistive technology point out the importance of this type of technology in the solution of dilemmas in the nursing practice, using machines that are inserted in the actions and processes that encompass the different elements of care ^[62]. Professional knowledge and the process of interpersonal relationships become of great value, being also considered as process technologies in health work actions ^[63].

The Southeast region had the largest number of publications, followed by the South. The Southeast-South axis concentrates the largest number of Undergraduate Nursing courses as well as nurses, which may favor the development of a greater number of publications and greater technological production. Besides the number of professionals, the Southeast region was the first to have Stricto Sensu graduate courses ^[64,65].

Nurses have the competence to select which technological productions meet the needs for a better professional performance ^[66]. The results found in the publications made at REBEn during the studied period demonstrate that the technologies applied in assistance were priority.

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Information technology professionals are required to have logical reasoning, concentration, precision in analysis and development, and knowledge of software, hardware, operating systems and programming languages. This technical knowledge is important for the creation of innovations^[67]. The absence of partnerships with these professionals limits the creation and adequacy of knowledge which are not part of the training and competence of nurses, and this hinders the process of proposing and developing new technologies.

There was a considerable number of publications about validation of instruments. Building reliable measures and instruments that support safe professional nursing practice and based on scientific knowledge is essential^[68]. That is why methodological rigor with reliable measures is essential for an adequate validation^[69]

It should be noted that in the analyzed articles, no information was found regarding intellectual ownership or patent registration for the technologies produced, nor even data regarding the nurses' responsibility to protect their technological productions.

The studies indicate a small production of patents created and registered by researchers in nursing productivity with the National Research Council (CNPq)^[70].

It is worth to emphasize the importance of mobilizing nurses to cooperate with other professionals when producing technologies, especially when using computerized technologies. It is also essential that nurses recognize that the registration of patents, software's, ideas and innovations in nursing ensure their insertion in the scientific community.

The patent registration process in Brazil has become subject of discussion in the scientific context in institutions and especially in universities. The possibility of a product generated from a research obtaining a patent means that researchers have the opportunity to achieve not only the recognition of their research, but also its applicability and commercialization.

The publications that refer to technological productions denote the complexity of the nurses activities. This complexity is indicated by the plurality of services, the target audience, sectors and duties, requiring entrepreneurship and competence from these professionals to perform nursing care with all the humanistic requirements and which attest its importance in the practice.

CONCLUSION

The journal produced by the Brazilian Nursing Association fulfills one of its purposes - to provide space for publishing articles produced by nurses and demonstrate that nursing is part of the scientific community.

Regarding the publications in REBEn in the period from 1990 to 2019, made available online, it was seen that nurses presented part of their technological production. This partly so because research on the theme "nursing technologies" published and inserted in several databases is underway. With this research, it will be possible to demonstrate the Brazilian scenario in its entirety.

Although the present study presents only the manuscripts on nursing technologies published in REBEn, it is possible to state that nurses have knowledge to produce technologies to perform nursing care. In this context, nurses must be recognized as producers and not only as consumers of new technologies.

The lack of information in the articles about the registration of intellectual ownership and/or patents may weaken nursing by reducing its possibilities for commercializing technologies, especially products.

Nursing technologies were built with the support of different types of knowledge, with emphasis on informatics and statistics, and these were destined to nursing care, care and assistance management, health and nursing education, and were applied in different fields of practice.

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