POTENTIALITIES AND DIFFICULTIES OF TECHNOLOGICAL MEDIATION IN THE WORK OF NURSE MANAGERS IN HOSPITALS

Lara Vandresen¹ (ID)
Denise Elvira Pires de Pires¹ (ID)
Maria Manuela Ferreira Pereira da Silva Martins² (ID)
Elaine Cristina Novatzki Forte¹ (ID)
Eliseth Leão³ (ID)
Mariana Mendes¹ (ID)

¹Universidade Federal de Santa Catarina, Programa de Pós-graduação em Enfermagem. Florianópolis, Santa Catarina, Brasil.
²Escola Superior de Enfermagem do Porto. Porto, Portugal.
³Instituto Israelita de Ensino e Pesquisa Albert Einstein, Faculdade Israelita de Ciências da Saúde Albert Einstein. São Paulo, São Paulo, Brasil.

ABSTRACT

Objective: to describe the potentialities and difficulties mentioned by nurse managers in the use of technologies in hospitals.

Method: qualitative, descriptive-exploratory study, conducted in the period of one year, 2019 to 2020, in Brazil and Portugal, in four hospitals. Data were collected through interviews, following a semi-structured script, involving 71 nurse managers. For data analysis, resources of the ATLAS.ti software were used, following the precepts of thematic content analysis and work process theory.

Results: nurse managers consider that technologies contribute to the improvement of institutional processes, information recording, time management, data storage and patient safety. Among the difficulties, problems related to the work instruments themselves are highlighted, such as lack of equipment/computers, slowness and lack of systems integration; and related to the workforce, such as time management, cultural adaptation, lack of knowledge and training to use technology.

Conclusion: innovative technologies contribute to management work, but their effectiveness depends on training, adequate number of professionals, in addition to efficient and integrated equipment and information systems.

DESCRIPTORS: Information technology. Health management. Hospital administration. Nursing. Technology. Administration of health services.

POTENCIALIDADES E DIFICULDADES DA MEDIAÇÃO TECNOLÓGICA NO TRABALHO DE ENFERMEIROS GESTORES EM HOSPITAIS

RESUMO

Objetivo: descrever potencialidades e dificuldades mencionadas por enfermeiros gestores no uso de tecnologias em hospitais.

Método: estudo qualitativo, descritivo-exploratório, realizado no período de um ano, 2019 a 2020, no Brasil e Portugal, em quatro hospitais. Os dados foram coletados através de entrevistas, seguindo roteiro semiestruturado, envolvendo 71 enfermeiros gestores. Para análise dos dados utilizou-se recursos do software ATLAS.ti, seguindo preceitos da análise de conteúdo temática e da teoria do processo de trabalho.

Resultados: enfermeiros gestores consideram que tecnologias contribuem para melhoria dos processos institucionais, registro de informações, gestão do tempo, armazenamento dos dados e segurança do paciente. Dentre as dificuldades destacaram problemas relacionados aos próprios instrumentos de trabalho, como: a falta de equipamentos/computadores, lentidão e falta de integração de sistemas; e relacionados à força de trabalho, como: gestão do tempo, adaptação cultural, falta de conhecimento e capacitação para utilizar a tecnologia.

Conclusão: tecnologias inovadoras contribuem para o trabalho de gestão, mas sua efetividade depende de capacitação, quantitativo adequado de profissionais, além de equipamentos e sistemas de informação eficientes e integrados.

DESCRITORES: Tecnologia da informação. Gestão em saúde. Administração hospitalar. Enfermagem. Tecnologia. Administração de serviços de saúde.

POTENCIALIDADES Y DIFICULTADES DE LA MEDIACIÓN TECNOLÓGICA EN EL TRABAJO DE LOS GERENTES DE ENFERMERÍA EN LOS HOSPITALES

RESUMEN

Objetivo: describir las potencialidades y dificultades mencionadas por los enfermeros gestores en el uso de las tecnologías en los hospitales.

Método: estudio cualitativo, descriptivo-exploratorio, realizado durante un año, 2019 a 2020, en Brasil y Portugal, en cuatro hospitales. Los datos fueron recolectados a través de entrevistas, siguiendo un guión semiestructurado, involucrando a 71 enfermeros gestores. Para el análisis de datos se utilizaron los recursos del software ATLAS.ti, siguiendo los preceptos del análisis de contenido temático y la teoría de proceso de trabajo.

Resultados: los gestores de enfermería consideran que las tecnologías contribuyen para la mejora de los procesos institucionales, el registro de informaciones, la gestión del tiempo, el almacenamiento de datos y la seguridad del paciente. Entre las dificultades, destacaron problemas relacionados con los propios instrumentos de trabajo, como: la falta de equipos/computadoras, lentitud y falta de integración de sistemas; y relacionados con la fuerza de trabajo, tales como: gestión del tiempo, adaptación cultural, desconocimiento y capacitación en el uso de la tecnología.

Conclusión: las tecnologías innovadoras contribuyen al trabajo de gestión, pero su eficacia depende de la formación, número adecuado de profesionales, además de equipos y sistemas de información eficientes e integrados.

DESCRIPTORES: Tecnología de la información. Manejo de la salud. Administración hospitalaria. Enfermería. Tecnología. Administración de servicios de salud.

INTRODUCTION

Today's world is significantly impacted by the process of technological innovation, visible in all sectors of the economy. Healthcare is part of the political-social macro scenario, constituted and constituent of historical totalities[1]. In health, cultural aspects related to the perception of human suffering, institutional aspects of the organization and management of services and those related to the costs are involved. It is also important to highlight the importance of the availability of knowledge about the health-disease process, including its social determination, from health promotion to the production of care technologies, for the treatment of problems experienced by individuals and populations. It constitutes a space of challenges and permanent demand for new knowledge and technologies applicable to the solution of practical challenges and problems[2–4] that present themselves in this vast scenario. It is a field of complex activities in which management of work and institutional are interconnected.

The workforce is highly relevant for health and nursing outcomes[5], but technological mediation can hinder or potentiate actions, depending on multiple factors. In human labor in general, and in healthcare, the workforce uses multiple instruments to obtain products. Instruments include institutional structure, machinery, materials, tools and technologies (materials and non-materials)[6].

This technological mediation has resulted in significant changes in care and management work in health and nursing[7–8]. Regarding management, new technologies are incorporated to reduce costs and/or reproduce capital and have also contributed to the quality and safety of care[2,9]. In this process, Information and Communication Technologies (ICT) are highlighted.

ICT are tools and technical means used to obtain/treat information, with a view to improving care practice, communication and assisting the decision-making process. They involve a large number of products, technologies and services, such as cloud-based, mobile and remote technology, medical devices, teleconsultation and monitoring tools, assistant and sensor technologies, electronic health records, among others used in healthcare[10].

Research on the impacts of new technologies on hospital management indicates the importance of ICT in improving the quality of institutional and care processes, positively influencing good management practices and the qualification of care provided to users[7,11]. An study[12] reported that hospitals have incorporated different technologies, especially ICT, in order to produce better care results. Among the most used, software which contributes to the development and registration of provided care, and which have different functionalities and different levels of complexities are highlighted.

The introduction of these technologies has been growing exponentially in management work in hospitals, including the work performed by nurses. However, its proper application requires specific training and knowledge[12].

The incorporation and use of technological innovations in healthcare has encouraged significant changes in the way nurses work in different scenarios, especially in the management in hospitals[13]. Its potential to expand the scope of nurses' activities, in addition to stimulating innovative attitudes regarding the production of better health outcomes has also been mentioned[14]. Also, the use of innovative technologies strengthens the profession and provides numerous benefits to patients[15]. International institutions, such as the American Association of Colleges of Nursing and the Institute of Medicine of the National Academy of Sciences, have encouraged the use of ICT by professionals to support decision-making. However, the use of innovative technologies requires training for proper management, which is recognized in studies on its use in nursing management, signaling the importance of skill development during professional training[16].

Studies[8,10,17–18] discuss the process of incorporating technologies and their impact on the care provided to health services users. However, there are still gaps regarding the evaluation of these technologies, potentialities and difficulties related to their use by nurse managers. It is important to question the relationship between technology and the workforce in nursing management performed in hospitals, including the identification of benefits and difficulties in management, as well as contributions to the good performance of activities in services. If they are adequate to communication processes in hospitals, if they are positively influencing the work process including the management of time, people and processes, as well as the use and disuse in relation to what the technology itself proposes.

In this context, the study aimed to describe the potentialities and difficulties regarding the use of management technologies mentioned by nurse managers working in Brazilian and Portuguese hospitals.

METHOD

A qualitative study with a descriptive-exploratory approach, guided by the theoretical framework of the work process[6]. The study was conducted with nurse managers from two countries, Brazil and Portugal. The Consolidated Criteria for Reporting Qualitative Research (COREQ) was used for development of the study and the presentation of the results.

Data were collected through interviews which followed a semi-structured script. The study involved 71 nurse managers from two hospitals in Brazil and two in Portugal, including an accredited hospital and a university hospital from each country.

For the definition of countries, institutions and nurse managers participating in the research used the criteria of intentionality and convenience. Firstly, the inclusion of Portuguese hospitals were considered due to ease of access, which was made possible by the partnership between researchers from both countries. Secondly, the inclusion of hospitals considered of quality in both countries was chosen because they are more sensitive to the technological innovation process. For this, two criteria that could be paired in both countries were used: university hospitals, because they are a reference in higher education of health professionals; and accredited hospitals for following international quality standards, such as accreditation by the Joint Commission. Thirdly, regarding the inclusion of nurse managers, it was considered: to work in hospital management (care units or higher levels of the institution). Professionals on leave for any reason during the data collection period were excluded.

Data collection in the four institutions was performed by the principal researcher between March 2019 and March 2020. The nurse managers were interviewed in their workplaces during working hours. The participants were approached through previous visits made to the institutions in order to identify the number of nurse managers, followed by an invitation to participate in the research through direct contact. All nurse managers were included, respecting the desire to participate in the research, availability and choice of the most convenient place and time.

The participants answered the following guiding question: regarding their work as a nurse manager, what facilities and difficulties are found in the use of innovative technologies available in their institution? The answers were recorded by the main researcher in a specific form for each participant during the face-to-face meeting. All innovative technologies mentioned by the participants were considered in the analysis, without a theorization regarding the technological innovation process.

Regarding data analysis, the records of the forms were transcribed in a word processor (Microsoft Word) and inserted individually in the ATLAS.ti 8.0[19] software, totaling a set of 71 documents. Next, the data were analyzed following the precepts of Thematic Content Analysis[20]. In the software, the significant excerpts (quotations) that highlighted the potentialities and difficulties regarding the use

of technologies by managers were selected, followed by the association with codes. In relation to each code, the magnitude was verified, i.e., the number of times it was attributed in the participants' statements, and each participant freely mentioned one or more facilities, and/or difficulties, in the management of technologies used to perform their work.

Later, the codes were organized into thematic groups, seeking relationships and interpreting them based on the theoretical framework of the work process applied to healthcare[6,21]. This analytical process gave rise to two categories: "potentialities in the use of management technologies" in which the focus on the process and outcome for patients stood out; and "difficulties in the use of management technologies", in this category a thematic group related to the workforce was highlighted, especially in the management of technology, and another related to the work instruments themselves.

In Brazil, the research project was approved by the Ethics Committee on Research with Human Beings (CEPSH) of UFSC, via *Plataforma Brasil*. In Portugal, the research project was approved by the ethics committees of the two participating institutions. All participants from both countries signed the Free and Informed Consent Form (TCLE). The participants' statements were coded using: E (nurse), HU (university hospital), HA (accredited hospital), PT (Portugal), BR (Brazil), followed by a number of order, for example, EHUBR1 and EHAPT2.

RESULTS

The results are presented in two analytical categories, potentialities and difficulties in the use of technologies by nurse managers in the four studied hospitals.

Potentialities in the use of management technologies

In both countries, nurse managers consider that the use of management technologies expands the possibility of improving work processes in hospitals. The findings, i.e., the number of times that the participants mentioned each idea/aspect, according to the magnitude, highlight that the improvements in the processes (n=16) stand out among the potentialities in the use of management technologies, followed by ease of registration (n=15), time management (n=12), quick responses (n=12), data storage (n=9) and patient safety (n=8).

The nurse managers highlight improvements in the work processes and facilities in the recording of patient information as a result of the use of technologies. The organization of records and optimization in the processing of information stand out, as mentioned in the following statements.

[...] *Optimization/avoid rework, facilitate the process and the intelligent system, have more time to monitor management* (EHABR19)*.*

[...] *I think what contributes is the fact that we can run the circuits much faster* [...]. It *facilitates the transmission of requests and communications* (EHUPT3).

[...] *Organization of records in a computerized manner, greater ease of data collection* (EHAPT10).

[...] *Makes it easy for the records to be recorded in an automated way. Makes it easy to share all information* (EHUBR4*)*.

Time management and quick responses in nursing work were also identified as benefits regarding the use of technology, due to the agility with which information is processed. For the participants, the use of technologies improves the time-response of activities, granting greater assertiveness to the process of sending and receiving requests, which in turn favors the continuity of care.

[...] *For sure it is much faster, when I was going to place the warehouse orders it was all on paper and we lost all that time, so now it is much easier to get here and place orders online. We lose less time doing it like this* (EHUPT1).

[...] *People receive our request almost immediately, our message, and this is very beneficial* (EHUPT3).

[...] *If I want to do an investigation of any nature of the patient here, it is very easy to access the data, or if I want to know the room entrance, output, antibiotic schedule. We get all this information from Cerner today* (EHABR3).

[...] *Quick response. It is much faster than when I started here, I have been working here for 20 years, 26 years in intensive care and I didn't have these things that I could have in my hands quickly so I could improve care. The ability to give and get a quick response for me is the best* (EHABR5).

The storage of information and the ease of access to data were highlighted as essential for the proper functioning of services and for more effective management, through the use of indicators offered by the management systems used. Information security and record efficiency are also highlighted by nurse managers.

[...] *Ease of access to data, numbers, management without numbers is not possible* (EHABR26).

[...] *Agility, faster data, more practical data compilation* (EHUBR17).

[...] *The record made is not deleted or lost. Easy to take indicators. The probability of deceiving us is lower, if you have associated procedures it's even better. We have care plans that through the information stored there the nurses make the nursing diagnoses, associate interventions for the diagnoses and, therefore, everything is easier. When the patient´s status changes, improves, it is much easier to keep track with electronic support* (EHUPT22).

The use of technologies was also fundamental in management planning and care actions aimed at patient safety, with emphasis on recording information pertinent to care and the reduction of injuries. It is important to highlight that this potentiality was mainly highlighted by nurses managing accredited hospitals.

[...] *All quality and safety strategies are based on electronic records* (EHABR15).

[...] *Reduced time and risk of errors in records, alert systems to help professionals* (EHAPT27).

Difficulties in the use of management technologies

In general, the difficulties were related to two elements of the work process: the instruments themselves and the workforce. The difficulties mentioned by the nurse managers in the use of technologies in their work in hospitals in both countries are illustrated in Figures 1 and 2.

Figures 1 and 2 summarizes the findings related to the analytical category "difficulties in the use of management technologies". It presents the evidence, quotations, which are significant excerpts highlighted from the participants' discourse, according to hospital, country and participant. The significant excerpts are linked to the codes (synthesis idea) and these to the thematic categories, workforce and work instruments, constructed on the theoretical framework of the work process applied to healthcare.

There was a predominance of difficulties related to the management of technologies by the workforce. The main difficulties were related to time management, cultural adaptation to the use of technology and lack of training of professionals for its use. In addition to identifying a humanization versus mechanization dilemma.

With regard to time management, the following was highlighted: the time for innovative technologies to be available for nursing management work; the time required to turn data recorded into information for decision making; and the accumulation of management and care responsibilities. The latter is associated with the need to perform the records in different technologies, which implies managing the time to perform the activities relevant to the two dimensions and the mastery of different resources, which can cause work overload.
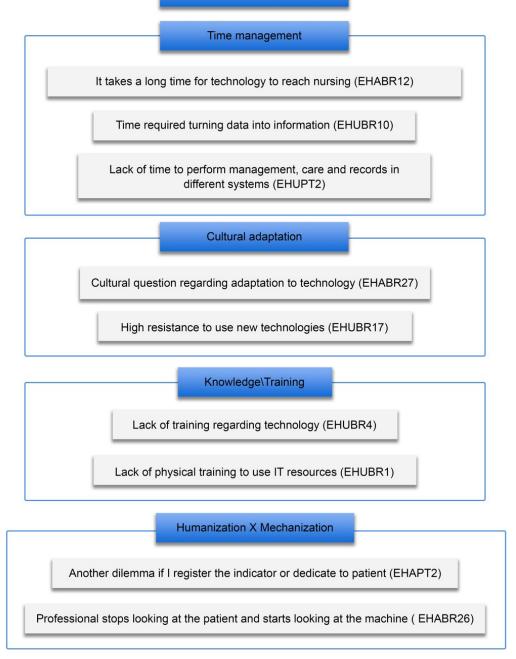
Figure 1 - Difficulties in the use of technologies by nurse managers, related to workforce. Florianópolis, SC, Brazil, 2019-2020.

In relation to cultural adaptation in the use of technology, a relationship was identified between resistance to the use of technology, the age of professionals and their ability and adaptation to the use of new technological tools. The lack of training/training regarding technologies influenced their usability. In the humanization versus mechanization dilemma, the nurse managers mentioned the challenge of registering the records properly, using all the resources made available by the technologies and, concomitantly, providing humanized care.
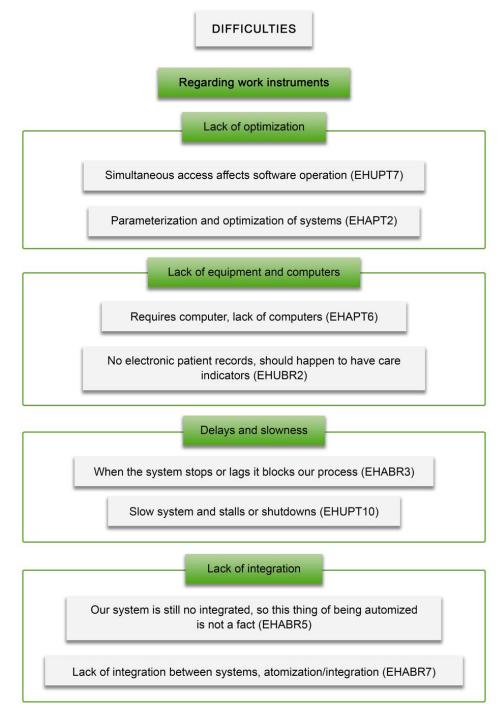
Figure 2 - Difficulties in the use of technologies by nurse managers, regarding work instruments. Florianópolis, SC, Brazil, 2019-2020.

As for the difficulties regarding the work instruments category, problems pertaining to the technology itself were identified, especially its functionality and problems related to the equipment necessary for its complete use. Nurses highlighted the structural weaknesses that hinder the use of technology, such as the insufficient number of computers.

The fragmentation of the systems used was also highlighted, demanding multiple records with interoperability deficits. For the participants, the lack of integration between different systems at the same institution causes repetition and makes it difficult to capture indicators needed to plan care.

DISCUSSION

The results of this research conducted with nurse managers working in four state-of-the-art hospitals, two in Brazil and two in Portugal, showed that their work is mediated by technologies and the innovation process. Technologies positively influence their work, however, problems and difficulties in their use are also significant.

Technologies are understood here as work tools used by nurse managers to transform the multiple work objects present in the various areas of management in hospitals, in order to improve processes and obtain more effective results.

Among the potentialities provided by the technology, the following stood out: facilitation of records; more articulated workflows, inter-relating the multiple activities developed in the scope of management; the facility to store information and access data; use of technological resources for time management; and agility in responses and decision-making, directly impacting patient safety.

Other studies also mention positive aspects regarding technological innovation in healthcare and nursing management, with emphasis on digital technologies and ICT[11,13–14,22–23]. The use of technological resources also produce, in an articulated way, improvements in nursing care and management, allowing the realization of more accurate records, which contributes to the implementation of the Systematization of Nursing Care (SAE)[7].

The use of management technologies enhances the organization of information and improves the flow of data, which positively affects the entire work process. Patient safety is also influenced by the use of management technologies, enabling care risks to be measured based on indicators, which identify or direct attention to specific problems. And, for safety indicators to be effective, the use of management technologies is fundamental, due to the management of large amounts of data[24–25].

Research in hospitals in the Netherlands[23] shows that robust information systems produce more reliable indicators. Investments in hospital infrastructure should prioritize systems for electronic patient records and the incorporation of technologies that expand the possibilities of resolution of actions[13,23,26]. In the context of technological evolution in health, nursing has the potential to improve the management of services and promote changes in the organizational context, aiming at improvements to care and management.

However, the use of innovative technologies in the context of nursing management is also permeated by challenges. Professionals recognize the potential of technologies, but highlight difficulties in their use. The main difficulties are related to the aspects of the instruments themselves and to the workforce, especially in the management of the technology.

With regard to technologies, understood as working instruments in themselves, there were difficulties related to equipment, their availability, functionality, as well as usability, utility and interoperability/integration of systems used in hospitals. In the same sense, another study highlights the importance of systems interoperability and the influence of macropolicies and regulatory structures for their effectiveness[27].

The results of this research also identified problems such as deficits in the functionality of the technology itself and the insufficient number or out-of-date equipment as hindering the use of technologies by nurse managers. The slowness of the systems, as well as the abrupt or scheduled stops, also hinder the work dynamics and the registration process. The difficulties related to the lack of equipment and operational divergences and resource utilization lead to disturbances in the day to day work and restrict its performance.

Regarding the use of material technologies, a study conducted with nursing professionals in Intensive Care Units (ICUs) shows the importance of the functionality of the equipment to perform the work[28]. Other studies[4,27] that deal with the use of innovative health technologies, especially digital

technologies, also record some challenges not mentioned in the research conducted with nurse managers. Among them, the respect for ethical aspects and safety of information related to patients' health has strong relevance, and that there is a relationship between characteristics of the technology itself and the experience of users.

In general, the main difficulties in the use of technologies related to the workforce involve time management, cultural adaptation for its use, training and/or problems with training and the dilemma between humanization and mechanization of care. The same studies already mentioned[4,27], that address the challenges in digital health, also show the importance of considering multiple aspects inherent to the workforce for the effective use of technologies.

In time management, the use of technologies is presented together with potentiality and difficulty. Technologies enable you to record information more quickly and efficiently build data. However, they also confer complexity in the process of use and management of technology, especially in relation to the delay in the implementation of technological resources in services and the training for mastery and full use of resources made available by technologies. In other words, professionals need to know the resource and its features to use it effectively and efficiently[12].

With regard to cultural adaptation, some professionals are resistant to the use of innovative technologies, especially because of the ease with which they perform paper records and the usual way they relate to norms/routines and different ways of providing care. The training and continuing education of professionals for the proper use of technologies incorporated into services should be a priority for managers, in order to prepare them for the introduction of new work methodologies. The process of implementing technologies is a challenge for nursing professionals, as in most cases, there is an overload of work related to the old and new ways of doing until the total adaptation to the new method. In the same perspective, multiple aspects of the relationship between technology and stakeholders (involved/interested parties) are also documented in the literature[12,27].

Regarding the dilemma of humanizing care versus mechanizing actions, the main fear of professionals is that the more technologies are used to perform the work, the more mechanized care can become. There is a concern about the loss of focus on the users' needs to the detriment of the need to master/have competence to properly utilize instruments/technologies. A study[29] conducted in the scope of primary healthcare identified that nurses sometimes accumulate management and care functions, and it is necessary to appropriate different functionalities to perform management and care records in different software. The performance of such complex work which require different skills and knowledge, even if related, has been recorded as a generator of increased workloads of these professionals[29].

The work overload of nurses and the way technologies are implemented can be harmful to patients and professionals. Thus, it is necessary to promote more humanized work environments and stimulate relationships of trust that promote job satisfaction, there should also be a balance between the use of technologies and the maintenance of humanized care, to ensure excellent results[26].

The use of ICT in health services brings benefits to management work, however, there is a lack of adequate training of human resources for its use, lack of financial investment and lack of structured systems[8]. In this sense, investing in the training and qualification of nursing professionals is crucial to ensure knowledge and mastery of technological innovations in healthcare.

Notably, the process of incorporating and using technological innovations to improve health outcomes is complex and multifaceted, involving technical and political issues.

As limitations of the study, it is highlighted that, although the findings concern state-of-the-art hospitals, studies in other hospitals with the same qualification can identify different aspects in

the mediation of technology with the management work performed by nurses. It is also possible to find different relevancies, since the historical-social and institutional scenarios interfere in the way technology is made available and used.

CONCLUSION

The nurse managers consider that technologies contribute to the improvement of their work process, by facilitating the records and, consequently, improving results that can influence the quality and safety of patients. Understanding the use of technologies, and analyzing their impact on the work process, allows to identify gaps to be explored by health service managers, in general and by nursing in particular, with a view to improving their use.

The difficulties of nurse managers are related, especially, to structural factors and training to use technologies with a view to efficient management for improvements in the quality of results. These difficulties can be minimized through training and articulation of teaching and research, in order to highlight existing gaps in relation to technology, technological innovation and management work in nursing.

In addition to the use of technologies, the implementation of macropolicies that enable the learning teaching process, with the insertion of technological resources which impact the training and work process of future professionals are a challenge and a necessity. The change of culture, the acquisition of information through data, will allow to break barriers in services. Even with the difficulties presented, nurses consider the use of tools that improve care and management results as positive.

REFERENCES

1. Pochmann M. Structural trends in the world of work in Brazil. Cien Saude Colet [Internet]. 2020 [cited 2022 Jun 10];25(1):89-99. Available from: https://doi.org/10.1590/1413-81232020251.29562019.

2. Fogliatto FS, Anzanello MJ, Tonetto LM, Schneider DSS, Magalhães AMM. Lean-healthcare approach to reduce costs in a sterilization plant based on surgical tray rationalization. Prod Plan Control [Internet]. 2020 [cited 2022 Jun 12];31(6):483-95. Available from: https://doi.org/10.1080/09537287.2019.1647366

3. Guimarães R, Morel CM, Aragão E, Paranhos J, Palácios M, Goldbaum M, et al. Health Science, Technology and Innovation Policy (ST&I/H): an update for debate. Cien Saude Colet [Internet]. 2021 [cited 2022 Jun 09];26(12):6105-16. Available from: https://doi.org/10.1590/1413-812320212612.18632021

4. Cummins N, Schuller BW. Five crucial challenges in digital health. Front Digit Health [Internet]. 2020 [cited 2022 May 27];2:536203. Available from: https://doi.org/10.3389/fdgth.2020.536203

5. The Lancet [Editorial]. COVID-19: protecting health-care workers. Lancet [Internet]. 2020 [cited 2022 May 27];395(10228):922. Available from: https://doi.org/10.1016/S0140-6736(20)30644-9

6. Marx K. Capital: critique of political economy. São Paulo, SP(BR): Boitempo; 2013.

7. Pissaia LF, Costa AEK, Moreschi C, Rempel C, Carreno I, Granada D. The impact of technologies in the implementation of hospital nursing assistance systematization: an integrative reviews. R Epidemiol Control Infec [Internet]. 2018 [cited 2022 Jun 17];8(1):92-100. Available from: https://doi.org/10.17058/reci.v1i1.8953

8. Sudré A, Vergilio HAS, Jesus L, Sudré MRS. Study of the implantation of information technologies in the area of health in nursing: an integrative review of literature. J Health Inform [Internet]. 2020 [cited 2022 Mar 21];12(1):24-30. Avalilable from: https://jhi.sbis.org.br/index.php/jhi-sbis/article/view/588/381

9. Vandresen L, Pires DEP, Martins MM, Forte ECN, Lorenzetti J. Participatory planning and quality assessment: contributions of a nursing management technology. Esc Anna Nery [Internet]. 2019 [cited 2022 Jun 19];23(2):e20180330. Avalilable from: http://doi.org/10.1590/2177-9465-ean-2018-0330

10. Aceto G, Persico V, Pescapé A. The role of information and communication technologies in healthcare: taxonomies perspectives and challenges. J Netw Comput Appl [Internet]. 2018 [cited 2022 Jun 19];107:125-54. Avalilable from: https://doi.org/10.1016/j.jnca.2018.02.008

11. Motta KF, Poncetti AFU, Esteves RZ. The impact of information technology on hospital management. Rev Saúde Pública Paraná [Internet]. 2019 [cited 2022 Jun 19];2(1):93-102. Avalilable from: https://doi.org/10.32811/25954482-2019v2supl1p93

12. Martins MMFPS, Trindade LL, Vandresen L, Leite MJMGC, Pereira CMG, Landeiro MJL. Technologies used by nursing managers in Portuguese hospitals. Rev Gaucha Enferm [Internet]. 2020 [cited 2022 Mar 15];41:e20190294. Avalilable from: https://doi.org/10.1590/1983-1447.2020.20190294

13. Cordeiro ALAO, Fernandes JD, Mauricio MDALL, Silva RMO, Barros CSMA, Romano CMC. Structural capital in the nursing management in hospitals. Texto Contexto Enferm [Internet]. 2018 [cited 2022 Jun 18];27(2):e4880016. Avalilable from: https://doi.org/10.1590/0104-07072018004880016

14. Reynolds NR. Advancing the contribution of nursing to universal health coverage with innovative mHealth technologies: promise and perils. Rev Referencia [Internet]. 2019 [cited 2022 Mar 21];IV(22):3-9. Available from: https://www.redalyc.org/journal/3882/338826155001/html/

15. Lottenberg C, Silva PE, Klajner S. The digital revolution in health: how artificial intelligence and the Internet of Things make care more humane, efficient and sustainable. São Paulo, SP(BR): Editor of the Editors; 2019.

16. Jensen R, Guedes ES, Leite MMJ. Informatics competences essential to decision making in nursing management. Rev Esc Enferm USP [Internet]. 2016 [cited 2022 Mar 21];50(1):109-17. Available from: https://doi.org/10.1590/S0080-623420160000100015

17. Apell P, Eriksson H. Artificial intelligence (AI) healthcare technology innovations: the current state and challenges from a life science industry perspective. Technol Anal Strateg Manag [Internet]. 2021 [cited 2022 Mar 21]. Available from: https://doi.org/10.1080/09537325.2021.1971188

18. Novaes HMD, Soárez PC. Health technologies assessment: origins, development, and current challenges. In the international and Brazilian scenarios. Cad Saude Publica [Internet]. 2020 [cited 2022 Jun 17];36(9):e00006820. Available from: https://doi.org/10.1590/0102-311X00006820

19. The Qualitative Data Analysis & Research Software. ATLAS.ti. Version 8.0 [Software]. 2020 [cited 2022 Jun 14]. Available from: https://atlasti.com/pt.

20. Bardin L. Content Analysis. São Paulo, SP(BR): Edições 70; 2016.

21. Pires DeP, Trinity LL. Workloads: a benchmark to understand the relationship between work and health. Porto Alegre, RS(BR): Moriá; 2022.

22. Fagherazzi G, Goetzinger C, Rashid MA, Aguayo GA, Huiart L. Digital health strategies to fight COVID-19 worldwide: challenges, recommendations, and a call for papers. J Med Internet Res [Internet]. 2020 [cited 2022 Jun 17];22(6):e19284. Available from: https://doi.org/10.2196/19284

23. Botje D, Asbroek GT, Plochg T, Anema H, Kringos DS, Fischer C, et al. Are performance indicators used for hospital quality management: a qualitative interview study amongst health professionals and quality managers in the Netherlands. BMC Health Serv Res [Internet]. 2016 [cited 2022 Jun 19];16(1):574. Available from: https://doi.org/10.1186/s12913-016-1826-3

24. Carmo HO, Silva KG, Lemos SHG, Silva CFG. Indicators of people management: essential tools in the work of nurses. Rev H-Tec Human Tecnol [Internet]. 2018 [cited 2022 Mar 15];2(1):64-81. Available from: https://www.revista.fateccruzeiro.edu.br/index.php/htec/article/view/73

25. Bao ACP, Amestoy SC, Trindade LL, Moura GMSS, Braga P. The use of quality indicators: difficulties and strategies in the voice of nurse-leaders. Rev Enferm Cent-Oeste Min [Internet]. 2021 [cited 2022 Jun 17];11:3484. Available from: http://doi.org/10.19175/recom.v11i0.3484

26. Ouchi JD, Lupo APR, Alves BO, Andrade RV, Fogaça MB. The role of nurses in the intensive care unit in the face of new health technologies. Hail Focus [Internet]. 2018 [cited 2022 Mar 21];10:412-28. Available from: https://portal.unisepe.com.br/unifia/wp-content/uploads/sites/10001/2018/07/054_O_PAPEL_DO_ENFERMEIRO_NA_UNIDADE_DE_TERAPIA_INTENSIVA.pdf

27. Sheikh A, Anderson M, Albala S, Casadei B, Franklin BD, Richards M, et al. Health information technology and digital innovation for national learning health and care systems. Lancet Digit Health [Internet]. 2021 [cited 2022 May 21];3(6):e383-96. Available from: http://doi.org/10.1016/S2589-7500(21)00005-4

28. Peres Junior EF, Oliveira EB. Technological innovations in intensive care unit: effects on nursing staff health. Rev Enferm Atual In Derme [Internet]. 2016 [cited 2022 Jun 18];77(15):9-15. Available from: https://doi.org/10.31011/reaid-2016-v.77-n.15-art.368

29. Biff D, Pires DEP, Forte ECN, Trindade LL, Machado RR, Amadigi FR, et al. Nurses' workload: lights and shadows in the Family Health Strategy. Cien Saude Colet [Internet]. 2020 [cited 2022 Jun 18];25(1):147-58. Available from: https://doi.org/10.1590/1413-81232020251.28622019

NOTES

ORIGIN OF THE ARTICLE
Article extracted from the thesis - Management technologies in the work of nurses: brazil - Portugal study, presented to the Graduate Program in Nursing, Universidade Federal de Santa Catarina, in 2020.

CONTRIBUTION OF AUTHORITY
Study design: Vandresen L, Pires DEP, Martins MMFPS.
Data collection: Vandresen L, Pires DEP, Martins MMFPS, Lean E.
Data analysis and interpretation: Vandresen L, Pires DEP, Martins MMFPS, Leão E.
Discussion of results: Vandresen L, Pires DEP, Forte ECN, Mendes M.
Writing and/or critical review of the content: Forte ECN, Mendes M.
Review and final approval of the final version: Vandresen L, Pires DEP, Martins MMFPS, Leão E, Forte ECN, Mendes M.

APPROVAL OF ETHICS COMMITTEE IN RESEARCH
In Brazil, approved by the Ethics Committee in Research of the Universidade Federal de Santa Catarina, opinion n. 3.037.275, CAAE: 91962218.9.1001.0121. Approved by the Research Ethics Committee at Hospital Israelita Albert Einstein, opinion n. 3.656.172, CAAE: 91962218.9.3001.0071. In Portugal, approval opinions under references 83/19 and 14/2019.

CONFLICT OF INTEREST
There is no conflict of interest.

EDITORS
Associated Editors: Melissa Orlandi Honório Locks, Monica Motta Lino.
Editor-in-chief: Roberta Costa.

HISTORICAL
Received: June 26, 2022.
Approved: October 07, 2022.

CORRESPONDING AUTHOR
Mariana Mendes
mariana.mendes@unochapeco.edu.br