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Nursing informatics competences in hospitals with the highest level of technological development

Competências de enfermagem em informática nos hospitais com nível máximo de desenvolvimento tecnológico

Competencias informáticas de enfermería en los hospitales con mayor nivel de desarrollo tecnológico

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Abstract

Objective: to analyze the use of nursing competencies in information technology among nurse managers and management support staff in hospitals with the highest level of technological development in Brazil. **Method:** single case study with a quantitative and qualitative carried out sequentially in three hospitals with level seven digital certification. Data was collected from December 2020 to June 2021 using a Likert questionnaire and semi-structured interviews with 21 nurses. The quantitative stage analyzed percentages and the qualitative stage content analysis. **Results:** the quantitative competencies that stood out the most were: include nursing processes and administrative functions of the nursing team in Information System requirements; specify system requirements based on the organization's needs; Assess information systems in the workplace; and collaborate with the multidisciplinary team to assess the Information System. Qualitatively, three categories emerged: nurses' contribution to health informatics; challenges and facilities; strategies for developing and enhancing competencies. **Conclusion and implications for practice:** nursing competencies in information technology are used but need to be adjusted to the Brazilian hospital context, considering technological advances and the need to adapt to the reality of each hospital.

Keywords: Computer Literacy; Nursing Informatics; Hospitals; Information Technology; Electronic Health Records.

Resumo

Objetivo: analisar a utilização das competências de enfermagem em informática de enfermeiros gestores e de apoio à gestão nos hospitais com nível máximo de desenvolvimento tecnológico no Brasil. **Método:** estudo de caso único, com abordagem quantitativa e qualitativa, realizado de forma sequencial em três hospitais com nível sete de certificação digital. Dados foram coletados de dezembro de 2020 a junho de 2021 por meio de questionário Likert e entrevistas semiestruturadas com 21 enfermeiros. Na etapa quantitativa, analisaram-se as porcentagens, e na qualitativa, a análise de conteúdo. **Resultados:** as competências quantitativas com maior destaque foram: incluir processos de enfermagem e as funções administrativas da equipe de enfermagem nos requisitos dos sistemas de informação; especificar os requisitos dos sistemas fundamentados nas necessidades da organização; avaliar os sistemas de informação nos locais de trabalho; e colaborar com a equipe multiprofissional para avaliar o Sistema de Informação. Qualitativamente, emergiram três categorias: contribuição de enfermeiros em informática em saúde; enfrentamentos e facilidades; estratégias para desenvolver e potencializar competências. **Conclusão e implicação para a prática:** as competências de enfermagem em informática são utilizadas, mas necessitam de ajustes para o contexto hospitalar brasileiro, considerando o avanço tecnológico e a necessidade de adaptações para a realidade de cada hospital.

Palavras-chave: Competência em Informática; Informática em Enfermagem; Hospitais; Tecnologia da Informação; Prontuário Eletrônico.

Resumen

Objetivo: analizar el uso de las competencias de enfermería en tecnología de la información entre los enfermeros gestores y el personal de apoyo a la gestión de los hospitales con mayor nivel de desarrollo tecnológico de Brasil. **Método:** un estudio de caso único con un enfoque cuantitativo y cualitativo, llevado a cabo secuencialmente en tres hospitales con certificación digital de nivel siete. Los datos se recopilaron entre diciembre de 2020 y junio de 2021 mediante un cuestionario tipo Likert y entrevistas semiestructuradas a 21 enfermeros. En la etapa cuantitativa, se analizaron porcentajes, y en la cualitativa, análisis de contenido. **Resultados:** las competencias cuantitativas que más destacaron fueron: incluir los procesos de enfermería y las funciones administrativas en los requisitos de los sistemas de información; especificar los requisitos del sistema en función de las necesidades de la organización; evaluar los sistemas de información en el lugar de trabajo; y colaborar con el equipo multiprofesional para evaluar el sistema. Cualitativamente, surgieron tres categorías: contribución de los enfermeros a la informática sanitaria; retos y facilidades; estrategias para desarrollar y mejorar las competencias. **Conclusión e implicaciones para la práctica:** se utilizan competencias de enfermería en TI, pero necesitan ser ajustadas al contexto hospitalario brasileño, considerando los avances tecnológicos y la necesidad de adaptación a la realidad de cada hospital.

Palabras-clave: Alfabetización Digital; Informática Aplicada a la Enfermería; Hospitales; Tecnología de la Información; Registros Electrónicos de Salud.

INTRODUCTION

Competency is the synergy between individual knowledge, skills and attitudes, but which has an impact on better organizational results as it positively influences individuals, teams and organizations in achieving objectives.[1] The American Nurses Association also links competency to performance, describing competency as "an expected level of performance that integrates knowledge, skills, abilities and judgment".[2]

In the meantime, nursing informatics works to transform data into necessary information and support workflows with technology, lead the development, guide and implement new technologies, leveraging them to improve health, equity, safety, quality and healthcare outcomes.[3] It can be defined as science and practice that integrates nursing, from its knowledge and information, to the management of information and communication technologies with the aim of promoting the health of people, families and communities around the world.[2]

The American Association of Colleges of Nursing, American Nurses Association, American Organization of Nursing Executives, and National League for Nursing have suggested improvements in nursing education at all levels due to technological advances in healthcare.[4] After the start of the movement to teach nursing informatics skills to nursing students in the United States, through the Technology Informatics Guiding Education Reform (TIGER) initiative, other countries also joined this theme. Countries in Europe and Asia have also adopted health informatics teaching in nursing training, and have concluded that, due to advances in health information technology, it is essential to teach informatics skills in the training of these professionals.[5,6]

In Finland, the requirements for increasing nursing informatics competencies were noted in eHealth strategies in 2015. At this point, the definition of eHealth addressed by the Healthcare Information and Management Systems Society (HIMSS) applies, which considers it as: the use of information and communication technology and digital applications to improve healthcare by enabling better patient access to health information.[7] Nurses who graduated after eHealth rated themselves as more competent than nurses who graduated earlier.[8] Another study that mapped published research on technological literacy in nursing education identified that there is a lack of pedagogical models that aim to teach the entire process of acquiring, measuring and maintaining technological literacy.[9]

If the need for teaching computer skills in nursing training is still under discussion,[10,11] the same is reflected in nurse managers' competencies. Nurse managers are defined as those who perform human and financial resource management functions and can influence the selection, implementation, use and assessment of technologies in health settings.[12]

There is concern that most nurses in nursing management roles in hospitals do not have sufficient competency and readiness to participate meaningfully in strategic decision-making related to the acquisition and use of information and communication technology.[4] Nursing informatics competencies are essential for more than just nurse leaders in care. There is a set of competencies specific to nurses in management roles, such as nurse coordinators, managers, and directors, that can impact a much broader range of patients by improving support activities, not just core activities.[10,11]

Discussion about the importance of nursing informatics skills is essential, since they are part of the digital transformation in health. They are addressed in the digital health principle, including one of the eight principles of inclusive digital health in the health sector, in the framework proposed by HIMSS for digital transformation and in the World Health Organization global strategy on digital health 2020-2025.[7,13,14]

In this context, many hospitals seek accreditation and certification processes as a guide to improve their flows, standards and actions in healthcare. With a focus on assessment and certification, aiming to optimize healthcare services and care results through information technology (IT), there is HIMSS, which focuses on improving health through technology and information.[15] The main effects perceived with the search for HIMSS certification were the reduction or elimination of printed documents, a systematic digitalization of work processes, a reduction in errors and an improvement in care safety.[16]

It is worth noting that the HIMSS Analytics digital certification with Electronic Medical Record Adoption Model (EMRAM) classification has stages from 0 to 7. Stage 7 includes hospitals that have complete electronic medical records and maximum integration in all hospital departments, providing clinical and care results processed by Business Intelligence (BI) solutions. HIMSS level 7 is so exceptional that, in Brazil, only recently eight hospitals achieved this certification.[7]

Meeting the requirements for digital certification is a challenge not only for IT professionals, as it involves all healthcare professionals who work in direct patient care, administrative sectors and senior hospital management.[15] Hospitals that achieve this certification seal undergo an intense review of their processes, covering several sectors of the hospital related to health IT, governance, quality improvement and patient safety, at different levels of complexity.

Thus, the study aimed to analyze the use of nursing competencies in informatics by nurse managers and management support nurses in hospitals with the highest level of technological development in Brazil.

METHOD

This is a single case study with a quantitative and qualitative approach, carried out sequentially, which made it possible to analyze the use of computer competencies for nurses in hospitals with level 7 digital certification by HIMSS. As proposed by Yin, the case study is critical, in-depth and seeks to confirm the veracity of what is proposed through evidence of data.[17]

Eight private hospitals that have the HIMSS Analytics digital certification with EMRAM stage 7 classification in Brazil in 2020 were identified, and no public hospitals. Of the eight institutions, three agreed to participate in the research; two refused, alleging that nurses were overworked due to the COVID-19 pandemic; and three did not respond. Therefore, the case study was

conducted in three hospitals. One was in the northeast, in the state of Bahia, and was the first digital hospital in the state. It provides high-complexity care and has 549 beds and 13 operating rooms. Two are in the southeast, one in Minas Gerais, a general high-complexity hospital that is a reference for 35 municipalities in eastern Minas Gerais, with 558 beds and three units, one of which is exclusively for oncology treatment. And one hospital in the state of São Paulo offers high-complexity treatments, especially in oncology, cardiology, and neurology, and has 248 beds and ten operating rooms.

Twenty-one nurses participated in this study, with the following inclusion criteria: managerial nurses and nurses in management support positions, IT nurses, quality committees or centers, continuing education, hospital infection control committee (HICC), sector coordinators and participants in committees and teams supporting care; having a period of experience in the position or job equal to or greater than six months. The exclusion criteria adopted were: nurses who were on vacation, leave or away for any reason during the data collection period.

After the research was approved by the *Universidade Federal de Santa Catarina* Research Ethics Committee, contacts with the hospitals by telephone and email began at the ethics and research department of each hospital, from October to December 2020, in order to obtain authorization and contact details of nurse managers and management support for the research. After the research was approved, the hospitals provided lists with the names, emails and work sector of the nurses indicated to participate in the study. All eligible nurses were contacted via email to be invited to participate in the research.

Although the case study method foresees the triangulation of different data sources, since in-person fieldwork was not permitted during the study development period due to the COVID-19 pandemic, strategies such as participant or non-participant observation were discarded. Thus, as an opportunity to approach the topic from different perspectives, it was decided to approach the participants in two stages: a quantitative questionnaire in Google Forms® format; and scheduling an interview to collect qualitative data via video call through Google Meet®. Quantitative and qualitative data collection took place sequentially between December 2020 and June 2021.

In the quantitative stage, a cross-sectional study was carried out based on the identification of 23 nursing competencies in informatics according to the list of competencies translated and adapted by Melo (2018), who provided the sworn translation carried out by a committee of experts and a sworn translator in three stages: 1) translation into Portuguese; 2) translation synthesis; and 3) back-translation. Between stages 1 and 2, a meeting was held with translators at the Department of Languages and Linguistics of the *Universidade Federal de Sergipe*. The translation synthesis of the list of competencies was considered regarding its semantic, idiomatic, experimental and conceptual equivalence.[18]

The measurement scale used in this study is a Likert-type scale, with a score for each assertion ranging from 1 to 5, such as 1 (completely disagree), 2 (partially disagree), 3 (neither agree nor disagree), 4 (partially agree) and 5 (completely agree), and professional identification data. The sample for the quantitative stage was for convenience and 21 nurses participated.

Qualitative data were obtained through semi-structured interviews, divided into two sections: personal data and professional trajectory, and five open-ended questions regarding the proposed topic. The triggering question was: how do you perceive the exercise of computer skills by nurses in the hospital context? The interviewee's preference was respected, as well as the day and time that the researcher and interviewees were available to schedule. Only 11 nurses agreed to participate in the interview. The average duration was 45 minutes, and all interviews were audio-recorded and transcribed in full.

The collected data were stored in an organized manner in notes in Microsoft Word®, Excel® and Google Drive®. Quantitative data analysis was performed using an electronic spreadsheet, in which the data collected in Google Forms® were converted to an Excel® spreadsheet for analysis of percentages. The personal and professional characterization data and the data related to nurses' computer skills were described using tables in Microsoft Word®.[17]

Qualitative analysis was carried out descriptively based on the content analysis proposed by Bardin (1977), with text skimming, corresponding to pre-analysis. Subsequently, the material was explored, with reading and understanding, the results were processed and what was said about the topic was interpreted. Then, coding was carried out, when the data was processed, corresponding to the transformation and cuts to represent the expression of the content.[19]

The reading, exploration, interpretation and treatment of results were carried out in three stages: 1st stage: the collected data were organized in a text editor, transcribed in full, skimming and filed in a folder named after the respective hospital; 2nd stage: horizontal reading and coding of the data, observing similarity of ideas and establishing relationships. In this stage, we sought to observe explanations for the topic studied. The explanations to be analyzed and the relevant conditions described emerge from the theoretical propositions that help to organize the entire analysis;[19] 3rd stage: from coding and exhaustive reading of evidence, the data were organized into categories, and qualitative and quantitative data corroboration was analyzed, specifying where there is conformity of ideas.

Nurses were invited to participate voluntarily by accepting and signing the Informed Consent Form (ICF). To ensure anonymity, the locations and interviewees were identified by pseudonyms for hospitals (H1, H2 and H3) and for interviews with nurses (N01, N02, N03), according to the sequence. The project was approved by the Research Ethics Committee, with the Certificate of Presentation for Ethical Consideration (In Portuguese, *Certificado de Apresentação para Apreciação Ética* - CAAE) 39059620.7.0000.012.

RESULTS

Of the 21 study participants, the quantitative stage showed a higher number of females (90.5%). Concerning age, 61.9%

were between 29 and 39 years old. Regarding the length of experience as a nurse, 80.9% had between 1 and 19 years of experience. As for academic background, 90.4% of participants had a graduate degree in the *lato sensu* modality, with the most common being hospital management (28.5%), emergency, and Intensive Care Unit nursing (23.8%). In relation to professional category, 33.3% were unit supervisors; 28.5% were nursing coordinators; 28.5% worked in management support; and 9.5% were nursing managers. Regarding the sector in which they worked, the majority came from the following sectors: inpatient unit (19%); continuing education (14.2%); Intensive Care Unit (9.5%); outpatient clinic (9.5%); followed by epidemiology, care practice management, nursing management, Diagnosis Related Groups (DRG) and oncology, all with 4.7%.

Table 1 shows nurses' computer skills, with three categories for the results: least used (1 and 2); neutral (3); and most used (4 and 5). The most favorable skills expected were: inclusion of nursing processes in information system requirements; specifications of system requirements; information system assessment and collaboration with multidisciplinary teams;

Table 1. Nursing competencies in informatics in the hospital context.

Item	Nursing competencies in informatics	Least used	Neutral	Most used
1	Include nursing processes and administrative functions of the nursing team in Information System requirements.	0		21 (100%)
2	Involve the care team in the development and selection of Information Systems.	1 (4.8%)		20 (95.2%)
3	Specify system requirements based on the organization's needs.	0		21 (100%)
4	Collaborate with a multidisciplinary team in the Information Systems selection process.	1 (4.8%)		20 (95.2%)
5	Assess information systems in the workplace.	0		21 (100%)
6	Involve healthcare staff in developing information systems requirements.	1 (4.8%)		20 (95.2%)
7	Advocate that new applications meet interoperability standards.	2 (9.5%)		19 (90.5%)
8	Advocate for the development (or purchase) and use of cost-effective, integrated Information Systems within the organization.		3 (14.2%)	18 (85.8%)
9	Determine priorities for new technology requirements within budgetary constraints and organizational priorities.		3 (14.2%)	18 (85.8%)
10	Determine the costs and benefits of computer technology used in professional practice, training, management, and/or research.	4 (19%)		17 (81%)
11	Collaborate with a multidisciplinary team on financial matters.	6 (28.5%)		15 (72.5%)
12	Ensure the implementation of systems that are compatible with the vision, mission, strategic plans and tactical plans.	2 (9.5%)		19 (90.5%)
13	Use project management concepts in the implementation of Information Systems.	4 (19%)		17 (81%)
14	Control the impact of change due to the implementation of an Information System.	4 (19%)		17 (81%)
15	Ensure that the healthcare team is involved in the design, implementation and testing of applications and/or systems related to professional practices.	2 (9.5%)		19 (90.5%)
16	Improve the use of information technology in nursing practice.	1 (4.8%)		20 (95.2)
17	Collaborate with the multidisciplinary team to manage information systems.	4 (19%)		17 (81%)
18	Analyze access to information in the systems.	6 (28.5%)		15 (72.5%)
19	Analyze the use of data (obtaining, storing and disseminating texts, images, data or sounds).	5 (23.8%)		16 (76.2%)
20	Analyze access to personal health data (Privacy and Data Confidentiality Policy).	6 (28.5%)		15 (72.5%)
21	Ensure that test plans are assessed at each stage of information systems implementation.	6 (28.5%)		15 (72.5%)
22	Ensure that the support team (users) is involved in the assessment of the systems.		3 (14.2%)	18 (85.8%)
23	Collaborate with the multidisciplinary team to assess the Information System.	0		21 (100%)

ensuring assessments in system implementations, privacy policies and data confidentiality; analysis of access to information; and collaboration in financial matters.

It is observed that neutrality appears when the competency involves budgetary and cost-related decisions, ensuring that the care team is involved in system assessment. There was total agreement on aspects such as inclusion of nursing processes in information system requirements, specifications of system requirements, information system assessment and collaboration with multidisciplinary teams. On the other hand, there was less use of the following competencies: ensuring assessments in system implementations, privacy policies and data confidentiality; analysis of access to information; and collaboration on financial issues.

In the qualitative stage, based on the coding and analysis of the data obtained in the interviews, it was found that the information fit into three categories, which will be described below:

Competent nurses' contribution in health and nursing informatics

The data show that, in the three hospitals certified with HIMSS stage 7, nurses have nursing skills in informatics. They demonstrated, through their reports, their participation in the construction of computerized tools in the electronic medical record system, providing ideas, involving the care and multidisciplinary team in the computerization process, managing and analyzing data and interfacing with the company, according to reports:

> [...] *the largest group involved in the system implementation was nurses. Nursing technicians participate in system version testing and report difficulties and improvements* [...] (H1N04).
>
> [...] *during the transition of systems, I was responsible for the interface with the company in building all processes within the system* [...] (H1 N04).

A nurse reported that together with another nurse they participated in the entire structuring process for the HIMSS stage 7 certification. Structuring is understood as the organization of processes in the digital certification project, which is confirmed in the report:

> [...] *the board handed the project over to the nurses who worked throughout the hospital* [...] (H1N04).
>
> [...] *in the coordination of continuing education, it was possible to access records, create evolution, standard text, structured assessments, configure the Systematization of Nursing Assistance (SNA), create kits and charge for medications with codes, change parameters in the system so that it would meet and improve nursing needs, and carry out training* [...] (H1 N04).

Regarding care team and multidisciplinary team involvement, a nurse reported the integration between teams:

> [...] *whenever it is necessary to implement and deploy a system, nursing works together with IT.* [...] (H3N06).

The following report demonstrates compliance with items 2, 4, 6, 7, 14 and 23 (Table 1):

> [...] *when physicians noticed the improvements, they began to participate more in the creation of templates and macros for the system.* [...] (H1N04).

One nurse reported that to be an IT reference nurse it was essential to have worked in other areas of the hospital, as she believes it is necessary to have knowledge about the processes in all areas of the hospital.

> [...] *having worked in different areas contributed a lot to my coming to IT* [...] (H1N10).

Nurses' knowledge of care processes and their competency in IT contribute to engagement and participation in the development of computerized tools for healthcare, as can be seen in the following report:

> [...] *at the time, Tasy did not have a palm and we designed the medication checking and material traceability plan with the company, Tasy's headquarters, we improved the process* [...] (H1N10).

Medical records are all electronic and nurses play a major role in the construction of this computerized system. Hospital managers are always encouraging the automation of processes and improvements to the system. A nurse reports:

> [...] *an IT governance system was implemented to help with questions about what can be developed within the system* [...] (H1N11).

A nurse reports that when she started working at the hospital in 2014 there were a lot of printed materials, and the processes were automated with the arrival of HIMSS certification and the help of an IT nurse who promoted team interaction, according to the following report:

> [...] *an IT nurse assisted the healthcare team in interacting with IT. The protocols were automated and patient data was generated in the system. The data from the MV system feeds the BI and the indicators are generated automatically, facilitating the analysis and mapping of processes.* [...] (H2N01).

Regarding training teams on how to use the system:

> [...] *the employee is trained upon arrival at the hospital on information security and customer assistance, use of*

> *a personal and non-transferable password, closing the system when leaving, and not sharing information on social networks.* [...] (H3N08).

> [...] *the continuing education nurse provides support in the area of technology and trains professionals on electronic medical records* [...] (H2N07).

To control training, the use of a dashboard was reported, but they mention the possibility of an application to beep the employee's badge and see which training sessions were carried out.

The billing coordinator nurse reported that she enters the contracts into the system and considers that:

> [...] *the fact of being a nurse helps a lot to suggest improvements to the system* [...] (H2N09).

Computerization process challenges and advantages in hospitals

The nurses interviewed also reported some difficulties related to the computerization process, as reported below:

> [...] *work overload due to time spent in meetings to discuss the system to be implemented* [...] (H1N02).

The frustration of feeling overwhelmed is demonstrated, but also the planning and management of actions to build computerized systems. Another report says that the difficulty is related to:

> [...] *paradigm shift in the change from manual to digital processes* [...] (H1N03).

A nurse reports that:

> [...] *installing the system on the server and getting it running is easy. The difficult part is adapting it to the reality experienced in the assistance* [...] (H1N04).

Another difficulty mentioned was related to nurses' low knowledge of computerized systems.

> [...] *it is not a reality to find health professionals with good computer knowledge. They think about Word®, Excel®, PowerPoint®, and not about the architecture of the system and how it was developed.* [...] (H1N04).

Another nurse says that:

> [...] *at college, the computer science subject only talked about the history of computers and IT, it didn't teach technical skills* [...] (H2N07).

A nurse who served as an IT nurse during the hospital digital transformation process said:

> [...] *it is a challenge for the IT nurse to understand all the hospital processes. It was necessary to visit all the sectors* [...] (H1N10).

In another interview, the delay in IT responding to requests about the system was mentioned,

> [...] *the difficulty is the slowness for IT to respond to requests. It takes up to six months* [...] (H1N11).

It was reported that, after approval of the request, made by support professionals, the improvement or proposed system, carried out only by IT professionals, does not always meet exactly what was requested.

The act of copying and pasting reports was also cited as a difficulty that requires training and awareness. Another report said about the age range of employees:

> [...] *older generation employees have more difficulty with the system and require more training* [...] (H2N07).

There were also reports on the time spent filling in information in the system and the time spent providing bedside care.

> [...] *the difficulties are inherent to the profession. Much of the information that is the responsibility of the food nurse in the system could be shared with the multi-team. The computerization process showed the time spent filling in information that other professionals could fill in and the time spent at the bedside* [...] (H2N01).

Another point reinforced was the need for teamwork:

> *If the IT team works alone, the language will not be compatible. Electronic health records benefit greatly from partnership between teams.* (H2N09)

There was a report that considered the lack of involvement of frontline professionals, i.e., nursing professionals and nursing assistant technicians, in IT matters.

> [...] *even if the manager has already gone through the assistance, he alone cannot suggest a suitable system* [...] (H3N08).

There was a report about the need to print some documents:

> [...] *although the culture is not to print paper, some information is printed. The HICC records are scanned and discarded due to lack of space for physical files* [...] (H3N06).

This shows that even though it is a paperless hospital, there are still limitations that prevent some documents from being generated entirely within the system.

The computerization system and digital transformation of hospitals, in addition to challenges, have facilities and bring many benefits to the hospital, clients and healthcare professionals. There were some reports about the management of indicators, security with electronic prescriptions, and bedside checking and agility in obtaining data and analysis when asked about the system facilities:

> [...] *management of indicators and statistics and greater safety and standardization of care* [...] (H1N02).
>
> [...] *optimization of working time and safety. Alerts, traceability, medication checking and clinical decision support* [...] (H1N03).
>
> [...] *ease related to agility and time savings for nursing and multidisciplinary teams* [...] (H1N05).
>
> [...] *having information in real time saves time. Do not prescribe medication that has already been suspended. When suspended, it is immediately removed from the electronic prescription. Implementation of the therapeutic plan and creation of the electronic prescription on the PDA* [...] (H1N10).
>
> [...] *ease is the expertise acquired with the technique, having a broader view and being able to create a panel with patient information. Being familiar with the PEP and being able to suggest improvements* [...] (H1N11).

This report shows the satisfaction of being involved with the information system and feeling competent to contribute to improvements. One nurse said that she noticed an improvement in nursing time and data integration when some forms began to be completed by members of the multidisciplinary team.

> [...] *together, the nurse manager, IT nurse, physicians and IT professionals were able to integrate and transform clinical data into information. Automated processes save time, generate indicators, measure working time, track medication failures and intervene* [...] (H2N01).

Having an IT nurse was also highlighted as a benefit.

> [...] *the IT nurse was in charge of building the tools based on suggestions from other nurses* [...] (H2N01).

This construction is carried out with team support in conjunction with IT. The ease is also related to the possibility of adapting the system according to the needs of each area.

> [...] *reports from healthcare professionals on obstacles, quality and patient safety for system adjustments are very important* [...] (H2N09).

The advantages were also related to the security of data storage, reports and developments with quick completion in tools with ready-made text, completion with clicks, and greater agility in the nursing process in a more complete manner.

> [...] *greater security, less loss and misplacement of data, quick filling in templates that can be selected with just one click, quick access to information without having to leaf through an entire medical record. More complete and faster nursing prescriptions* [...] (H3N08).

Strategies to develop and enhance nursing competencies in health informatics

To reach HIMSS stage 7, hospitals adopted strategies aimed at raising employee awareness and clarifying the advantages of the digitalization process in search of greater support and involvement from their employees.

> [...] *there has been a culture of innovation since 1998. When someone needs a new tool, they start talking about a template* [...] (H1N04).
>
> [...] *seek accreditation, have to meet information systems requirements to achieve accreditation* [...] (H3N08).
>
> [...] *meetings to raise awareness among teams by showing the benefits* [...] (H3N06).

In one of the hospitals, in cases of new employees, a sponsor was appointed to train them.

> [...] *when a new employee joins, they are directed to a sponsor who will provide training on how to use the system for 120 days* [...] (H1N03).

A nurse also reported on the creation of strategic groups involving nurses and professionals from the multidisciplinary team. Another report called for a transition group composed of nurses and members of the multidisciplinary team for the system transition office.

> [...] *definition of strategic groups to monitor the processes to obtain accreditation criteria* [...] (H1N04).
>
> [...] *bring these people into the transition office so that each person can contribute to their needs and carry out customization* [...] (H1N04).

Recognition was reported regarding the value that computerization and digital certification added to the hospital, its employees and customers.

> [...] *HIMSS is part of the quality policy. Certification seeks continuous improvement; we cannot stop. Today, HIMSS is a priority for quality. Today, no one talks about paper anymore. When someone needs to create a tool, they already talk about a template.* [...] (H1N04).

It was considered that the use of the Personal Digital Assistant (PDA), with beeps from the identification bracelet, medication and the employee's badge, guarantees more accuracy, agility and eliminates waste.

> [...] *we do bedside traceability with the PDA, medication and material tracking, blood bags and breast milk. This is safety.* [...] (H1N04).

A nurse stated that he considers HIMSS a practice that transforms and reduces costs:

> [...] *in the end, it is cheaper to invest in technology* [...] (H1N04).
>
> [...] *we demonstrated the amount of paper we stopped printing. We measured nursing time, reduced legal processes, we were able to demonstrate the gains with digitalization and we saw that the investment pays off* [...] (H1N04).

Another nurse reported that:

> [...] *the pursuit of HIMSS certification encourages thinking about computerization* [...] (H1N11).

It is considered that the automation of systems has facilitated the analysis of indicators.

It was reported that the operational team is included in IT matters, providing their opinions before the system is built.

> [...] *indicator tools for pressure injuries are built, for instance* [...] (H2N01).

Then a pilot test is carried out before implementation.

> [...] *when we are going to build a form or improve something, we go to the operational team to see their opinion and what their needs are. We do a pilot project and tests before putting the system into operation* [...] (H2N07).

As for safety, a nurse reported that the hospital provided a lot of guidance and training to raise awareness about the use of electronic medical records and secure registration. She reported that the involvement of IT professionals in bedside check-up training was a positive point.

> [...] *training on secure registration, how to use the tools. Bedside checks were carried out with the IT team* [...] (H2N07).

Another nurse considers the nursing team involvement with IT and Lean Six Sigma projects as a facilitator:

> [...] *the fact that the hospital is digital means that professionals have the culture of doing more in less time* [...] (H2N09).

Another hospital reported the use of a Distance Learning (DL) platform for online awareness and information. It was reported that information is also available within the electronic medical record system. HIMSS certification appeared in another report as a motivator for healthcare professionals to engage in the hospital computerization process.

> [...] *a lot of information was provided about the benefits of accreditation. There were rounds of the hospital with managers explaining about accreditation. Even though it is laborious, the professional knows that it has to happen* [...] (H3N08).

The nurses interviewed have experience in using the electronic medical record system, work with hospital management and IT professionals to suggest improvements, implement and deploy digital modules, but only one hospital had a nurse designated as an IT nurse.

It is noticeable that nurse managers and management support nurses are included in the hospital digitalization process and are improving their IT skills through training provided by senior management together with IT professionals and guiding actions promoted by certifying and accrediting companies.

DISCUSSION

Before beginning the discussion, it is important to recall the objective of the work to inform the reader about the aim of this study: "to analyze the use of nursing competencies in informatics by nurse managers and management support nurses in hospitals with the highest level of technological development in Brazil".

This discussion begins with the characterization of nurse managers and management support positions. Only one interviewee did not have a graduate degree, while one of the graduate students has a master's degree. Thus, it can be stated that nurses working in IT nursing in Brazil are experienced in the role, with training beyond graduation, working in various management support functions, such as continuing education, epidemiology, hospital infection control, billing and DRGs. The core competencies of specialist nurses are the set of vital skills necessary to ensure the effectiveness of their activities in hospitals.[20]

During the interviews, the professional trajectory of these nurses in care and management activities was highlighted, and when involved in the digital transition of hospitals, the need for constant training and education was highlighted. In the United States, TIGER was created with the aim of teaching nursing computer skills to nursing students. In Europe and Asia, health computer education was also included in training nurses.[5,6] Although some initiatives for teaching nursing competencies in informatics in undergraduate nursing courses have already been mapped in the literature at an international level, when it comes to continuing education, a scoping review indicated that no explicit continuing education programs were identified for nursing professions.[21] This demonstrates the need to continue teaching nursing competencies in informatics after graduation.

Although nurses may have difficulty with some aspects of IT and healthcare, it is clear that nursing is always involved in digital transformation in their institutions. Studies show that nurses are considered creative, optimistic and have knowledge in healthcare that mainly helps in system design.[22] In this regard, a highly developed characteristic in nursing, teamwork, enhances the ability to articulate knowledge and expertise in an interdisciplinary manner. The integration of knowledge is noted as an important skill and attitude in the application of competencies in health informatics.[23]

Among other perceptions, it was also reported that nurses are the professionals who link with the multidisciplinary team. The benefits and security of electronic prescriptions demonstrate the clarity of what is prescribed. Clinical decision-making, data management and cross-referencing, and indicator panels demonstrate the results, the profile of services, and improvements in the electronic medical record.

In some reports, it is clear how nurses developed computer skills in their daily practice. The integration of knowledge, skills and attitudes in the performance of activities is noted. This profile of Brazilian nurses is in line with scientific literature, in which nurses, although they do not have specific training in health informatics, have experience and knowledge of day-to-day practice associated with other complementary training, which favor the expected profile for management and management support positions in more traditional institutions.[24]

On closer inspection, although they are a minority, some respondents were emphatic with answers of "totally disagree" for competencies such as determining priority of new requirements, collaboration with financial issues, analysis of access to information, data analysis, data privacy policy and ensuring assessments of the implementation phases of systems. It is also noteworthy that the item "improve the use of IT in practice" received the highest number of responses with "totally agree".

Governance or autonomy to interfere in financial investment or priorities in information systems seems to be an important challenge for nurse managers and those in management support positions. Thus, fully developed competency in health and nursing informatics could enhance or favor greater participation of nurses. [19] However, the history of power relations in hospital institutions in the healthcare dimension can interfere with this management context, in which nurses contribute, but are not active decision-making agents, giving other areas and disciplines greater authority.[25]

In one of the interviews, it was reported that many digital transformation projects to meet HIMSS certification requirements were the responsibility of nurses, among other responsibilities. A few years ago, this perception of assigning a nurse to IT was cited[26] in relation to the advancement of technology at the Naval Hospital Pensacola, United States. The aim is to assist computer professionals in building systems with a more intuitive design and focused on improving healthcare, considering the quality and safety of care, patient costs and health data. In short, nurses in activities linked to IT help integrate data and information systems, working to implement improvements and effectively train teams on the use of digital systems.[26]

IT nurses' work was also considered capable of changing the management model and strategic plans. The results are consistent with findings described in the literature. Nursing competencies in informatics and project management skills are believed to be linked to improvements in quality and patient safety.[27]

The computer skills of nurses are important because, given their prior knowledge and skills in nursing computer science, Chinese nurses demonstrated the ability to suggest innovative ideas and assist in the construction of systems with intuitive tools that favored secure access to information as well as data management.[28] The level of knowledge of nurses about health and nursing informatics,[28] training for the acquisition of skills[20] and interdisciplinary work with academic support[29] have an influence on the performance and performance of functions in patient care in hospitals with computerized systems for electronic health records, access and management of data, among other more advanced functions.

Another example of the importance of nurses' IT skills can be seen in a joint effort involving a group of nurses from a university hospital in Brazil,[29] with professors and a team of IT professionals to develop a computerized system of quality indicators in nursing care by concluding that knowledge in computing made it possible to plan a system that, from a pedagogical point of view, had a friendly, intuitive and attractive interface, an interactive database and tools aimed at contributing to work quality.

Health informatics skills and their learning face the challenge of technological advancement and changes.[30,31] Therefore, nurses and other healthcare professionals must seek new skills and abilities that favor the use of data in an inductive and deductive way in order to keep up with technological advances.

CONCLUSION AND IMPLICATIONS FOR PRACTICE

The majority of nurses declared themselves in favor of the 23 competencies listed in the quantitative questionnaire, with a view to meeting the prerequisites of the certifier, but also as an interest in improving nursing work processes in partnership with the multidisciplinary team. In the interviews, they reported the activities they perform, which fit into the competencies, but they were unable to name them as a competency. This indicates a limitation in the responses to the questions and can be minimized in future research by providing nurses with the list of competencies at the time of the interview.

Although the majority agreed with the competencies listed in the quantitative questionnaire, some nurses indicated "totally disagree" for the competencies related to: determine priorities for new technological requirements within budgetary constraints and organizational priorities; collaborate with the multidisciplinary team on financial issues. Analyzing access to system information, analyzing data use (obtaining, storing and disseminating) and analyzing access to personal health data (privacy policy) are also skills that some nurses have not yet developed. It is important to ensure that testing plans are assessed at each stage of information

systems implementation. Although some nurses are involved and trained, there are still nurses who have not developed these skills.

From an academic point of view, this list of nursing competencies in informatics was translated and authorized by Melo (2018) with the aim of assisting in the training process in nursing schools. Even though technology is constantly updated, a discipline that encompasses the topic can help in the knowledge and notions of innovation and technology linked to nursing care. Space is opened for new research and the development of new nursing competencies in informatics, considering technological advances and the need for adaptations according to the reality of each hospital or health institution that has a computerized system.

This study had some limitations: it was conducted during the COVID19 pandemic, at a time of work overload in hospitals, especially for nurses, who were constantly changing to adapt to safety requirements and public health guidelines. Therefore, it is understood that this process may have influenced the access of participants and their willingness to respond to the invitation to participate in the research. Another important limitation is that the study only included hospitals with a high level of technological development certified by HIMSS stage 7, and its results cannot be generalized to scenarios that do not present similar characteristics.

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CONFLICT OF INTEREST

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