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HEALTH INFORMATICS IN THE HOSPITAL SETTING: REVIEW OF NURSES' PERFORMANCE

INFORMÁTICA EM SAÚDE NO CONTEXTO HOSPITALAR: REVISÃO SOBRE A ATUAÇÃO DE ENFERMEIROS

TECNOLOGÍA INFORMÁTICA EN SALUD EN EL CONTEXTO HOSPITALARIO: UNA REVISIÓN SOBRE EL DESEMPEÑO DE ENFERMEROS

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ABSTRACT

Objective: to identify, within the scientific community, the main aspects about nurses' performance in health informatics in hospital settings. ***Method****:* integrative literature review with searches conducted in the databases MEDLINE/PubMed, PubMed Central, Scopus, *Cochrane Library,* and *Web of Science* using the keywords: *nurses; information technology; medical informatics; nursing informatics; hospitals; computer systems*. The PRISMA method was used and, after selection and analysis, the final sample consisted of 16 articles. ***Results****:* two dimensions were identified: "Attitude aspects of nurses towards health informatics" and "Aspects of organizational support". In the questions regarding attitude, it was perceived that the level of knowledge, training, skills, and interdisciplinary work influence the performance of care and management functions. In turn, organizational support was considered important in the participation of nurses for the implementation and improvement of computerized systems. ***Conclusion****:* research shows that the use of computerized systems in hospital and outpatient settings is related to attitude issues of nursing professionals as well as organizational support for the efficient use of technological resources, showing paths for an update in professional training, as well as the insertion in new work environments.

Descriptors: Nursing; Information Technology; Medical Informatics; Nursing Informatics; Hospitals; Computer Systems.

RESUMO

Objetivo: identificar em pesquisas, no âmbito da comunidade científica, os principais aspectos sobre a atuação de enfermeiros na informática em saúde no contexto hospitalar. ***Método:*** revisão integrativa da literatura com buscas realizadas nas bases de dados MEDLINE/PubMed, PubMed Central, Scopus, *Cochrane Library* e *Web of Science* utilizando os descritores: *nurses; information technology; medical informatics; nursing informatics; hospitals; computer systems*. Utilizou-se o método PRISMA e, após a seleção e análise, a amostra final foi constituída por 16 artigos. ***Resultados:*** foram identificadas duas dimensões: “Aspectos atitudinais de enfermeiros em relação à informática em saúde” e “Aspectos sobre o suporte organizacional”. Nas questões atitudinais, percebeu-se que o nível de conhecimento, treinamento, habilidades e trabalho interdisciplinar influencia a atuação e o desempenho de funções assistenciais e gerenciais. Por sua vez, o suporte organizacional foi considerado importante na participação de enfermeiros para a construção e o aperfeiçoamento dos sistemas informatizados. ***Conclusão*****:** as pesquisas evidenciam que o uso de sistemas informatizados em ambientes hospitalares e ambulatoriais tem relações com questões atitudinais dos profissionais da Enfermagem tanto quanto o suporte organizacional para o uso de recursos tecnológicos de forma eficiente,

mostrando caminhos para uma atualização na formação profissional, bem como a inserção em novos ambientes de trabalho.

***Descritores*:** Enfermagem; Tecnologia da informação; Informática médica; Informática em Enfermagem; Hospitais; Sistemas computacionais.

RESUMEN

Objetivo: identificar en la investigación, en el ámbito de la comunidad científica, los principales aspectos sobre la actuación de los enfermeros en informática en salud en el contexto hospitalario. ***Método:*** revisión integradora de la literatura con búsquedas realizadas en las bases de datos MEDLINE/PubMed, PubMed Central, Scopus, *Cochrane Library* y *Web of Science* utilizando los descriptores: enfermeros; tecnologías de la información; informática Médica; informática de enfermería; hospitales; sistemas informáticos. Se utilizó el método PRISMA y, tras la selección y el análisis, la muestra final quedó constituida por 16 artículos. ***Resultados:*** se identificaron dos dimensiones: “Aspectos actitudinales de los enfermeros en relación a la informática en salud” y “Aspectos sobre el apoyo organizacional”. En cuanto a las cuestiones actitudinales, se percibió que el nivel de conocimientos, formación, habilidades y el trabajo interdisciplinario influyen en el desempeño y desempeño de las funciones asistenciales y de gestión. A su vez, se consideró importante el apoyo organizacional en la participación de los enfermeros en la construcción y perfeccionamiento de los sistemas informatizados. ***Conclusión:*** la investigación muestra que el uso de sistemas informatizados en ambientes hospitalarios y ambulatorios está relacionado con cuestiones actitudinales de los profesionales de Enfermería, así como el apoyo organizacional para el uso eficiente de los recursos tecnológicos, mostrando formas de actualización en la formación profesional, así como la inserción en nuevos entornos de trabajo.

Descriptores: Enfermería; Informática; Informática Médica; Informática de Enfermería; Hospitales; SistemasInformáticos.

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INTRODUCTION

Healthcare information systems have been developing and gaining space in health services. Information Technology (IT) and the entire infrastructure for computer use, management, and data security stand out in the healthcare area, and nursing knowledge in informatics is related to the success of digital transformations and usability in care and management services.[1] From this perspective, nursing professionals, due to their theoretical and scientific knowledge, as well as their hospital care experience, are increasingly involved with data, information, and technology.

There are records that, in the 1970s, the first Nursing conference on informatics was held in the United States[2] and, in Brazil, the National Policy on Health Information and Informatics (NPHII) was instituted by Ordinance No. 589/15 with the purpose of improving work processes with innovation and creativity, using IT to generate a National Health Information System (NHIS).[3]

In view of the movements to include this topic in the practice of healthcare professionals, there is a need to understand the impact on nurses, who, even with studies showing weaknesses in the development of competencies in informatics in nursing and healthcare during the nurses' professional training,[4] are gaining new spaces and positions in the area of health informatics, occupying strategic positions such as directors or coordinators of nursing informatics.[2,4] Among the different designations, the informatics specialist nurse remains the most common title (24%); followed by clinical analyst (13%), clinical informatics director (11%), and clinical informatics manager (10%) are increasing their use in health services, indicating a growing appreciation of professionals who articulate knowledge in informatics and nursing/healthcare in institutional management.[5]

When seeking to characterize the profile of nurses' performance in informatics, the HIMSS Nursing Informatics Workforce Survey in 2020 showed that nursing plays an important role in the development, implementation, and optimization of information systems and applications, including clinical documentation and electronic health records. With regard to practice setting, hospitals and health systems (68%) remain the most common primary workplace for nurses to work in informatics.[5]

Other elements, such as the offer of specialization courses in nursing informatics in and the increase of themes in the universe of Information and Communication Technologies (ICTs), highlight the importance of identifying studies on the subject, since nurses today are challenged to produce innovative solutions capable of making systems more intuitive and accessible through the use of information systems, electronic health records, data management, big data, artificial intelligence, clinical decision support, and the electronic patient record.[4]

Aware of the challenges that nurses have experienced in a scenario of constant transformations promoted by the inclusion of technology in the care and management routine of inpatient units in hospitals, the following question was posed: "Which aspects about nurses' performance in the hospital context have stood out in research on health informatics?".

To identify the main aspects of nurses' performance in health informatics in the hospital context through research within the scientific community.

METHOD

The research that fostered this article was an integrative literature review, characterized as a substantial inference based on the analysis of a group of studies on the studied phenomenon.[6] A flowchart based on the PRISMA method7 and a review protocol validated by researchers with expertise on the topics of Nursing and Technology were developed.

The precepts of the literature review were: formulating the review's initial question; definition of study inclusion criteria and sample selection; representation of studies in chart format; critical analysis of findings; interpretation of results and description of the evidence found.[6]

In the first stage, based on the research guiding question, the descriptors and their synonyms in English were identified, duly selected from the Descriptors in Health Sciences (Decs) database and from the Medical Subject Headings (MeSH) vocabulary: nurses; information technology; medical informatics; nursing informatics; hospitals; computer systems, properly combined with one another, considering their synonyms and Boolean operators and and or.

The databases chosen were MEDLINE/PubMed (Medical Literature Analysis and Retrieval System Online/PubMed Central (PMC), Scopus, Cochrane Library, and Web of Science. The review on these databases was conducted in April 2021. We chose to include studies in English, Portuguese, and Spanish from the year 2010, considering a broader characterization of the participation of nurses in the area of health informatics and the various regulations and policies adopted by the Ministry of Health from this period for the management of health technologies and criteria for feeding the databases.[8-9]. In total, 357 studies were located and 46 studies were excluded for duplicity, using the reference manager EndNote®.

With the articles cataloged in MS Excel® spreadsheet, selections were made by reading the titles and abstracts, aiming to verify whether the articles had connections with the researched object, being excluded 255 articles at this stage.

Subsequently, the 56 selected articles were read in their entirety for final eligibility and, even so, many were articles that dealt with similar themes, but not adherent, which resulted in the identification of 16 articles in the final sample. Throughout the article selection process, double checking was performed by a second researcher to confirm the decision and qualify the eligibility of the final sample.[6-7]Figure 1 summarizes these actions.

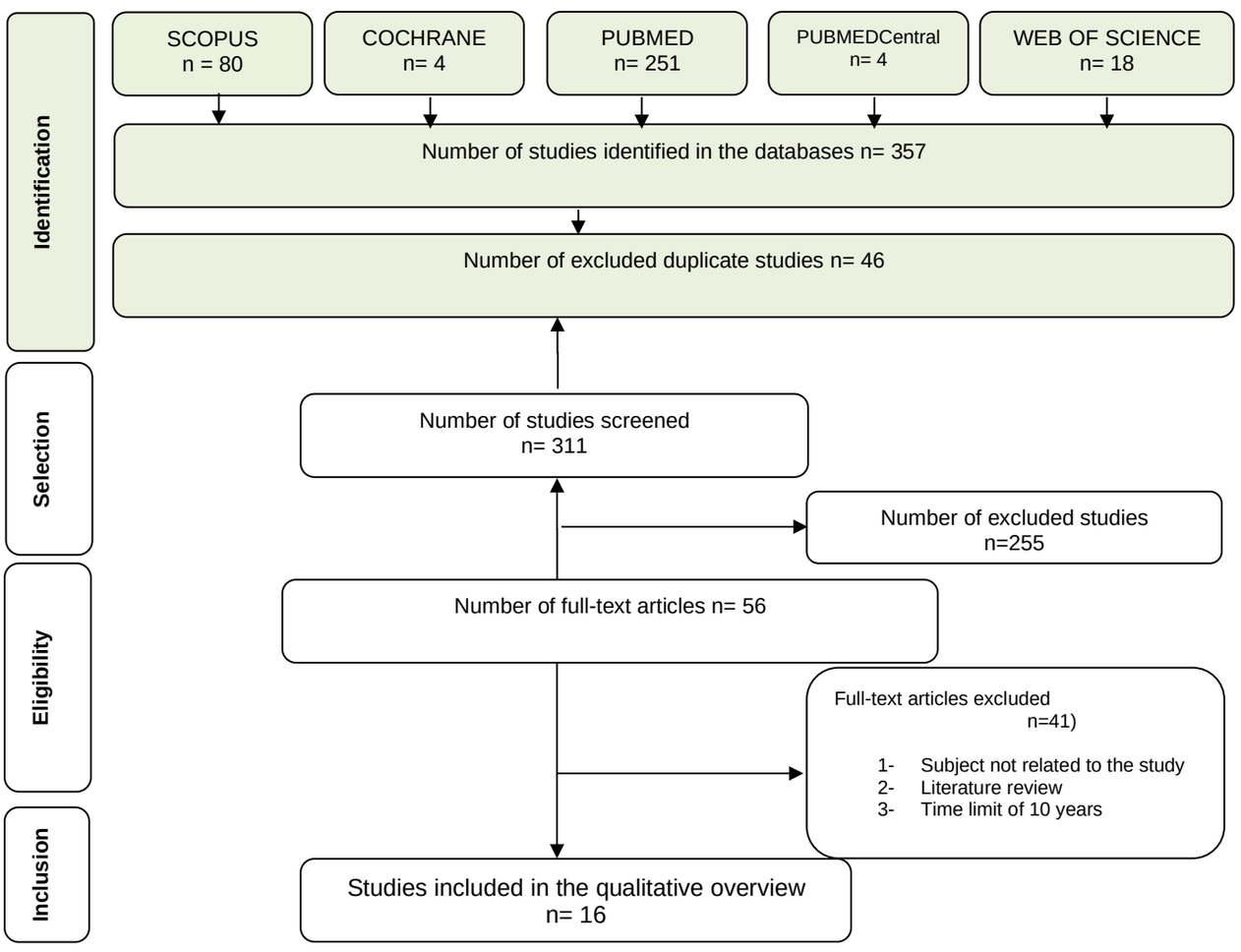

Figure 1. Flowchart of the selection of articles for the review. Florianópolis (SC), Brazil, 2021.

Source: prepared by the author and adapted from the PRISMA method.6

The main aspects studied and researched on the subject were extracted from the selected articles, bringing elements to achieve the research objectives. To facilitate the article description, the results and the analysis will highlight them according to their nationalities.

RESULTS

From the analysis of the 16 selected articles, it was found that only one is national and 15 studies are international. As for the country of origin of the study, Taiwan presented three articles, China, two articles, India, two articles, and Iran, two articles. The UK, South Africa, Jordan, Canada, USA, Finland, and Brazil had one article each.

The profile of the institutions where the research took place ranged from tertiary hospitals, public hospitals, hospital outpatient clinics, university hospitals, psychiatric hospitals, and private hospitals. The participants were care nurses, nurse managers and IT nurses.

After the analysis of the findings, two categories emerged: Attitudinal aspects and Organizational support. Chart 1 shows studies related to the first category, which demonstrates the influences of attitudinal aspects of nurses when faced with the reality of health informatics in the various situations researched.

Title	Country/Year	Resultsfound
Construction of Nursing Quality Control Information System in Large Hospitals [10]	China 2018	Construction of computerized systems for quality control and nursing management. IT andnursing management.
An investigation on task-technology fit of mobile nursing information systems for nursing performance [11]	Taiwan 2012	Mobile information systems in Nursing produce positive effect in data registration, information acquisition, integration and interpretation of data.
Computerized system for managing nursing care indicators at the São Paulo Hospital [12]	Brazil 2011	Computerized system of Nursing indicators of the São Paulo Hospital (NICS-SPH) developed by a group of nurses.
Effects of the implementation of the web-based patient support system on staffs attitudes towards computers and IT use: a randomized controlled trial [13]	Finland 2010	Nurses' attitudes toward computer use related to implementation of web-based patient support system.
Evaluation of clinical nursing information system in Taiwan Regional Hospital [14]	Taiwan 2017	Younger nurses and those who already had management experience showed positive acceptance in the usability of the information system.
Information Technology (IT) in Hospitals' Nursing Management: Mixed Method Study [15]	Iran 2018	Participants, for the most part, believe that the hospital information system makes their work easier. Nurse managers use informationtechnologytomanageinstitutional data.
Nurses' Interest, Readiness and Absorptive Capacity to Information Technology: A Survey in China [16]	China 2017	Different levels of education and job position influence nurses' interest, readiness, and absorptive capacity in IT.
Job type influence in the use of information technology by nurses in private hospitals in the state of tamilnadu in India [17]	India 2016	Skill in using computers on site, comparing part-time and full-time nurses. Job type influences behavior.
An investigation of the effect of nurses' technology readiness on the acceptance of mobile electronic medical record systems [18]	Taiwan 2013	Nurses exhibit personality traits in relation to technology readiness for electronic record acceptance: they are innovative, optimistic, and secure.

Nurses' resistance to the adoption of information technology in Jordanian hospitals [19]	Jordan 2014	The importance of adequate training and support in the transition from manual to digital systems. Need for investment in raising awareness about the change process within the organization.

Chart 1. Synthesis of research related to attitudinal aspects. Florianópolis (SC), Brazil, 2021.

In chart 2, you can see the studies related to organizational support issues.

Title	Country/Year	Results found
Problems Faced by Nurses in Use of Electronic Health Records During Clinical Practice[20]	India 2016	Most agree that using the computerized system improves documentation and facilitates the work of Nursing in care.
Developing a vital sign alert system [21]	USA 2013	Contribution and active participation of IT nurse for the implementation of the alert system.
Evaluation of organizational support for use of online information resources in nursing care [22]	Iran 2014	Organizational support in the introduction of computerization in Nursing care and evidence-based practice.
Computer usage among nurses in rural health-care facilities in South Africa: obstacles and challenges [23]	South Africa 2013	Organizational support factors that inhibit computer use by nurses. A study of 40 nurses from three public hospitals in KwaZulu-Natal province, rural South Africa.
The role of organizational context and individual nurse characteristics in explaining variation in use of information technologies in evidence based practice [24]	Canada 2012	Frequency of device use varied according to the availability of individual personal digital assistants and tablets to access evidence-based information.
Medical and nursing staff perspectives on an electronic health record implementation in hospital outpatient departments: A qualitative study in four English Hospital Trusts C3 - HEALTHINF 2013 - Proceedings of the International Conference on Health Informatics [25]	United Kingdom 2013	Upgrade of electronic medical record system in National Health Service (NHS) hospital outpatient clinics. Reports of slowness in the system, number of times the system crashed, lack of interoperability, increased number of clicks, duplication of data, and dependence on IT professionals to use the system. Testing is needed before implementation. Healthcare professionals perceived that managers were not listening to their concerns.

Chart 2. Summary of research regarding organizational support. Florianópolis (SC), Brazil, 2021.

The six articles that show aspects of organizational support researched the participation of the nursing professional as part of the system, offering support and facilitating the use of IT in care practice, increased efficiency, reduced implementation time, improved planning of system implementation, and adoption of new practices.

Attitudinal aspects

Nurses' level of knowledge about health informatics and nursing,[10] the training for skill acquisition[11] and interdisciplinary work with academic support[12] have an influence on the performance of their functions, both in patient care and in the electronic health record, as well as in data access and management. It is noted that the preparation of these nurses to work in health informatics, such as previous training and even professional training in health informatics, can positively impact their attitudes both in the handling of an electronic medical record system and in helping to build or improve it through innovative ideas.

Given their prior knowledge and skills in nursing informatics, Chinese nurses presented the ability to suggest innovative ideas and assist in building systems with intuitive tools that favored access to information in a secure manner, as well as data management.[10] The information system developed for

quality control within hospitals has improved the quality of Nursing care and facilitated Nursing management for quality indices.

In identifying the adjustment factors between Nursing assignments and the use of mobile information systems, a study[11] evidenced that the use of mobile information systems in a well-trained team can facilitate the work of Nursing with accurate and real-time information, data management and improvements in the efficiency and effectiveness of Nursing care.

A joint work that involved a group of nurses from a university hospital in Brazil,[12] with faculty and team of IT professionals, for the development of a computerized system of indicators of quality in nursing care. It was concluded that knowledge in informatics made it possible to plan a system that, from a pedagogical point of view, had a friendly, intuitive, attractive interface, with an interactive database and tools that aimed to contribute to the quality of work.

It has been observed, in some researches, the position of neutrality[13] and acceptance[14-15] in the use of information systems according to some levels of education and job position,[16] as well as different working hours.[17] The negative attitude, on the other hand, was related to lack of knowledge[18-19] and skill in health informatics,[19] the rapid introduction of technology, the increase in workload[19] and the distancing from the process of creating and developing computerized systems.[20]

In a survey conducted in Finland, when evaluating nurses' attitude towards the use of IT in web-based health education for psychiatric patients, it was found that the increased use of computers and the neutral attitude of nurses presented no barrier to the implementation of the software.[13] A similar result was obtained in a survey conducted in a hospital in Taiwan in which younger nurses who had experience in management positions and had advanced computer knowledge showed positive acceptance of the implementation of the information system for clinical nursing.[14] A similar result was obtained in a survey conducted in a hospital in Taiwan in which younger nurses who had experience in management positions and had advanced computer knowledge showed positive acceptance of the implementation of the information system for clinical nursing.[15]

When comparing between groups, in this case between full-time and part-time nurses in a hospital in India, it was found that full-time nurses had a more positive and confident attitude towards computer use than part-time nurse.[17] As for the different levels of education and job position, these influence interest and readiness, which seems to correlate with overall IT absorptive capacity.[16]

Nurses' resistance to change to computerized health systems was reported in the study developed in Jordanian hospitals: the reasons were lack of organizational support, sudden change, increase in workload, and lack of ability to use the system.[19] Additionally, it was pointed out that nurses with some deficit in computer knowledge could present anxiety and negative expectation in the use of electronic health record, and it was detected that optimism influences the attitude.[18]

Organizational Support

Organizational support appeared as one of the pillars for the success of the changes related to the implementation, consolidation and efficiency in the use of digital tools, with emphasis on the effective participation of nurses in the process of building or improving computerized systems,[20-21] culture and organizational climate[22] and infrastructure.[23,25]

A study on an IT nurse's participation in the computerization project of a sepsis early identification system in a hospital in the United States showed that the nurses' ability to design effective systems and an environment of personal/professional growth are related to the successful usability achieved in that setting.[21]

A study conducted in India[20] showed that 60% of the nurses considered the electronic health record system easy to use, however, some reported some difficulties and suggested more training. The

difference in point of view is related to having more practice time with previous computer use, more training, and support available during orientations, and system design. The limitations are also related to the involvement of nurses during the construction and implementation of the systems.[20]

Regarding organizational climate and culture, a study developed in a university hospital in Iran aimed to evaluate the institutional support for the introduction of computerization in Nursing care. Although the results indicated that cultural factors dominated the attitude of Nursing in the local context, when comparing this aspect in other countries, a relationship with social influences, leadership, strong organizational culture, and work climate was perceived.[22] This study could fall under the attitudinal aspect, but it looked at impacts related to organizational support.

Concerning the infrastructure for the use of technology, a survey carried out with nurses working in public hospitals in a province in rural South Africa, who faced problems in the implementation of computerized systems, highlighting difficulties in communication with Nursing management, lack of support from the IT team to clarify questions, difficulty in obtaining login and password to access the system, and insufficient number of computers.[23]

The influence of organizational support on the use of mobile devices in Nursing care was verified and some variables of the organizational context explained the variation in the use of devices by nurses: equipment that does not work properly; insufficient training; difficulty in accessing the system and mobile device not available.[24] This is related to another study in the UK in which nurses reported that after the implementation of a new version of the electronic health record system, they observed slowness in the system, an increase in the number of clicks to reach the desired screen, lack of data interoperability, dependence on the support of IT professionals to use the system, and a feeling that the nurse manager did not listen to their comments about the difficulties.[25] It was concluded that better planning is needed before implementing improvements or new systems.

DISCUSSION

With the advance of IT, the efficiency and effectiveness of software for electronic health record and the interoperability of systems, nurses stand out with their contributions in the use, construction and improvement of systems facilitating Nursing care, quality and patient safety.[26] These highlights can be seen in innovative ideas, template suggestions, click-through reduction, clinical decision support, indicator analysis, and data management.

Although this study, delimited to the initial descriptors, may present indications of limitations in the reduced number of articles, on the other hand, it evidences a theme in growing evolution in the technical-scientific environment, an area in full expansion for Nursing. Attitudinal aspects linked to the level of knowledge and training for the acquisition of skills were highlighted as elements that influence the performance of nurses in relation to ICTs. In view of the evolution of the use of computerized systems in hospitals in recent decades, one example is the introduction of a course in health informatics for nurses in the final year of the Bachelor of Nursing in Ireland, aimed at qualifying professionals for the job market,[27] in this line, it is recalled that in Brazil, the development of knowledge and skills on ICTs is recommended in the National Curriculum Guidelines for the training of nurses.[28] Despite the recognized importance of the subject, there are weaknesses in the development of this competence in the national context.[29]

In the current scenario, in which electronic records are increasingly present in the care dynamics, the need for a minimum level of knowledge for nurses about informatics in nursing and the awareness of its influence on the performance of both their clinical and managerial functions are foreseen.[27] In this

sense, based on what has been published, it can be seen that the level of education and the performance in strategic positions in the institution are related to the attitude of neutrality or acceptance for the use of computerized systems, thus overriding the need for formal education on the subject.

A study that sought to identify the competencies in nursing informatics perceived as relevant and required for professional practice by nurse leaders and managers pointed to an urgent need for education in health informatics[30] in face of the increasing complexity of the leadership role in Nursing and the challenging context of management and development of technologies for care. It is understood that knowledge in health IT should not be delegated exclusively to specialists, but should be a basic competence for the performance of nurses' professional practice.[30] Still with regard to nursing education, technological stress related to the increased use of digital technologies and medical devices was recorded, indicating the need to revise the curriculum or the teaching-learning processes in order to ensure qualified learning.[31]

Although the rapid introduction of technology and the increase in workload, associated with lack of knowledge, have generated negative attitudes among nurses, advantages related to patient safety and the quality of nurses' work are reported with the use of technology when accompanied by an implementation and/or training protocol.[32]

The participation of nurses in computerization tends to create a new scope of work, opening space for the ICT nurse. Nursing has a significant number of professionals in hospitals, who deal with a lot of data that feeds the computerized systems and could perform both data management and care management, in a safer way and with quality to patients, supported by information technology resources.[33]

In order to improve patient safety, quality, and work processes, hospitals have increasingly benefited from and exploited technological resources. Technological advances in health care require nurses to be trained in informatics knowledge and skills, and this can be a challenge for many nurses, since organizational success in information systems usability is directly related to Nursing informatics competencies.[34]

Nursing stands out for its work contingent in the midst of these processes. The use of artificial intelligence, algorithms programmed to predict patient risks, electronic medical records, the Internet of Things, and mobile devices in hospitals have shown that their participation in the implementation of new systems or improvements in existing systems is crucial to ensure benefits such as: time gain in electronic records, increased time at the bedside, and prevention of sepsis-related complications through early risk prediction.[35] These include improvements in medication management, error reduction, quality of care for patients, as well as improvements in other processes.[36]

Automated health control encompasses several sectors in the hospital, starting from the patient's entry into the emergency room with automated risk classification protocols, electronic record, electronic planning management[37] of the inpatient units and clinical decision support with algorithms programmed to meet the requirements.[38] However, for a proper functioning, there is a need for a team of health professionals with IT knowledge, especially nurses with health IT skills, able to make the link between care and IT, assisting in building intuitive, innovative systems that facilitate the work, ensuring data security.[35-36]

In wards and critical sectors, such as the Intensive Care Unit and surgical center, there is also a need for the involvement of nurses with computer skills and knowledge. The nurse can, both in the implementation of systems in mobile devices or other innovative ideas, provide and promote the language used in the description of care needs and in the programming of algorithms, transiting and making a link between health professionals and IT professionals.[36]

A university hospital in Brazil, in 2000, began the computerization of the Nursing process, with the implementation of software, aiming to assist nurses in clinical decision making about Nursing

interventions and expected results. The construction of this system and its implementation depended on the direct involvement of nurses in matters that were previously exclusive to IT teams.[37]

The perception of nurses, as well as other health professionals, influences the attitude towards the use of ICT[39] and an adequate training for the effective involvement of these professionals in the whole process of construction and implementation of computerized systems. It is believed that they become more confident and improve their perception regarding optimization of work time, planning, safety, and quality in health care.

CONCLUSION

The main discussions that highlighted two important aspects for the performance of nurses in healthcare IT were identified: attitude issues and organizational support, according to the review conducted using articles that portrayed investigations in various hospital settings around the world.

The emergence of a new function for nursing professionals, called IT nursing, is present in all the articles, presenting possibilities and, mainly, indications of increased quality, efficiency, and productivity. However, for both attitude and organizational support issues, formal and continued education for nursing professionals is needed for their effective participation, as well as for the success of the objectives of health informatics in hospital environments. The articles showed that the nurse's participation was relevant for the development of innovative ideas, understanding of the reality, as well as more speed and better planning in the implementation of new systems.

Further studies, involving attitude issues and the involvement of nurses in organizational support in environments with ICTs, may open space for the expansion in the nurses' scope of work, since there is a need for professionals trained in health informatics, especially in the hospital context.

This study presents a contribution to the management of people in the hospital area, IT management, and hospital management with a focus on healthcare IT issues. It also opens space for the education sector to evaluate the possibility of investing in training in the area of health informatics both at the undergraduate and graduate level.

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