

RESEARCH ARTICLE (ORIGINAL)

Nurse managers' use of technologies in the management process

Utilização das tecnologias pelos enfermeiros gestores no processo de gestão

Uso de las tecnologías por parte de los enfermeros gestores en el proceso de gestión

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Abstract

Background: Information and communication technologies (ICTs) offer a myriad of tools in the area of health care. Nurse managers are expected to manage the available resources efficiently using ICTs.

Objective: To identify the technological profile of nurse managers.

Methodology: This is an exploratory, descriptive, quantitative study with a sample of 74 nurse managers who completed a questionnaire on using ICTs in management. Data were treated using statistical and descriptive analysis.

Results: The nurse managers were over 51 years old, with more than 28 years of professional experience and more than 11 years in management. Their knowledge of informatics was acquired through self-learning. The best-known and most used ICTs for nurse managers were email and video conferencing.

Conclusion: This study allowed understanding nurse managers' technological profiles and identifying the technologies that can be used to improve management processes and care delivery.

Keywords: information technology; health management; nursing

Resumo

Enquadramento: As tecnologias de informação e comunicação (TIC) oferecem uma multiplicidade de ferramentas na área da saúde. Com a sua utilização é esperado que os enfermeiros gestores possam gerir os recursos disponíveis eficientemente.

Objetivo: Identificar o perfil tecnológico dos enfermeiros gestores.

Metodologia: Estudo quantitativo, descritivo e exploratório. A amostra é constituída por 74 enfermeiros gestores que preencheram um questionário sobre o uso das TIC na gestão. Os dados foram tratados com recurso a análise estatística e descritiva.

Resultados: Os enfermeiros gestores têm mais de 51 anos, mais de 28 anos de exercício profissional e mais de 11 anos na gestão. Adquiriram conhecimento sobre informática através da autoaprendizagem. As tecnologias mais conhecidas e utilizadas pelos enfermeiros gestores são o *e-mail* e a vídeo conferência.

Conclusão: Este estudo permitiu conhecer o perfil tecnológico dos enfermeiros gestores e identificar as tecnologias que podem ser usadas para melhorar os processos de gestão e a prestação de cuidados.

Palavras-chave: tecnologia da informação e comunicação; gestão em saúde; enfermagem

Resumen

Marco contextual: Las tecnologías de la información y la comunicación (TIC) ofrecen una multiplicidad de herramientas en la asistencia sanitaria. Con su uso, se espera que los responsables de enfermería puedan gestionar los recursos disponibles de forma eficiente.

Objetivo: Identificar el perfil tecnológico de los enfermeros gestores.

Metodología: Estudio cuantitativo, descriptivo y exploratorio. La muestra está formada por 74 enfermeros gestores que rellenaron un cuestionario sobre el uso de las TIC en la gestión. Los datos se procesaron mediante análisis estadísticos y descriptivos.

Resultados: Los enfermeros gestores son mayores de 51 años, cuentan con más de 28 años de ejercicio profesional y más de 11 años en gestión. Adquirieron conocimientos sobre informática a través del autoaprendizaje. Las tecnologías más conocidas y utilizadas por los enfermeros gestores son el correo electrónico y la videoconferencia.

Conclusión: Este estudio permitió conocer el perfil tecnológico de los enfermeros gestores e identificar las tecnologías que pueden utilizarse para mejorar los procesos de gestión y la prestación de cuidados.

Palabras clave: tecnología de la información y la comunicación; manejo de la salud; enfermería

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Introduction

The modern world faces several challenges posed by the continuous organizational changes demanded by increasingly complex, dynamic, and competitive markets. Moreover, the accelerated process of economic globalization caused by numerous political, economic, financial, social, and cultural transformations calls for innovative and secure solutions.

The emergence of Information and Communication Technologies (ICTs) and the consequent mass expansion of their use allows for meeting the challenges of a globalized society while contributing to its development in different sectors. Yee et al. (2018) assume health care as one of the sectors included in this development, where more effective quality care delivery and improved health standards in the general population are expected. Based on this assumption, ICTs are considered one of the pillars of success for organizations, as they contribute to the operation of processes and facilitate access to different data sources, proving to be exceptionally useful in managing activities (Aceto et al., 2018). In health care management, ICTs influence care efficiency, effectiveness, and safety (Martins et al., 2020). Considering the observed technological progress, nurse managers must adopt a proactive attitude about using the available technologies and ensure that the nursing practice, the quality of care, and the safety and quality of life of staff members and patients are significantly improved (Nikolic et al., 2018; Santos, 2019). The development of ICTs has allowed nurse managers to make faster and more objective decisions, increasing the quality of the services provided, reducing their costs, and contributing to the sustainability of health systems (Leonardsen et al., 2020; Santos, 2019). Thus, nurse managers must understand the impact of ICTs on health care and master their use to maximize management processes. Furthermore, it is urgent to understand the profile of technological skills acquired by nurse managers. This study aims to identify the technological profile of nurse managers.

Background

The last decades have witnessed an unprecedented movement of technological innovation. ICTs have become ubiquitous in societies and are increasingly present in people's daily lives, affecting and modifying lifestyles and influencing areas ranging from the economic to the social sector. For Araújo et al. (2019), using ICTs has shaped the information society by facilitating the availability and access to information. Today, information drives human and organizational activities, assuming great relevance in decision-making and problem-solving.

ICTs are essential tools for organizational management, as with the internet and constant updates and innovations, most information, a vital element for management, is online. Using ICTs allows capturing, processing, storing, and disseminating information. Moreover, according to Yee et al. (2018), ICTs enhance the evolution of management processes, making organizations efficient within

a restructured environment.

Ferreira (2015) supports ICTs' contribution to defining and implementing organizational strategies. According to the author, ICTs enable access to information and knowledge, make organizational information available, facilitate services, provide greater security and speed up decisions, reduce the time for service provision, automate procedures and simplify routines, and enable the coordination and organization of work.

Similarly, the demands created by technological evolution also impacted the health care sector. Institutions are forced to rethink their organizational culture and the management models adopted to ensure quality care delivery and health professionals' and patients' satisfaction (Cruz & Ferreira, 2014), thus highlighting the ICTs' contribution to health care. For the Portuguese *Direção-Geral da Saúde* (DGS - Directorate General of Health) in the National Health Plan 2012 - 2016 with an extension to 2020, this contribution is embodied in the quality of the service provided to citizens, the development, rationalization, and quality of health care delivery, the efficiency of health care facilities management, and the clever use of the information available (DGS, 2015). Thus, the development of ICTs has been decisive in the health care sector, promoting significant changes for its professionals and patients seeking services. Health technologies offer professionals a myriad of tools, such as telemedicine, clinical databases, email communication with patients, virtual libraries of information, medication prescription, tests/exams interpretation, work schedules distribution, and result reports. They also provide patients with a wide range of services and information, such as checking health-related information or booking an online appointment (Leonardsen et al., 2020).

In turn, incorporating ICTs in nursing supports nursing practice, management, consulting, research, teaching, and development as a profession, making nursing care delivery more effective, efficient, and safe (Wu et al., 2017). Thus, stakeholders seeking to improve continuously the quality of health care services must use technologies considerably and consciously (Landeiro et al., 2015).

In this sense, nurse managers contribute substantially to the sustainability of health care institutions, as they coordinate a large group of health professionals and participate in assessing the needs of patients who seek health care resources (Kirsch & Rodriguez, 2020). Thus, these professionals' use of ICTs is expected to optimize management processes as they allow organizing care delivery, meeting the patients' needs, managing human and material resources, and, at the same time, ensuring the quality of the organization's services (Ferreira, 2015; Rocha et al., 2016).

Among the technologies nurse managers use, it is worth noting: the generic type, such as email, intranet, discussion groups, and blogs; the clinical information recording type, such as *SCLínico*, SAPE (*Sistema de Apoio à Prática de Enfermagem* - Nursing Practice Support System) and SAM (*Sistema de Apoio ao Médico* - Physician Support System); the management type, such as SISQUAL, Hepic (Epidemiological surveillance in healthcare units), and SINAL; and the teaching type, such as e-learning, chats,



and video conferencing (Landeiro et al., 2015; Martins et al., 2020). Nurse managers using these technologies are expected to coordinate health services within quality standards and manage their human and material resources efficiently, thus contributing to organizational goals. For this to happen, it is crucial that nurse managers develop not only management and consultancy skills (Regulation no. 76/2018) but also informatics and information management skills (Landeiro et al., 2015). This aspect is particularly significant as, according to Pereira and Pinto (2017), it is urgent to avoid the illiteracy/digital appropriation correlation. Illiteracy can lead to a lack of appropriation, which occurs when individuals do not use ICTs because they lack the necessary knowledge. In turn, lack of appropriation can also lead to illiteracy, which occurs when individuals have access to ICTs but do not use or see the need to acquire knowledge.

Therefore, based on this assumption, it becomes relevant for managers to understand the potential benefits of using ICTs while understanding the need to acquire digital skills that allow them to use these resources appropriately.

Research question

Do nurse managers use ICTs in their work as part of the management process?

Methodology

An exploratory, descriptive, quantitative study was conducted considering the theme, the research question, and the established objective. This study's participants included nurse managers working at a Hospital Center in the Portuguese North Region (CHRN) and nurses who were members of the Portuguese Association of Nurse Managers and Leadership (APEGEL). The inclusion criteria were to be a nurse manager working at a CHRN or a nurse manager member of APEGEL.

The nurse managers were asked to complete a self-administered questionnaire about their socio-demographic, professional, and academic profile (gender, professional experience as a nurse, professional experience as a nurse manager, professional experience in the current service, and education). Nurse managers were also asked about their technological profile, namely their use of technological resources, knowledge, and use of teaching and management technologies for completing face-to-face training, the technologies they would like to receive training in, and how they would like to acquire knowledge about information technology and distance learning.

The nurse managers at the CHRN received the questionnaire by hand, and their data collection occurred between May and September 2017. The nurse managers who were APEGEL members received the questionnaire via email, and their data collection took place between May and June 2020. This study used a non-probability convenience sampling technique, with the data collection instrument being made available to all nurses in the sample.

Data analysis was performed using the IBM SPSS Statistics® software, version 25.0. Descriptive statistics (measures of central tendency and dispersion) were used to describe the variables under study, and the Chi-square (χ^2) test was used for variable association. A significance level of $p < 0.05$ was considered for comparing the groups.

This study obtained favorable opinions from the Portuguese CES - Ethics Committee for Health (CES 159 - 13), the President of the Board of Directors of the CHRN where the study was conducted, and the President of the APEGEL. Before beginning the study, the participants signed informed consent forms. The participants' confidentiality, anonymity, and privacy were ensured throughout the research process, following the ethical principles for medical research involving human subjects of the Declaration of Helsinki.

Results

This study's sample consisted of 30 nurse managers from a CHRN and 44 nurse managers who were members of the APEGEL, in a total of 74 participants, primarily women (73.0%). The nurse managers' mean age was 51.6 years (± 7.7), ranging from a minimum of 30 to a maximum of 62 years. They worked for a mean of 28.6 years (± 7.8), between 7 and 40 years. Regarding their management activity, the nurses worked as managers for a mean of 11.7 years (± 8.5) and worked in their current service for a mean of 9.2 years (± 8.6). The maximum time observed for management activity and permanence in the current service was 35 years.

Among the nurse managers, most held the title of specialist (94.6%), distributed by the nursing specialization areas of rehabilitation (32.4%), medical-surgical (31.0%), child health and pediatrics (12.2%), community (10.8%), mental and psychiatric health (4.1%), and maternal health and obstetrics (4.1%). When examining their education, 29 (39.2%) had a master's degree, 26 (35.1%) had a postgraduate degree, and 4 (5.4%) had another type of degree. The nurse managers mostly worked in hospital units (75.7%), followed by primary health care (14.8%) and nursing schools (2.7%). The questionnaire had a non-response rate of 6.8%.

The data obtained through the questionnaire allowed identifying the technological profile of this study's nurse managers and their relationship with distance learning concepts. Email (90.5%) was the most used technology for any purpose, followed by video conferencing (59.5%). It is worth noting that 68 (70.3%) nurse managers reported using other technological resources.

Regarding the nurse managers' knowledge of teaching technologies, video conferencing (66.2%), email (54.1%), and discussion groups (45.9%) were the most popular. Only 8 (10.8%) nurse managers reported knowing other technologies for teaching. In turn, email (37.8%) was the most used technology by nurse managers for teaching, followed by video conferencing (36.5%). About 10.8% of the participants reported using other technologies for teaching.

Email (60.8%) was the technology in the management area most known by nurse managers, followed by web technologies, discussion groups, and video conferencing, all with a percentage of knowledge equal to 36.5%. It is worth highlighting that 6 (8.1%) nurse managers expressed knowing other technologies that can be used in management. Email (4.3%) was also identified as the most used technology for management by the nurse managers in the sample, followed by web technologies (28.4%) and discussion groups (25.7%). Nevertheless, six (8.1%) nurse managers reported using other types of technologies for management. Regarding technologies that can be used to supplement

face-to-face training, it was demonstrated that video conferencing (63.5%), email (60.8%), and discussion groups (50.0%) were the most mentioned by nurse managers. Only 8.1% of the sample mentioned other types of technologies that can be used to supplement face-to-face training. Considering training needs, web technologies (33.8%), discussion groups (32.4%), blogs (32.4%), and video conferencing (29.7%) were the technologies that nurse managers would be interested in receiving training. The Chi-square (χ^2) non-parametric test for the association of variables was applied to determine whether there were statistical differences between the CHRN and APEGEL groups. Table 1 shows the results obtained.

Table 1

ICTs used among the CHRN and APEGEL nurse managers' groups

	Technologies	Group	Yes	No	χ^2	<i>p</i>
			<i>n</i> (%)	<i>n</i> (%)		
Have you ever used it for any purpose?	Web technologies	CHRN	17 (56.7%)	13 (43.3%)	10.26	0.003
		APEGEL	9 (20.5%)	35 (79.5%)		
Have you ever used it for any purpose?	Chat	CHRN	14 (46.7%)	16 (53.3%)	9.87	0.003
		APEGEL	6 (13.6%)	38 (86.4%)		
Do you have the knowledge to use it in teaching?	Discussion Groups	CHRN	21 (70.0%)	9 (30.0%)	11.75	0.001
		APEGEL	13 (29.5%)	31 (70.5%)		
Do you have the knowledge to use it in teaching?	Video conferencing	CHRN	25 (83.3%)	5 (16.7%)	6.61	0.013
		APEGEL	24 (54.4%)	20 (45.5%)		
Have you ever used it for teaching?	Discussion Groups	CHRN	13 (43.3%)	17 (56.7%)	8.24	0.004
		APEGEL	6 (13.6%)	38 (86.4%)		
Have you ever used it for teaching?	Video conferencing	CHRN	6 (20.0%)	24 (80.0%)	5.92	0.026
		APEGEL	21 (47.7%)	33 (52.3%)		
Do you have the knowledge to use it in management?	Email	CHRN	23 (76.7%)	7 (23.3%)	5.32	0.029
		APEGEL	22 (50.0%)	22 (50.0%)		
Have you ever used it for management?	Video conferencing	CHRN	27 (90.0%)	3 (10.0%)	5.62	0.026
		APEGEL	6 (13.6%)	38 (86.4%)		

Note. CHRN = Hospital Center in the Portuguese North Region. APEGEL = Portuguese Association of Nurse Managers and Leadership. χ^2 = Chi-square test. *p* = Probability.

In general, nurse managers acquired their knowledge about informatics through self-learning (75.7%), training courses (23.0%), or friends (23.0%). It was observed that the entire sample (100.0%) had Internet access at home. Nurse managers demonstrated limited knowledge regarding their relationship with the concepts of distance learning and e-learning. Although 62.2% of the sample had already participated in in-service education initiatives and training activities in this area, most participants (77.0%) reported being unfamiliar with these concepts.

Discussion

The introduction of ICTs in the health sector has facilitated access to data sources, contributing to the effectiveness and efficiency of management processes. Thus, nurse managers must possess the skills to take full advantage of ICTs use in their daily management activities. In this sense, this study sought to define the technological profile of the nurse managers in the sample to identify and understand the type of technical training they have, the ICTs they use most, and their knowledge about distance

learning concepts. In general, self-learning was the most common form for nurse managers to obtain knowledge about informatics, which may be associated with the ubiquitous presence of ICTs in society. This assumption relates partially to another finding: the entire sample (100.0%) had internet access at home. Similar results were found in the studies of Ferreira (2015), Landeiro et al. (2015), and Martins et al. (2020), in which most nurses also had internet access at home. Extrapolating these data to the Portuguese national context, the Portuguese National Institute of Statistics (INE, 2019), in a survey on ICTs use per household, observed that 80.9% of Portuguese households had internet access at home. This study demonstrates that the most used technologies, for any purpose, by nurse managers were email (90.5%) and video conferencing (59.5%). Other studies also found these technologies to be used by nurses in their professional activity and at a personal level (Ferreira, 2015; Landeiro et al., 2015; Martins et al., 2020).

Most nurse managers also mentioned email (74.3%) as the technology most used and most well-known for management. This corroborates Ferreira's findings (2015), which demonstrated that email was one of the most known and used technologies by nurse managers. These results align with Martins et al. (2020), who strengthened the importance of ICTs as essential tools for nursing management. Therefore, professionals seeking continuous improvement in their performance must use technologies thoughtfully and carefully (Landeiro et al., 2015).

Among the technologies mentioned, nurse managers would like to receive training in web technologies (33.8%), discussion groups (32.4%), blogs (32.4%), and video conferencing (29.7%). Ferreira (2015) also obtained similar results by determining technological training needs on video conferencing, discussion groups, web technologies, and email, among others. Landeiro et al. (2015) pointed out that nurses would like to receive training to increase their computer skills, highlighting that these significantly improve information management and ICTs use in health.

When examining the data regarding nurse managers' knowledge of technologies for teaching, video conferencing (66.2%), email (54.1%), and discussion groups (45.9%) are the most mentioned. Regarding the use of these technologies for teaching, email (37.8%) and video conferencing (36.5%) stand out as the most used. These data are corroborated by the studies of Ferreira (2015) and Landeiro et al. (2015), who also identified these technologies as being known by nurse managers, thus reinforcing their usefulness for teaching. Moreover, Landeiro et al. (2015) emphasized the importance of using distance learning techniques, such as e-learning, chats, and video conferencing, because these enable and promote nurses' continuous learning.

The technologies that nurse managers considered as strategies to assist face-to-face training are video conferencing (63.5%), email (60.8%), and discussion groups (50.0%). Similarly, evidence from Ferreira (2015) and Landeiro et al. (2015) also highlighted, among other technologies, email and video conferencing as resources that can assist

face-to-face training. However, despite the knowledge of these technologies as a supplement to face-to-face training, the results indicate that nurse managers have limited knowledge about e-learning, with 57 (77%) participants reporting a lack of familiarity with this concept. On the other hand, when analyzing the responses regarding these nurses' participation in distance learning and e-learning initiatives, 46 (62.2%) participants reported having already participated in such events. This finding can be explained by the fact that, although these nurses already had experience in distance learning activities, they considered that they should deepen their knowledge of the concepts related to this topic. Nurse managers also reported participating in educational and in-service training activities on distance learning and e-learning.

The Chi-square (χ^2) non-parametric test was applied to determine which of the two nurse managers' groups (the APEGEL members or the CHRN staff members) used more ICTs. The results demonstrated that the nurse managers from the CHRN group used web and chat technologies for any purpose and were more familiar with discussion groups and video conferencing technologies for teaching. They also made more use of discussion groups for teaching, were more familiar with email technology for management, and used more video conferencing technology for management. Although the data were collected from the two groups of nurse managers at different moments, it was demonstrated that the CHRN nurse managers used and knew more about the technologies than those from the APEGEL group. This fact may be explained by the type of settings where the nurses of the sample worked, as all the professionals from the CHRN group belonged to a hospital unit, while those from the APEGEL group had more diverse work settings.

Another relevant finding was that the nurse managers of the APEGEL group used video conferencing more significantly for teaching than the nurse managers of the CHRN group. This can be due to the period in which their data were collected, which corresponded to the COVID-19 pandemic context.

Thus, ICTs' contribution to the health sector at the management level and throughout the value chain is highlighted. Health technologies make various tools available to nurse managers, improving decision-making processes and providing efficient and quality services. The nurse managers of this study used several technological resources, such as video conferencing, email, and chat, to maximize productivity through adequate management of the available resources.

The findings of this study allowed for identifying nurse managers' technological profiles, proving that they mainly acquire their digital knowledge through self-learning. It was observed that all of them have internet access at home and that most nurses had already participated in distance learning/e-learning training initiatives. Regarding the participants' knowledge of technologies, video conferencing, email and discussion groups were the best known for teaching, and email was the best known for management.

It is worth noting that this study has limitations. Its main limitation relates to the data collection period, which was carried out in two different moments. Nevertheless,

this study's findings increase the knowledge of nursing management and contribute to consolidating the existing information.

Another limitation of this study is that the participants did not have the opportunity to specify the technologies when answering "other" in the questionnaire.

Conclusion

Information is the current driver of organizational activities due to its relevance in decision-making processes. Thus, data collection, processing, and presentation are essential for efficient management. ICTs are technological resources that help the treatment and dissemination of information and have been increasingly used in management processes, including nursing management.

This study allowed for identifying the technological profile of a sample of nurse managers, highlighting the technologies they know and use in their professional practice. Nevertheless, further studies on this theme will be relevant. This study recommends that further research be conducted to explore the most commonly used ICTs in each context of nurse managers' clinical practice and their influence on resource management and quality of care. This study has met its objective by answering its research question. Despite the limitations inherent to the study, the results demonstrated that ICTs possess the strong potential to simplify and streamline the nursing management process. Thus, nurse managers must acquire the necessary skills to maximize the use of ICTs, improving management processes and, simultaneously, care delivery in health services.

Author contributions

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