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Challenges of ICT use for nurse-patient communication in Portugal: a mixed methods research

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Abstract

Background The future of digital health holds enormous potential to improve communication with patients and optimize the delivery of care. The current study aims to answer the central question of which knowledge, skills, and competencies in the use of Information and Communication Technologies (ICT), health professionals should develop to promote efficient remote communication processes with patients.

Methods A mixed-method approach was used for data collection, combining an online survey with semi-structured interviews. The study was structured into four key phases/question groups: professional context, practices related to the use of ICT in patient communication, training needs, and other relevant information. Qualitative data from open-ended responses were analysed using thematic analysis and triangulated with quantitative findings where applicable. The target population consisted of nursing professionals with patient care experience. The survey was distributed electronically, with 194 nurses fully or partially completing the questionnaire. Additionally, 24 interviews were conducted.

Results The data shows that around 25.85% of professionals do not establish distance communication and 95.4% do not use telehealth. Telephone and cellular contact are the most used means of communication with patients (62.60%). Despite the predominance of face-to-face care, 62.5% stated that they do not experience difficulties or concerns, recognizing ICT as an increasingly integrated and advantageous tool for remote communication. Most professionals (80.1%) believe that there should be more training and courses in digital communication with patients and the use of ICT in healthcare, to address gaps in academic training. The growth of telemedicine and the digitalization of healthcare services reinforce the need for continuous professional training in this area.

Conclusions Most professionals have a positive perception of the opportunities created by emerging technologies, but they also express concerns about the ethical, social, safety and technical challenges that need to be addressed. The introduction of mandatory ICT courses in academic education and the implementation of continuous training are essential to prepare professionals for the challenges of telehealth and digital communication in healthcare. They emphasize the need for a well-structured digital transition, ensuring that technologies complement healthcare rather than replace human care.

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Keywords Nurse-patient remote communication, ICT, Education, Professional training, Digital health, Telehealth

Introduction

The integration of Information and Communication Technologies (ICT) into contemporary healthcare has progressively reshaped traditional models of communication. ICT, a term encompassing devices such as computers, smartphones, tablets, and the Internet, comprises technological resources that facilitate interaction and information exchange across sectors including education, business, and scientific research [1]. Within the health sector, ICT — often referred to as Information and Communication Technologies in Health (ICTH) — serves a pivotal function, allowing the generation, storage, transmission, and secure access to data. As early as 2005, the World Health Organization (WHO) recognized the significance of these developments by defining eHealth as the safe and cost-effective use of ICTs in support of healthcare delivery, surveillance, health education, and research [2]. The twenty-first century has witnessed exponential growth in these technologies, particularly in the form of telehealth, which delivers medical services remotely via digital platforms [3].

This digital transformation has become a central priority within healthcare policy frameworks, notably in the European Union and Portugal's National Health Service (SNS). The 2024 Digital Decade eHealth Indicator Study reveals that Portugal is among the leading nations in digital health advancement, ranking 10 th in access to digital health data and achieving a perfect score in citizen access to electronic health records. These outcomes place Portugal above the European Union average and underscore national progress in digital inclusion, particularly among children and the elderly. The country's integration into international networks such as the Health Information Network (HIN) and the Global Digital Health Certification Network (GDHCN), both under the WHO umbrella, further evidences its commitment to secure, interoperable, and high-quality digital health systems.

Simultaneously, the rise of technologies such as high-speed internet, wearable sensors, and secure communication systems has enabled real-time interaction between healthcare providers and patients, overcoming geographic limitations [4–6]. The widespread adoption of eHealth and telemedicine, enhanced by developments in Artificial Intelligence (AI), is reshaping the patient experience and the delivery of care [7, 8]. These tools not only extend access but also improve continuity of care and empower patients to take active roles in their health management.

Despite these promising developments, the integration of ICT into everyday clinical practice presents persistent challenges. Professionals often struggle to keep up with rapidly evolving technologies while serving an increasingly diverse and aging population [9–11]. In Portugal, social, cultural, and economic disparities, recognized by the Portuguese National Statistics Institute (INE), further complicate equitable access and usage [12]. These obstacles highlight the necessity for well-structured, evidence-based strategies that can support healthcare professionals in effectively incorporating digital tools into patient communication.

Nurses play a critical role in this transformation. Representing the largest professional group in the healthcare system, nurses are central to the quality and safety of care delivery [13]. Teleconsultations and virtual visits have enhanced the nurse-patient relationship by allowing personalized, timely, and geographically unrestricted care [14, 15]. These technologies enable nurses to address patient concerns in real time, improving satisfaction and engagement while supporting adherence to treatment plans [16–18]. Active patient participation in healthcare decisions has been shown to lead to improved health outcomes [19], and telemedicine further facilitates this by fostering connection and trust [20]. Nurses have emerged as key players in implementing telemedicine, and their leadership is essential to building a more accessible and effective digital healthcare system. The continuous professional development ensures that nurses remain competent and well-equipped to provide high-quality care to their patients [21, 22].

Beyond their clinical role, nurses act as public health educators who combat misinformation and disseminate accurate health information [23]. This expanded responsibility requires not only technical aptitude but also strong communication skills, digital fluency, and ethical awareness [11]. Maintaining therapeutic relationships in virtual settings presents unique challenges, as does upholding the same ethical standards, such as privacy, informed consent, and data security, across both digital and in-person care environments [24–27]. Addressing these ethical dimensions is vital to ensuring that telemedicine upholds the highest standards of professional care [9].

To meet these demands, nurses must be adequately prepared through targeted education and training programs. Research consistently points to gaps in both academic curricula and professional development in relation to ICT use, which remain significant barriers to technology adoption [11, 28, 29]. Ensuring that nurses are involved in the design and implementation phases of digital solutions, and that they are supported

with appropriate technological infrastructure, can foster an organizational culture more conducive to innovation [30]. Moreover, communication and interpersonal skills, particularly when mediated through digital platforms, are increasingly regarded as essential competencies for effective clinical practice [11].

Considering this context, the present study seeks to explore and clarify the specific knowledge, skills, and competencies that healthcare professionals, especially nurses, must develop to ensure effective communication with patients through digital means. The study investigates not only the contexts in which ICT is most beneficial or necessary but also the barriers faced in its adoption and the ethical, relational, and practical considerations involved. Through this inquiry, the aim is to generate scientific evidence that can inform the development of structured training programs and professional development strategies. These programs will seek to enhance communication abilities, support humanized and ethical care, and ultimately promote informed decision-making and improved health literacy among patients, families, and communities.

This study is important and original in its focus on the communication competencies nurses need to deliver effective, ethical, and humanized care in digital healthcare settings. While ICT integration in health is advancing rapidly, especially in leading countries like Portugal, there is a lack of targeted research on the practical and ethical challenges nurses face. By addressing these gaps and proposing evidence-based training strategies, this study contributes essential insights to support equitable, patient-centered digital healthcare.

Methods

Aim, design and setting of the study

This study employed a convergent mixed-methods design (QUAL + quan), as outlined by Creswell [31], integrating qualitative and quantitative data collection within the same timeframe. The research aimed to explore the use of digital technologies in nurse-patient communication, professional training needs, and contextual factors influencing these practices.

Data collection was structured into four thematic areas: (1) professional context, (2) practices involving the use of ICT in patient communication, (3) training needs, and (4) additional relevant information (personal points of view of the participants that help to complement the answers given in previous questions). Both the survey and interviews were designed to capture data aligned with these domains. Thematic analysis was used to interpret qualitative data [32, 33].

A qualitative exploratory component was included to gain deeper insights from nursing professionals. Participant selection followed a non-probability convenience sampling method [34, 35, 36], targeting individuals who were readily accessible during the study period. While this approach is efficient in terms of time and cost, it limits the generalizability of the findings [37].

Data were collected through a digital survey and online interviews, focusing on effective digital tools and multimedia applications used in clinical communication; contexts in which these tools are most beneficial; training needs to enhance communication in nursing practice. The triangulation of qualitative data from open-ended responses with quantitative findings was applied when the research questions and the nature of the data allowed for a meaningful comparison and corroboration of insights across both data types. This was particularly relevant in understanding the nuances behind the quantitative trends observed in areas such as the perceived benefits or challenges of ICT use.

The participants included individuals with professional experience in patient care within the nursing field.

The online survey, comprising both closed- and open-ended questions, was developed using the University of Aveiro's digital form platform and disseminated via email. The interviews, conducted through Zoom Meetings, followed a semi-structured format consisting exclusively of open-ended questions (see Supplementary Material 1– Interview Guide). The principal investigator, who conducted the interviews, had received prior training in the interview procedures and was supervised throughout the data collection process. During the interviews, this investigator read each question aloud and documented responses verbatim. Participants were later provided with a transcribed PDF of their responses for verification.

Data collection occurred over a two-month period (November 1 to December 31, 2024). On average, surveys took approximately 15 min to complete, while interviews lasted around 30 min. All data are securely stored in a restricted-access digital repository, accessible only to the principal investigator. The data will be retained for a maximum of two years, after which all records will be permanently deleted.

The rationale for using a Mixed Methods Research (MMR) design was to leverage the strengths of both quantitative and qualitative approaches, enabling the collection of both objective data and subjective insights from a diverse participant pool [38, 39]. In health research, qualitative methods are increasingly valued for their role in elucidating human experiences, attributing meaning to health and illness, supporting the humanization of care, informing evidence-based practice, and driving change at individual and policy levels [40–42]. Despite its advantages, this approach does not eliminate the limitations associated with non-random sampling and potential biases in participant representation [37].

The study collected data from nurses with direct patient care experience, focusing on their use of digital technologies in communication with patients. Information was gathered on professional background, including years of experience, work setting, and patient demographics. The study explored the types of technologies and communication channels used, such as computers, smartphones, telehealth applications, email, chat, and video conferencing, along with the frequency and contexts in which these tools were applied. Participants provided their perceptions of the impact of ICT on communication quality, patient care, and workflow efficiency, as well as perceived benefits and limitations such as improved accessibility, potential loss of personal connection, and challenges interpreting non-verbal cues. The study also addressed technological and organizational barriers, including lack of resources, internet access issues, limited digital literacy, and cultural or linguistic obstacles. Data were collected on the availability and effectiveness of technical support in healthcare settings, and on the extent of academic and professional training received in digital communication. Participants were invited to reflect on their training needs and propose relevant topics for future educational programs. Finally, the study included open-ended questions encouraging nurses to express their views on the evolving role of digital health technologies and their anticipated impact on future communication practices in healthcare.

Characteristics of participants

The participants included nursing professionals with experience in patient care. Individuals without experience in the nursing profession were excluded.

The collaborating institutions in Portugal were: Unidade Local de Saúde da Região de Aveiro, E. P. E..; Unidade Local de Saúde de Entre Douro e Vouga, E.P.E.; Unidade Local de Saúde de Gaia e Espinho, E.P.E.; Unidade Local de Saúde de Matosinhos, E.P.E.; and Escola Superior de Saúde de Santa Maria, Porto. Authorization to conduct this research were obtained from the CE-ICVS (Ethics Committee for Research in Life and Health Sciences) of the CAC-EMHA (Centro Académico Clínico Egas Moniz Health Alliance) [35].

Five healthcare professionals acted as liaison links/interlocutors between the principal investigator and each of the collaborating institutions involved. These liaisons sent an institutional email to all nursing professionals in their institution, with an invitation to complete the online survey. Simultaneously, each liaison established a personal contact with five nursing professionals of their own choice, inviting them to participate freely and voluntarily as interviewees in the study, with the requirement that they should and could not complete the online survey. Each liaison then informed the interviewer of each participant's availability to then schedule the best date for the online interview through the Zoom Meeting platform. The interviewer only had contact with the interviewees when the interviews were conducted. Each participant interview was identified by a code and no personal information was shared.

Data analysis

Descriptive statistics using SPSS 29.0 were applied to calculate frequencies, means, SD, and correlation analysis. Interview data were transcribed word-for-word, and all data were securely stored, managed, accessed, and analysed within a protected SharePoint environment.

Results

The results showed that out of 309 accesses to the survey platform, 292 began filling it out. However, 6 quit immediately, 92 only answered the sociodemographic phase, 8 abandoned after the second phase, 11 after the third phase, and 175 completed the questionnaire in its entirety. 194 participants who answered at least up to the second phase were considered valid, with 90% completed the survey in full. Regarding the interviews, 25 nursing professionals were initially invited, with one dropout, resulting in 24 completed interviews.

Quantitative results

Professional context

The survey respondents are predominantly experienced, with 74.2% having more than 15 years of practice, and nearly half (47.9%) with over 20 years of experience. Only 4.1% are at the beginning of their careers. The interviewed professionals also exhibit a high level of experience, with 83.4% having over 10 years of practice and 41.7% exceeding 20 years of experience. However, there is a more balanced distribution between those with 10 to 19 years (41.7%) and those with more than 20 years, reflecting a group with diverse professional backgrounds.

Among the survey respondents, 99% work in the National Health Service (SNS), with 84% employed in three Local Health Units (ULS de Gaia/Espinho, ULS de Entre Douro e Vouga, and ULS da Região de Aveiro). The presence in educational institutions, such as the Escola Superior de Saúde de Santa Maria, is minimal (1%). Among the interviewed professionals, the majority work in hospital settings (88.5%), specializing in intensive care, obstetrics, oncology, and neurology. Only 12.5% work in primary care and the private sector, a slightly higher percentage than reported in the survey.

The survey respondents have more experience with adults (45%) and elderly patients over 70 years old (22.3%), with young people up to 17 years old being the least frequent group (6.4%). In contrast, the interviewed professionals report a more diverse patient

profile, covering adults and elderly (87.5%) but also infants, children, and young people (12.5%). They highlight experience with chronic patients and patients with specific needs.

Practices related to the use of ICT in patient communication

ICT used and consistency of distance communication with patients The results indicate that 24.7% of professionals do not use any technology for remote communication, reflecting the predominance of in-person care. Among those who use ICT, the most common devices are the landline telephone (23.1%) and the mobile phone (23.1%), highlighting the prevalence of traditional methods. Only 21.9% use a computer, 6.9% rely on a smartphone, and tablet usage is marginal.

Although some professionals use different means depending on the context, 27.0% report not using any channel for remote communication (Fig. 1). The most used method is telephone contact (41.2%), followed by email (23.5%). The adoption of chat tools (written messages 4.2%, audio messages 0.3%) and video conferencing (3.8%) is minimal, suggesting that these tools are not widely accessible or considered practical in the analysed contexts.

Adherence to telehealth is low, with only 4.6% of professionals using specific applications. Among the mentioned platforms are teleconsultation tools, SClínico, Patient Care, and SNS platforms. The main barriers include a lack of training, resistance to technology, lack of confidence in its effectiveness, and technological and institutional limitations.

Many professionals (36.6%) never use ICT for remote communication, reflecting the predominance of in-person care (Fig. 2). Another 19.6% communicate occasionally, 14.9% use it rarely, and only 22.2% regularly use ICT whenever physical presence is not essential. Just 4.1% systematically use ICT to minimize unnecessary travel.

The primary situation identified for the use of ICT is conducting follow-up consultations and scheduling surveillance appointments (69.1%). Other contexts include emergency situations (51.4%), post-operative or rehabilitation follow-up (39.2%), and pre-surgical clarification (29.8%). Additionally, ICT is used for summons, providing information about patients to family members, managing the National Vaccination Program, caregiver education, and post-discharge follow-up (24–48 h).

It is important to mention that most participants in this study work in Local Health Units (ULS) which are integrated healthcare organizations in Portugal that combine primary care, hospital care, and community health services under a single administrative structure. Their goal is to ensure coordinated, continuous, and efficient care for a specific geographic population.

Perceptions of the potential, benefits, difficulties and risks associated with the use of ICT Most respondents (85.1%) believe that ICT facilitates communication, providing greater flexibility in patient interaction. Additionally, 84.6% consider that these technologies enable better patient follow-up, reducing the dependence on in-person consultations. However, concerns remain regarding the lack of training, inadequate infrastructure, and the resis-

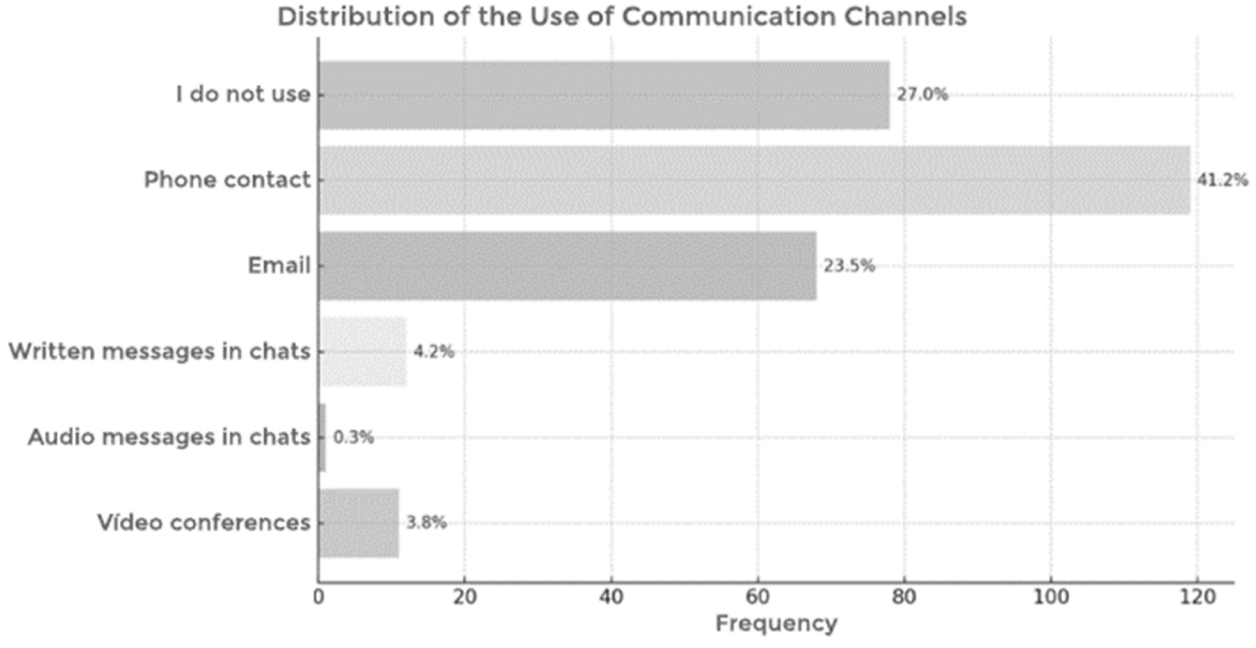

Fig. 1 Distribution of the use of communication channels

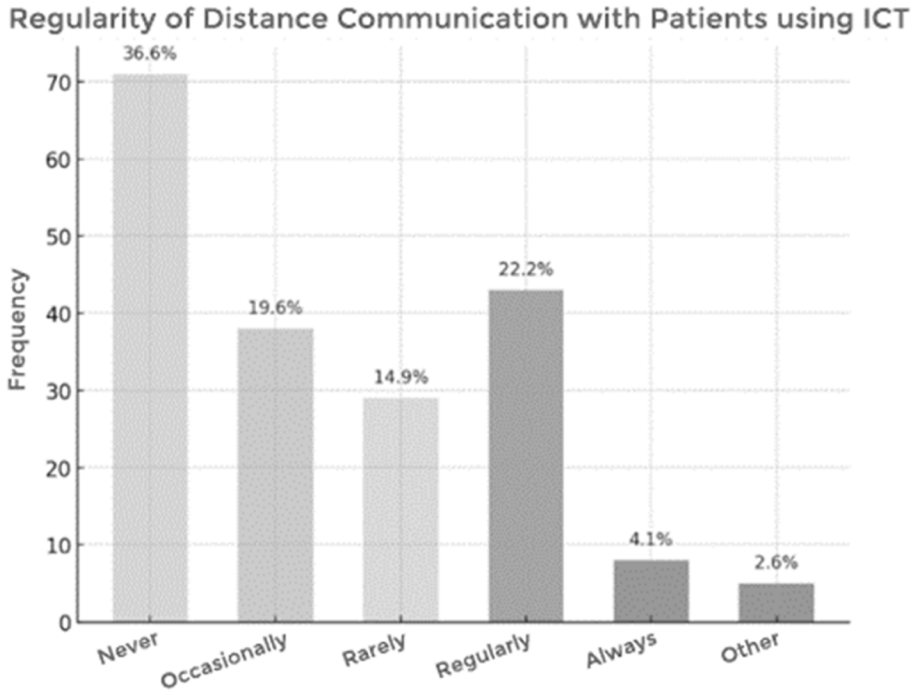

Fig. 2 Regularity of distance communication with patients using ICT

tance of some professionals and patients to adopting these tools.

Approximately 71.2% of professionals recognize the potential of ICT to mitigate the shortage of human and material resources. However, 17% of respondents express scepticism about its effectiveness, suggesting that the current infrastructure may not be sufficient for a significant impact.

Despite the benefits, 52.1% of professionals express concerns about the risk of diagnostic errors due to failures in information transmission. Additionally, 76.2% acknowledge that digital communication may hinder the interpretation of non-verbal cues, compromising the quality of care.

Although 79.9% of respondents believe that ICT increases patient satisfaction by improving follow-up, 49.5% report that some patients experience discomfort due to a lack of experience with these technologies. The need for greater digital literacy training is evident to optimize ICT adoption.

Some of the challenges identified are related to: infrastructure and technical support (32.5% of professionals report not having access to adequate technical support); privacy and security concerns (18% of professionals are concerned about the security of patient data); cultural and linguistic barriers (24.2% of professionals face difficulties related to cultural diversity and language barriers); and depersonalization of care (37.6% of respondents perceive a decline in the quality of interpersonal relationships).

Table 1 University education, awareness or participation in professional training courses related to remote communication or telehealth

Training on remote communication with patients or telehealth		
	University education	**Awareness or professional training**
No	84,4%	89,2%
Yes	15,6%	10,8%

Training needs

The vast majority of healthcare professionals (84.4%) indicated that they did not receive university training on the use of ICT in patient communication (Table 1). Only 15.6% had academic training in this field, suggesting that academic curricula still do not comprehensively integrate content on telemedicine and eHealth.

Professional training in ICT and telehealth is even more limited: 89.2% of respondents stated that they were unaware of or had not attended professional training courses in this field. Only 10.8% had access to specific training, highlighting the limited availability of courses in this area. The identified courses include short training sessions on digital communication platforms, information security, and the use of electronic clinical systems.

Most professionals (80.1%) believe that more training and courses on ICT and emerging technologies in patient communication should be available. The growing digitalization of healthcare services requires professionals to acquire the necessary skills to use these tools safely and effectively.

Qualitative results

Practices related to the use of ICT in patient communication

ICT used and regularity with which distance communication is established The use of Information and Communication Technologies (ICT) in remote communication between healthcare professionals and patients presents a diversity of practices, with variations depending on the specialty and available institutional resources. The results indicate that most of professionals interviewed use at least one technology to communicate with patients, while very few report not using any digital means.

Telephone is the most widely used tool for immediate contact, essential in urgent situations and post-discharge follow-up. Email is used for sending formal information, such as reports, informational brochures, or administrative communication. Some professionals use videoconferencing in teleconsultation contexts, though still facing operational limitations. Some teams use WhatsApp for quick information exchange, but with concerns about data security. Other institutional platforms, such as RSE Live and Telessaúde SPMs services are used for telemonitoring, but adoption remains limited due to technological barriers (16.7%).

The frequency of contact varies according to the specialty. Specialties such as paediatric oncology and postnatal care maintain daily or weekly contact, Telemonitoring systems enable continuous communication but still face implementation challenges, and follow-up consultations are commonly conducted via telephone, though the lack of a structured system for remote follow-up limits their efficiency.

Perceptions of the potential, benefits, difficulties and risks associated with the use of ICT The professionals highlight the following positive effects of ICT on communication with patients: greater accessibility and faster service; ease of contact; reduction of geographical and mobility barriers and possibility of remote monitoring.

Despite the advantages, the professionals interviewed express concerns about information security and patient identity verification. Other report difficulties related to patients' digital literacy and their own adaptation to technologies. Other important challenges were identified, related to resistance from elderly patients, lack of non-verbal communication, technological failures and access difficulties and problems in interpreting transmitted information. However, most do not report any difficulties, viewing ICT as an integrated and beneficial tool:

> *"I have no difficulty using ICT, however, I recognize certain limitations in its use because the target audience is highly vulnerable. The information conveyed through technology may not always be delivered correctly and empathetically by healthcare professionals. Additionally, non-verbal language and the ability to perceive what recipients are interpreting and feeling (being aware of the other's perception) are crucial in our field. Without the in-person component, many "unspoken" messages go unnoticed." (P5)*

> *"Firstly, the health services should be better equipped with the means to communicate with patients remotely. Family members should be more involved since they have more experience in using technology, given the age of the patients. We—health professionals and nurses—should be more interested in using technology, there isn't much curiosity yet." (P12)*

> *"The use of ICT can interfere with communication processes because patients do not see us or our expressions—unless it is a video call, which may affect understanding and safety. When dealing with different age groups, information given over the phone may not be retained or correctly understood, potentially compromising the healthcare plan." (P4)*

> *"In my understanding, we must know how to capitalize on emerging technologies. The patient must be at the center, and technology must be used intelligently, with many ethical issues safeguarded. It must be seen from a "win–win" perspective, benefiting both the patient and the healthcare professional. AI should not replace healthcare professionals—nothing in healthcare should replace the therapeutic relationship built on trust between the patient and the professional. That trust can only be established between people, not machines. Human involvement must always be present." (P9)*

> *"Some people lack access and/or the skills and knowledge to use ICT, which creates a risk of not reaching everyone. Progress must be inclusive, ensuring that no one is left behind, especially those who do not have the same capabilities." (P4)*

Training needs

A significant number of professionals interviewed received training in communication during their academic education, but did not receive any training on ICT during their academic education, a small group reported learning to use ICT in a self-taught manner and another group stated that the topic was covered in postgraduate training.

Professional training in ICT and telehealth remains limited with professionals being unaware of training opportunities in this field. Some have never attended courses on digital communication with patients and others have had indirect exposure to the topic through webinars and institutional events. Nursing professionals

report a lack of structured and accessible training opportunities, consider available courses to be superficial and insufficiently practical and state that they learned to use ICT through self-directed learning.

Discussion

The data analysis of this study reveals mixed opinions and perceptions regarding the use of Information and Communication Technologies (ICT) in remote communication with patients and the overall impact of digitalization on healthcare.

The findings indicate a high level of acceptance of ICT among healthcare professionals, particularly in the context of remote communication between nurses and patients. A significant majority (85.1%) reported that ICT improves communication in healthcare, while 84.6% recognised its role in enhancing patient follow-up. Moreover, 79.9% believed that ICT contributes positively to patient satisfaction, and 83% considered it a valuable tool in their daily practice. These results highlight a perception that ICT not only facilitates faster and more flexible communication but also supports patient-centred care.

Professionals also acknowledged the strategic value of ICT in addressing challenges within the National Health Service, with 71.2% identifying its potential to mitigate resource constraints. Additionally, 84.5% recognised the positive impact of ICT in enabling healthcare interventions that would otherwise not be feasible, particularly in contexts marked by geographic isolation or limited mobility. It increases accessibility related to reduction of geographical and mobility barriers, improving access to services and decreasing waiting lists and unnecessary travel. Telemedicine interventions help bridge healthcare gaps, reduce health disparities, and improve health outcomes in vulnerable populations [43], enhancing patient care, improving health outcomes, and overcoming geographical barriers in healthcare delivery [44, 45]. This aligns with qualitative findings from the interviews, in which 12.5% of professionals specifically noted that ICT reduces geographical and mobility barriers, offering significant advantages for patients who have trouble travelling to healthcare facilities. By leveraging telecommunication technologies, healthcare providers can remotely assess, diagnose, and treat patients, overcoming geographical challenges and reducing the burden on physical healthcare infrastructure [46]. The reduction of travel also minimizes the ecological footprint, while optimized resource management enhances the sustainability and efficiency of healthcare systems.

It enhances communication efficiency and resource optimization, reducing bureaucracy, allowing professionals to dedicate more time to patient care. It helps reduce waiting times for consultations and follow-ups. The most common applications included follow-up consultations (69.1%), urgent communications (51.4%), and post-discharge monitoring (39.2%). These patterns suggest that ICT is becoming integrated into various stages of the care continuum, supporting clinical decision-making and enabling timely interventions. Telemedicine has shown promise in reducing hospital readmissions, a critical factor in healthcare costs and patient well-being [47]. Finally, the potential of artificial intelligence (AI) will support clinical decision-making and remote patient monitoring.

However, despite the overall positive outlook, important concerns persist regarding the quality of remote interactions. Healthcare digitalization raises significant concerns related to the quality of interactions, the humanization of care, and information security. Notably, 76.2% of respondents reported that digital communication makes it difficult to interpret non-verbal cues, which are critical to building empathy and understanding in clinical encounters. Telemedicine, while convenient, can sometimes feel impersonal, leading to concerns about the loss of the "human touch" in healthcare [48]. Digital interactions should complement physical interactions and never replace human interactions. It should complement traditional care by creating multiple communication channels and uncluttering resources [10]. This aligns with interview findings where professionals expressed that the absence of facial expressions and body language compromises the emotional dimension of care, particularly in the communication of sensitive or complex information. Excessive reliance on ICT may weaken interpersonal relationships, reducing empathy and trust and making it harder to address patients'emotional needs, increasing the risk of dehumanization in care. Related to this, 52.1% of survey participants expressed concerns over the diagnostic reliability of remote consultations, suggesting that the lack of visual and tactile assessment may reduce clinical accuracy. Moreover, 37.6% of respondents perceived some degree of depersonalization in ICT-mediated communication, indicating that technological tools may weaken the interpersonal connection essential to therapeutic relationships. Although many professionals recognised ICT as a useful complement to face-to-face care, particularly in enhancing accessibility and efficiency, there was consensus that it cannot fully replicate the human presence needed in certain clinical situations. Interview participants emphasized that in cases requiring emotional support, empathy, or complex decision-making, in-person interaction remains irreplaceable.

Nevertheless, confidence in the use of ICT is growing, with 62.5% of professionals reporting no significant difficulties or concerns. Benefits identified included improved accessibility and continuity of care (41.7%),

time and resource efficiency (25%), and improved security and traceability of clinical information (up to 12.5%). Digital communication is a source of opportunities, however, questions about quality, access, and equality with respect to the older adults and chronically ill patients remain [10]. Still, digital literacy and infrastructure limitations, particularly among older or more vulnerable patients, continue to pose barriers to equitable implementation. Many patients, particularly the elderly and socioeconomically disadvantaged groups, lack the necessary digital skills to use ICT effectively, may lead to the exclusion of vulnerable groups. Not all patients have equal access to digital devices, or the digital literacy required for telemedicine. This can exacerbate health disparities, as those without access to technology may be excluded from telehealth services [49]. Nurses must work to provide equitable access to care for all patients, regardless of their technological resources or abilities. To address disparities, nurses and healthcare organizations need to explore alternative communication methods [50].

The increasing reliance on digital solutions also raises concerns about data protection and the ethical implications of AI-driven decision-making, underscoring the need for secure digital platforms and regulatory frameworks. Improper use of digital devices in telenursing can lead to errors in data collection, transmission, and analysis, which can affect patient safety and quality of care [50]. Maintaining the privacy and security of patient health information in a telemedicine environment is paramount [51]. Nurses must ensure that patient health information is securely transmitted and stored during telemedicine interactions. Protecting patient privacy and confidentiality in the digital realm is paramount [24].

The findings suggest that ICT is often perceived as an alternative resource rather than a primary communication tool. Healthcare professionals, including nurses, may resist the adoption of telemedicine due to concerns about changes in workflow, potential job displacement, or perceived limitations in the quality of care [52]. Some nurses may resist telemedicine because they value in-person interactions with patients or believe that it cannot fully replace physical assessments [53]. The results also show that nearly half of the respondents (49.5%) believe that, although a portion of patients is receptive to communication via ICT (35.1% rated it as sufficient and 8.2% as very good), difficulties in using digital tools and a lack of knowledge and experience on how to operate new technologies may cause discomfort among patients, leading them to prefer face-to-face consultations only. Several other factors contribute to the limited adoption of ICT in healthcare communication, including: a preference for traditional in-person care and telephone communication, structural and technological barriers preventing widespread use of telehealth applications, and insufficient institutional support and investment in digitalization. Insufficient bandwidth and outdated equipment can hinder the effectiveness of telemedicine consultations [54]. The results indicate that the primary barrier to the use of ICT in remote healthcare communication is the lack of adequate equipment and software, reported by 50.0% of respondents. Connectivity issues were also reported by 16.0% of respondents, highlighting the importance of improving network infrastructure to ensure reliable access to digital resources. Additionally, 34.0% identified the need for professional training as a limiting factor in the adoption of these tools, suggesting that investment in capacity building is essential to increase both acceptance and effective use of ICT.

Nurses need to be proficient in using telemedicine platforms, conducting virtual assessments, and ensuring the technology does not compromise the quality of care [21]. Inadequate training can lead to technical difficulties during consultations and decreased confidence in using telemedicine [55]. To address the existing training gaps, various measures were suggested by the participants in this study. These include the development of structured and certified training programs incorporating practical applications and case-based learning, the integration of ICT training into academic curricula to ensure future healthcare professionals are prepared for digital healthcare challenges, and the promotion of continuous professional development programs within healthcare institutions to encourage ongoing learning and adaptation. Additionally, the creation of e-learning platforms was recommended to provide flexible and easily accessible training opportunities for professionals at all career stages.

The respondents identified four key areas for targeted training in digital health. The first area focuses on strategies for digital health communication, emphasizing the need to adapt communication approaches for different age groups, effectively convey severe diagnoses via ICT, enhance patient adherence to treatment plans using digital tools, and empower patients to utilize ICT for healthcare management. The second area pertains to mastering telehealth technologies and platforms, which includes training in telemonitoring and remote patient care systems, creating accessible and engaging digital health content, and utilizing digital platforms for sending alerts and reminders to patients. The third area highlights security and ethics in digital communication, stressing the importance of implementing best practices in data protection and upholding ethical principles in telehealth interactions. Lastly, digital literacy and ICT project development emerged as a crucial area, underscoring the need to enhance digital literacy among healthcare professionals and develop innovative ICT solutions tailored to the evolving needs of healthcare services.

To address these issues, healthcare institutions must prioritize training initiatives, invest in technology, and raise awareness among professionals regarding the benefits of digitalization in healthcare. The effective integration of technological and digital solutions requires a collective effort from institutions, professionals, and policymakers to ensure the modernization of healthcare services. To address the challenges in implementing telemedicine in nursing practice, a multifaceted approach is required, which include investments in technology infrastructure, policy reform, ongoing education and training for nursing staff, and a commitment to ensuring equitable access to care for all patients, regardless of their digital resources or abilities [56]. It is recommended that nurses stay abreast of technological innovations and be prepared to adapt to new tools and platforms as they emerge. Healthcare organizations should invest in state-of-the-art telemedicine infrastructure to support nursing practice [9].

Despite the contributions of this study to understanding the use of Information and Communication Technologies (ICT) in nurse-patient communication, the use of a non-probabilistic sampling strategy inherently introduces selection bias, as participants were recruited through institutional liaison, being geographically and institutionally concentrated, limiting the representativeness of the sample and, consequently, the generalizability of the results to the broader population of nursing professionals in Portugal. As a result, the findings may not adequately reflect the diversity of healthcare settings, particularly in underrepresented sectors such as private practice or rural primary care services. Methodologically, while the study employed a mixed methods design to integrate quantitative and qualitative insights, there was a notable imbalance between the two components: the qualitative sample was relatively small (24 interviews) compared to the quantitative survey (194 responses), which may have restricted the breadth of experiences and minority perspectives represented. Furthermore, the process of collecting interview data through responses that were documented by the principal investigator during the conversations, a potential interpretation bias may have led to the loss of subtle but important information. The study also presents limitations regarding external validity. While participants' years of experience were considered, the analysis lacks further demographic exploration, such as the influence of age, regional differences, or specific nursing roles on ICT use. Similarly, the study does not delve into how socioeconomic or cultural contexts may shape access to or attitudes toward digital communication tools, an especially pertinent issue in increasingly diverse healthcare environments.

Future research should pursue longitudinal investigations to assess how nurses' use of ICT evolves over time, particularly in response to training interventions, technological advancements, and policy changes. Such studies would help clarify the long-term effects of digital health adoption on clinical outcomes, care quality, and professional well-being. Comparative research across different care settings (urban vs. rural, public vs. private, hospital vs. community care) is also needed to identify contextual barriers and enablers. Additionally, comparing the experiences of nurses with those of other healthcare professionals may shed light on interprofessional dynamics in digital communication practices.

As digital health tools become more embedded in care delivery, it is essential to address equity and inclusion. Research should explore the obstacles faced by vulnerable populations, including the elderly, migrants, and individuals with low digital literacy, to ensure that ICT solutions do not inadvertently widen healthcare disparities. This also calls for innovation in the inclusive design of health technologies. In parallel, future investigations should address the ethical and emotional dimensions of digital communication, particularly around data protection, patient consent, and the impact of reduced face-to-face interaction on therapeutic relationships. The emotional quality of nurse-patient communication remains central, even in digital contexts, especially in sensitive areas like palliative care or mental health. Moreover, implementation science approaches are needed to examine how organizational readiness, leadership, and technological investment influence ICT integration. Developing validated assessment tools could assist institutions in planning and evaluating digital transitions effectively.

Finally, the perspectives of patients and caregivers should be more systematically incorporated into future studies. Participatory research and co-design methodologies can ensure that digital solutions are tailored to real-world needs and promote mutual understanding between healthcare providers and service users. In sum, a multifaceted and inclusive research agenda is necessary to support the ethical, effective, and equitable integration of ICT into nursing practice, ensuring that technological progress truly enhances the human dimension of care.

Conclusion

The digitalization of healthcare has significantly changed how professionals interact with patients, leveraging Information and Communication Technologies (ICT) to enhance communication, enable remote monitoring, and reduce commuting travel and time. However, challenges remain in fully adopting these technologies, particularly related to the limited use of digital tools, lack of training, and institutional barriers.

This study contributes to a growing body of evidence highlighting both the potential and the challenges of integrating ICT into nurse-patient communication. As

healthcare systems increasingly adopt digital solutions, the need to deepen our understanding of how these technologies are used and experienced becomes more urgent. The findings point to important gaps in training, infrastructure, and institutional support that limit widespread ICT adoption, especially in a context where nurses are at the forefront of patient care.

For digital communication to be more effectively integrated into healthcare, it is crucial to invest in training for professionals, strengthen information security, and maintain the human aspect of care. As healthcare becomes more digital, a structured training framework for healthcare workers is essential to ensure safe, high-quality patient care. Continuous education programs, including courses on evaluating online health information and ethical digital communication, should be developed in collaboration with universities and healthcare organizations. There is a pressing need to evaluate the effectiveness of different training approaches in enhancing nurses' competence and confidence in using ICT. Studies that test simulation-based, e-learning, or blended models can inform best practices in educational programming, especially if they also examine the impact of curriculum content related to ethics, communication, and digital platforms.

This study provides a foundation for defining the digital skills needed in nursing curricula and emphasizes the importance of adapting traditional care models to incorporate both physical and digital communication. As healthcare evolves, it is essential to ensure that digital tools are accessible, equitable, and secure for all patients, with measures in place to safeguard patient safety and data privacy while fostering collaboration between healthcare professionals and patients.

Supplementary Information

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Supplementary Material 1.

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Authors' contributions
RSA and MP conceived and designed the study. MP conducted the surveys and interviews, performed the quantitative and qualitative data analysis, and created the data visualizations. MP drafted the initial manuscript. RSA and AM contributed to the writing and revision of the manuscript. All authors (MP, RSA, AM) reviewed and approved the final manuscript.

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Data availability
The data are available upon reasonable request from the first author (MP).

Declarations

Ethics approval and consent to participate
Ethics approval obtained from Ethics Committee for Research in Life and Health Sciences) of the CAC-EMHA (Centro Académico Clínico Egas Moniz Health Alliance Reference 37-CE-ICVS/CAC-EMHA/31.07.2024. Informed consent was obtained from the participants and the study was conducted in accordance with the principles of the Declaration of Helsinki.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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