

International Conference on Business and Economics - Hellenic Open University

Vol 5, No 1 (2025)

Proceedings of the ICBE-HOU 2025



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To cite this article:

Theodorou, P., Vlissari, E., Flokou, A., Leri, A., & Kostagiolas, P. (2026). Information literacy and digital competences of the nurses of primary health care . *International Conference on Business and Economics - Hellenic Open University*, 5(1). Retrieved from <https://eproceedings.epublishing.ekt.gr/index.php/ICBE-HOU/article/view/9734>

Information literacy and digital competences of the nurses of primary health care

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Abstract

The study investigates the levels of information literacy and digital skills among nurses working in primary health care settings, as well as the variation in these characteristics across the sample's demographic characteristics. The study was conducted from February to March 2024 in 117 nurses (95.9% response rate) from the 5th Health Region of Thessaly and Central Greece. The assessment of information literacy and digital skills was conducted using a tool based on the DigComp 2.2 framework, which comprises five dimensions of digital competence. Results showed that nurses had a moderate level of Information Literacy, which was positively correlated with work experience and better computer literacy, and negatively correlated with age. Digital skills were also rated as moderate, while the highest scores were recorded in the sub-skills 'Safety' and 'Problem solving', and the lowest in 'Communication and collaboration' and especially in 'Content creation'. 'Communication and Collaboration' was positively correlated with experience and computer knowledge, but negatively correlated with gender (lower scores for women). Finally, perceptions of overall current information were positively correlated with work experience and computer knowledge, and were lower among women. Enhancing

information literacy and digital skills can improve nursing staff performance, positively impacting service quality and patient safety.

JEL Classifications: I18, J24, O33

Keywords: Health literacy, digital competence, nurses, primary health care

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1 Introduction

Technological advances have brought radical changes to all areas of society, including healthcare, which is constantly adapting to the new digital reality. Digital literacy, which includes not only knowledge but also the ability to safely navigate, evaluate, and create information using digital technologies, is now a basic skill (Alipour & Payandech, 2022). A digitally literate person can use technology strategically, both to search for and evaluate information and to communicate, collaborate, create, and share original content, and effectively use the internet and technological tools (Terry et al., 2019). In the health sector, information plays a primary role, directly influencing the quality of services provided (Kostagiolas et al., 2012), while its management and distribution are mainly carried out via the internet (Kostagiolas et al., 2014).

Digital health is an emerging field in which healthcare incorporates digital technologies. According to the World Health Organization (WHO), the use of these technologies can contribute to achieving the Sustainable Development Goals by improving access to and the quality of health services worldwide (WHO, 2020). In line with European strategies, the integration of digital technologies in the health sector and the development of related digital services are also a priority for the Greek state (OECD, 2021).

As digital health is at the heart of contemporary developments, information literacy, i.e. a set of skills required by individuals to recognize when they need information and to have the ability to locate, evaluate and effectively use the information necessary to achieve their personal, social, professional, and educational goals, is becoming essential (Kostagiolas et al., 2023; Norman & Skinner, 2006; UNESCO, 2023). Especially in the field of health, digital technology affects not only citizens but also health professionals (Nikoloudakis et al., 2016), who need to develop the necessary digital skills to meet the growing demands of a digitally connected society (Terry et al., 2019). Furthermore, upgrading the information literacy of healthcare professionals, as the main users of digital technologies in the healthcare sector, is considered a key factor in strengthening the corresponding capacity of patients (Alipour & Payandech, 2022).

More specifically, in older studies, nurses (Kritsotakis et al., 2021) or nursing students (Rathanayke & Senevirathma, 2019; Tubaishat & Habiballah, 2016) showed a moderate level of information literacy, while several international studies show a low level of information literacy significantly related to a number of demographic characteristics, such as gender, age and holding a master's degree) (Nesari et al., 2019; Tegegne et al., 2023).

In particular, nurses are encouraged to use digital technologies and the internet for their continuing education, thereby enhancing the support they provide to patients and their families (Intas et al., 2013). Familiarizing and training nursing staff in new digital practices is becoming increasingly necessary as it contributes significantly to improving the quality and effectiveness of the care provided (Gartrell et al., 2020; NHS, 2017) while similar findings have been recorded in nursing students, as their competence in information literacy is directly linked to the quality of care they will provide as future health professionals (Liu et al., 2024).

For this purpose, it was deemed necessary to investigate the digital skills of nurses in Greece, as there is no corresponding research dealing with this specific scientific field. On the contrary, there are several sources on the information literacy of nurses, but they are not specifically related to their digital skills.

The purpose of this study is to investigate and evaluate the information literacy and digital skills of nurses working in primary care facilities in the 5th Health Region of Thessaly and Central Greece, and to analyze variation in these characteristics by demographic factors.

2 Hypotheses

This research examines the following three core hypotheses:

A. Information literacy of the participants was moderate, indicating adequate but not fully developed ability to search for, evaluate, and use health information (Tegegne et al., 2023).

B. Digital skills of the participants were moderate, indicating that participants have basic knowledge of common tools, but are not sufficiently proficient in advanced applications, or complex problem solving. (Liebl et al., 2024; Wynn et al., 2023).

C. There is a significant inverse relationship between Information Literacy and demographic variables such as age, indicating that older individuals tend to have lower levels of information literacy (van der Vaart & Drossaert, 2017).

3 Methodology

3.1 Study Population

A synchronous observational study was conducted using convenience sampling because this method allows for the efficient collection of data across a broad demographic within a limited timeframe, minimizing temporal bias. Additionally, while convenience sampling limits the ability to generalize findings to the broader population, it was deemed appropriate for this exploratory study to identify initial trends while we controlled for demographic variables to ensure the sample maintained sufficient diversity to support our preliminary conclusions. This research could be methodologically extended in future studies utilizing stratified random sampling to reduce selection bias and enhance generalizability.

The questionnaire consists of five distinct parts where the first part covers the demographic characteristics of the participants, the second concerns the employment characteristics of the sample, the third and fourth assess the information literacy and digital skills of the participants using DigCompSat (Digital Competence Self-Assessment Tool), while the fifth records their perceptions of the overall current information situation.

The survey was conducted in primary healthcare facilities in the 5th Health Region of Thessaly and Central Greece, with a sample of 117/122 nurses (response rate: 95.9%) from all educational levels. Data collection took place from February to March 2024, following written approval from the scientific council of the 5th Health Region of Thessaly and Central Greece.

3.2 Measuring tools

The assessment tool based on the structure of the DigComp 2.2 framework (Vuorikari et al., 2022), adapting the five key areas of digital competence (information literacy, communication and collaboration, digital content creation, safety, problem solving) to the specificities of clinical practice and the professional needs of nurses. The questions were designed to reflect the everyday use of digital technologies in healthcare, including topics such as searching for scientific information, secure management of patient data, ethics in digital communication, and technical problem-solving in health information systems. This adaptation is in line with the guidelines of the DigComp 2.2 framework itself, which is designed as a flexible tool that can be adapted to different environments and target groups. As pointed out, "it is up to the users, institutions, intermediaries, or initiative developers to adapt the reference framework to their needs when tailoring interventions [...] to fit the specific needs of target groups" (Vuorikari et al., 2022).

DigCompSat is a self-assessment tool that allows respondents to evaluate their level of digital competence and identify any areas for improvement. In this study, the questionnaire

assesses three key elements (knowledge, skills, and attitudes) in each of the following sub-sections of the model: "Communication and collaboration," "Digital content creation," "Safety" and "Problem solving" (Vuorikari et al., 2022; National Documentation Center 2021). Specifically, the first sub-section (Communication and collaboration) includes nine questions that explore the degree of influence of digital skills on communication and collaboration in the working environment of nurses, the second sub-section (Digital content creation) consists of three questions that examine the role of digital skills in digital content creation, the third sub-section (Safety) includes six questions that assess the relationship between digital skills and safe work while the fourth sub-section (Problem Solving) includes five questions that record the impact of digital skills on problem solving in the professional environment of nurses. All questions are answered on a five-point Likert scale from 1 [= Not at all] to 5 [= Very much].

To check the reliability of the questionnaire, Cronbach's alpha reliability index was applied, with values ranging from 0.713 to 0.903 across the various dimensions, indicating very good internal reliability and validity for the questionnaire (Table 1).

Table 1: Internal consistency coefficients Cronbach's alpha of the questionnaire

Information literacy	0.871
Digital skills	
Communication and collaboration	0.903
Digital content creation	0.781
Safety	0.852
Problem solving	0.889
Perceptions of Current Information	0.713

3.3 Ethics

The questionnaires were administered anonymously, and all principles of research ethics, as outlined in the Helsinki Declaration of 1975, were upheld to ensure the protection of personal data. Participation was entirely voluntary, and there was no form of pressure.

3.4 Statistical analysis

The absolute and relative frequency distributions of the characteristics of the 117 nurses who participated in the study were estimated. Frequency distributions and measures of position and dispersion of the scores of the five individual Health Literacy scales were also

calculated, while their distribution was checked using the Blom method (QQ plot) and the asymmetry coefficient. The reliability of the scales was checked using Cronbach's alpha coefficient. Their correlation with the characteristics of the participants was checked using the non-parametric Spearman method. The significance level for all tests was set at 0.05. Data analysis was performed using IBM SPSS version 29.0 (Statistical Package for Social Sciences).

4 Results

The majority of the sample were women (80.3%), aged 35-47 (46.2%), graduates of technical education (51.3%), with a good knowledge of English (75.2%, level B2 and above) and very good computer skills (70.9%). Most worked in Health Centers (63.2%) and in the Region of Thessaly (59%), held permanent positions (58.1%), and had a total of 9-23 years of previous work experience (44.3%). At the same time, 94% of participants did not hold a position of responsibility, while 58.1% had not attended any digital education program related to information literacy and/or digital skills during the period 2020–2024 (Table 2).

Table 2: Demographic and occupational characteristics of the participants

Characteristics	N	%
Sex		
Men	21	17.9
Women	94	80.3
Other	1	0.9
I don't answer	1	0.9
Age		
<34	26	22.2
35-47	54	46.2
48-60	37	31.6
Educational level		
Highschool graduate	19	16.2
Technological institute graduate	60	51.3
University graduate	38	32.5
Level of English language proficiency		
I don't know English	8	6.8
Basic knowledge (A1 – A2) Level	8	6.8
Moderate knowledge (B1) Level	13	11.1
Lower (B2) Level	33	28.2
Advanced (C1) Level	22	18.8

Proficiency (C2) Level	33	28.2
Computer skills		
Very good	83	70.9
Moderate	32	27.4
None	2	1.7
Seminar/workshop/lifelong learning program/digital education initiative (2020-2024)		
Region of Thessaly and Central Greece	11	9.4
Hellenic Nurses Association	8	6.8
Lifelong Learning Center (National and Kapodistrian University of Athens, University of Thessaly, etc.)	25	21.4
I have not attended	68	58.1
Other	5	4.3
Employment service		
Health center	74	63.2
Local Health Unit (TOMY)	28	23.9
Other	15	12.8
Employment relationship		
Permanent	68	58.1
Other employment status (auxiliary, fixed-term, contract work, etc.)	49	41.9
Total years of work		
≤ 8	39	33.9
9-23	51	44.3
24-38	25	21.7
Supervisors		
Yes	7	6.0
No	110	94.0
Geographical area of work		
Region of Thessaly	69	59.0
Region of Central Greece	48	41.0

Overall, participants scored at a moderate level across all six domains, with mean values ranging from 3.28 to 3.89 (Tables 3, 4, 5). The highest scores were recorded in Information Literacy (Mean = 3.89) and Perceptions of Current Information (Mean = 3.87), whereas the lowest score was found in Digital Content Creation (Mean = 3.28). Among the digital skills subscales, Safety (Mean = 3.70) and Problem Solving (Mean = 3.66) scored higher than Communication and Collaboration (Mean = 3.40) and Digital Content Creation (Mean = 3.28) (Table 4). At item level, participants reported stronger performance in using search engines within nursing work (Mean = 4.21) (Table 3) and a high perceived need for seminars on digital information literacy and digital skills (Mean = 4.49) (Table 5). Lower scores were

observed in items related to the use of artificial intelligence applications in daily tasks and decision-making (Mean = 2.44) (Table 4), indicating more limited familiarity with AI-related tools in professional practice.

Figure 1 presents a comparison of the average scores for the six individual areas, highlighting significant differences between them. Regarding information literacy, the analysis of the mean value showed that the participants' level was moderate, indicating adequate but not fully developed ability to search for, evaluate, and use health information.

Figure 1: Comparison of average scores for Information Literacy, Digital Skills, and Perceptions scales for the sample's current information literacy

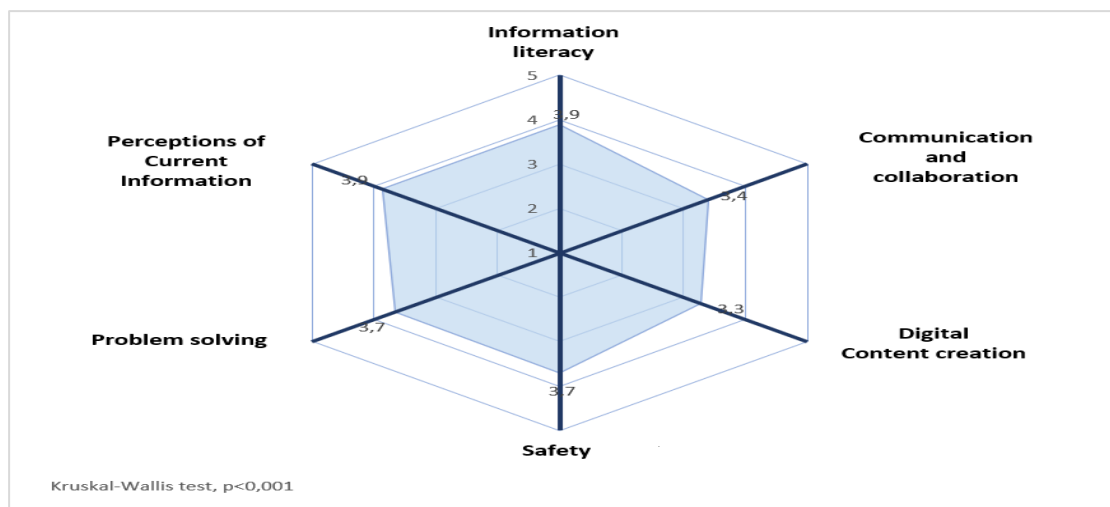


Table 3: Participants' responses to questions concerning the Information Literacy questionnaire

N=117	Mean	St. Deviation	Median
Information Literacy	3.89	0.80	4.00
Use of general software	4.02	1.01	4.00
Use of technological devices	4.18	0.90	4.00
Finding/evaluating information in the context of your work as a nurse through search engines	4.21	0.86	4.00
Finding/evaluating information in the context of your work as a nurse on social networks, websites, blogs	3.46	1.16	3.00
Finding/evaluating information in the context of your work as a nurse in online repositories using search terms, synonyms, etc.	3.66	1.15	4.00
Finding scientific evidence/bibliography in scientific	3.85	1.05	4.00

databases and associations/organizations in the context of your work as a nurse

Table 4: Participants' responses to questions concerning the Digital Skills questionnaire

N=117	Mean	St. Deviation	Median
Communication and collaboration	3.40	0.84	3.44
Use of file management software	3.48	1.09	3.00
Collaboration via open access educational platforms	3.28	1.07	3.00
Use of teleconferencing software	3.58	1.01	4.00
Use of daily task/calendar management software	3.8	1.22	4.00
Participation in professional/scientific digital networks for sharing ideas, experiences, and scientific information	2.93	1.18	3.00
Participation in professional/scientific digital seminars/workshops/educational resources	3.70	1.14	4.00
Use of artificial intelligence applications for performing daily tasks and decision-making	2.44	1.09	2.00
Understanding of appropriate behaviour, ethics and etiquette in online communication	3.69	1.11	4.00
Recognition of the impact of digital information on professional relationships	3.69	1.06	4.00
Digital content creation	3.28	0.95	3.33

Creating content/posts on social networks	3.15	1.22	3.00
Creating video, image, and audio files	3.12	1.02	3.00
Rules of ethics and conduct when sharing information online	3.56	1.16	4.00
Safety	3.70	0.77	3.66
Knowledge of creating strong passwords/secure management of personal and professional data	3.54	0.96	3.00
Knowledge of installing and activating protection software and services	3.32	0.99	3.00
Identifying malware that attempts to gain access to sensitive information and personal data	3.51	1.03	3.00
Understanding how third parties and organizations on the internet use personal data, violating the General Data Protection Regulation (GDPR)	3.97	1.10	4.00
Understanding how excessive use of digital technology can affect health	3.78	0.93	4.00
Understanding the Rules of Ethics and Conduct (e.g., sensitive personal data, patient confidentiality, references to sources) when sharing information online, as well as proper ethical and conduct behaviors	4.06	1.06	4.00
Problem solving	3.66	0.78	3.80
Use of technological devices	3.74	0.89	4.00
Knowledge of digital tools for solving technological problems	3.66	0.88	4.00
Ability to select auxiliary tools for better access to information and content on the internet	3.41	0.98	4.00
Understanding the importance of identifying false and misleading news	3.70	0.98	4.00
Evaluating digital information as reliable, true, and relevant to current requests, appropriate references and collaborations, proper guidance, and a goal-oriented approach	3.81	0.93	4.00
Response rating from 1: not at all to 5: very much			

Table 5: Responses regarding participants' perceptions of current information

(N=117)	Mean	St. Deviation	Median
Perceptions of current information	3.87	0.60	4.00
How satisfied are you with your overall current knowledge as a nurse?	3.50	1.06	4.00
How useful do you consider the internet to be for your knowledge as a nurse?	4.15	0.69	4.00
To what extent do you consider that you can use the internet to evaluate the information you find for use as a nurse?	4.01	0.856	4.00
To what extent do you consider artificial intelligence useful for your information as a nurse?	3.18	0.94	3.00
To what extent do you consider that seminars on digital information literacy/digital skills specifically for nurses in Greece are necessary?	4.49	0.78	5.00

Response rating from 1: not at all to 5: very much.

In addition, Spearman's correlation coefficient was applied to investigate the relationship between the scores on the Information Literacy and Perceptions for overall current information scales with the demographic characteristics of the participants, specifically gender, age, level of education, total work experience, and computer skills. The results showed a statistically significant correlation between Information Literacy and the variables of age ($\rho = -0.229$, $p < 0.05$), total work experience ($\rho = 0.333$, $p < 0.05$), and computer skills ($\rho = -0.308$, $p < 0.05$), suggesting that older individuals with less work experience and low computer skills tend to have lower levels of information literacy.

Similarly, the factor "Communication and Cooperation" showed a negative correlation with gender ($\rho = -0.302$, $p < 0.05$), indicating lower scores for women, and a positive correlation with work experience ($\rho = 0.332$, $p < 0.05$), as well as a negative correlation with computer skills ($\rho = -0.281$, $p < 0.05$), suggesting that participants with limited work experience or low computer skills performed less scores in this area. In addition, participants with limited computer skills also scored lower in the "Safety" ($\rho = -0.207$, $p < 0.05$) and "Problem Solving" ($\rho = -0.199$, $p < 0.05$) sections. Finally, the section "Perceptions of overall current information" was negatively correlated with gender ($\rho = -0.187$, $p < 0.05$), positively

with work experience ($p = 0.245$, $p < 0.05$), and negatively with computer skills ($\rho = -0.312$, $p < 0.05$), demonstrating that women, as well as those with less work experience or limited computer skills, had lower perceptions of the accessibility and usefulness of current information (Table 6).

Table 6: Correlations between the scales of Information Literacy, Digital Skills, and Perceptions of Current Information, with the demographic characteristics of the sample

	Sex (1:men , 2:wom en)	Age (years)	Educational level (1: Highschool , 2: Technological institute, 3: University)	Total years of work (years)	Computer skills (1: very good, 2: moderate, 3: none)
rho-Spearman					
Information literacy	-0.168	0.229*	-0.164	0.333*	-0.308*
Communication and collaboration	-0.302*	-0.180	-0.122	0.332*	-0.281*
Digital content creation	-0.159	-0.089	-0.040	0.081	-0.096
Safety	-0.051	-0.051	-0.025	0.155	-0.207*
Problem solving	-0.111	-0.064	-0.064	0.137	-0.199*
Perceptions of Current Information	-0.187*	-0.037	-0.059	0.245*	-0.312*

A higher score or $\rightarrow 5$ indicates a greater relative scale.

* $p < 0.05$

5 Discussion

Our findings indicate that the majority of participants have a moderate level of information literacy, a finding that is consistent with 1st hypothesis of our study and similar Greek (Gkountara et al., 2023; Kritsotakis et al., 2021) and international studies (Isazadeh et al., 2020; Longhini et al., 2024). Similar levels have been recorded in studies focusing on nursing students (Park & Lee, 2015; Tubaihat & Habiballah, 2016). However, some international studies report that nurses have lower levels of information literacy, suggesting possible differences related to age, educational background, professional experience, and access to digital tools (Comparcini et al., 2024; Longhini et al., 2024; Tegegne et al., 2023).

These characteristics may influence nurses' perceptions of digital technologies and their willingness to adopt them in clinical practice (Wynn et al., 2023).

An important finding of this study is the low familiarity of nurses with artificial intelligence applications, as recorded in the subsections "Communication and Collaboration" and "Perceptions of Overall Current Information." Similar findings have been reported in studies involving nurses (Yogurtcu & Ozurk, 2022) and nursing (Wang et al., 2024) and medical students (Stewart et al., 2023), where, despite a positive attitude towards artificial intelligence, their knowledge remains limited, mainly due to a lack of training.

However, some studies show a high intention to adopt artificial intelligence among nurses and nursing students, highlighting the potential of technology to improve clinical care (Allam et al., 2023; Tuncer GZ & Tuncer M, 2024). In contrast, other international studies report moderate awareness and caution, particularly among women and older nurses, with the main inhibiting factors being lack of training, limited familiarity, and fear of replacing human interaction (Amin et al., 2025; Labrague et al., 2023).

The participants' digital skills were assessed as moderate in the sub-categories "Safety" and "Problem Solving", while "Digital Content Creation" and "Communication and Collaboration" were recorded at moderate to low levels. These results are generally consistent with 2st hypothesis of our study according to which digital skills of the participants were moderate. Similar findings have been reported in a recent study of nurses working in inpatient care facilities in Germany (Liebl et al., 2024), while a survey of health professionals in northwestern Ethiopia (Tegegne et al., 2023) recorded adequate levels of skills in Safety and Problem Solving. The timely integration of digital technologies into academic education and the development of specific training programs for nurses are considered critical to enhancing their digital skills (Adif et al., 2024).

Furthermore, it has been pointed out that inadequate training of healthcare professionals in digital technologies can lead to low self-efficacy, affecting the quality of healthcare (Borges et al., 2023). At the same time, it has been observed that nurses receive less training in digital skills and technology management than doctors, while formal training from the organizations where they work remains limited for all healthcare professionals (Navarro-Martínez et al., 2023) or is rarely utilized, mainly due to workload, lack of time, and limited resources (Navarro Martínez et al., 2022).

Additionally, older individuals with less work experience and limited computer skills demonstrated a lower level of information literacy. These results are consistent with 3st hypothesis of our study according to which there is a significant inverse relationship between

information literacy and demographic variables such as age. A similar result is reported in a Greek study, where higher information literacy was recorded in professionals with more than 24 years of experience, compared to their younger colleagues (Doulgeri et al., 2023). In contrast, another study found that younger nurses and those with more than 6 years of experience had lower information literacy, suggesting the multifactorial nature of the relationship between experience and information literacy (Wu et al., 2024). However, in this particular study, limited computer knowledge and use were also associated with low information literacy; while other studies emphasize that the absence of digital source evaluation skills prevents nurses from identifying reliable online information (Karvinen et al., 2017; McCutcheon et al., 2015). In addition, limited computer knowledge was associated with lower scores in the factors "Communication and Collaboration," "Safety," and "Problem Solving." This finding is consistent with related research, which found a correlation between Information and Communication Technology (ICT) skills and digital skills in the sub-sections "Communication and Collaboration" and "Problem Solving," highlighting the importance of ICT expertise for the optimal use of digital technologies in the clinical environment (Barbosa et al., 2023).

This study highlights new findings regarding nurses' digital skills and information literacy. However, certain limitations must be taken into account when interpreting and generalizing the results. The small number of participants and the use of convenience sampling are key limiting factors, while the fact that the study was conducted in only one Health Region (HR) does not allow the findings to be applied at the national level. Therefore, future studies in a larger, nationwide sample are necessary for more reliable conclusions.

In conclusion, the findings of this study can guide strategies to enhance nurses' digital skills. The development of targeted training programs to improve their information literacy is expected to enhance the effective use of existing and emerging clinical care technologies. As a result, increasing digital readiness can improve the quality of healthcare services and enhance patient safety.

It is also becoming evident that there is an increasing need for studies involving larger, comprehensive samples that integrate both qualitative and quantitative methodologies. Such studies should aim not only to estimate nurses' information literacy and digital skills but also to investigate their relationship with the quality of healthcare services provided the corresponding patient satisfaction and the ethical implications of data management in the digital era.

In addition, the enhancement of digital skills should not be approached as an

isolated educational process, but as part of a broader digital transformation strategy within healthcare organizations. It is essential to ensure that technological infrastructures are user-friendly, allowing nurses to remain focused on person-centered care. Finally, policy-makers should encourage the active participation of nurses in the design of clinical systems, ensuring that technology serves as a facilitator rather than an obstacle in daily clinical practice.

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