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ORIGINAL PAPER

A comparison of digital health competence and associated factors among Czech nurses using online versus paper-based data collection methods: a cross-sectional study

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Abstract

Aim: To compare digital health competence (DHC) and associated factors among Czech nurses from various healthcare settings, using online versus paper-based data collection methods. *Design:* A cross-sectional survey. *Methods:* Data were collected from October 2023 to July 2024. The survey included demographic and professional data, along with two DHC instruments: DigiHealthCom and DigiComInf, translated from English to Czech. Descriptive analysis, likelihood ratio (LR), χ^2 and Fisher's exact tests, and the Mann-Whitney U test were used to analyze the data. *Results:* The survey was fully completed by 263 nurses. Significant differences were observed between the paper-based and online subgroups in most demographic and professional variables, with large effect sizes for educational level ($Z = -7.436$; $p < 0.001$) and frequency of patient interactions ($Z = -6.243$; $p < 0.001$). Overall, most DHC items received favorable ratings for digitalization and associated factors. While subjectively perceived DHC differed significantly between the subgroups in most factors, the effect sizes of these differences were not large. *Conclusion:* Although the level of DHC was favorable, further research is warranted due to extensive missing data, which may be the result of limited experience and a lack of established opinions on certain items.

Keywords: competence, digitalization, digital health, digital technology, healthcare, nurses, online.

Introduction

The dynamic digital era and advancements in science and technology have revolutionized therapy and healthcare delivery, a trend accelerated by the COVID-19 pandemic. This has necessitated the rapid adoption of new technologies and remote communication methods (Kang, 2023; Lee et al., 2023). Consequently, healthcare workers, including nurses, must adapt to new roles and integrate digital services into their practice. These changes significantly impact nursing practice, education, and research (Kang, 2023; Nazeha et al., 2020).

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Healthcare professionals' ability to enhance the digital patient experience and utilize modern technologies hinges on their digital health competence (DHC). Defining DHC is complex due to continuously developing digital innovations in health care. In addition, recent research highlights the importance of considering non-technical aspects of digitalization, such as ethical issues, motivation, attitudes towards digital technologies, coaching skills, communication, support, and organizational and educational factors (Jarva et al., 2023). Therefore, the definition of DHC broadly involves effectively integrating digital technologies into high-quality, patient-centered care. This includes all competence attributes: knowledge, skills, attitudes, values, and performance. Additionally, it encompasses hybrid approaches that blend digital and traditional

methods tailored to patient needs (Jarva et al., 2022; Jarva et al., 2023). At the same time, recent literature emphasizes the need to consider the intergenerational gap in digital competence. This gap exists between digital natives–individuals who have grown up with digital devices–and older generations who encountered digital technology only in adulthood (Hammarén et al., 2024).

In the Czech Republic (CR), recent professional literature highlights efforts to implement digital innovations, such as a virtual clinic for remote rehabilitation services (Pětioký et al., 2022), the digitalization of pharmacy services with the "eRecept" electronic prescription system (Těšinová et al., 2023), and the establishment of the National eHealth Centre (Ministry of Health of the Czech Republic, 2020a). Additionally, there is a recognized need for the digital education of Czech healthcare professionals to keep pace with these innovations (Těšinová et al., 2023). To address this challenge, the Czech digitalization strategy aims to establish an educational system for healthcare professionals by 2030 (Ministry of Health of the Czech Republic, 2020b). This aligns with the Global Strategy on Digital Health 2020–2025 (World Health Organization [WHO], 2021), developed to leverage digital technologies in improving global health outcomes. Recognizing that the successful implementation of digital health initiatives depends on the ability of healthcare workers to effectively use digital tools and technologies, the WHO places significant emphasis on building and enhancing the digital competences of healthcare professionals.

A crucial step for effective implementation of any educational system is thoroughly assessing learning needs and identifying gaps between current and target knowledge, skills, and attitudes (Armson et al., 2020). At the same time, general and pediatric nurses, constituting the largest occupational group in the Czech healthcare sector with a total exceeding 80,000 (Institute of Health Information and Statistics of the Czech Republic, 2022), play a crucial role in addressing digitalization challenges.

Limited research evidence concerning these issues in the Czech Republic has been identified. Těšinová et al. (2023) explored the challenges associated with delivering digital health services through focus group discussions with healthcare experts and patients. The study highlighted several issues, including insufficient training programs, low digital literacy among health professionals, and concerns regarding the safe use of digital technologies, and the effective provision of remote care. Notably, nurses were not included in this study. Additionally, as this was a qualitative study, the findings cannot be generalized to the broader population of Czech nurses. Nonetheless, based on a literature review of recommendations from international clinical practice guidelines, Czech nursing experts have acknowledged the necessity of establishing national telenursing strategies that incorporate educational programs (Búřilová et al., 2022). However, while this represents a positive development, there is currently no published data on the DHC of Czech nurses. By thoroughly examining their DHC, tailored educational programs can be designed to effectively address the identified challenges.

Aim

The study aimed to compare the DHC and associated factors among Czech general and pediatric nurses from various healthcare settings, using online and paper-based data collection methods. By accessing nurses in various healthcare settings across the Czech Republic, we could gather nurses' subjective opinions throughout the entire spectrum of digital competence. Consequently, the research questions aimed to compare two subgroups of nurses, categorized based on the data collection methods: online and paper-based. The comparisons focused on: 1) demographic and professional characteristics, 2) self-perceived personal digital health competence (DHC), and 3) self-perceived organizational and educational factors in the workplace related to DHC. The primary objective was to encompass a broad range of nurses and gain insights into their perspectives by comparing the two subgroups, while simultaneously analyzing how demographic and professional characteristics may influence these differences.

Methods

The report of the study is consistent with the STROBE checklist (von Elm et al., 2007).

Design

This study presents the results from a nation-wide survey of allied health professionals, focusing on the DHC of Czech general and pediatric nurses and associated factors. Data were collected by employing a cross-sectional design from October 2023 to July 2024 from participants identifying as general or pediatric nurses.

Sample

Data were collected using a convenience sampling method from nurses aged 18 or older, currently

employed in healthcare institutions, irrespective of the duration of their employment, and excluding students. The data collection took place via an online- and paper-based approach since these two approaches could capture the different generations (e.g., digital natives vs. non-digital natives) from across the whole country. Specifically, the decision to use a paper-based survey was driven by the goal of maximizing participation across various generations while avoiding digital exclusion (Wilson-Menzfeld et al., 2025). On the other hand, the online version had the potential to reach nurses regardless of their geographical location. In other words, the main goal of this dual strategy was to gather the perspectives of nurses with diverse skills and attitudes from various settings and ultimately to provide a well-rounded understanding of the topic.

The G*Power software (Version 3.1.9.7; Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany) (Faul et al., 2007; Kang, 2021) was used to obtain the minimum sample size required to achieve a medium effect (effect size, d = 0.5), a power of 95%, and a statistical significance level of 0.05 while considering the possibility of a varied allocation ratio. The required sample size was 220 to 248 nurses for allocation ratios ranging from 1:1 to 2:1. To account for potential attrition, the target enrollment was doubled to include at least 500 nurses. This was because initial discussions with several healthcare experts indicated that substantial amount of missing data was expected, primarily due to the topic's novelty and the relatively low motivation of the nurses from some of the settings to participate in surveys. Five hundred and sixty general or pediatric nurses submitted the questionnaires; however, only 263 (114 in the paper-based subgroup and 149 in the online subgroup) were completed fully with no missing data. For this allocation ratio (1:1.3), the required sample size was 224 nurses in total (97 nurses in one subgroup and 127 nurses in the other subgroup).

Data collection

Two instruments, DigiHealthCom and DigiComInf (Jarva et al., 2023), along with an 11-item questionnaire on demographic and professional variables developed for the purposes of this study, were used to measure DHC and its associated factors. DigiHealthCom (42 items across five factors) and DigiComInf (15 items across three factors) assess various aspects of DHC, including knowledge, skills, attitudes, and organizational and educational factors existing in the workplace (Jarva et al., 2023). Both instruments use a four-point Likert scale (1 = completely disagree, 2 = partially disagree, 3 = partially agree, 4 = completely agree).

The instruments were translated from English to Czech using a forward and back translation procedure. In the cultural adaptation, two DigiHealthCom items were modified to make them more appropriate for the Czech context. The first one concerned the sources of reliable information that are available for Czech customers (Factor 1: Counselling, item 16). The second concerned the provided examples of digital social and health services existing in the Czech Republic (Factor 4: Evaluation, item 6). Ten healthcare professionals reviewed the translated items and provided feedback on their clarity and relevance, which enabled further refinement. Item ratings were used to calculate the item content validity index (I-CVI) and the scale-level content validity index using the averaging method (S-CVI / Ave) (Polit et al., 2007).

For clarity, the I-CVI for both instruments ranged from 0.8 to 1.0, and the S-CVI / Ave was 0.97. For relevance, DigiHealthCom had an I-CVI of 0.7–1.0 and an S-CVI / Ave of 0.94, while DigiComInf had an I-CVI of 0.8–1.0 and a S-CVI / Ave of 0.89. These values exceed the acceptable threshold of 0.80 (Polit et al., 2007), indicating good content validity. The internal consistency, measured by Cronbach's alpha, was calculated for each factor, with values ranging from 0.82 to 0.93, indicating good reliability (Tavakol & Dennick, 2011).

Paper questionnaires were distributed through three institutions: a secondary care hospital and a university in the Pardubice region, and an educational institution in Prague. Nurses in the hospital were invited by their manager, while those in educational institutions were invited by lecturers during continuing education courses. First, the potential participants received written information detailing the study's aim, inclusion and exclusion criteria, data collection procedure, and the estimated time required to complete the survey. They were not explicitly informed that they could skip questions to reduce the likelihood of them doing so. Only nurses who signed the informed consent were allowed to complete the survey. The consent form explained that participation was voluntary, anonymous, and could be withdrawn at any time without consequence. After completing the survey, they placed the signed consent form and the survey in an envelope and sealed it. The lecturers and managers who facilitated the data collection then handed the sealed envelopes to the researchers.

Online data were collected nationwide using the LimeSurvey platform. Invitations were distributed to nurses via social media and email through healthcare organizations like the Czech Nurses Association and the National Center for Nursing and Allied Health Professions. Additionally, two universities with allied health study programs (one in the Pardubice region and one in Prague) helped recruit nurses by informing potential participants about the study. Using the LimeSurvey platform, potential participants received the same study information as the paper-based subgroup, with minor adjustments to accommodate the online format. The digital informed consent form contained the same details but was "signed" by clicking a consent button, eliminating the need for pen and paper. Additionally, completed questionnaires were submitted online by clicking a button at the end of the survey, rather than being placed in envelopes.

All data were securely stored, with access restricted solely to the research team. Personal data were anonymized before data analysis.

Data analysis

Data analysis was conducted using SPSS software, version 24.0 (SPSS Inc., Chicago, IL, USA). Questionnaires with missing data were excluded from the analysis to ensure relevant results. A significance level of $p < 0.05$ was applied for all statistical tests.

To achieve the stated objectives, we initially investigated whether there were statistically significant differences between the online and paper-based subgroups across various demographic and professional variables, including gender, workplace, department, workload, region, age, educational level, years since graduation, years of experience, frequency of patient interactions, and perceived exposure to patients who use digital technologies. To examine DHC, we utilized items from the DigiHealthCom and DigiComInf questionnaires, assessing whether the score distributions differed significantly between the two subgroups.

The workplace variable was dichotomized since the majority of nurses in both subgroups worked in hospitals, while other settings (such as health centers, home care, primary care, private clinics, nursing homes, and social services) were much less common. Three variables were ranked using an ordinal scale: educational level (1 = high school to 4 = master's degree), frequency of patient interactions (1 = daily; 2 = weekly; 3 = a few times a month; 4 = a few times in several months; 5 = currently no work with patients), and exposure to patients who use digital technologies (1 = fewer than 10% of patients use digital technologies; 2 = 25%; 3 = 50%; 4 = 75%; 5 = more than 75%). In the past, a high school diploma was adequate for entering the profession of general or pediatric nursing in the Czech Republic, hence, it was listed as one of the educational options. For comparisons of categorical variables, χ^2 tests were employed. Fisher's exact test was applied for 2×2 contingency tables if the assumptions of the χ^2 test were violated. For larger tables, the likelihood ratio (LR) was applied. The effect size was determined using φ for 2×2 contingency tables or Cramer's V for larger tables. Effect sizes were categorized as small (0.2), medium (0.5), and large (0.8 or greater) (Goulet-Pelletier & Cousineau, 2018).

For the comparison of the differences between the paper-based and online subgroups in continuous variables (age, years since graduation, and years of experience), the assumptions for the independent sample t-test (normality and / or homogeneity of variance) were not met. Consequently, medians and interquartile ranges (IQR) were reported. The Mann-Whitney U test was used to compare the differences between the paper-based and online subgroups in DigiHealthCom and DigiComInf items, as well as in all relevant demographic and professional variables (Harpe, 2015). In addition, for consistency with other papers, the mean and sample standard deviations were calculated, together with the grand mean. The grand mean represents the mean value of all ratings in each factor.

Given that the score distributions for both subgroups differed in shape, the Mann-Whitney U test was employed to assess differences in the rating distributions of the two subgroups, rather than their medians. When a statistically significant difference in ratings was found between the subgroups, the effect size was calculated using the point biserial correlation (r_{pb}) (Ellis, 2010; Kornbrot, 2014). The effect size was interpreted as small ($r_{pb} = 0.10$), medium ($r_{pb} = 0.20$), or large ($r_{pb} = 0.30$) (Brydges, 2019).

Results

A total of 560 general or pediatric nurses submitted the questionnaire, with 338 responses collected online and 222 on paper. However, only 44.1% of the online questionnaires and 51.4% of the paper questionnaires were fully completed. Consequently, the online subgroup comprised 149 nurses (56.7%), while the paper-based subgroup included 114 nurses (43.3%). The average age of the online subgroup was

40.54 ± 10.68 years, while the average age of the paper-based subgroup was 39.95 ± 10.47 years. Other demographic and professional characteristics are detailed in Table 1.

Significant differences were observed between the two subgroups in all demographic and professional variables, except for age and years of experience (Table 1). Among these nine variables, large effect

Table 1 Characteristics of nurses included in the study (n = 263)

	Online (n = 149)	Paper-based (n = 114)	p-value	ES
Age in years, median (IQR)	42 (32–49)	40 (31–48)	0.492	
Gender, n (%)			0.043*	0.131_d
females	147 (98.7)	107 (93.9)		
males	2 (1.3)	7 (6.1)		
Workplace (dichotomized), n (%)				
hospital	143 (96.0)	97 (85.1)	0.002*	0.191_d
other settings	6 (4.0)	17 (14.9)		
Department, n (%)			0.000*	0.418_e
inpatient ward	59 (39.6)	66 (57.9)		
outpatient care and services	60 (40.3)	12 (10.5)		
intensive care	9 (6.0)	8 (7.0)		
emergency services / on-call	2 (1.3)	0 (0.0)		
operating theater	8 (5.4)	6 (5.3)		
research unit	1 (0.7)	0 (0.0)		
home care / rehabilitation or home hospital	4 (2.7)	8 (7.0)		
administration	2 (1.3)	2 (1.8)		
elderly and disability services / social work	4 (2.7)	1 (0.9)		
multiple departments	0 (0.0)	11 (9.6)		
Amount of work, n (%)			0.001*	0.214_d
full-time	140 (94.0)	91 (79.8)		
part-time	9 (6.0)	23 (20.2)		
Region, n (%)			0.001*	0.751_e
Capital City of Prague	41 (27.5)	5 (4.4)		
South Bohemian region	5 (3.4)	0 (0.0)		
South Moravian region	7 (4.7)	0 (0.0)		
Karlovy Vary region	2 (1.3)	0 (0.0)		
Vysočina region	3 (2.0)	2 (1.8)		
Hradec Králové region	19 (12.8)	8 (7.0)		
Liberec region	5 (3.4)	1 (0.9)		
Moravian-Silesian region	6 (4.0)	2 (1.8)		
Olomouc region	3 (2.0)	1 (0.9)		
Pardubice region	7 (4.7)	86 (75.4)		
Plzeň region	4 (2.7)	0 (0.0)		
Central Bohemian region	41 (27.5)	7 (6.1)		
Ústí region	4 (2.7)	2 (1.8)		
Zlín region	2 (1.3)	0 (0.0)		
Educational level, median (IQR)$_a$	4 (2.0–4.0)	2 (1.0–3.0)	0.001*	-0.439_f
high school, n (%)	21 (14.1)	46 (40.4)		
higher education (diploma), n (%)	25 (16.8)	26 (22.8)		
university (bachelor's degree), n (%)	8 (5.4)	28 (24.6)		
university (master's degree), n (%)	95 (63.8)	14 (12.3)		
Years since graduation, median (IQR)	10 (4.0–17.0)	15 (5.0–27.0)	0.003*	0.220_f
Years of experience, median (IQR)	20 (10.0–29.5)	18 (7.0–26.3)	0.520	
Frequency of patient interactions, median (IQR)$_b$	1 (1.0–1.0)	2 (1.0–2.0)	0.000*	0.314_f
daily (min. 5 days a week)	124 (83.2)	53 (46.5)		
weekly (1–4 days a week)	21 (14.1)	49 (43.0)		
monthly (a few times a month)	2 (1.3)	10 (8.8)		
less frequently (a few times in several months)	0 (0.0)	1 (0.9)		
currently no work with patients	2 (1.3)	1 (0.9)		
Exposure to patients who use DT, median (IQR)$_c$	3 (2.0–4.0)	2 (1.0–3.0)	0.035*	-0.133_f

*DT – digital technology; ES – Effect size; IQR – Interquartile range; $_a$ from 1 (high school) to 4 (master's degree); $_b$ from 1 (daily) to 5 (no work with patients); $_c$ from 1 (< 10% of patients use DT) to 5 (> 75%); $_d$ based on φ; $_e$ based on Cramer's V; $_f$ based on point biserial correlation r_{pb}; * $p \leq 0.05$.*

sizes were found for the differences in the following variables: educational level ($Z = -7.436$; $p < 0.001$; $r_{pb} = -0.439$) and frequency of patient interactions ($Z = -6.243$; $p < 0.001$; $r_{pb} = 0.314$). In addition, a large effect size was found for the differences in region (LR (13) = 172.657; $p < 0.001$; Cramer's $V = 0.751$). In the remaining six cases, the effect sizes of the statistically significant differences were medium or smaller.

Based on the descriptive statistics, the online subgroup primarily came from two regions: the capital city Prague and the Central Bohemian region (each with n = 41; 27.5%, totaling n = 82; 55.0%) (Table 1). The paper subgroup was mainly from the Pardubice region (n = 86; 75.4%).

Descriptive statistics and mean ranks indicated that the online subgroup had a higher educational level (median 4 – master's degree vs. 2 – diploma; IQR 2.0–4.0 vs. 1.0–3.0, mean rank 161.0 vs. 94.1, respectively) and more frequent patient interactions (median 1 – daily vs. 2 – weekly; IQR 1.0–1.0 vs. 1.0–2.0, mean rank 110.9 vs. 159.5, respectively) compared to the paper subgroup. Most nurses in the online subgroup held a master's degree (n = 95; 63.8%), while most nurses in the paper subgroup had a high school education (n = 46; 40.4%). Additionally, 124 nurses (83.2%) in the online subgroup had daily interactions with their patients, compared to 53 nurses (46.5%) in the paper subgroup.

The perceived exposure to patients who use digital technologies did not significantly differ between the two groups. The median for the online subgroup was 3 (indicating that nurses believed 50% of their patients used digital technologies), while the median for the paper subgroup was 2 (indicating 25% of patients used digital technologies).

The results for DigiHealthCom and DigiComInf are presented in Tables 2–4 and 5, respectively. Overall, the median responses indicate that participants in both subgroups either fully or partially agreed with the statements in the DigiHealthCom items (Tables 2–4). The most common median response was 3 (partially agree) across all factors, except for Factor 3 (Information and Communication Technology Competence), where the median was 4 (completely agree) for all but one item. Nurses showed partial disagreement (median = 2) on only two items: in the paper subgroup, on item 12 in Factor 1 ("I can evaluate whether customers receive equal service in remote counselling.") and on item 5 in Factor 4 ("I can boldly experiment and implement digital solutions in my work."). For the DigiHealthCom grand means, the online subgroup had scores ranging from 2.87 for Factor 4 to 3.71 for Factor 3, while the paper-based subgroup had scores ranging from 2.63 for Factor 4 to 3.52 for Factor 3.

Significant differences were found between the two subgroups in 23 (54.8%) of the DigiHealthCom items, spanning Factors 1–4, although none of these differences had a large effect size. No significant differences were observed between the subgroups for any items in Factor 5 (Ethical Competence Related to Digital Solutions). For all the DigiHealthCom factors, the grand means were higher for the online subgroup compared with the paper-based subgroup.

For DigiComInf, the median responses show that participants in both subgroups generally partially agreed with the statements (median = 3), except for item 3 in Factor 3 ("Colleagues are eager to develop their own work on digital solutions"), for which participants expressed partial disagreement (median = 2) (Table 5). For the DigiComInf grand means, the online subgroup had scores ranging from 2.59 for Factor 3 to 2.95 for Factor 1, while the paper-based subgroup had scores ranging from 2.77 for Factor 2 to 3.05 for Factor 1.

Significant differences were found between the two subgroups in 5 DigiComInf items (33.3%), specifically in Factors 1 and 3, although none of these differences had a large effect size. No significant differences were observed between the subgroups for any items in Factor 2 (Organizational Practices as Part of Digital Competence Development). For all the DigiComInf factors, the grand means were higher for the paper-based subgroup compared with the online subgroup.

Table 2 DigiHealthCom (Jarva et al., 2023) results (n = 263)

	Online (n = 149)		Paper-based (n = 114)		p-value	ES[b]
Factor 1 (Counselling): Human-centered remote counseling competence[a]	**Mean ± Sample SD**	**Median (IQR)**	**Mean ± Sample SD**	**Median (IQR)**		
1. I can act in reciprocal (aiming towards respect and equality) interaction with the customer in remote counseling.	3.57 ± 0.70	4 (3.0–4.0)	3.38 ± 0.82	4 (3.0–4.0)	0.049*	-0.126
2. I can set goals together with the customer in remote counseling.	3.21 ± 0.76	3 (3.0–4.0)	3.07 ± 0.81	3 (3.0–4.0)	0.163	
3. I can form a confidential relationship with the customer in remote counseling.	3.18 ± 0.71	3 (3.0–4.0)	3.07 ± 0.82	3 (3.0–4.0)	0.349	
4. I can recognize the customer's need for support and guidance in remote counseling.	3.10 ± 0.74	3 (3.0–4.0)	3.03 ± 0.76	3 (3.0–4.0)	0.426	
5. I can motivate the customer into action / self-care in remote counseling.	3.18 ± 0.68	3 (3.0–4.0)	3.13 ± 0.71	3 (3.0–4.0)	0.574	
6. I can take into consideration the special characteristics of online interaction (e.g., wording, addressing empathy) in remote counseling.	3.23 ± 0.77	3 (3.0–4.0)	3.06 ± 0.73	3 (3.0–4.0)	0.029*	-0.114
7. I can recognize when the customer's service (e.g., care or guidance) can be delivered remotely.	3.11 ± 0.77	3 (3.0–4.0)	2.89 ± 0.80	3 (2.0–3.0)	0.015*	-0.138
8. I can guide the customer verbally in remote counseling (e.g., on the phone without video).	3.25 ± 0.75	3 (3.0–4.0)	3.10 ± 0.79	3 (3.0–4.0)	0.096	
9. I can guide the customer by utilizing a video connection in remote counseling.	2.72 ± 1.01	3 (2.0–3.0)	2.42 ± 0.97	3 (2.0–3.0)	0.011*	-0.151
10. I can evaluate the customer's situation (need for care or service) in remote counseling.	3.01 ± 0.76	3 (3.0–3.5)	2.75 ± 0.84	3 (2.0–3.0)	0.010*	-0.161
11. I can guide the customer in writing (e.g., chat service) in remote counseling.	2.85 ± 0.92	3 (2.0–3.5)	2.68 ± 0.91	3 (2.0–3.0)	0.109	
12. I can evaluate whether customers receive equal service in remote counseling.	2.69 ± 0.79	3 (2.0–3.0)	2.45 ± 0.85	2 (2.0–3.0)	0.009*	-0.147
13. I can recognize the customer's willingness to use digital solutions.	3.23 ± 0.73	3 (3.0–4.0)	2.94 ± 0.73	3 (2.8–3.0)	0.001*	-0.194
14. I can act professionally in remote counseling.	3.50 ± 0.65	4 (3.0–4.0)	3.32 ± 0.71	3 (3.0–4.0)	0.025*	-0.130
15. I can evaluate the customer's digital readiness.	3.03 ± 0.78	3 (3.0–4.0)	2.82 ± 0.81	3 (2.0–3.0)	0.031*	-0.130
16. I can guide the customer to find reliable information (e.g., from the National Institute of Public Health, the Czech Social Security Administration, the National Health Information Portal, the National Medical Library, and the National Center for Nursing and Allied Health Professions).	2.99 ± 0.73	3 (3.0–3.0)	2.68 ± 0.84	3 (2.0–3.0)	0.003*	-0.189
Grand mean ± Sample SD	3.12 ± 0.80		2.92 ± 0.85		0.000*	-0.115

*ES – Effect size; IQR – Interquartile range; SD – Standard deviation; [a] 1 (completely disagree), 2 (partially disagree), 3 (partially agree), 4 (completely agree); [b] based on point biserial correlation r_{pb}; * $p \leq 0.05$. Note: Item 16 in Factor 1 was adapted to ensure culture equivalence. See details in the text.*

Table 3 DigiHealthCom (Jarva et al., 2023) results (n = 263)

	Online (n = 149)		Paper-based (n = 114)		p-value	ES_b
Factor 2 (Attitude): Digital solutions as part of work[a]	**Mean ± Sample SD**	**Median (IQR)**	**Mean ± Sample SD**	**Median (IQR)**		
1. The transfer to digital services is a positive change.	2.97 ± 0.86	3 (2.0–4.0)	2.75 ± 0.84	3 (2.0–3.0)	0.034*	-0.127
2. Digital solutions should be used more in social and health services.	3.05 ± 0.89	3 (3.0–4.0)	2.87 ± 0.81	3 (2.0–3.0)	0.039*	-0.107
3. I am motivated to use digital solutions in my work.	2.91 ± 0.96	3 (2.0–4.0)	2.76 ± 0.83	3 (2.0–3.0)	0.117	
4. I consider digital solutions as useful.	3.22 ± 0.78	3 (3.0–4.0)	2.90 ± 0.82	3 (2.8–3.0)	0.001*	-0.195
5. I am interested in learning about digital solutions in my work.	3.38 ± 0.83	4 (3.0–4.0)	3.01 ± 0.80	3 (3.0–4.0)	0.000*	-0.218
6. Digital solutions support my work.	3.08 ± 0.87	3 (3.0–4.0)	2.76 ± 0.82	3 (2.0–3.0)	0.002*	-0.183
7. Digital services are a good way to deliver social and health services (e.g., customer work, care, rehabilitation).	3.01 ± 0.88	3 (3.0–4.0)	2.84 ± 0.85	3 (2.0–3.0)	0.079	
8. Digital solutions are a natural part of my work.	2.86 ± 0.94	3 (2.0–4.0)	2.65 ± 0.87	3 (2.0–3.0)	0.047*	-0.114
9. Digital solutions do not slow down my work.	2.70 ± 0.97	3 (2.0–3.5)	2.67 ± 0.86	3 (2.0–3.0)	0.697	
Grand mean ± Sample SD	3.02 ± 0.91		2.80 ± 0.84		0.000*	-0.122
Factor 3 (ICT): Information and communication technology competence[a]						
1. I can use the most common computer programs and services (e.g., email, intranet) in my work.	3.89 ± 0.39	4 (4.0–4.0)	3.65 ± 0.61	4 (3.0–4.0)	0.000*	-0.230
2. I can use equipment based on information technology (e.g., computer) in my work.	3.88 ± 0.40	4 (4.0–4.0)	3.61 ± 0.63	4 (3.0–4.0)	0.000*	-0.249
3. I can ask for help in information technology issues (e.g., ICT support).	3.71 ± 0.52	4 (3.0–4.0)	3.57 ± 0.72	4 (3.0–4.0)	0.183	
4. I can use the patient / client information system in my work.	3.65 ± 0.58	4 (3.0–4.0)	3.48 ± 0.76	4 (3.0–4.0)	0.100	
5. I can solve most common information technology challenges (e.g., login problems, display settings, printer settings) in my work.	3.41 ± 0.70	4 (3.0–4.0)	3.28 ± 0.78	3 (3.0–4.0)	0.206	
Grand mean ± Sample SD	3.71 ± 0.56		3.52 ± 0.71		0.000*	-0.147

*ES – Effect size; ICT – Information and communication technology; IQR – Interquartile range; SD – Standard deviation; [a] 1 (completely disagree), 2 (partially disagree), 3 (partially agree), 4 (completely agree); [b] based on point biserial correlation r_{pb}; * $p \leq 0.05$.*

Table 4 DigiHealthCom (Jarva et al., 2023) results (n = 263)

	Online (n = 149)		Paper-based (n = 114)		p-value	ES_b
Factor 4 (Evaluation): Competence in utilizing and evaluating digital solutions[a]	**Mean ± Sample SD**	**Median (IQR)**	**Mean ± Sample SD**	**Median (IQR)**		
1. I can recognize what digital solutions are in social and health services.	2.80 ± 0.89	3 (2.0–3.0)	2.71 ± 0.78	3 (2.0–3.0)	0.240	
2. I can recognize factors (e.g., resources, motivation) that influence the utilization of digital solutions.	2.88 ± 0.74	3 (3.0–3.0)	2.54 ± 0.75	3 (2.0–3.0)	0.000*	-0.218
3. I can utilize digital solutions (e.g., smart devices, applications) in customer care / guidance.	3.11 ± 0.82	3 (3.0–4.0)	2.79 ± 0.85	3 (2.0–3.0)	0.001*	-0.191
4. I can utilize digital solutions creatively (e.g., usage according to different customer needs) in my work.	2.88 ± 0.88	3 (2.0–3.5)	2.66 ± 0.77	3 (2.0–3.0)	0.020*	-0.130
5. I can boldly experiment and implement digital solutions in my work.	2.55 ± 0.90	3 (2.0–3.0)	2.37 ± 0.86	2 (2.0–3.0)	0.144	
6. I can explain digital social and health services (e.g., the National Health Information Portal, Online Health Advice) to customers.	2.81 ± 0.87	3 (2.0–3.0)	2.44 ± 0.85	3 (2.0–3.0)	0.001*	-0.210
7. I can use my professional skills when using digital solutions.	3.01 ± 0.83	3 (3.0–4.0)	2.78 ± 0.77	3 (2.0–3.0)	0.016*	-0.138
8. I can critically evaluate new digital solutions.	2.94 ± 0.82	3 (2.0–3.5)	2.78 ± 0.85	3 (2.0–3.0)	0.138	
Grand mean ± Sample SD	2.87 ± 0.86		2.63 ± 0.82		0.000*	-0.139
Factor 5 (Ethics): Ethical competence related to digital solutions[a]						
1. I can secure the customer's privacy when using digital solutions.	2.99 ± 0.88	3 (3.0–4.0)	2.94 ± 0.87	3 (2.8–4.0)	0.620	
2. I can ensure the secure processing of customer data.	3.12 ± 0.93	3 (3.0–4.0)	3.25 ± 0.80	3 (3.0–4.0)	0.400	
3. I can acknowledge the customer's autonomy when using digital solutions.	3.02 ± 0.72	3 (3.0–3.0)	2.89 ± 0.73	3 (2.0–3.0)	0.094	
4. I can recognize the ethical aspects of digital solutions (e.g., freedom of choice, privacy, fairness).	3.08 ± 0.70	3 (3.0–3.5)	2.92 ± 0.81	3 (3.0–3.0)	0.112	
Grand mean ± Sample SD	3.05 ± 0.81		3.00 ± 0.81		0.230	
DigiHealthCom (Factor 1–5):						
Grand mean ± Sample SD	3.11 ± 0.85		2.92 ± 0.86		0.000*	-0.111

*ES – Effect size; IQR – Interquartile range; SD – Standard deviation; [a] 1 (completely disagree), 2 (partially disagree), 3 (partially agree), 4 (completely agree); [b] based on point biserial correlation r_{pb}; * $p \leq 0.05$. Note: Item 6 in Factor 4 was adapted to ensure culture equivalence. See details in the text.*

Table 5 DigiComInf (Jarva et al., 2023) results (n = 263)

	Online (n = 149)		Paper-based (n = 114)		p-value	ES[b]
Factor 1: Support from management[a]	**Mean ± Sample SD**	**Median (IQR)**	**Mean ± Sample SD**	**Median (IQR)**		
1. My manager's example supports the development of my DC.	3.05 ± 1.01	3 (2.0–4.0)	3.18 ± 0.84	3 (3.0–4.0)	0.507	
2. My manager supports the implementation of digital solutions.	3.05 ± 0.98	3 (3.0–4.0)	3.16 ± 0.80	3 (3.0–4.0)	0.698	
3. My manager gives feedback about the development of my DC.	2.65 ± 1.11	3 (2.0–4.0)	2.98 ± 0.97	3 (2.0–4.0)	0.019*	0.155
4. My manager can lead the development of my DC (e.g., prediction of competence development, communication, clear guidance, support for renewal and participation).	2.77 ± 1.01	3 (2.0–4.0)	3.02 ± 0.94	3 (3.0–4.0)	0.043*	0.124
5. My manager supports my participation in continuing education to strengthen my DC.	3.10 ± 0.94	3 (3.0–4.0)	3.10 ± 0.86	3 (3.0–4.0)	0.744	
6. Top management supports the uptake of digital solutions.	3.06 ± 0.95	3 (3.0–4.0)	2.86 ± 0.94	3 (2.0–4.0)	0.050*	-0.105
Grand mean ± Sample SD	2.95 ± 1.02		3.05 ± 0.90		0.173	
Factor 2: Organizational practices as part of DC development[a]						
1. Education about the digital solutions used at my work has been sufficient.	2.60 ± 0.96	3 (2.0–3.0)	2.75 ± 0.83	3 (2.0–3.0)	0.275	
2. DC development is planned in my unit according to individual needs.	2.67 ± 0.92	3 (2.0–3.0)	2.75 ± 0.94	3 (2.0–3.0)	0.451	
3. The orientation for digital solutions is conducted systematically at my work unit.	2.62 ± 0.97	3 (2.0–3.0)	2.75 ± 0.89	3 (2.0–3.0)	0.363	
4. My organization's practices support opportunities to develop my DC.	2.71 ± 0.92	3 (2.0–3.0)	2.82 ± 0.82	3 (2.0–3.0)	0.415	
Grand mean ± Sample SD	2.65 ± 0.94		2.77 ± 0.87		0.077	
Factor 3: Colleagues' adoption and influence[a]						
1. Colleagues are not reluctant to start using digital solutions at work.	2.56 ± 0.94	3 (2.0–3.0)	2.80 ± 0.85	3 (2.0–3.0)	0.036*	0.128
2. The implementation of digital solutions has been perceived positively in my work community.	2.51 ± 0.87	3 (2.0–3.0)	2.71 ± 0.87	3 (2.0–3.0)	0.076	
3. Colleagues are eager to develop their own work on digital solutions.	2.33 ± 0.89	2 (2.0–3.0)	2.49 ± 0.85	2 (2.0–3.0)	0.167	
4. Colleagues do not have a negative influence on the development of my DC.	2.84 ± 0.92	3 (2.0–4.0)	2.93 ± 0.84	3 (2.0–4.0)	0.499	
5. Colleagues in my work community have mainly a good level of DC.	2.73 ± 0.80	3 (2.0–3.0)	2.98 ± 0.78	3 (3.0–3.0)	0.006*	0.156
Grand mean ± Sample SD	2.59 ± 0.90		2.78 ± 0.85		0.000*	0.105
DigiComInf (Factor 1–3):						
Grand mean ± Sample SD	2.75 ± 0.97			2.88 ± 0.89	0.000*	0.071

*DC – digital competence; ES – Effect size; IQR – Interquartile range; SD – Standard deviation; [a] 1 (completely disagree), 2 (partially disagree), 3 (partially agree), 4 (completely agree); [b] based on point biserial correlation r_{pb} * $p \leq 0.05$.*

Discussion

The use of digital health technologies is and will increasingly be part of current nursing practice (International Council of Nurses, 2023). Considering the crucial role of digital technology in healthcare and nursing practice, it is essential for nurses to be proficient in this area. This study aimed to assess the DHC of Czech nurses across various healthcare settings, utilizing both online and paper-based data collection methods. The sample primarily consisted of experienced nurses, with a median and mean age of 40–42 years, aligning with the average age of general nurses in the Czech Republic (Strnadová et al., 2021).

For practical reasons, nurses were not given the option to choose between the paper and online versions of the questionnaire. Online methods only provide access to a subset of nurses, as membership in national organizations such as the Czech Nurses Association is voluntary and does not ensure comprehensive reach through this channel. Additionally, establishing collaboration with relevant institutions for paper-based survey completion across all regions turned out to be unfeasible. Obtaining permission to collect data using the paper-based questionnaire required not only ethical clearance from the researchers' institutional review board but also approval from institutional administrators, necessitating further negotiations. Most hospital administrators that were approached in various parts of the country either did not respond or indicated that accessing nurses through their institution was not possible. This hesitancy on the part of the institutions could be seen as a significant barrier to accessing nurses face-to-face and collecting data using the paper-based method. By using online methods, hospital gatekeepers could be bypassed, which enabled data collection from nurses to whom access would otherwise have been impossible. However, this approach may also have negative aspects, one of them being limited sampling technique options in research.

While there were statistically significant differences between the two subgroups in all other demographic and professional characteristics, the effect size of the difference was large for only two variables: educational level and frequency of patient interactions. In addition, the effect size for another variable–region–approached a large effect size, reflecting the data collection strategy described earlier. However, despite the differences in individual characteristics, the overall average age and years of professional experience were quite similar for both subgroups. In light of these findings, the generational distinction between digital natives and non-natives was not supported. Essentially, online data collection did not deter older nurses from participating. Thus, our findings align with previous research suggesting that birth year is only one factor influencing digital skills, and that with sufficient exposure to technology, individuals can significantly improve their digital proficiency–potentially reaching a level comparable to that of digital natives (Evans & Robertson, 2020).

Educational level achieved might have been affected by the Act No. 96 / 2004 Coll. (Act on Non-Medical Health Professions, 2004). According to this act, professional qualification to work as a general nurse could be obtained by completing the general nurse program at a secondary healthcare school, provided the first year of study began in the 2003 / 2004 school year or earlier. According to the same act, for pediatric nurses, the first year of study had to begin in the school year 1996 / 1997 at the latest. After these dates, high school education was no longer sufficient. Currently, to become a general or pediatric nurse in the Czech Republic, it is necessary to graduate from a university or higher vocational school (Act on Non-Medical Health Professions, 2004).

This suggests that general and pediatric nurses with a high school educational level might be older and have more years of experience compared with those with higher educational levels. Indeed, most of the 46 nurses with high school education in the paper-based subgroup completed their studies in the 1990s and, on average, had 25.1 years' experience. Conversely, nurses with the same educational level in the online subgroup had an average of only 14.1 years' experience. In fact, some of these nurses obtained a degree quite recently, which seems inconsistent with the mentioned act. This discrepancy might have arisen because the degree reported may not be in nursing, as the questionnaire did not specify the field of study that nurses should report.

The relatively high percentage of nurses with a master's degree in the online subgroup could be due to recruitment methods which targeted nurses through channels used by those involved in professional advancement, e.g., through universities and professional organizations. These nurses are likely motivated to further their careers through formal education and training. Additionally, our findings align with observations documented in the professional literature, which suggest that educational level is a more influential factor than chronological age in embracing digital technology and being comfortable in the online environment (Evans & Robertson, 2020).

Moreover, over 80% of the nurses in the online subgroup worked with patients daily, compared with less than half of the nurses in the paper-based subgroup. This indicates that, despite holding advanced degrees, most nurses were primarily involved in frontline nursing care. Consequently, these nurses may stay technologically savvy due to continuous advancements in healthcare and the necessity to operate complex medical equipment. This proficiency could also predispose them to a favorable perception of the role of digitalization in healthcare.

As mentioned before, the observed differences between the two subgroups in demographic and professional characteristics may be attributed to the varied data collection strategy, which aimed to capture the DHC of nurses in multiple clinical environments across the Czech Republic. This approach aligns with similar strategies found in professional literature. For instance, Clark et al. (2022) used both paper questionnaires and Facebook to recruit custodial grandmothers in the US for a cross-sectional survey on parenting self-efficacy and psychological well-being. Their comparison of online and paper subgroups revealed significant differences, leading to the conclusion that using multiple data collection methods can reach a larger and more diverse participant pool with diverse levels of digital proficiency compared with relying solely on paper-based methods.

Another advantage of using a combined approach to data collection is the potential for a larger sample size compared to studies that rely on a single method. Professional literature often highlights low completion rates in similar research designs, resulting in small samples. In our study, the completion rate was 44.1% for the online subgroup and 51.4% for the paper subgroup, with a substantial amount of missing data. This raises the question of whether the questionnaires were too lengthy. Additionally, some nurses reported skipping items due to a lack of opinion, possibly stemming from insufficient experience.

Although our sample size was smaller than anticipated, the response rate in the study that developed DigiHealthCom and DigiComInf was even lower, at 3.5% (Jarva et al., 2023). In a Finnish study evaluating anesthesia nursing competence among students, an online survey achieved only a 9% response rate, which increased to 21% after incorporating a paper format (Jeon et al., 2020). Meanwhile, a Greek study on influenza vaccination among health professionals during the COVID-19 pandemic, using both online and paper questionnaires, had a response rate of 39.9% (Avakian et al., 2023). Therefore, the completion rate in our study aligns with the experiences of other researchers.

Regarding the DigiHealthCom and DigiComInf results, both subgroups generally had a favorable attitude, as indicated by their tendency to partially agree with the positively formulated statements, which represented an adequate level of DHC. The only exception was the item "Colleagues are eager to develop their own work on digital solutions," which both subgroups perceived somewhat negatively. However, this item reflects an opinion on the attitude of others rather than oneself and may have presented a distorted view of the situation. Nevertheless, it is crucial to take this aspect into account. Konttila et al. (2019) emphasized the importance of collegial and organizational support in enhancing the digital competence of healthcare professionals. It emphasized that a positive workplace atmosphere, fostered by collegiality, is crucial for the successful adoption and implementation of digital technologies in healthcare settings.

Overall, workplace aspects were viewed slightly more positively in the paper-based subgroup, based on a comparison of the DigiComInf grand means across all three factors. In contrast, the DigiHealthCom grand means for all five factors were somewhat higher in the online subgroup, indicating that participants in this group perceived their personal DHC as higher than those in the paper-based subgroup. The reasons for this difference are unclear. One possible explanation is that participants may have been influenced by their environment while completing the survey. Nurses might have filled out paper-based questionnaires in the presence of their colleagues, which could have made them feel supported in their work. Conversely, it was less likely for participants to have colleagues around when completing the survey online, potentially leading to feelings of isolation not only during the survey but also in general. However, since we did not gather any information about the environment in which the data collection occurred, this aspect would need to be investigated in a separate study.

Additional insights were obtained from nurses' comments in response to an optional question about their digital competence. Comments on technical skills varied widely, from non-existent to proficient. For example, one nurse remarked, "My 13-year-old child fares better than I do and gives me advice." Nurses expressed a willingness to learn new skills but emphasized the need for proper training. Several nurses, especially those caring for the elderly or patients with dementia, voiced concerns about digitalization, stressing that personal contact

is irreplaceable. One nurse commented, "Digitalization is harmful. Patients need human harmony." Another stated, "I do not know how to care for pressure ulcers digitally." Occasionally, nurses mentioned a lack of support from their supervisors. These comments highlight the importance of proper training, addressing nurses' fears, and demonstrating that digitalization, if used wisely and tailored to individual situations, can facilitate care and human contact.

Given the aforementioned statements, a positive attitude from supervisors is essential. We examined responses from the two most represented and closely interconnected regions in our study: Prague and the Central Bohemian Region. Over 35% of nurses from these regions were in supervisory roles, with 90% belonging to the online subgroup. When comparing the grand means, their responses to the DigiHealthCom were almost identical to the entire online subgroup, while their responses to the DigiComInf were more favorable, similar to the paper-based subgroup. When comparing the medians, the supervisors showed a more favorable attitude towards digitalization, even on items towards which the entire sample showed less favorable attitudes. While this positive attitude is encouraging, it may be challenging for supervisors to transmit it to frontline nurses.

Comparing the DHC results with those of other studies is challenging due to the various definitions of DHC and related frameworks, as well as ongoing technological advancements (Longhini et al., 2022). A systematic review focusing on DHC among health professionals, which included 26 quantitative studies, found that only half of the studies provided a definition of DHC (Longhini et al., 2022). Upon re-accessing and re-analyzing the data, the authors identified 368 DHC items, classifying them into four competence areas: "self-rated competences," "psychological and emotional aspects toward the use of digital technologies," "knowledge about digital technologies," and "use of digital technologies" (Longhini et al., 2024). Most scores indicated a moderate level of DHC, aligning with the nurses' evaluations in our study. However, Longhini et al. (2024) found a poor level in "use of digital technologies" and a good level in "knowledge about digital technologies." A more detailed examination is necessary for a clearer picture. For instance, the authors categorized the use of a mobile phone or computer under "self-rated competence" rather than "use of digital technologies," and both competences were rated well.

In our study, the technical aspects of digital technology use are primarily covered in DigiHealthCom, Factor 3 (ICT competence), where both subgroups achieved the highest median (4) for almost all items and the highest grand mean. This factor was viewed most favorably. Knowledge about digital technologies is spread across items in most other DigiHealthCom factors, with nurses generally partially agreeing with the statements. Although our findings concerning this aspect suggest a lower level of competence compared to Longhini et al. (2024), drawing definitive conclusions is difficult due to the varying DHC definitions in literature.

Analyzing the results from the perspective of relevant professional Czech literature is challenging, as the issue of DHC has received only marginal attention in the Czech Republic so far. However, in a project entitled *"The competent nurse for the 21st century: an analysis and design of the optimization of nursing education and professional practice"*, a framework has been developed for the adaptation of newly graduated nurses and their lifelong learning (Holá et al., 2024). The framework also emphasizes the development of soft skills and effective communication. Therefore, any educational strategies aimed at promoting DHC among nursing staff could leverage the existing instruments and processes, focusing on both personal skills and organizational aspects.

Limitation of study

Several limitations were identified in this study. First, the sample size was not large enough to allow generalization of the results to the entire population of general and pediatric nurses in the Czech Republic. Thus, although the response rate aligns with professional literature and achieved sufficient effect size, our findings should be interpreted with caution. Self-selection bias may have skewed the population representation, as nurses with a more negative attitude towards DHC or those with perceived inadequate DHC knowledge and skills might have opted out of participating. In fact, this is a common behavior in health research when people lack personal experience with the subject being studied (Robinson et al., 2023). However, our sampling technique included both an online and a paper-based approach to maximize participation and minimize digital exclusion. Additionally, as already mentioned, the settings in which nurses completed the questionnaires could have influenced the results, but we did not collect detailed information on this aspect. Another limitation is that the questionnaires were used in Czech for the first time

and were not subjected to psychometric evaluation using advanced statistical methods.

Conclusion

Based on the study's findings, it is recommended that future research strategies continue to employ both online and paper surveys to capture diverse demographics among nurses. While significant differences were observed in educational level, patient interaction frequency, and region, overall perceptions of digital health competence (DHC) were favorable. However, there is a noted reluctance among nurses to engage in digital solutions development.

Nurses with higher levels of education and more frequent patient interactions are more likely to perceive themselves as competent in using digital tools. Such findings are promising, as these factors, unlike chronological age, are amenable to modification. Thus, targeted educational programs and increased patient interaction opportunities could further enhance DHC among nurses. Simultaneously, addressing nurses' concerns, whether related to their skills or the potential loss of the human aspect of care, is of paramount importance. Future initiatives should focus on these factors to promote the effective adoption of digital solutions in healthcare. Effective educational strategies could leverage the emerging positive attitude noted among supervisors, as well as the existing structural and procedural instruments that support professional development of Czech nurses. Concurrently, the adoption of appropriate strategies by policymakers to promote the digitalization of healthcare services could prove beneficial. In turn, enhanced DHC could positively impact the utilization of these instruments and promote the provision of high-quality nursing care.

The study's successful translation and validation of the DigiHealthCom and DigiComInf questionnaires in the Czech context are promising, but further research should be broadened to include all allied health professionals in the Czech Republic. In addition, alternative research designs and data collection strategies could facilitate a more thorough examination of the underlying factors. However, achieving this will require gaining greater acceptance among relevant stakeholders regarding the value of such an inquiry. Finally, simplifying research tools and clarifying the role of nurses in digital healthcare adoption will be crucial in enhancing participation in future studies.

Ethical aspects and conflict of interest

Ethical clearance was obtained from the Ethics Committee of the Faculty of Health Studies, University of Pardubice, Czech Republic (ID No. 5 / 2023 / 4.10.2023). Participants in the paper subgroup signed a paper informed consent form, and online participants provided digital consent. During the translation phase of the research instrument, the primary author of this work was employed by the Faculty of Health Sciences at Palacký University, Olomouc, Czech Republic.

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Author contributions

Conception and design (KM, MT, EJ, PM), data analysis and interpretation (PM, KM, MT, EJ), manuscript draft (PM), critical revision of the manuscript (PM, KM, MT, EJ, ZČ, JP, MK), final approval of the manuscript (PM, KM, MT, EJ, ZČ, JP, MK).

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