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Healthcare professionals' digital health competence profiles and associated factors: A cross-sectional study

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Abstract

Aims: To identify healthcare professionals' digital health competence profiles and explore associated factors to digital health competence in healthcare settings.

Design: A cross-sectional study.

Methods: Data were collected from 817 healthcare professionals from nine organizations with an electronic questionnaire by using Digital Health Competence instrument (42 items) and Aspects Associated with Digital Health instrument (15 items) between 1st March and 31st July 2022. K-means clustering was used to describe digital health competence profiles. Binary logistic regression analysis was used to explore associated factors.

Results: Analysis revealed three digital health competence profiles: A – high competence ($n = 336$), B – intermediate competence ($n = 352$) and C – low competence ($n = 129$). Between the profiles, digital health competence showed significant differences ($p < .001$). Recent graduation year, working in outpatient environments and leader or specialist position were associated with higher digital health competence. Organizational practices and the influence from colleagues improved competence in human-centred remote counselling, digital solutions as part of work, competence in utilizing and evaluating digital solutions and ethical competence. Support from management improved digital solutions as part of work and ethical competence.

Conclusion: Nursing and allied health professionals working in other than outpatient environments should be specifically acknowledged when digital health competence development initiatives are designed and targeted. The positive influence from colleagues could be harnessed by enhancing their involvement in digital health competence development methods such as orientation, mentoring or coaching. Additionally, managers should take a stronger role in supporting different areas of digital health competence.

Impact: This was the first study that explored healthcare professionals' digital health competence profiles and associated factors. The detection of healthcare professionals' digital health competence profiles guides the development of digital health education according to different needs in healthcare environments.

Reporting Method: The study has adhered to STROBE guidelines.

Patient or Public Contribution: No patient or public contribution.

KEYWORDS
allied health personnel, cluster analysis, delivery of health care, logistic models, nursing personnel, professional competence, surveys and questionnaires, telemedicine

1 | INTRODUCTION

Digital competence is a constantly evolving umbrella term for knowledge, skills, abilities and attitudes needed to use and evaluate digital technologies in working life, education and everyday life (Ilomäki et al., 2016). As digitalization has pierced all aspects of modern societies globally, the versatile utilization of digital technologies by various healthcare professionals is also routine in the healthcare context. Healthcare professionals use digital services, devices and information and communication technology to plan, deliver and document care and rehabilitation in the form of electronic health records, robotics, mobile health (mHealth) and digital care paths in their everyday work. Therefore, digital health competence can be considered as one aspect of healthcare professionals' core competence (Al Jabri et al., 2021). In the future, the increasing use of artificial intelligence in clinical decision-making (Giordano et al., 2021) and patient encounters in digital environments (Kaihlaniemi et al., 2023), the emergence of proactive ePatients (Ammenwerth, 2018) and issues related to health data management (Kolitsi et al., 2021) present new opportunities and challenges for healthcare professionals' work role and competence requirements.

2 | BACKGROUND

Organizations and associations nationally and internationally have put efforts into defining and constructing goals and operational models to support the effective and patient-centric use of digital services and devices in healthcare by committing to improve healthcare professionals' digital skills. For example, the recommendations of the World Health Organization's digital health action plan, DigitalHealthEurope, and the Finnish Nurses Association's strategy for digital social and health services have set specific priorities to strengthen healthcare professionals' digital health capacities and improve education on different aspects of healthcare digitalization (Ahonen et al., 2021; Kolitsi et al., 2021; World Health Organization, 2022). The European Union has also proposed several actions to enhance digital competencies on a wider scale through a separate policy initiative known as the Digital Education Action Plan (European Commission, 2020). According to the most recent data released by the Digital Economy and Society Index, which presents indicators of Europe's digital performance, 54% of Europeans possess at least basic digital skills. However, countries in the EU have pronounced differences in digital skills and the European Union has set a goal that at least 80% of all European Union citizens have at least basic digital skills (European Commission, 2022). This is also visible on national levels, for example, the Finnish Nurses Association's strategy for digital social and health services aims to increase the participation of nurses in the development and utilization of digital services (Ahonen et al., 2021).

As the need to respond to healthcare professionals' competence needs in a digitized world has been recognized, several studies and systematic reviews have aimed to determine and synthesize the contents of healthcare professionals' digital health competence. In a systematic review, Konttila et al. (2018) have concluded that healthcare professionals' competence in digitalization is a combination of knowledge of and skills to use digital technology, social and communication skills, ethical considerations of digitalization in the context of patient care, and motivation and willingness to expose oneself to digitalization at work. According to healthcare professionals' perceptions, they should have the ability to evaluate what digital health entails and combine new digital methods with existing traditional methods (Jarva, Oikarinen, et al., 2022). In some studies, terms such as digital maturity and digital adaptability have been utilized to describe the competence and capabilities of healthcare professionals to develop, use and organize digital technologies or electronic healthcare services (eHealth) in healthcare (Bleijenbergh et al., 2023; Neunaber & Meister, 2023). Another well-known term is eHealth literacy, which has been used to describe the ability to utilize an electronic source to find information to solve a health problem (Norman & Skinner, 2006). Simultaneously, nursing informatics competence has been defined to include three core competency areas among nursing professionals; nursing documentation, working in digital environment and ethics and data protection (Kinnunen et al., 2019). In the context of primary healthcare, healthcare professionals' digital health competence has been identified to focus on basic information technology skills and the use of electronic health records (Jimenez et al., 2020; Odendaal et al., 2020). More recently, aspects related to cybersecurity, privacy and the utilization of big data have been identified as important topics to be considered from a competence perspective (World Health Organization, 2022). In conclusion, the definition of healthcare professionals' digital health competence is broad, and the relevance of what should be included in the definition is often context-bound (Nazeha et al., 2020), which requires more detailed inspection to provide properly targeted competence development methods to various healthcare settings (Peltonen et al., 2019).

Studies on healthcare professionals' digital health competence evaluation are quite scarce. One study based on self-evaluation has identified that healthcare professionals' competence is good, especially in general information technology competencies (e.g., email use and word processing) and electronic documentation according to national standards (Kinnunen et al., 2019). However, a more recent study showed that ethics and data protection competencies have been evaluated as high but skills in electronic documentation need development (Saranto et al., 2022). Also, competence in patient interaction when using digital methods and generally working in digital environments have been evaluated as low (Kujala et al., 2018; Saranto et al., 2022) and acceptance of using digital tools in health care as conflicting, due to various associated factors such as prior experience, professional background and the user-friendliness of the solutions (Hennemann et al., 2017; Odendaal et al., 2020). Healthcare professionals perceive digital solutions as positive when the solutions support their work or somehow improve the possibilities to deliver quality patient care, as negative experiences are connected to a lack of time or expertise in using new methods of communication or the experience of increased workload (Konttila et al., 2018; Laukka et al., 2020).

The factors that influence healthcare professionals' digital health competence are multifaceted. Colleagues, work community, managers, orientation, and the possibilities provided to participate in continuous education seem to either support or hinder digital health competence development (Jarva, Mikkonen, et al., 2022; Konttila et al., 2018). The possibility to participate in training or education improves healthcare professionals' evaluation of their digital health competence (Jimenez et al. 2020; Peltonen et al., 2019). Still, the majority of healthcare professionals experience a lack of sufficient training on digital health competence, especially among older respondents (Kinnunen et al., 2019; Konttila et al., 2018). Additionally, healthcare professionals' motivation, adoption willingness and previous experience of using digital tools have been found to affect not only digital health competence development but also digital health competence itself (Jarva, Mikkonen, et al., 2022; Odendaal et al., 2020). Differences between different healthcare professional groups in accepting digital health solutions have not been found previously (Hennemann et al., 2017). In the past, more advanced age has been associated with lower digital health competence among healthcare professionals (Kaihlanen et al., 2021; Kleib & Nagle, 2018; Shiferaw & Mehari, 2019). However, elsewhere it has been reported that age is not directly associated with digital health competence (Hennemann et al., 2017). More recent graduation is associated with a higher evaluation of digital health competence (Kaihlanen et al., 2021).

Previous studies have mainly focused on studying specific healthcare professional groups, such as nursing professionals' (Kaihlanen et al., 2023) and physicians' (Jimenez et al., 2020) competencies in digitalized healthcare. Also, studies have investigated competence in digitalization from a narrower perspective, excluding, for example, the attitude perspective or including only a few statements that represent different areas of digital health competence (Kujala et al., 2018). There is still a lack of studies with a broader outlook on how different healthcare professional groups evaluate their digital health competence. Additionally, exploring specific healthcare professional groups' digital health competence has not considered the various aspects of digital health competence areas or identified how different factors influence digital health competence.

3 | THE STUDY

The aim of the study was to identify healthcare professionals' digital health competence profiles and explore associating factors to digital health competence in healthcare settings. The research questions were as follows: (1) How do healthcare professionals' self-assessed digital health competence levels cluster into profiles? (2) What factors are associated with the competence profiles of healthcare professionals in healthcare settings?

4 | METHODS

4.1 | Study design

This research followed an explorative cross-sectional study design. The STROBE checklist provided an accurate report on the study process with potential strengths and weaknesses (von Elm et al., 2007).

4.2 | Study participants

Healthcare professionals ($N = 23{,}100$) from nine organizations across Finland were invited to participate in the study using a purposive sampling method. Inclusion criteria included the right to practise their profession according to the guidelines of the National Supervisory Authority for Welfare and Health in Finland (Valvira, 2022) and a professional qualification from a university of applied sciences. University degree-level healthcare professionals (e.g. physicians) were excluded since their degree programmes are significantly longer than university of applied sciences degree programmes. Therefore, the invited pool of professionals consisted mostly of professionals with a nursing or allied health background. The target organizations were five specialized healthcare services in different parts of Finland (university hospitals), three primary healthcare organizations and one private organization in the Northern Ostrobothnia region. Healthcare professionals' clinical working environments in the invited organizations varied from inpatient and outpatient wards with different specialities to home care and administrative services. A total of 817 healthcare professionals responded to the questionnaire, which gives a response rate of 3.5%. The effect size of the sample has been measured according

to Cohen's *d* measures, showing an acceptable effect size varying from 0.30 to 4.04.

4.3 | Data collection and instruments

Data were collected using an electronic Webropol Survey & Reporting program questionnaire between 1st March and 31st July 2022. Information about the study and an anonymous link to the questionnaire were distributed via email, using contact persons in each organization. The contact persons were informed of the study's inclusion criteria and sent the information forward to potential participants in the organizations' units. Participation reminders were sent biweekly on two or three occasions, depending on the organization. The respondent data were used earlier for instrument development and validation (Jarva et al., 2023), but the respondents' evaluation of digital health competence or associated factors has not been previously reported.

The self-assessed instruments used to collect the data were the healthcare professionals' Digital Health Competence (DigiHealthCom) instrument and Aspects Associated with Digital Health Competence (DigiComInf) instrument. The instruments include a total of 15 background questions, and two questions relating to the use of various digital solutions at work and during leisure time. DigiHealthCom consists of five factors (42 items): *human-centred remote counselling competence* (16 items), *digital solutions as part of work* (9 items), *information and communication technology (ICT) competence* (5 items), *competence in utilizing and evaluating digital solutions* (8 items) and *ethical competence related to digital solutions* (4 items). DigiComInf consists of three factors (15 items): *support from management* (6 items), *organizational practices as part of digital competence development* (4 items) and *colleagues' adoption and influence* (5 items). The items were evaluated using a four-point Likert scale (1 = completely disagree, 2 = partially disagree, 3 = partially agree, 4 = completely agree). The instruments have been evaluated to be valid and reliable (Jarva et al., 2023) with Cronbach's alpha ranging from 0.91–0.97 in DigiHealthCom and 0.74–0.88 in DigiComInf.

4.4 | Data analysis

IBM SPSS Statistics (V27.0) computer software was used in data analysis. The data did not include any missing values. Descriptive statistics served to analyse respondent characteristics that are presented as percentages, means and standard deviations. K-mean cluster analysis was used to identify professionals' digital health competence profiles. Optimal cluster formation was determined by identifying that each cluster has sufficient sample representation (at least 5% of the study sample). DigiHealthCom and DigiComInf factors were transformed as sum-variables, and dependence between variables were analysed together with background questions for each profile by using One-way Anova, Chi-square and Kruskal–Wallis tests. Also, Fisher's exact and Monte Carlo tests were used to obtain an accurate *p*-value and an unbiased estimate of the exact significance levels (Mehta & Patel, 1989). Additionally, digital solutions were analysed for each profile using Chi square and Fisher exact tests. Competence levels of profiles have been interpreted according to the meaning of the Likert scale, with a mean value of ≤2.49 indicating low competence, a mean value of 2.50–3.49 indicating intermediate competence and a mean value of ≥3.50 indicating high competence.

Logistic regression was utilized to identify significant factors from health care professionals' backgrounds associated with digital health competence variables. Age, gender, graduation year, clinical working environment, professional background, amount of patient work and aspects associated with digital health competence (DigiComInf sum variables support from management, organizational practices and colleagues' adoption and influence) were tested to build logistic regression models. The forced entry method was used in model building to find the best suitable model without discriminating any variables (Munro, 2005). The outcome variables were transferred to a dichotomous format (0 = 1–2,49 – disagree; 1 = 2,5–4 – agree) to enable analysis. The results are presented as odds ratios (ORs) to show the probability of the occurrence over non-occurrence, with confidence intervals of 95%. The significance level was set at $p < .05$ in all conducted tests. The goodness of fit was analysed with Omnibus and the Hosmer-Lemeshow tests. Cox & Snell and Nagelkerke R square results present the variance of the model (Munro, 2005). The effect size was interpreted according to Cohen's *d* equivalence; small ($d \leq 0.2$), medium ($d \leq 0.5$) and large ($d \leq 0.8$) (Cohen, 1992).

4.5 | Ethical considerations

The study followed the responsible conduct of research guidelines by the Finnish National Board on Research Integrity (Responsible Conduct of Research, 2012). Ethical principles for medical research involving human subjects were also followed (Declaration of Helsinki, 2013). Research permission was collected from all participating organizations ($n = 9$) during autumn 2021 and spring 2022. The application for ethical approval was not necessary according to the Finnish National Board on Research Integrity (Responsible Conduct of Research, 2012) as the research participants did not include minors and the research did not induce any direct or indirect psychological or physical harm to the participants (Medical Research Act, 2010). Responding to the questionnaire was voluntary and anonymity was secured by distributing the electronic link through contact persons. The study aims and information about how the respondent's answers and information were to be utilized were enclosed in the questionnaire's cover letter. Informed consent was separately requested at the beginning of the questionnaire. The data were stored in password-secured files and only the research group members defined in the research permissions had access to the data. The data will be stored for 10 years and eventually destroyed with

the assistance of the first author's organization's (University of Oulu) research data support personnel, according to general data protection regulations (European Union, 2016).

5 | RESULTS

5.1 | Healthcare professionals' characteristics

The total number of respondents ($n = 817$) included different healthcare professionals, from which a clear single professional group was registered nurses (52.8%) (Table 1). Also, other nursing professions and administration positions such as assistant head nurses and head nurses were widely represented. Other professions included physical therapists, occupational therapists, social workers, paramedics and social advisors. Some 86.7% of the respondents identified as females and the respondents' age range was from 19 to 67 years (mean 43.7 years). Of the respondents, 51.8% worked in different inpatient environments (including hospital wards, intensive care units, operating theatres and delivery rooms). The second biggest clinical working environment was an outpatient clinic or reception where 30.0% of the respondents worked. Some 69.2% did patient work daily, and 4.8% did not work with patients in their current position.

5.2 | Healthcare professionals' digital health competence profiles

Three cluster groups, or profiles, were found to be most suitable to represent the dataset, presenting healthcare professionals' digital health competence levels (Table 2). Between the profiles, digital health competence outcomes were statistically significant ($p < .001$) in all five DigiHealthCom sum variables. Healthcare professionals in all profiles evaluated information and communication technology competence as the highest. Competence in human-centred remote counselling was evaluated as the lowest competence across all profiles, and digital solutions as part of work were evaluated as equally low in profile A.

Profile A explained 41.1% ($n = 336$) of all respondents and had the highest mean score of competence evaluation in digital health (mean variation 3.49–3.84). Profile A included respondents who had statistically significantly a more recent graduation year from the highest education level (mean value 2009), had more respondents who worked in outpatient clinics (40.5%), home care/assisted living units (4.2%) or other healthcare environments (5.4%) and had the least amount of respondents who had responsibilities in patient work on a daily basis (66.4%) when compared to the intermediate or low digital health competence groups. Additionally, statistical significance was also shown in the number of professionals with a background in social services (6.8%) when compared to other profiles. Respondents in profile A were slightly younger, had the least work experience and had the most professionals who had completed a master's degree, but these variables did not reach statistical significance.

TABLE 1 Respondent characteristics.

Characteristics	Respondents ($n = 817$)
Gender	*n*, %
Female	708 (86.7%)
Male	96 (11.8%)
Other	5 (0.6%)
Prefer not to say	8 (1.0%)
Age	
Mean	43.7 years
Min	19 years
Max	67 years
SD	11.4
Profession	*n*, %
Registered nurse	431 (52.8%)
Practical nurse	51 (6.2%)
Physical therapist	45 (5.5%)
Midwife	40 (4.9%)
Occupational therapist	32 (3.9%)
Public health nurse	19 (2.3%)
Laboratory nurse/bio-analyst	14 (1.7%)
Radiographer	12 (1.5%
Social worker	10 (1.2%)
Paramedic	9 (1.1%)
Social advisor	8 (1.0%)
Other (rehabilitation advisor, podiatrist, prosthetist/orthotist)	5 (0.6%)
Assistant head nurse	58 (7.1%)
Head nurse	56 (6.9%)
Service manager/supervisor	16 (2.0%)
Specialist/project coordinator	11 (1.4%)
Clinical working environment/unit	*n*, %
Inpatient (including hospital ward, emergency ward, intensive care unit, operating theatre, delivery room)	423 (51.8%)
Outpatient	245 (30.0%)
Home care and assisted living	27 (3.3%)
Emergency care	12 (1.5%)
Administration and research	53 (6.5%)
Other	57 (6.9%)
Patient work	*n*, %
Daily (at least 5 days/week)	565 (69.2%)
Weekly (1–4 days/week)	163 (20.0%)
Monthly (a few times/month)	29 (3.5%)
Rarely (a few times during several months)	21 (2.6%)
I do not do patient work currently	39 (4.8%)

Profile B included the highest number of respondents 43.1% ($n = 352$). Healthcare professionals in this profile evaluated their digital health competence levels as good (mean variation

TABLE 2 Healthcare professionals' ($N = 817$) digital health competence profiles and outcomes.

Outcomes	Profile A ($n = 336$) 41.1%	Profile B ($n = 352$) 43.1%	Profile C ($n = 129$) 15.8%	*p*-value	Cohen's *d* (min-max)
Demographic					
Age in years				0.764[a]	
Mean (SD)	43.41(11.15)	43.50 (11.72)	44.76 (11.33)		
Min – max	20–65	19–67	25–64		
Gender, %				0.689[b]	
Female	87.8	85.8	86.0		
Male	11.3	11.9	12.4		
Prefer not to say/other	0.9	2.3	1.6		
Work experience in years				0.486[a]	
Mean (SD)	16.46 (10.50)	16.79 (11.32)	18.38 (10.67)		
Min – max	0–42	0–41.3	1.1–43		
Highest education, %				0.523[b]	
Vocational education (e.g. practical nurse)	6.3	7.4	4.7		
University of applied sciences degree (bachelor's)	68.2	73.0	76.0		
University degree (bachelor's)	3.3	2.3	2.3		
University of applied sciences degree (master's)	11.3	9.1	10.1		
University degree (master's)	9.5	8.0	7.0		
Other	1.5	0.3	–		
Graduation year from highest education				**0.007**[a]	
Mean (SD)	2009.47 (10.44)	2008.63 (10.69)	2006.45 (10.92)		
Min – max	1984–2023	1983–2022	1984–2022		
Operational area, %				**0.031**[b,c]	
Health services	86.6	86.1	94.6		
Rehabilitation services	6.3	8.5	3.9		
Social services	6.8	4.8	0.8		
Other	0.3	0.6	0.8		
Clinical working environment/unit, %				**<0.001**[b,e]	
Inpatient (hospital and emergency ward, intensive care unit, operating theatre, delivery room)	39.6	54.5	76.0		
Outpatient	40.5	25.6	14.7		
Home care and assisted living	4.2	2.8	2.3		
Emergency care	0.9	2.0	1.6		
Administration, virtual services and research	7.1	8.0	3.1		
Social welfare	2.4	2.6	–		
Other	5.4	4.5	2.3		
Professional background, %				0.246[b]	
Nursing (registered, practical, public health, laboratory, midwife, radiographer, paramedic)	67.0	72.4	74.4		
Rehabilitation (physical therapist, occupational therapist, podiatrist, rehabilitation counsellor)	9.2	10.8	10.1		
Social work (social worker or advisor)	3.0	2.0	0.8		

TABLE 2 (Continued)

Outcomes	Profile A ($n=336$) 41.1%	Profile B ($n=352$) 43.1%	Profile C ($n=129$) 15.8%	p-value	Cohen's d (min-max)
Leader or specialist (head nurse, assistant head nurse, service manager/supervisor, specialist/project coordinator)	20.8	14.8	14.7		
Work time, %				0.776[b]	
Full time	88.7	89.8	87.6		
Part time	11.3	10.2	12.4		
Patient work, %				**0.012**[b]	
Daily (at least 5 days/week)	66.4	71.6	69.8		
Weekly (1–4 days/week)	20.2	19.6	20.2		
Monthly (a few times/month)	4.8	3.7	–		
Rarely (a few times during several months)	4.2	1.7	0.8		
I do not do patient work currently	4.5	3.4	9.3		
DigiHealthCom and DigiComInf sum-variables*					
DigiHealthCom, mean (SD)**					
Human-centred remote counselling competence	3.49 (0.34)	2.74 (0.49)	1.73 (0.62)	**<0.001**[d]	1.77–4.04
Digital solutions as part of work	3.49 (0.44)	3.00 (0.45)	2.67 (0.67)	**<0.001**[d]	0.66–1.59
ICT competence	3.84 (0.47)	3.66 (0.55)	3.02 (1.01)	**<0.001**[d]	0.35–1.23
Competence in utilizing and evaluating digital solutions	3.55 (0.34)	2.79 (0.40)	2.01 (0.54)	**<0.001**[d]	1.76–3.79
Ethical competence related to digital solutions	3.76 (0.34)	3.11 (0.51)	2.06 (0.66)	**<0.001**[d]	1.49–3.76
All sum-variables	3.62	3.06	2.30		
DigiComInf, mean (SD)**					
Support from management	2.75 (0.69)	2.50 (0.60)	2.10 (0.69)	**<0.001**[d]	0.39–0.94
Organizational practices as part of digital competence development	2.49 (0.65)	2.24 (0.58)	1.83 (0.57)	**<0.001**[d]	0.41–1.05
Colleagues' adoption and influence	2.90 (0.54)	2.75 (0.45)	2.48 (0.50)	**<0.001**[d]	0.30–0.79
All sum-variables	2.71	2.50	2.14		

Note: $p<.05$ (marked in bold).

*Likert 1–4. **M: mean (SD: standard deviation).

[a]One-way Anova.

[b]Chi square.

[c]Fisher's exact.

[d]Kruskal-Wallis.

[e]Monte Carlo.

2.74–3.66). When compared to other profiles, profile B included the most professionals who worked in administration, virtual services or research (8%) and rehabilitation services (10.8%), which presented statistical significance. Statistical significance was also acknowledged in the number of professionals in profile B who worked with patients daily (71.8%), which is the highest share among the profiles.

Profile C was the smallest with 15.8% ($n=129$) of all respondents. Digital health competence levels (mean variation 2.01–3.02) were evaluated as the lowest among the profiles. Professionals in this profile had statistically significantly the longest time from graduating from the highest education (mean value 2006), had the most professionals working in health services (94.6%), more specifically in inpatient environments (76%), had a background in nursing (74.4%) and had the biggest share of professionals who did not have responsibilities in patient work in their current position (9.3%). Moreover, profile C included respondents who had the longest work experience, had the most professionals with a bachelor's degree from a university of applied sciences as their highest level of education and the most professionals who worked part-time, yet these background factors were not statistically significant.

Use of digital health solutions in both work and leisure time was also investigated in relation to digital health competence profiles (Table 3). Statistical differences were found in the use of smartphones, health information exchange services, well-being applications, digital workplaces or platforms and video conferencing

TABLE 3 Digital health competence profiles and use of digital solutions during work and leisure time.

	Profile A		Profile B		Profile C		*p*	
Use of digital solutions	**Work**	**Leisure**	**Work**	**Leisure**	**Work**	**Leisure**	**Work**	**Leisure**
Computer, %								
Daily	99.4	43.8	97.4	34.7	97.7	39.5	0.118[a]	**0.024**[a]
Weekly	0.6	30.1	2.6	33.5	2.3	21.7		
Monthly	–	10.7	–	16.5	–	17.1		
More seldom	–	9.5	–	11.1	–	16.3		
Not in use	–	6.0	–	4.3	–	5.4		
Smart phone, %								
Daily	77.4	99.7	61.4	98.9	55.8	97.7	**<0.001**[a]	0.177[b]
Weekly	5.4	–	11.1	0.3	13.2	–		
Monthly	1.8	–	4.0	–	2.3	–		
More seldom	2.4	–	6.8	–	8.5	0.8		
Not in use	13.1	0.3	16.8	0.9	20.2	1.6		
Tablet, %								
Daily	2.4	25.0	2.6	19.9	2.3	19.4	0.826[a]	**0.024**[a]
Weekly	8.0	18.5	9.9	16.2	7.0	11.6		
Monthly	9.2	11.0	9.7	11.6	7.8	9.3		
More seldom	16.4	14.6	19.6	21.0	21.7	14.0		
Not in use	64.0	31.0	58.2	31.3	61.2	45.7		
Wearable technology, %								
Daily	10.7	43.2	7.1	36.6	7.0	34.9	0.310[b]	0.143[a]
Weekly	3.0	6.5	1.1	7.7	0.8	3.9		
Monthly	1.2	4.5	0.9	2.3	0.8	2.3		
More seldom	3.3	6.8	4.0	7.1	1.6	6.2		
Not in use	81.8	39.0	86.9	46.3	89.9	52.7		
Robotics, %								
Daily	1.5	1.2	1.4	–	2.3	–	0.866[b]	0.146[b]
Weekly	3.6	5.1	1.7	2.6	2.3	0.8		
Monthly	3.0	5.4	3.1	4.5	2.3	5.4		
More seldom	4.5	10.1	6.0	10.5	4.7	8.5		
Not in use	87.5	78.3	87.8	82.4	88.4	85.3		
Health information exchange services (e.g. My Kanta pages), %								

TABLE 3 (Continued)

Use of digital solutions	Profile A		Profile B		Profile C		*p*	
	Work	Leisure	Work	Leisure	Work	Leisure	Work	Leisure
Daily	18.8	3.0	9.7	2.6	3.9	1.6	**<0.001**[a]	**0.004**[a]
Weekly	23.2	15.2	16.8	9.7	10.9	8.5		
Monthly	17.3	44.0	14.8	52.3	7.8	35.7		
More seldom	15.2	32.1	22.7	29.5	20.9	43.4		
Not in use	25.6	5.7	36.1	6.0	56.6	10.9		
Wellbeing applications, %								
Daily	9.8	8.9	6.3	6.5	3.9	5.4	**0.001**[a]	0.077[a]
Weekly	9.5	10.1	6.3	9.4	2.3	5.4		
Monthly	7.4	11.6	5.4	8.5	3.1	7.0		
More seldom	15.8	26.8	16.5	33.0	10.1	26.4		
Not in use	57.4	42.6	65.6	42.6	80.6	55.8		
Digital workspaces or platforms (e.g. Google Drive), %								
Daily	73.8	29.5	57.1	20.2	48.1	18.6	**<0.001**[a]	**<0.001**[a]
Weekly	20.5	24.1	26.7	23.0	30.2	20.9		
Monthly	2.4	20.8	9.1	17.0	10.1	10.9		
More seldom	2.1	13.1	2.6	25.9	3.9	20.9		
Not in use	1.2	12.5	4.5	13.9	7.8	28.7		
Video conferencing programmes (e.g. Microsoft Teams, Zoom), %								
Daily	48.5	11.0	32.4	4.0	19.4	2.3	**<0.001**[a]	**<0.001**[a]
Weekly	31.0	24.1	31.5	15.3	28.7	10.1		
Monthly	13.1	26.5	21.3	31.3	23.3	20.2		
More seldom	5.4	26.8	12.2	34.9	18.6	41.1		
Not in use	2.1	11.6	2.6	14.5	10.1	26.4		
Games console, %								
Daily	0.3	2.4	–	1.4	–	3.1	0.855[b]	0.262[a]
Weekly	0.3	6.0	0.9	5.1	0.8	3.9		
Monthly	1.5	9.2	1.1	6.5	0.8	3.1		
More seldom	3.6	13.7	5.1	17.0	5.4	13.2		
Not in use	94.3	68.8	92.9	69.9	93.0	76.7		

Note: $p < .05$ (marked in bold).

[a]Chi square.

[b]Fisher's exact.

programs when considering use at work. The professionals in profile A used more of these digital solutions daily, whereas the use in profiles B and C focused on less frequent use. Users in profile C, especially, used these digital solutions less; for example, 56.6% do not use health information exchange services (e.g. My Kanta pages) at all. Additionally, 80.6% of the respondents in profile C did not use any well-being applications, while the share in profile A was 57.4%. In leisure time use, significant differences were found in computer, tablet, health information exchange service, digital workspace or platform and video conferencing program use. No statistically significant differences were found in the use of wearable technology, robotics or game consoles in work or leisure contexts. Users in profile A used computers the most daily but also had the highest number of respondents among the profiles who did not use a computer at all. Only a few respondents used health information exchange services in all profiles daily, but weekly use was highest in profile A. The use of digital workspaces or video conferencing programs was quite evenly distributed between daily, weekly or monthly use, but respondents in profile C clearly used those digital solutions less when compared to profiles A or B.

5.3 | Background factors associated with digital health competence profiles and areas

The outcomes related to the associated educational and organizational factors from the DigiComInf sum variables were also statistically significant ($p < .001$) between the profiles. Colleagues' adoption and influence were evaluated as the most relevant factor influencing digital health competence in all profiles. Organizational practices were evaluated as the least influencing factor in all profiles. Associated educational and organizational factors were evaluated as highest in profile A (mean variation 2.49–2.90), intermediately in profile B (mean variation 2.24–2.75) and lowest in profile C (mean variation 1.83–2.48). In addition to the sum-variables, graduation year, operational area, clinical working environment and amount of patient work showed statistically significant differences between the profiles.

Binary logistic regression models predicted that age, graduation year, clinical working environment, professional background, patient work and educational and organizational factors associated with digital health competence affect digital health competence areas differently (Table 4). A more recent graduation year, working in outpatient, home care or other healthcare environments (such as school healthcare) and background as a leader or a specialist were found to be associated with higher competence in human-centred remote counselling. Lack of patient work was associated with lower competence in human-centred remote counselling. In addition to more recent graduation year, working in an outpatient environment and background as a leader or a specialist, also lower age was associated with higher competence in digital solutions as part of work. Working in an outpatient unit was associated with higher competence in utilizing and evaluating digital solutions, as lack of patient work and professional background in rehabilitation indicated lower competence in utilizing and evaluating digital solutions.

The analysis showed that experienced support from management enhanced competence in integrating digital solutions as part of work and ethical competence related to digital solutions. All four competence areas included in the analysis were perceived to be supported by organizational practices and colleagues' adoption and influence.

6 | DISCUSSION

This study has introduced three profiles (A, B and C) that display healthcare professionals' digital health competence levels and associated factors with digital health competence. The profiles present high digital health competence (A), intermediate digital health competence (B) and low digital health competence (C). All sum variables from the DigiHealthCom and DigiComInf instruments had statistically significant differences between the profiles, and all competence areas were evaluated as highest in profile A and lowest in profile C. Altogether, 688 (84.2%) respondents were included in either profiles A or B, which means that most of the professionals evaluated their digital health competence at least at an intermediate level. Moreover, information and communication technology competence was evaluated as the highest competence in all profiles. The same results have been reported by Kinnunen et al. (2019), in which general information technology competence in particular was found to be at a good level among healthcare professionals. Additionally, in a recent study by Kaihlanen et al. (2023), the majority of registered nurses were included in either moderate or high nursing informatics competence groups. Finland (along with the Netherlands) has the most digitally competent citizens out of all European Union member states with 79% per cent of people having basic or above basic digital skills (European Commission, 2022). Therefore, our study findings strengthen the understanding that Finnish citizens are digitally competent, also in the context of healthcare.

Professionals evaluated human-centred remote counselling competence as the lowest in all profiles. This finding is also supported by previous research as healthcare professionals, specifically nurses, evaluated their competence in working in a digital environment as low (Kujala et al., 2018; Saranto et al., 2022). Counselling in digital environments has become an important channel in patient care delivery (Kaihlaniemi et al., 2023). In our study, this includes the competence to guide and support patients to use digital services according to their needs, communicate with patients using digital solutions, and work in the digital healthcare environment. Lower competence in remote counselling could be argued to be explained by lack of training (Kujala et al., 2018) and therefore expertise in the area (Kaihlaniemi et al., 2023), but also the fact that not necessarily all respondents use remote counselling or digital environments in their daily work. Digital solutions as part of work competence, i.e. attitudes towards digitalization of services, also scored lower in profile

TABLE 4 Background factors and educational and organizational factors related to digital health competence areas.

	Outcome variables							
	Human-centred remote counselling competence (low $n=188$, high $n=629$)		Digital solutions as part of work (low $n=109$, high $n=708$)		Competence in utilizing and evaluating digital solutions (low $n=170$, high $n=647$)		Ethical competence related to digital solutions (low $n=120$, high $n=697$)	
Independent variables	**OR (CI 95% lower, upper)**	***p***	**OR (CI 95% lower, upper)**	***p***	**OR (CI 95% lower, upper)**	***p***	**OR (CI 95% lower, upper)**	***p***
Background factors								
Age	1.01 (0.98, 1.03)	0.655	0.96 (0.93, 0.99)	**0.004**	0.98 (0.95, 1.00)	0.067	1.00 (0.97, 1.03)	0.990
Gender								
Female (ref.)								
Male	1.28 (0.72, 2.28)	0.393	0.71 (0.37, 1.38)	0.319	1.44 (0.77, 2.69)	0.260	1.78 (0.87, 3.64)	0.113
Prefer not to say/ other	2.00 (0.48, 8.34)	0.339	0.70 (0.16, 3.12)	0.641	0.67 (0.19, 2.35)	0.529	0.89 (0.23, 3.48)	0.862
Graduation year	1.04 (1.01, 1.06)	**0.005**	1.03 (1.00, 1.06)	**0.045**	1.02 (1.00, 1.05)	0.063	1.02 (0.99, 1.05)	0.134
Clinical working environment								
Inpatient (ref.)								
Outpatient	7.12 (4.17, 12.16)	**<0.001**	1.82 (1.07, 3.09)	**0.027**	2.64 (1.67, 4.18)	**<0.001**		
Home care	5.41 (1.52, 19.27)	**0.009**	1.37 (0.39, 4.75)	0.622	2.08 (0.69, 6.23)	0.193		
Emergency	2.86 (0.54, 15.13)	0.216	1.43 (0.25, 8.25)	0.686	1.10 (0.24, 5.04)	0.897		
Administration	1.18 (0.56, 2.48)	0.656	3.08 (0.67, 14.09)	0.147	2.32 (0.87, 6.20)	0.092		
Social welfare	2.17 (0.37, 12.57)	0.389	1.97 (0.32, 12.23)	0.467	4.66 (0.69, 31.40)	0.114		
Other	7.08 (1.99, 25.13)	**0.002**	2.77 (0.73, 10.56)	0.134	1.48 (0.59, 3.74)	0.402		
Professional background								
Nursing (ref.)								
Rehabilitation	1.55 (0.77, 3.13)	0.223	1.53 (0.70, 3.35)	0.285	0.54 (0.30, 0.97)	**0.040**	0.99 (0.52, 1.90)	0.978
Social work	3.96 (0.39, 40.11)	0.244	0.31 (0.06, 1.66)	0.173	0.46 (0.10, 2.10)	0.314	2.79 (0.36, 21.78)	0.326
Leader or specialist	2.67 (1.34, 5.32)	**0.005**	3.67 (1.56, 8.64)	**0.003**	1.96 (0.98, 3.91)	0.056	0.92 (0.45, 1.87)	0.820
Patient work								
Daily (ref.)								
Weekly	1.01 (0.61, 1.66)	0.979			0.66 (0.41, 1.09)	0.103	1.06 (0.61, 1.82)	0.845
Monthly	3.78 (0.47, 30.29)	0.210			1.52 (0.31, 7.39)	0.602	3.37 (0.42, 26.79)	0.253
Rarely	0.45 (0.13, 1.53)	0.199			2.43 (0.29, 20.01)	0.410	3.08 (0.38, 24.95)	0.293
No patient work	0.02 (0.07, 0.55)	**0.002**			0.30 (0.11, 0.84)	**0.022**	0.46 (0.17, 1.24)	0.124

(Continues)

TABLE 4 (Continued)

	Outcome variables							
	Human-centred remote counselling competence (low $n=188$, high $n=629$)		Digital solutions as part of work (low $n=109$, high $n=708$)		Competence in utilizing and evaluating digital solutions (low $n=170$, high $n=647$)		Ethical competence related to digital solutions (low $n=120$, high $n=697$)	
Independent variables	**OR (CI 95% lower, upper)**	***p***	**OR (CI 95% lower, upper)**	***p***	**OR (CI 95% lower, upper)**	***p***	**OR (CI 95% lower, upper)**	***p***
Educational and organizational factors								
Support from management	1.06 (0.70, 1.61)	0.771	1.87 (1.13, 3.09)	**0.015**	1.42 (0.94, 2.15)	0.098	1.68 (1.06, 2.68)	**0.027**
Organizational practices	1.78 (1.17, 2.71)	**0.008**	3.13 (1.71, 5.74)	**<0.001**	2.70 (1.70, 4.29)	**<0.001**	1.93 (1.16. 3.22)	**0.011**
Colleagues' adoption and influence	2.12 (1.40, 3.19)	**<0.001**	2.40 (1.47, 3.94)	**<0.001**	1.98 (1.31, 2.98)	**0.001**	2.09 (1.35, 3.25)	**0.001**
Omnibus		**<0.001**		**<0.001**		**<0.001**		**<0.001**
Hosmer & Lemeshow		0.468		0.443		0.829		0.770
Cox & Snell, Nagelkerke R^2	16%–24.2%		13.5%–24.7%		13.1%–20.5%		6.8%–12%	
Classification	78.8%		88%		81.4%		85.4%	

Note: $p < .05$ (marked in bold).

Outcome variables classified into low competence (0 = 1–2.49 Likert scores) and high competence (1 = 2.50–4 Likert scores).

A. Still, this competence area, along with human-centred remote counselling competence, was evaluated clearly higher in profile A when compared to profiles B or C. Profile A included the highest percentage of leaders and specialists and they are in a critical position in supporting healthcare professionals in change as digital solutions shape practices (Kujala et al., 2019). Therefore, it is important that they perceive digital solutions as supporting their and other healthcare professionals' work and assisting in care processes by improving quality of patient care (Mikkonen et al., 2023).

Overall, ethical competence related to digital solutions was evaluated quite highly in all profiles but not as highly as in previous research among nursing professionals (Kaihlanen et al., 2023; Saranto et al., 2022). Healthcare professionals' knowledge of ethical, legal and regulatory requirements as well as privacy and security issues related to digital solutions have been identified as major domains in several digital health competency frameworks and should be considered in training for all healthcare professionals (Nazeha et al., 2020). Therefore, the results of our study indicate that developing different healthcare professionals' skills in data protection, customer autonomy and privacy should be further enhanced in various healthcare settings, as has also been addressed in the regional digital health action plan for the World Health Organization European Region 2023–2030 (World Health Organization, 2022). As digital solutions in healthcare are undergoing constant and rapid evolvement, acknowledging healthcare professionals' up-to-date ethical competence is of high importance to ensure that human rights and privacy are not violated in the context of digital healthcare and to avoid the deepening of the digital divide among different groups in vulnerable positions.

The use of digital solutions in the work and leisure time contexts was examined to recognize the difference in use behaviour between the profiles. Daily use of smartphones, health information exchange services, wellbeing applications, digital workspaces and video conferencing programs was more evident among profile A users. As the users in profile A were more recently graduated and were more likely to have completed a higher degree, they could be more accustomed to using similar digital tools in their studies. This is supported by the aspect that healthcare professionals who had graduated after national eHealth educational initiatives were more competent in using nursing information technology when compared to professionals who had graduated earlier (Kaihlanen et al., 2021). Moreover, also previously the attainment of a master's degree or doctoral qualification has been identified as being associated with higher self-evaluated informatics competence and thus more experienced use of digital solutions (Brown et al., 2020; Kleib & Nagle, 2018). Additionally, profile A had more respondents working in outpatient clinics or home care than other profiles. These users might be more accustomed users as digital solutions have become more evident in these environments, especially since the COVID-19 pandemic (Gareev et al., 2021), and the initiatives to deliver care more efficiently and cost-effectively by using remote solutions (Lundgren et al., 2020). However, the use of robotics, wearable technologies and digital games was less frequent in both work and leisure in all competence profiles, which indicates that these technologies have not yet gained widespread popularity or possibilities in healthcare.

The evaluation of associating educational and organizational factors was examined in relation to each profile and included in binary logistic regression analysis. Mean value differences of the associating factors were not as distinct as in digital health competence areas between the profiles, yet colleagues' adoption and influence were evaluated as the most influential factor on professionals' evaluation of their digital health competence. Societal influence, especially from colleagues and managers, has also been previously found to impact healthcare professionals' information technology use (Konttila et al., 2018) and acceptance of digital solutions (Hennemann et al., 2017). In our study, colleagues' adoption and influence were significant in four competence areas and especially influential in affecting professionals' attitudes towards digital solutions as part of work, which hasn't been previously indicated in research. Moreover, all three educational and organizational factors supported respondents' ethical competence significantly, but none of the background variables were significantly associated with ethical competence related to digital solutions in logistic regression analysis.

In this study, managers' support only improved healthcare professionals' attitudes towards digital solutions and ethical competence related to digital solutions. Leaders have been previously recognized as key stakeholders in ensuring healthcare professionals' digital health competence (Laukka et al., 2022), especially when considering change management and individual support when implementing new digital services (Konttila et al., 2018). One main finding of our study is that managers have succeeded in supporting healthcare professionals' positive outlook on digital solutions and ethical competence, but the promotion of using and evaluating digital solutions as well as human-centred remote counselling competence should be focused on managers and leaders in the future. Organizational practices, which include educational activities and orientation, had a reinforcing effect on four digital health competence areas in logistic regression analysis. Therefore, as previous studies have concluded (Nazeha et al., 2020), individually designed systematic training and orientation are extremely important in healthcare professionals' digital health competence development and exceed the influence from managers or colleagues.

Higher age was associated with lower evaluation of digital solutions as part of work. The results from our study indicate a continuous decrease in self-evaluated competence as the respondents age. This gives insight and supports the perception that younger professionals are more comfortable with digital solutions and have a more positive attitude towards digitalization at work than older professionals. Previous studies have found that especially nurses' more advanced age is associated with lower nursing informatics competence (Kaihlanen et al., 2023). Healthcare professionals have had negative attitudes towards technology education and in general older professionals use less technology (Konttila et al., 2018) but it has not been possible to directly connect the age of respondents to the evaluation of attitudes towards digital health. However, as the effect was only visible in one aspect of digital health competence, a generalization effect of age on digital health competence cannot be presented.

A clinical working environment and professional background were associated with human-centred remote counselling competence, digital solutions as part of work, and competence in utilizing and evaluating digital solutions. Attitudes towards the use of digital solutions did not differ significantly between professional groups otherwise, except among respondents with leadership or specialist backgrounds who perceived digital solutions more positively compared to other professionals. This supports previous findings as management positions have earlier been reported to increase respondents' motivation and attitudes towards the use of digital technologies (Konttila et al., 2018; Secginli et al., 2014).

The results of this study support previous findings by Kaihlanen et al. (2021) that healthcare professionals who have graduated more recently evaluated their digital health competence as higher in human-centred remote counselling competence when compared to those who had graduated earlier. However, our study also included professionals who had conducted master's or doctoral-level degrees, as the results of the study by Kaihlanen et al. present professionals who have graduated in a certain profession from a university of applied sciences (i.e. registered nurse), meaning they had conducted lower-level studies. Therefore, our study supports the findings from Kleib & Nagel (2018) that attending higher education increases healthcare professionals' self-evaluated digital health competence, especially in the areas of remote counselling and attitudes towards digital solutions as part of work.

Reasonably, professionals who did not have responsibilities in patient work evaluated their human-centred remote counselling competence as significantly low when compared to professionals who had direct patient work at least rarely. This was expected as previous studies have shown (Odendaal et al., 2020; Peltonen et al., 2019) that experience of using digital solutions increases competence in digitalization. Additionally, our study revealed that professionals working in inpatient units evaluate their human-centred remote counselling competence as lower when compared to professionals from outpatient or home care environments. The professional's position and responsibilities should be considered when designing digital health competence methods. Not all professionals are required to utilize digital channels in patient counselling, at least not yet, but they might still need the development of digital health competence in other areas. For example, remote counselling competence is related to clinical competence and overall patient involvement skills (Kaihlaniemi et al., 2023).

As our study examined healthcare professionals' digital health competence in the context of the Finnish healthcare system, future studies should explore and compare digital health competence internationally to attain a broader outlook on the state of healthcare professionals' competence in digitalization in different healthcare settings. Specifically, more research should be conducted in less digital-savvy countries to increase the understanding of healthcare professionals' competence needs as the digitalization of services is accelerating at a slower pace and to standardize digital health adoption and competence requirements (World Health Organization, 2022). Organizational practices and various digital health competence development methods should be further reinforced and unified to enable high and uniform digital health competence in different healthcare environments and job positions. Different methods that utilize and blend peer mentoring, orientation, training and individual support from specialists or leaders should be included in competence development models to attain the best result in healthcare professionals improved digital health competence confidence.

6.1 | Strengths and limitations

Even though the response rate remained low when compared to the overall study population, the number of respondents gives a fair overall presentation of different healthcare professionals from various healthcare settings across Finland. Most of the study participants had a background in nursing and worked in inpatient units or wards, which might diminish the generalizability of the results to other professions or clinical working environments. However, the study did include a variety of different healthcare professionals from various clinical working environments. Still, a larger population, also in an international setting, would have increased the generalizability of the results.

As the data were collected via a questionnaire based on self-assessment, we recognize that there is a possibility for response bias and the data collection method (electronic survey) could have neglected respondents who are less competent at using digital solutions. Additionally, the self-selecting sample contributed to this bias as professionals who perceive their digital health competence as higher might have been more prone to respond which limits the generalizability of the results. Data collected with paper questionnaires might have given more information regarding the factors associated with less digitally savvy healthcare professionals' digital health competence. Still, as the use of computers for patient documentation is commonplace in Finnish healthcare organizations, we assume that a lack of digital skills did not exclude potential respondents.

In logistic regression, all outcome variables presented a relatively limited explanation of total variance in percentages (from 6.8% to 24.7%), which can be considered as a limitation (Munro, 2005). Even though information and communication technology competence was evaluated as the strongest area of digital health competence in all profiles, analysis of associated factors' influence on this outcome was not possible due to the skewness of the data. Especially in profile C, the evaluation of information and communication technology competence had large variations. Therefore, the best regression model was found without the information and communication technology competence theme.

7 | CONCLUSION

The formed digital health competence profiles had distinct differences in digital health competence evaluation, where profile A presented the highest competence levels, profile B mediocre competence and profile C lowest competence among healthcare

professionals. Information and communication technology competence was evaluated as the strongest digital health competence area in all profiles, and human-centred remote counselling competence as the weakest. Therefore, the competence to conduct human-centred remote counselling should be further developed among all healthcare professionals to respond to the competence needs required to work in digital environments and evaluate customers' digital readiness and willingness of use. Additionally, ethical competence related to digital solutions requires more attention, as the rapid development of digital solutions used in healthcare, such as robotics and clinical decision support systems and applications guided by artificial intelligence, challenge healthcare professionals' position in healthcare delivery.

The use of health information exchange services, digital workspaces or platforms and video conferencing programs presented statistically significant differences between the profiles both in work and leisure use, and respondents with high digital health competence used these services more when compared to other respondents. However, more research is needed to understand the purposes these digital solutions are used for, both in different clinical working environments and leisure time contexts.

Age, graduation year from the highest level of education, clinical working environment, professional background, the amount of patient work and management support experience, organizational practices supporting digital health competence development, and colleagues' adoption and influence were associated with higher digital health competence. Remote counselling competence was higher among participants who had graduated more recently, worked in home care, and had a background as a leader or specialist. Also, attitudes towards digital solutions as part of work were more positive among professionals with a leader or specialist background and who had graduated more recently. Working in an outpatient clinic was associated with higher digital health competence in all analysed competence areas. Therefore, digital health competence development methods and contents should be designed according to healthcare professionals' clinical working environment, professional background, and amount of patient work, with a special focus on nursing and rehabilitation professionals who have longer time from graduation and who work in inpatient units. Positive societal influence from colleagues and work community members should be harnessed more efficiently in digital health competence development through developing methods that include and mix pair or group learning in digital health competence education, training and orientation.

AUTHOR CONTRIBUTIONS

All authors have agreed on the final version and meet at least one of the following criteria (recommended by the ICMJE*):

1. Substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data;
2. Drafting the article or revising it critically for important intellectual content.

*http://www.icmje.org/recommendations/.

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No conflict of interest has been declared by the author(s).

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

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