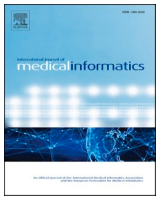
International Journal of Medical Informatics 193 (2025) 105658

Contents lists available at ScienceDirect

International Journal of Medical Informatics

journal homepage: www.elsevier.com/locate/ijmedinf



Social services and healthcare personnel's digital competence profiles: A Finnish cross-sectional study

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ARTICLE INFO

Keywords:
Digitalisation
Digital competence
Digital gaps
Social services
Healthcare

ABSTRACT

Background: Recent research has highlighted the deficiencies and variations in the digital competences of social services and healthcare personnel. Yet there is a shortage of data regarding how the personnel use digital devices and solutions and their attitudes towards digitalisation. Hence, a systematic investigation into digital devices and solutions in healthcare is warranted.
Objectives: This study aimed to analyse the similarities and differences in digital competences and organisational support among healthcare personnel, focusing on using digital applications and services. The primary research question was to investigate what kinds of digital competence profiles are identifiable through social services and healthcare personnel self-assessments.
Methods: The survey was conducted in the Wellbeing Services County of Central Finland at the end of 2023. It utilised validated self-assessment methods and garnered 643 responses from social services and healthcare professionals. Data analysis involved quantitative cluster analysis for grouping participants and qualitative content analysis for describing the clusters.
Results: The study resulted in a final model of seven clusters that presented distinct digital competence profiles with relatively even sizes. These clusters represented the different aspects of digital usage among social services and healthcare professionals. They could be categorised into three overarching profiles: 1) *Motivated digital experts*, 2) *Burdened digital users* and 3) *Frustrated survivors. Motivated digital experts* comprised up almost half of the respondents (45.1%). Still, the findings also facilitated identifying of a small group of *Frustrated survivors* (7.5%) who represented burdened and stressed digital users.
Conclusions: The results indicate significant variances in digital competence profiles among employees. Social services and healthcare personnel perceive the opportunities and challenges associated with digital applications and services differently. Further detailed research into the disparities between digital competence profiles is necessary, particularly regarding the types of support that benefit different profiles the most.

1. Introduction

The digitalisation of social services and healthcare (SSH) presents challenges, such as digital patient encounters, which demand enhanced digital competences from personnel. These competences, integrating skills, knowledge and attitudes and enable effective digital technology use in both professional and daily contexts [1,2]. Despite the recognised importance, empirical evaluations of digital competences within SSH

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https://doi.org/10.1016/j.ijmedinf.2024.105658
Received 21 March 2024; Received in revised form 26 August 2024; Accepted 16 October 2024
Available online 18 October 2024

are limited, even though significant deficiencies and disparities have been documented [3–5].

Recent findings highlight varied levels of digital competence among healthcare workers, who can be classified into high, moderate and low categories, particularly among nursing and allied health professionals [3,6,7]. Furthermore, insufficient digital competences can lead to increased technostress, a condition marked by the stress associated with new technology adoption, performance anxiety, and compulsive technology use beyond necessities [8,9]. These dynamics underscore the intricate relationship between digital competences, confidence and accountability, all of which influence the quality and efficiency of work and, consequently, the success of digital reforms in SSH [10]. Moreover, technostress can cause burnout, job dissatisfaction, and intention to leave the profession or organization [11,12]. It can affect general health status, quality of sleep, headache, and workability [12].

Despite the potential of digital health technologies to improve patient health and well-being outcomes, personnel must receive adequate training to harness these technologies effectively [13]. Enhanced digital skills not only improved care quality but also facilitated better technology utilisation and implementation [14]. However, there seem to be a notable gap in understanding the varied uses and perceptions of digital tools among personnel, which can lead to significant divides, affecting opportunities, motivation and the ability to utilise digital solutions in professional settings [3]. The digital divides may exacerbate workplace inequalities, undermining well-being and increasing scepticism towards technology [15].

The literature leaves certain areas unexplored, particularly what kinds of digital competence profiles emerge within the health and social sector [8]. The present study aimed to dissect the digital competences of SSH personnel, with a particular focus on digital applications, services, and organizational support. It employed new assessment tools—namely the Digital Health Competence (DigiHealthCom) and Aspects Associated with Digital Health Competence (DigiComInf) questionnaires developed by Jarva et al. [5] —to explore how these competences manifest among personnel. This investigation is grounded in previous findings that digital competences involve not only technical skills but also encompasses service development, patient interaction and ethical considerations [16,17]. By identifying distinct digital competence profiles through personnel self-assessments, this study aimed to contribute to effectively implementating digital reforms and developing digital competences in SSH.

2. Materials and methods

DigiHealthCom [5] included five factors on digital competences: *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 utilising and evaluating digital solutions (8 items),* and *ethical competence related to digital solutions (4 items)*. DigiComInf included three factors on educational and organisational aspects associated with digital competence: *support from management (6 items), organisational practices as part of digital competence development (4 items)* and *colleagues' adoption and influence (5 items)*. Examples of digital solutions were given to the respondents in parentheses after the questions to give context to the question. We supplemented the instruments with open-ended questions. These questions allowed the respondents to reflect and elaborate on their answers to the factor items. The open questions are presented in the supplementary material.

Data were collected via an electronic survey from one SSH organisation's personnel at the end of 2023, yielding 651 responses, 643 of which were usable. Among the respondents, 88 % were women, and over half held a bachelor's degree from a university of applied sciences. The ages ranged from 19 to 67. Detailed respondent background information is provided in Table 1.

Table 1
Background information of the survey respondents.

		Respondents (n = 643)	%
Gender			
	Female	566	88
	Male	71	11
	Other	2	0
	Prefer not to say	4	1
Age			
	Mean (years)	45,8	
	SD (years)	11	
	Min	19	
	Max	67	
Highest education			
	Vocational education	135	21
	University of Applied Sciences, bachelor's degree	339	53
	University of Applied Sciences, master's degree	11	2
	University of Master's Degree	96	15
	Doctoral Degree	5	1
Profession*			
	Nurse (registered, assistant or specialist)	566	88
	Social worker, sociologic, curator, school psychologist	137	21
	Medical doctor or dentist	27	4
	Rescue worker (fireman, etc.)	20	3
	Support service worker (secretary, developer, etc.)	37	6
	Other profession	7	1

* The respondent could choose several professional fields.

2.1. Analysis of the data

In our analysis, we developed an aggregated overview of SSH personnel's digital competence profiles by utilising cluster analysis [18]. The data included all 643 respondents and comprised four factors with 26 items from DigiHealthCom and three with 15 items from DigiComInf. Those respondents not engaged in remote counselling (n = 182) were excluded from *the human-centred remote counselling competence* factor because of their lack of responses, leading to this factor's exclusion from the cluster analysis.

We used IBM SPSS Statistics (V29.0) for the data analysis. Revisiting the validity and reliability of the assessment tools, which have been evaluated in [5], the alphas ranged from 0.83 to 0.94 in the reduced DigiHealthCom instrument and from 0.89 to 0.91 in the DigiComInf instrument. We converted instrument factors into mean sum variables, adhering to the original Likert scale (1 = completely disagree, 2 = partially disagree, 3 = partially agree, 4 = completely agree). Statistical pairwise analyses of sum-variable mean differences between clusters were performed with Bonferroni-adjusted Kruskal–Wallis tests. Competences and clusters were interpreted using the original Likert scale, with mean values categorised as follows: 1–1.74 indicates low, 1.75–2.49 indicates low-moderate, 2.5–3.24 indicates high-moderate and 3.25–4 indicates high competence.

As illustrated in Fig. 1, the analysis comprised two phases: i) a quantitative cluster analysis (see Table 2 column 1) and ii) a conventional qualitative content analysis of open-ended responses to describe the clusters (see Table 2 column 2). Initially, we aimed to identify a purposeful set of clusters to form descriptive and representative employee profiles by combining hierarchical cluster analysis and an exclusive *k-means* clustering algorithm [18,19]. The number of clusters was assessed using visual inspection of the dendrogram [20], which was obtained from the hierarchical clustering using Ward's method and Euclidean distance. This suggested three or seven clusters, where the seven-cluster solution was chosen because of its smaller clustering error and the more fine-grained differentiation of the respondents. After that,

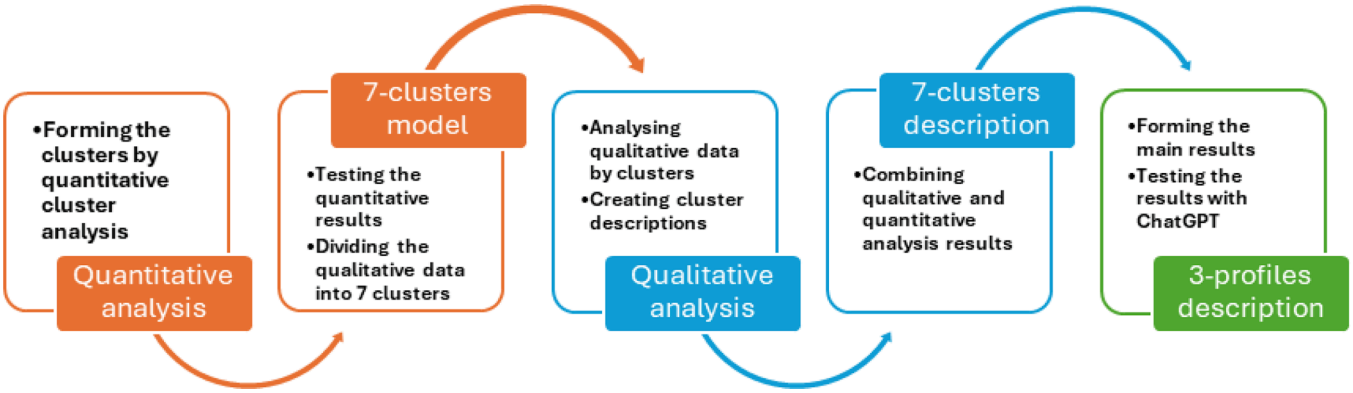

Fig. 1. Progress of the data analysis process illustrating interactive analysis between quantitative and qualitative methods.

Table 2
Example of the inductive (data-driven) analysis.

Analytical question	Data quotes	Initial codes	Content categories	Clusters
What characteristics can be identified in the open answers from different clusters?	*I am open-minded, quick to learn.*	Positive attitude towards learning	Open-minded, learn quickly	Motivated and engaged users
	I have been interested in the possibilities of digital services for a long time.	Interested in the possibilities	Participate in the development of digital solutions.	
	I was involved in e.g. piloting patient video receptions.	Participated in a developing project		
	Learning new programs has taken an awful lot of time and been frustrating.	Frustrated because it takes a lot of time to learn	Feel burdened and stressed.	Frustrated and stressed users
	Familiarization with digital devices is non-existent, and is left to the individual's own responsibility.	Suffers from being alone	Feel that they are left to their own devices.	

a nonhierarchical *k-means* clustering algorithm [19] was applied to form the final seven-cluster solution. The clustering result was further assessed to ensure the stability of the model with statistically significant ($p < 0.001$) high F-values indicating the separation of the clusters. The post-hoc tests indicating statistically significant differences and similarities supporting the fit of the chosen model and profile formation are reported in Section 3 (see Tables 3 and 4, Fig. 2). In the second phase, we sought to detail the cluster characteristics further. The four open-ended questions were answered by 31–50 % of the respondents, providing insights into employees' attitudes and experiences. We applied an inductive, conventional qualitative content analysis method [21–24] to analyse open-ended responses and the method's checklist [25] were used in the analysis. In the first step of the analysis, we copied the open-ended answers of the survey into a separate table by clusters and read them carefully. Next, the open answers were searched for answers to the analytical question: What characteristics can be identified in the open answers from different clusters? The unit of analysis was a meaningful entity. Initial codes were formed from the analysis units. Then, the initial codes were compared with each other and by clusters and were found to describe the differences and similarities of the clusters. Content descriptions of the clusters were formed from the codes (see Table 2).

We then tested the ability of ChatGPT version 3.5 from Open AI for the content analysis by running data excerpts and comparing the output with our actual analysis. The following prompts were used: i) Based on the text, can you analyse what attitudes and needs cluster represents? ii) What are the differences or similarities between the clusters? iii) How would you characterise your findings from the following text? Output from ChatGPT model was similar and complementary, thus confirming our descriptions of the clusters. The progression of the data analysis process from interactive analysis between quantitative and qualitative methods is illustrated in Fig. 1.

2.2. Ethical considerations

The research was conducted in an SSH setting in Finland, adhering to the ethical guidelines set by the Finnish National Board on Research Integrity TENK [26,27], which complied with the EU General Data Protection Regulation (GDPR) for Practical Research [28]. At the start of the study, the participants provided their consent for the use of their data. During the data establishment phase, the material was pseudonymised. Although we utilised an artificial intelligence application in the qualitative analysis, the participants' privacy was safeguarded. The research data processed by ChatGPT did not contain any identifiable personal information.

3. Results

The final seven-cluster model resulted in relatively balanced cluster sizes, each representing the unique facets of SSH personnel's digital competences (see Table 2). Upon comparison, these clusters align into three distinct profiles:

1) *Motivated digital experts* had excellent or good digital skills and exhibited high motivation to enhance their knowledge. Within this group, the "*Interested but slow learners*" cluster felt undersupported by the organisation and management. (n = 290, 45.1 %)
2) *Burdened digital users* demonstrated basic but adequate digital skills, yet they experienced working at the edge of their competences. The "*Critical and burdened users*" cluster perceived and reported positive organisational and managerial support from this profile. (n = 305, 47.4 %)
3) *Frustrated survivors,* forming the smallest profile, encompassed individuals struggling with inadequate digital skills, leading to feelings of burden and stress. Their motivation to improve their digital skills was notably low. This group statistically significantly differed from

Table 3
Description of seven clusters' profiles (n = 643).

Cluster	Cluster's descriptions	Profile
Cluster 1: Motivated and engaged users (n = 86)	Do well in their work with their digital skills. Open-minded, learn quickly. Participate in the development of digital solutions. Get support from management, the organisation and colleagues. Express disappointment with the usability of the systems. Hope for better system integration.	Motivated digital experts (n = 290, 45.1 %)
Cluster 2: Interested and critical users (n = 112)	Digital skills are at a good level. Interested in developing their skills further. Many of them use many digital solutions in their work. Assess the usefulness of digital solutions and speak critically of 'digital hype'. Emphasise the support of the work community, a positive attitude and sufficient resources for the success of the digital transformation.	
Cluster 3: Interested but slow learners (n = 92)	Digital skills are at a good level. Interested in developing their digital skills. Many experience challenges and obstacles in using digital tools. Hope for more support from management and supervisors and more time for learning.	
Cluster 4: Critical and burdened users (n = 103)	Survive with their own digital skills. Burdened by learning everything new. Recognise the differences in skills and attitudes related to digital technology in their communities. Experience challenges when using new digital tools and solutions. Some have a critical attitude towards digital services. Get support from the organisation and management.	Burdened digital users (n = 305, 47.4 %)
Cluster 5: Overburdened but positive users (n = 104)	Work at the limits of their competence. Need better support for using new digital devices. Need more hands-on support and time for learning. Have a positive attitude towards digital reforms. See that digital solutions bring added value to their work and customers/patients.	
Cluster 6: Abandoned and worried users (n = 98)	Basic digital skills are strong. Motivated in developing their skills. Do not receive support from the organisation. Feel that there is not enough time to learn new things. Developed their digital skills independently. Suffer from colleagues' weak skills and lack of motivation. Hope for more support from management. Hope for clearer communication between the different parties and more information about the benefits of digital methods.	
Cluster 7: Frustrated and stressed users (n = 48)	Survive at work at the limits of their digital competence. Feel that they are left to their own devices. Feel burdened and stressed. Might resist digital reforms. Motivation for developing digital skills is weak.	Frustrated survivors (n = 48, 7.5 %)

the others in ICT competence and the ability to use and evaluate digital solutions. (n = 48, 7.5 %)

The clusters and their profiles, as depicted in Table 2, were based on cluster analysis, and they are visualised in Fig. 2, with the mean scores for various sum-variable measures. The visual inspection in Fig. 2 shows the similarities and differences in clusters and profiles, reflecting the differences over different facets of competences and the corresponding needs for development. In terms of competence, the results showed that *Motivated digital experts* operated at the highest level of digital competence but demonstrated variability in attitudes towards digitalisation and in the experiences of support. *Burdened digital users* exhibited intermediate competence levels, and *Frustrated survivors* exhibited low digital competence. High means on competence variables did not automatically mean good overall experience. For example, Clusters 2 and 6 did well in ICT and ethical competence variables but showed a similar decline in the experiences of support.

The clusters within the three profiles showed some statistically significant differences, but the grouping similarities, especially the competence measurements, were apparent. For example, in ICT competence, there were no statistically significant differences within profiles, while between different profiles, the clusters had a significant ($p < 0.05$) difference. In addition, clusters within the profile of *Burdened digital users* differed significantly ($p < 0.001$) in ethical competence means. Similar within and between profiles differentiation was visible in the aspects associated (measures: Support from leadership, Support from organisation, Collegial influence) with the digital competence means. For example, in the profile *Motivated digital experts,* a significant ($p < 0.05$) difference in these measures between clusters within this profile existed. The post hoc analysis of pairwise comparisons between the clusters is given in Table 4.

As expected, cluster analysis produced statistically significant differences ($p < 0.05$) across individual clusters and over the three profiles in different digital competence areas and aspects associated with digital competence (Table 4). The table also confirms the results of the visual appearance in Fig. 2 indicating that the differences between the different clusters and profiles were the most pronounced in leadership and organisational support. This showed that mere consideration of employees' digital competences and skills would narrow the focus of planning training and continuous development on the organisational level. Fig. 2 and Table 4 show that the profile of *Frustrated survivors* with a 7.5 % portion could be singled out. This profile had the lowest overall digital competences and a significantly lower evaluation in all digital competences. The profiles and clusters generally had similarities and differences across all areas, reflecting the dispersed nature of digital competences in organisational settings.

4. Discussion

In the current study, we identified seven clusters and three distinct competence profiles among SSH personnel, corroborating prior findings of significant digital competence disparities among employees [3,6,7]. Methodologically, the statistical analysis was interpreted and complemented by qualitative content analysis to understand the meanings and shared perceptions, practice needed to effectively implement digital

Table 4
Pairwise comparisons with Bonferroni-adjusted Kruskal–Wallis significance values.

MEASURES **ICT Competence**		Motivated digital experts Cluster 1	 Cluster 2	 Cluster 3	Burdened digital users Cluster 4	 Cluster 5	 Custer 6
Motivated digital experts	Cluster 2	1					
	Cluster 3	1	1				
Burdened digital users	Cluster 4	**.0**	**.0**	**.0**			
	Cluster 5	**.0**	**.0**	**.0**	1		
	Cluster 6	**.0**	**.0**	**.0**	1	1	
Frustrated survivors	Cluster 7	**.0**	**.0**	**.0**	**.0**	**.0**	**.0**
Attitudes towards digitalization		Motivated digital experts Cluster 1	 Cluster 2	 Cluster 3	Burdened digital users Cluster 4	 Cluster 5	 Cluster 6
Motivated digital experts	Cluster 2	**.0**					
	Cluster 3	1	.082				
Burdened digital users	Cluster 4	**.0**	**.0**	**.0**			
	Cluster 5	**.0**	**.0**	**.0**	1		
	Cluster 6	**.0**	**.0**	**.0**	1	1	
Frustrated survivors	Cluster 7	**.0**	**.0**	**.0**	**.0**	**.0**	**.0**
Utilizing and evaluating		Motivated digital experts Cluster 1	 Cluster 2	 Cluster 3	Burdened digital users Cluster 4	 Cluster 5	 Custer 6
Motivated digital experts	Cluster 2	**.0**					
	Cluster 3	1	**.0**				
Burdened digital users	Cluster 4	**.0**	**.004**	**.0**			
	Cluster 5	**.0**	**.0**	**.0**	1		
	Cluster 6	**.0**	**.0**	**.0**	1	1	
Frustrated survivors	Cluster 7	**.0**	**.0**	**.0**	**.0**	**.009**	**.006**
Ethical competence		Motivated digital experts Cluster 1	 Cluster 2	 Cluster 3	Burdened digital users Cluster 4	 Cluster 5	 Custer 6
Motivated digital experts	Cluster 2	.219					
	Cluster 3	.574	.271				
Burdened digital users	Cluster 4	**.0**	**.0**	**.0**			
	Cluster 5	**.0**	**.0**	**.0**	**.0**		
	Cluster 6	**.002**	.065	1	**.0**	**.0**	
Frustrated survivors	Cluster 7	**.0**	**.0**	**.0**	**.002**	1	**.0**
Support from leadership		Motivated digital experts Cluster 1	 Cluster 2	 Cluster 3	Burdened digital users Cluster 4	 Cluster 5	 Custer 6
Motivated digital experts	Cluster 2	**.013**					
	Cluster 3	**.0**	**.0**				
Burdened digital users	Cluster 4	**.0**	1	**.0**			
	Cluster 5	**.0**	**.0**	.613	**.0**		
	Cluster 6	**.0**	**.0**	.289	**.0**	**.0**	
Frustrated survivors	Cluster 7	**.0**	**.0**	.331	**.0**	**.0**	1

(*continued on next page*)

Table 4 (*continued*)

Support from organization		Motivated digital experts			Burdened digital users		
		Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Custer 6
Motivated digital experts	Cluster 2	**.0**					
	Cluster 3	**.0**	**.0**				
Burdened digital users	Cluster 4	**.0**	1	**.0**			
	Cluster 5	**.0**	**.0**	1	**.0**		
	Cluster 6	**.0**	**.0**	**.0**	**.0**	**.0**	
Frustrated survivors	Cluster 7	**.0**	**.0**	**.0**	**.0**	**.0**	1
Collegial influence		Motivated digital experts			Burdened digital users		
		Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Custer 6
Motivated digital experts	Cluster 2	**.0**					
	Cluster 3	**.0**	**.001**				
Burdened digital users	Cluster 4	.334	**.0**	.102			
	Cluster 5	**.0**	.992	**.0**	**.0**		
	Cluster 6	**.0**	.160	**.0**	**.0**	1	
Frustrated survivors	Cluster 7	**.0**	.401	**.0**	**.0**	1	1

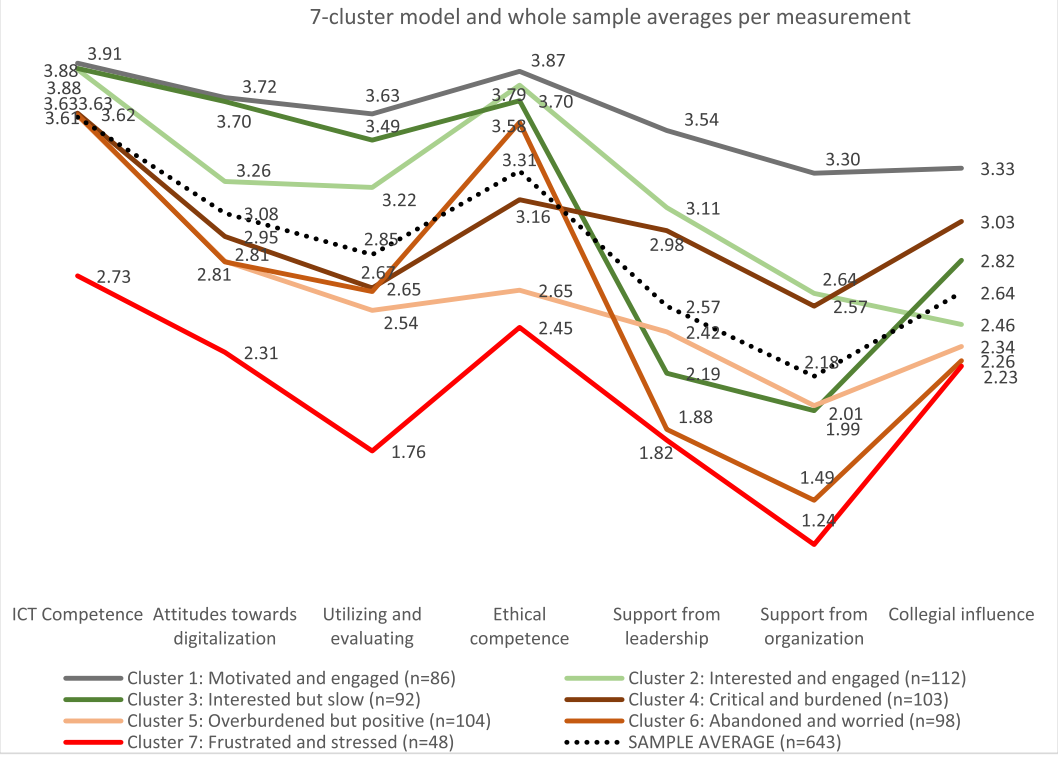

Fig. 2. The seven clusters produced three competence profiles visualised with whole group means.

reforms and develop digital competences in SSH. Our results have highlighted digital skill gaps between competence profiles [29], which may influence employees' stress levels and the quality of care provided [15]. Consistent with previous research, we found that digital competence is linked to technostress [12]. However, our findings provide a more detailed examination of how different competence profiles reflect personnel's perceived opportunities and challenges with digital tools and services. In addition, the provided explication of within-profile variation indicates that digital competences need to be addressed holistically. Recognising variations in employees' digital competences and organisational experiences of associated aspects is crucial because different profiles may require varied types of support. Notably, our results enable the identification of particularly overburdened and stressed users, thus facilitating targeted support and more effective implementation of digital reforms and competence development.

Digitalisation, especially AI-driven technologies in SSH, is a crucial

issue. Neither technology alone nor existing legislation can fully address the many concerns to be faced, which are related to ethical considerations [30]. Thus, in the future, there is a pressing need for ethically oriented research to develop new digital and ethical competences for professionals and consumers alike [30] to navigate these challenges. Understanding these competence profiles is essential for managers and leaders to steer their organisations through digital transformations effectively. Further research is needed to dissect the differences between digital profiles and adequately address the lack of digital skills. In particular, the needs of *Burdened digital users* and *Frustrated survivors* should be prioritised in developing organisational digital reforms. Moreover, the expertise of *Motivated digital experts* should be harnessed more effectively for organisational benefit. The identified competence profiles encompass various forms of digital agency, including digital competence, confidence, and accountability [10].

4.1. Study limitations and strengths

This study only investigated the digital skills of the personnel of one Wellbeing services county, so the representativeness of the data is evaluated from three perspectives: 1) The Wellbeing services county of Central Finland represents quite well the average well-being area in Finland. Its residents represent 5 percent of the entire country's population [31]. 2) The Finnish SSH system is based on public services and is, therefore, moderately uniform throughout the country [31]. 3) In addition, personnel working in Finnish SSH are trained in a unified public education system, which guarantees uniform competence for SSH personnel throughout the country [32]. The number of people who responded to the survey (6.5 %) was in line with similar surveys conducted elsewhere using the same measure [3,5]. Although electronic surveys may result in lower response rates than paper-based surveys, this approach was chosen as the most appropriate given the time frame. Although less digitally comfortable staff may have lower activity in answering the e-survey related to the use of technology, the actual content of profiles ranging from high to low indicate good applicability of the proposed method and the model. When the model is applied in practical settings, the potential bias should be acknowledged as it might cause difference in the profile proportions, namely, the count in and proportion of low digital competence profiles might actually be higher that is proposed here. The reliability of our findings is bolstered by the use of validated instruments and the wide range of professionals surveyed, even though the results are not universally generalisable beyond contexts with similar digital maturity levels as Finland's. The data collection coincided with significant administrative reforms in Finland's SSH, particularly the establishment of well-being service counties were established [33], which may have influenced employee attitudes and experiences towards digitalisation.

The idea of the research emphasizes the development of digital competence in a single social services and health care organization. In this study, we analyzed the research data from the perspective of the whole personnell using profiling related to generic digital competence and organizational support [5]. The metric used is a generic competence instrument [5] that is not targeted at any single professional group. Our research can be considered a baseline analysis of the level of digital competence highlighting need for future research investigating implications of differences for employee wellbeing, resilience, safety and risk in volatile digital environments.

4.2. Summary table

What was already known about the topic?

- Digital skill deficiencies and variances among healthcare employees have been identified.

What has this study added to our knowledge?

- DigiHealthCom and DigiComInf instruments identified three distinct digital competence profiles in healthcare settings.
- The social and health care personnel training can be developed based on the identified digital competence profiles.
- Digital reforms should target "*Burdened digital users*" and "*Frustrated survivors*" to address their specific needs in social and healthcare contexts.

Declaration of generative AI and AI-assisted technologies in the writing process: During the preparation of this work, the authors used ChatGPT from open AI, version 3.5 to test its ability to analyse the open answers of the survey. After using this service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication

CRediT authorship contribution statement

Minna Ylönen: Conceptualization, Data curation, Formal analysis, Qualitative analysis, Investigation, Methodology, Project administration, Visualization, Writing – original draft. **Panu Forsman:** Writing – review & editing, Visualization, Methodology, Formal analysis, Data curation. **Tapio Karvo:** Writing – review & editing, Software, Formal analysis, Data curation, Conceptualization. **Erika Jarva:** Writing – review & editing, Validation, Conceptualization. **Teuvo Antikainen:** Writing – review & editing, Validation, Conceptualization. **Petri Kulmala:** Writing – review & editing, Validation, Conceptualization. **Kristina Mikkonen:** Writing – review & editing, Validation. **Tommi Kärkkäinen:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Raija Hämäläinen:** Writing – review & editing, Supervision, Project administration, Funding acquisition.

Funding

This work was supported by the Academy of Finland [grant numbers 336231 and 353325].

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We would like to thank the social and healthcare personnel who gave their responses to the questionnaire. We would also like to thank the clinical specialist nurse, Sari Rantanen, for your contribution to this study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijmedinf.2024.105658.

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