



Työsuojelurahasto
Arbetskyddsfonden
The Finnish Work Environment Fund

Social services and healthcare personnel's digital competence

Minna Ylönen*
Teuvo Antikainen*
Tommi Kärkkäinen**
Raija Hämäläinen**

*Wellbeing Services County of
Central Finland, Jyväskylä, Finland

** University of Jyväskylä,
Jyväskylä, Finland

minna.h.ylonen@hyvaks.fi



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

Minna Ylönen^{a,b,*}, Panu Forsman^b, Tapio Karvo^a, Erika Jarva^c, Teuvo Antikainen^{a,b},
Petri Kulmala^d, Kristina Mikkonen^{c,e,f}, Tommi Kärkkäinen^g, Raija Hämäläinen^b

^a Hospital Nova, Wellbeing Services County of Central Finland, Hoitajantie 3, 40620 Jyväskylä, Finland

^b Faculty of Education and Psychology, University of Jyväskylä, PL 35, 40014 University of Jyväskylä, Finland

^c Research Unit of Health Sciences and Technology, Faculty of Medicine, University of Oulu, PL 8000, University of Oulu, Finland

^d Faculty of Medicine, University of Oulu, and Medical Research Center Oulu, Oulu University Hospital, Oulu, Finland

^e Medical Research Center Oulu, Oulu University Hospital and University of Oulu, Oulu, Finland

^f Department of Nursing, Midwifery and Health, Faculty of Health and Life Sciences, Northumbria University, Newcastle upon Tyne, United Kingdom

^g Faculty of Information Technology, University of Jyväskylä, PL 35, 40014 University of Jyväskylä, Finland

Background

- 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
- Organizations and associations 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
- 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
- In fact, digital competence could be considered as one aspect of healthcare professionals' core competence
- In the future, the increasing use of artificial intelligence in clinical decision-making and patient encounters in digital environments present new opportunities and challenges for healthcare professionals' work role and competence requirements
- What kind of digital skills support might work life need? How should the support be tailored to employees' individual needs?

Aims

- Studies on healthcare professionals' digital competence evaluation are quite scarce
- Recent studies have highlighted the deficiencies and variations in the digital competences of social services and healthcare personnel (see e.g. Jarva et al. 2024; Kaihlanen et al. 2023; Kinnunen et al. 2019)
- 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
- Furthermore, insufficient digital competencies can lead to increased technostress, a condition marked by the stress associated with new technology adoption, performance anxiety, and compulsive technology use beyond necessities
- And accordingly, enhanced digital skills not only improve care quality, but they also facilitate better technology utilisation and implementation
- Our study aimed to dissect the digital competences of healthcare personnel, with a particular focus on digital applications, services, and organizational support
- It employed new assessment tools to explore how these competences manifest among personnel
 - Named Digital Health Competence (DigiHealthCom) and Aspects Associated with Digital Health Competence (DigiComInf) questionnaires
 - The questionnaires were developed and tested by [Jarva et al. 2023](#)

Materials and methods

- DigiHealthCom included five factors on digital competences:
 1. human-centred remote counselling competence (16 items),
 2. digital solutions as part of work (9 items),
 3. information and communication technology (ICT) competence (5 items),
 4. competence in utilising and evaluating digital solutions (8 items), and
 5. ethical competence related to digital solutions (4 items).
- DigiComInf included three factors on educational and organisational aspects associated with digital competence:
 1. support from management (6 items),
 2. organisational practices as part of digital competence development (4 items) and
 3. colleagues' adoption and influence (5 items).
- We supplemented the instruments with open-ended questions. These questions allowed the respondents to reflect and elaborate on their answers to the factor items
- Data were collected via an electronic survey from one social services and healthcare organisation's personnel at the end of 2023, yielding 651 responses, 643 of which were usable
- Most of the respondents were women (88 %) and registered, assistant or specialist nurses (88 %)
- Other professional groups were represented in the data to a lesser extent
- You can find more information about the data in our article Ylönen et al. (2025)
 - International Journal of Medical Informatics
<https://pubmed.ncbi.nlm.nih.gov/39454327/>

Analysis

The analysis comprised two phases: i) a quantitative cluster analysis and ii) a conventional qualitative content analysis of open-ended responses to describe the clusters.

i. Quantitative cluster analysis:

- 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.
- a nonhierarchical *k-means* clustering algorithm 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 ($p < .001$) high F-values indicating the separation of the clusters

ii. Conventional qualitative content analysis:

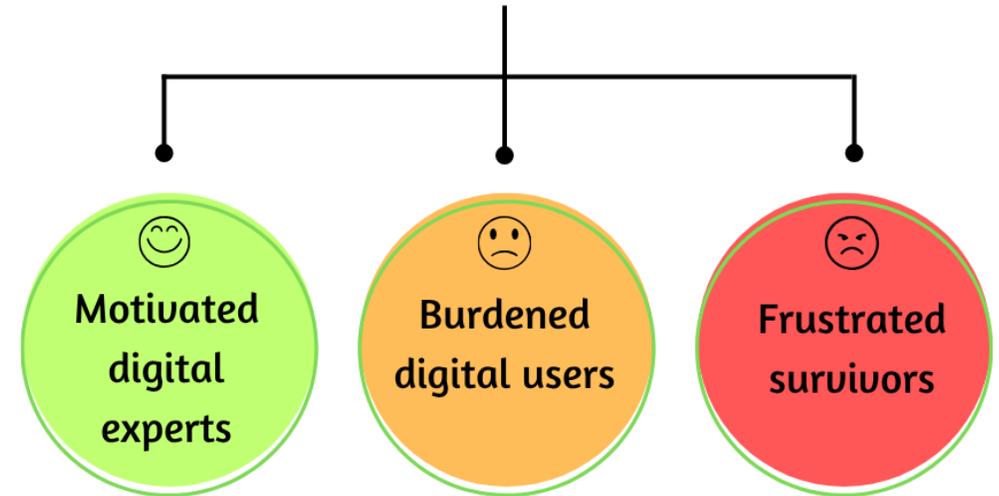
- We copied the open-ended answers of the survey into a separate table by clusters and read them carefully.
- Next, the open answers were searched for answers to the analytical question: What characteristics can be identified in the open answers from different clusters? The unit of analysis was a meaningful 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.



Results

- 1) **Motivated digital experts** (n=290, 45.1%) possessed excellent or good digital skills and had high motivation to enhance their knowledge. They felt they received sufficient support from the organization.
- 2) **Burdened digital users** (n=305, 47.4%) demonstrated basic but adequate digital skills, yet they experienced working at the edge of their competence. They might need more time for learning digital skills.
- 3) **Frustrated survivors** (n=48, 7.5%), 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.

3 Types of digiprofiles



Find out more about the results in our article published in International Journal of Medical Informatics (Ylönen et al. 2025)

<https://doi.org/10.1016/j.ijmedinf.2024.105658>



Työsuojelurahasto
Arbetskyddsfonden
The Finnish Work Environment Fund



JYVÄSKYLÄN YLIOPISTO
UNIVERSITY OF JYVÄSKYLÄ



THE WELLBEING
SERVICES COUNTY
OF CENTRAL
FINLAND

Conclusion

- Our results highlighted digital skill gaps between competence profiles, which may influence employees' stress levels, and the quality of care provided. Consistent with previous research, we found that digital competence may be linked to technostress. (Alasoini et al. 2022; Ragnedda et al. 2018)
- Notably, our results enable the identification of particularly overburdened and stressed users, thus facilitating targeted support and competence development.
- In particular, the needs of *Burdened digital users* and *Frustrated survivors* should be prioritised in the development of organisational digital reforms and tailored support.
- In addition, the expertise of motivated digital experts should be utilized more effectively for the benefit of the organization. It should be possible for them to use digital skills even more deeply
- Understanding these competence profiles and differences is essential for managers and leaders to effectively steer their organisations through digital transformations.
- The differences are crucial because different employee profiles may require varied types of support.

Limitations and further research

- The reliability of our findings is supported by the use of validated instruments, even though the results can not be generalised outside of contexts with digital maturity like Finland.
- However, the low response rate (6.5%) must be taken into account when interpreting the results.
- The respondents were mainly nurses, which is of course the largest professional group in our organization. However, it should be noted that the data does not comprehensively cover all professional groups.
- Our study also touches on a crucial issue: ethics and AI-driven digitalization. It is clear that neither technology alone nor existing legislation can fully address the concerns associated with the increasing influence of AI-driven healthcare and welfare technologies.
- There seem to be a pressing need for professionals and consumers alike to develop new digital competencies to navigate these challenges.
- Further research is needed to dissect the differences between digital profiles and adequately address the lack of digital skills.
- We are currently preparing a new data collection from our wellbeing county. Thus, our research will continue as a follow-up study, which means we will be able to assess whether the digital skills of the staff have changed over the past couple of years.

References

- Al Jabri, F. Y. M., Kvist, T., Azimirad, M., & Turunen, H. (2021). A systematic review of healthcare professionals' core competency instruments. *Nursing & Health Sciences*, 23(1), 87–102. <https://doi.org/10.1111/nhs.12804>
- Ammenwerth, E. (2018). From eHealth to ePatient: The role of patient portals in fostering patient empowerment. *European Journal of Biomedical Informatics*, 14(2), 20–23.
- Brown J, Pope N, Bosco AM, Mason J, Morgan A. Issues affecting nurses' capability to use digital technology at work: An integrative review. *J Clin Nurs*. 2020;29(15-16):2801-2819. doi:10.1111/jocn.15321
- Giordano, C., Brennan, M., Mohamed, B., Rashidi, P., Modave, F., & Tighe, P. (2021). Accessing artificial intelligence for clinical decision-making. *Frontiers in Digital Health*, 3, 645232. <https://doi.org/10.3389/fdgth.2021.645232>
- Ilomäki, L., Paavola, S., Lakkala, M., & Kantosalo, A. (2016). Digital competence – An emergent boundary concept for policy and educational research. *Education and Information Technologies*, 21(2016), 655–679. <https://doi.org/10.1007/s10639-014-9346-4>
- Jarva E, Oikarinen A, Andersson J, Pramila-Savukoski S, Hammarén M, Mikkonen K. Healthcare professionals' digital health competence profiles and associated factors: A cross-sectional study. *J Adv Nurs*. Published online February 7, 2024. doi:10.1111/jan.16096
- Kaihlanen A, Elovainio M, Virtanen L, et al. Nursing informatics competence profiles and perceptions of health information system usefulness among registered nurses: A latent profile analysis. *J Adv Nurs*. 2023;79(10):4022-4033. doi:10.1111/jan.15718
- Kaihlaniemi, J., Liljamo, P., Rajala, M., Kaakinen, P., & Oikarinen, A. (2023). Health care professionals' experiences of counselling competence in digital care pathways – A descriptive qualitative study. *Nursing Open*, 10, 4773–4785. <https://doi.org/10.1002/nop2.1729>
- Kinnunen UM, Heponiemi T, Rajalahti E, Ahonen O, Korhonen T, Hyppönen H. Factors Related to Health Informatics Competencies for Nurses—Results of a National Electronic Health Record Survey. *CIN: Comput Inform Nurs*. 2019;37(8):420-429. doi:10.1097/CIN.0000000000000511
- Koivisto T. *Digitoimijuus Terveystieteiden Ammattilaisen Työssä*. University of Tampere; 2023.
- Kolitsi, Z., Kalra, D., Wilson, P., Martins, H., Stroetmann, V., Schulz, C., Birov, S., Fabricius, C., & DHE Partners. (2021). DigitalHealthEurope recommendations on the European Health Data Space. Supporting responsible health data sharing and use through governance, policy and practice. DigitalHealthEurope report. <https://digitalhealtheuropa.eu/>
- La Torre G, Esposito A, Sciarra I, Chiappetta M. Definition, symptoms and risk of techno-stress: a systematic review. *Int Arch Occup Environ Health*. 2019;92(1):13-35. doi:10.1007/s00420-018-1352-1
- Lorzynski G. *Digitalization in Healthcare*. (Glauner P, Plugmann P, Lorzynski G, eds.). Springer International Publishing; 2021. doi:10.1007/978-3-030-65896-0

