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Digital Competencies and Barriers of Technology Adoption in Care Giving: A Systematic Literature Review

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Abstract. The ageing population, rising healthcare costs and shortage of professional caregivers are making significant changes to health and care systems around the world, including an increased demand for services, higher costs, workforce shortages, and a greater reliance on technology like tele-health and AI to improve efficiency and access to care. Therefore, having the competence and ability to use digital tools is compelling for professional caregivers and policymakers alike, as it underpins successful technology adoption and digital transformation. Yet, today, professional caregivers lack knowledge and skills that would support technology adoption and digital transformation. Most countries have set high ambitions to strengthen digitalisation of their citizens and society. This review article provides an overview of the challenges faced by the welfare sector, professional caregivers, and care homes due to the lack of or inadequate digital competencies among workers, highlighting how this has hindered the adoption of technology. Through a systematic literature review, 59 studies from the last 10 years were identified and obtained from well-known databases. The review of these papers identifies the gaps: there is often insufficient training for staff on how to use and integrate assistive technologies effectively, or staff may be unaware of the available technologies. Challenges such as technological limitations and low involvement of professional caregivers are noted. The literature review suggests that for technology adoption in the welfare and caregiving sector, especially for emerging technologies, it is necessary to prioritise and recognise professional caregivers' digital competencies, and find solutions for existing barriers.

Keywords: digital competencies, professional caregiver, emerging technology, welfare technology, barriers for technology adoption

1 Introduction

As we progress further into the 21st century, an unprecedented rapid increase in the total and relative number of older persons in both the developed and the developing world is being observed. The World Health Organization is tackling the multifaceted challenges of population ageing through a comprehensive approach that includes consolidating databases, building capacity through research and training, advocating for change, and developing effective policies (De Carvalho et al., 2017; OECD Health Policy Studies, 2020). Population ageing is leading to an increase in the prevalence of certain diseases, while advancements in technology and digital health monitoring tools (Zyzak and Martinussen, 2024) are driving the future need for professional caregivers. Additionally, socio-economic developments such as ageing populations, changing family structures, and rising economic pressures are leading to a decline in care, which is expected to increase the demand for welfare services in the coming years (European Commission, 2021; OECD Health Policy Studies, 2020).

Welfare technology, a concept originating from Scandinavia from the National Board of Health and Welfare in Sweden, includes digital tools aimed at maintaining and increasing safety, activity, participation, or independence for individuals at risk of impairment (Zander et al., 2021). The term welfare technology is broad and applicable to various technologies improving life quality, such as electronic medicine tablet dispensers, reminders, safety alarms, trackers, bed sensors, virtual reality (VR) for cognitive stimulation, smart door locks for keyless access, humanoid and pet robots, telepresence, rehabilitation, entertainment, domestic and fall detection/prevention, or social robots (Spann et al., 2022). Other commonly used terms are, emerging, assistive living technology and e-health (Zander et al., 2021).

professional caregivers in the welfare sector are engaged with personal care and assistance of patients and elderly, convalescent and disabled people in health care and residential settings. Jobs within this sector include healthcare assistants and home-based personal professional caregivers (Elfert, 2019). In this literature review, we focus on professional caregivers who work with the elderly in care homes or in home care settings. For the elderly, welfare technologies can be life changers in helping them to live more independently, stay connected with the world, and manage their health effectively (Zander et al., 2021). Yet, to be able to manage such technologies, they need support and help from competent professional caregivers. Therefore, the problem is twofold – for successful welfare technology adoption support is needed for those who benefit, and the supporting personnel, the professional caregivers, require digital competencies to be on top of such technologies.

Digital competence is the general term used to describe or explain the ability (of a citizen, a student, a teacher, etc.) to use information technology (IT) in a specific contex (Rizza, 2014). Digital competencies are increasingly essential as technology becomes integral to welfare in the daily support for elderly care and care of vulnerable individuals. Digital competence refers to the confident, critical, and responsible use of digital technologies for learning, work, and participation in society (Vuorikari et al., 2022). It encompasses a combination of knowledge, skills, and attitudes necessary to effectively navigate and utilize digital environments. Digital competence development is increasingly framed as a lifelong learning process, particularly for adults whose pro-

fessional roles evolve alongside rapid technological change (Platonova et al., 2024). European Council (European Commission, 2021; Kotsiou et al., 2022), has listed digital competence as one of the eight key competencies that support effective participation in education, work, and personal lives in present and future societies and economies. The DigComp framework (Vuorikari et al., 2022), valid throughout Europe, has been created to assess the digital competence of citizens in the EU. The DigComp framework creates an agreed vision in terms of competencies, which helps to reach a common understanding and solve the challenges that arise almost everywhere with digitalization (Sulakatko, 2024). It also acts as a guide for educational institutions and learners on their digital competence. Educational institutions, such as vocational schools for professional caregivers, can align their curricula, training activities, and programs for lifelong learning with the guidance of DigComp framework. In addition, the framework enables to evaluate individual digital competence. However, a significant segment of the framework has been missed from the DigComp framework of competencies. Specific digital competencies related to health and safety, such as using technology to monitor patients' health or manage emergencies, could be more explicitly detailed. Furthermore, DigComp framework does not include field-specific digital competencies, highlighting the need to identify IT skills specifically required by professional caregivers to use digital tools in their profession.

Digital competence is not the only factor influencing technology adoption. Technology-related impediments comprise factors such as technology anxiety and resistance to technology (Talwar et al., 2024), lack of technical competence (Spånt Enbuske, 2022), and lack of ability to operate equipment, low computer self-efficacy and fears of disruption of services (Nilsson et al., 2020). Resistance factors such as uncertainty, security concerns, privacy issues, lack of trust, threats to identity, information overload, system feature overload, fatigue, and technostress, can be exacerbated by insufficient training (Zander et al., 2021). It has been shown that anxiety among healthcare staff regarding the delivery of proper patient care with new technology, driven by self-doubt about their technical competence, skills, and knowledge, acts as a significant dissuading factor (Andersson et al., 2017). Several studies (Gullslett et al., 2022; Blindheim et al., 2022; Glomsås et al., 2020), have noted the impact of technical complexities and technical capabilities as reasons for resistance towards technological innovations. This leads us to a statement that professional caregivers need to be digitally fluent and stay on top of the latest care innovations for technology adoption readiness and new roles digitalisation and new digital tools introduce.

The aim of this review article is to identify the challenges faced by professional caregivers due to the lack of digital competencies. To synthesize and summarize the literature regarding the challenges and barriers of implementing emerging welfare technology, policy, and practice the following research questions are used:

RQ1: What are the key digital competencies acting as enablers for professional caregivers to effectively implement emerging technologies in the welfare sector?

RQ2: What barriers exist for professional caregivers in adopting and using welfare technologies and digital platforms?

The rest of the paper is organized as follows: Section 2 discusses the theoretical background, Section 3 describes the research method, Section 4 describes the results, Section 5 provides discussion, and Section 6 is summing up this literature review.

2 Theoretical Background

The transition to digitalization and the larger process of digital transformation began during the economic crisis of 2008-2009 (Novichenko, 2020). The latter is considered crucial for social development and progress, emphasizing the ongoing need for individuals to acquire and enhance digital skills and competencies. The EU's approach focuses on creating conditions that enable citizens to effectively utilize digital technologies while safeguarding themselves against potential risks in the digital environment. Additionally, it is vital to continually update these skills and recognize their importance in navigating an increasingly digital world (Vuorikari et al., 2022). Digitally competent citizens are the foundation of the digital state and a key element in driving economic development. Continuous digital transformation of countries has been regarded as one of the crucial steps in overcoming economic downturns (Novichenko, 2020). The future skills required for professional caregivers are shaped by the specific demands of the care sector as well as broader structural factors. According to reports by the European Commission and the European Centre for the Development of Vocational Training (Cedefop, 2024), several key factors will shape the future demand for care and the necessary skill sets for professional caregivers. One significant factor is the increasing integration of technology into healthcare, which is expected to improve access to high-quality, affordable care services and support independent living (European Commission, 2021). However, this technological advancement will require professional caregivers to undergo additional training.

The key factors shaping the future demand for professional caregivers include technical proficiency, integration skills, ethical competence, and a patient-centred approach (Schwiter and Steiner, 2020). Digital devices are transforming care work by enabling remote tasks and precise health monitoring. To thrive in this evolving landscape, professional caregivers must develop essential cross-disciplinary skills such as digital competence, problem-solving, initiative, continuous learning, cultural awareness, resilience, social intelligence, creativity, critical thinking, and adaptability (Schwiter and Steiner, 2020). Education and training play a vital role in fostering digital competence by providing essential activities that enhance knowledge, skills, and expertise (Cedefop, 2024).

Continuous education and training are crucial for professional caregivers, it enables to update their skills and knowledge, ensure adaptation to new technologies, and provide high-quality care (Lahe, 2025). Lifelong learning, as defined by the EU (European Commission, 2021), encompasses all learning activities throughout life aimed at improving knowledge, skills, and competencies in personal, civic, social, or employment-related contexts. For professional caregivers, digital competence involves both technical skills and digital literacy (Anthonysamy et al., 2020). Technical skills include operating and troubleshooting welfare monitoring tools, while digital literacy encompasses the ability to access, manage, evaluate, and create information. These skills help pro-

fessional caregivers to navigate digital environments safely and effectively, enhancing their ability to deliver personalized and efficient care (Rosell Magerøy et al., 2023).

3 Research Method

A systematic literature review was conducted to compile and analyse the key digital competencies that enable professional caregivers to effectively implement emerging technologies, as well as the barriers existing for the implementation in the welfare sector. Systematic literature review is a form of secondary study that uses a well-defined methodology to identify, analyse and interpret all available evidence related to a specific research question in a way that is unbiased and repeatable (Kitchenham et al., 2009). In this literature review, the Kitchenham method, which provides structured guidelines for defining search strategy allowing to choose studies that are closely related to the topic, was applied.

3.1 Search Strategy

After formulating the research questions, a targeted search strategy was developed to identify studies that provide evidence on the challenges and gaps in digital competencies, as well as the barriers professional caregivers encounter in implementing emerging technologies in the welfare sector. A set of keywords was identified as follows: *professional caregiver*, *digital competence*, *barriers* and *digital platforms*, and combined with *welfare technology* as described in Table 1. These keywords were identified based on the set research questions and expanded based on the results of quick pilot searches in key databases by inspecting titles and abstracts.

The selected terms were combined to search strings to ensure that all significant research on the utilization of digital competence and main gaps of technology usage for professional caregivers is included. Two search strings were composed targeting either RQ1 or RQ2. Using two different search strings helps make the literature search more complete and balanced. Each search string may capture studies that the other might miss, so using both increases the chances of finding all relevant research. When the results from both searches are combined, the review can address both research questions more effectively. This approach ensures that any overlapping or complementary studies are included and considered for both questions when appropriate. Overall, it leads to a fuller and more accurate understanding of the topic by drawing on the strengths of both search strategies.

The scope of the review was set to specifically target the following types of papers: study, literature review, ethnographical study, comparative study, scoping review, and pilot study due to their relevance and contribution to advancing knowledge in the field. The studies were limited to those published in English language with accessibility of findings for an international audience, and published within the time frame of last 10 years. The search was conducted against key academic resources such as IEEE Explore, ACM Digital Library, ScienceDirect, Wiley Online Library, PubMed, SpringerLink, and Taylor and Francis. Table 2 provides the details of the search.

Table 1. Description of used keywords.

Keyword	Description	Justification
professional caregiver	Individuals who provide care, often in a professional or familial role of patients, elderly or disabled people in health care and residential	Welfare technology is designed to support professional caregivers, easing their tasks and improving the quality of care they provide.
Digital Competence	Skills and knowledge necessary to effectively use digital tools and technologies	professional caregivers must possess digital competence to efficiently utilize welfare technologies, improving the quality of caregiving.
Barriers	Challenges that prevent or hinder the adoption or use of welfare technology	Identifying barriers, such as lack of training or resources, is essential to overcome obstacles in the successful use of welfare technologies.
Digital Platforms	Digital tools, systems, and interfaces used to manage and facilitate care giving tasks	Digital platforms play a critical role by enabling professional caregivers to access information, communicate and manage caregiving responsibilities more effectively.
Welfare Technology	Welfare technology refers to the digitalisation of health care and social services	For the elderly, welfare technologies can be life changers in helping them to live more independently, stay connected with the world, and manage their health.

Table 2. Details of the search.

Electronic databases	IEEE Xplore, ACM Digital Library, Scopus, ScienceDirect, Wiley online library, PubMed, SpringerLink, Taylor & Francis journals
Search strings	RQ1: (professional caregiver OR welfare) AND ”digital competence” AND ”welfare technology” RQ2: (professional caregiver OR welfare) AND ”welfare technology” OR ”digital platform” AND barrier
Type of searched literature	Study, Literature Review, Ethnographical Study, Comparative Study, Scoping Review and Pilot Study
Language of study	English
Publication period	From October 2014 to November 2024

3.2 Inclusion and Exclusion Criteria

On top of the search scope of the review (Section 3.1), additional inclusion and exclusion criteria were established. This refinement enhances the quality and focus of the review by including only studies on welfare technology that specifically address the key aspects under investigation. Following the principles of the Kitchenham (Kitchenham et al., 2009) method, these criteria were defined to ensure transparency, reproducibility, and relevance of the selected studies. In line with Kitchenham's systematic review guidelines, the inclusion and exclusion process aimed to minimize bias and maintain a clear link between the research questions and the reviewed evidence. The inclusion criteria were:

- Studies were included if they involved key stakeholders in elderly care, such as care workers, professional caregivers, managers, the elderly, care homes, home care services, or governmental bodies responsible for policies;
- The study had to focus on digital competencies, welfare technology in relation to professional caregivers, specifically, studies addressing barriers, training, competencies, or gaps in the use or implementation of digital and welfare technologies were considered relevant;
- The study was required to be long-term, lasting at least a month, to promote sustained engagement and meaningful learning outcomes. Studies with a duration of less than one month were excluded, as shorter studies may not provide sufficient time to observe meaningful outcomes, behavioral changes, or sustained effects of welfare technology interventions.

Additionally, exclusion criteria were integrated to strengthen the process of searching for evidence when assessing the relevance of each screened article:

- Studies not involving professional caregivers were excluded;
- Studies not focused on elderly care were excluded;
- Studies with a duration of less than one month were excluded.

These criteria ensured a systematic and rigorous selection process, focusing on high-quality and relevant studies for the literature review.

3.3 Study Search and Selection

The initial search carried out between 09–10 October 2024 identified 505 articles as follows: IEEE Xplore (n=14), The ACM Digital Library (n=183), ScienceDirect (n=82), PubMed (n=13), Scopus (n=13), Tandfonline (n=94), SpringerLink (n=59), and Wiley Online (n=47). During the identification step, the duplicates were removed (n=82), leaving 423 records for screening.

Next, during screening, the titles and abstracts of the papers were analysed, and papers not falling within the scope of this research, i.e., not addressing professional caregivers or elderly care in the research context (Section 3.2) (n=310) were excluded, reducing the number of articles to 113 for full-text review during eligibility check. During full-text analysis, of these 54 records were found not to discuss professional caregivers in elderly care context, resulting in their removal. The final study set therefore

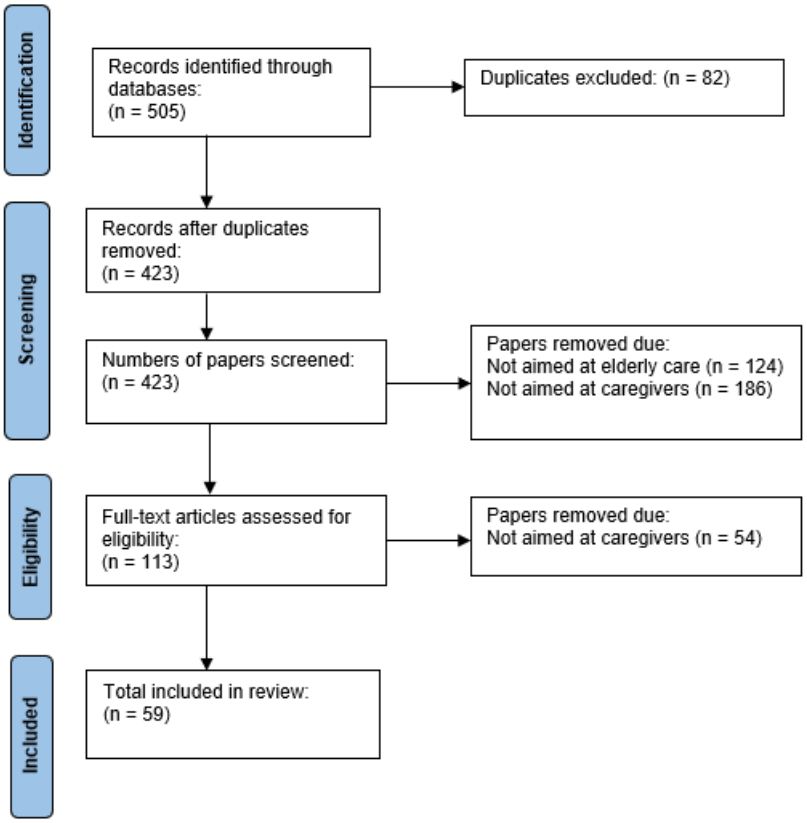

Fig. 1. The PRISMA flow diagram for this study adapted from (Haddaway et al., 2022).

consists of 59 papers. This literature selection process, is illustrated in Figure 1 as a PRISMA diagram.

In the analytical phase of the review, the selected papers underwent a rigorous open coding process conducted by a single researcher. The primary aim was a comprehensive examination of the reported digital competencies required for professional caregivers (RQ1), and the barriers that hinder the effective integration of new technologies (RQ2) in the welfare sector for professional caregivers. All studies were meticulously analysed using Microsoft Excel as the analysis tool.

During the analysis, each paper was carefully read and the following aspects documented in the allocated Excel spreadsheet:

– Problems addressed in the paper (as identified by the authors, e.g., research questions). Open coding was applied to categorize the problems as: training and competence, legal and ethical issue, economic and budgetary, technological barriers and professional caregiver's input;

- Type of welfare technology used in the studies. Open coding was applied over five different types of technologies used across the studies: digital care technology, multimedia, monitoring technology, service robots, social robots;
- Technology and digital competencies demonstrated or required in the studies (as reported by the authors). Open coding was applied to classify competencies such as basic digital skills, technological adaptability, information management, and data security awareness in digital practice. These categories correspond largely to Dimension 1 of the DigComp framework (Vuorikari et al., 2022), encompassing areas such as information and data literacy, safety, digital content creation, and problem solving. On a more detailed level, they align with Dimension 2 elements including managing digital content, protecting personal data, and identifying technological needs, illustrating a close connection between the empirical findings and the established DigComp framework.
- Location of each study, identified with the granularity of country in which the research was conducted. This was included as the geographical context can significantly influence the findings due to differences in cultural norms, social structures, healthcare systems, and policy frameworks. Open coding included the names of countries, in total counting for 15 labels.
- Type of research reported in the paper. Open coding was done through the following labels: study, literature review, ethnographical study, pilot study, comprehensive review, scoping review.
- Sample size and study duration as reported in the paper.
- Research method used in the paper, through the following labels: qualitative (e.g., interviews or observations), quantitative (e.g., surveys or statistical data), or mixed methods as the combination of the two latter.
- Summary of the key findings and insights, highlighting implications for practice, policy, or further research, and often suggesting recommendations for improving the implementation or use of welfare technology.

This detailed and structured approach allowed for a thorough analysis of each article, ensuring that all relevant aspects were considered and documented. The use of Excel as a tool facilitated a structured comparison of data across different studies, providing a clear and comprehensive overview of the findings. The focus was on identifying the digital competencies mentioned in the papers (RQ1), and the gaps in the adoption and usage of emerging technologies (RQ2).

4 Results

This section presents the findings of the systematic literature review, which analyses studies conducted between October 2014 to November 2024.

We start by characterising the 59 papers that this literature review on digital competencies and barriers of technology adoption in caregiving is based on. First, to characterise the papers, we analyse the geographical scope and research design of the final set of papers.

4.1 Overview of the Studied Literature

The global significance and interest in welfare technology were demonstrated across 59 studies conducted in 16 distinct countries. Four studies addressed multiple countrie resulting in a total of 84 country contributions as illustrated in Figure 2.

Overall, Norway emerged as a leading contributor with 25 contributions (29.8%), followed by Sweden with 13 contributions (15.5%) and Finland with 12 contributions (14.3%). China contributed six studies (7.1%), while Bangladesh, Pakistan, and the United States each contributed four (4.8%). Denmark and Taiwan contributed two and three studies respectively, and Germany, South Korea, the United Kingdom, Brazil, France, Switzerland, and Spain contributed between one and two studies each.

Interestingly, welfare technologies in the context of elderly care were predominantly studied in Scandinavia. Norway, Sweden, and Finland—neighbouring countries of Scandinavia—accounted for 50 contributions (59.5%), highlighting the regional importance of welfare technologies as solutions to the ageing population challenge.

Concerning the research design, the following types could be distinguished as described in Table 3. The majority of research (72.9%) in this literature review is original research covering various welfare topics. Literature reviews account for (20.3%), offering comprehensive analyses of existing studies. Ethnographical studies, pilot studies, comparative studies, and scoping reviews each constitute a smaller share, ranging from 1.7% highlighting their more specialized roles in research. Out of the total 59 articles included in the sample, 11 (19%) employed quantitative methods, 29 (49%) used qualitative approaches, and 19 (32%) followed a mixed methods design for research.

In conclusion, the predominance of original and qualitative studies suggests that research in this field is still in an exploratory phase, focusing on understanding complex

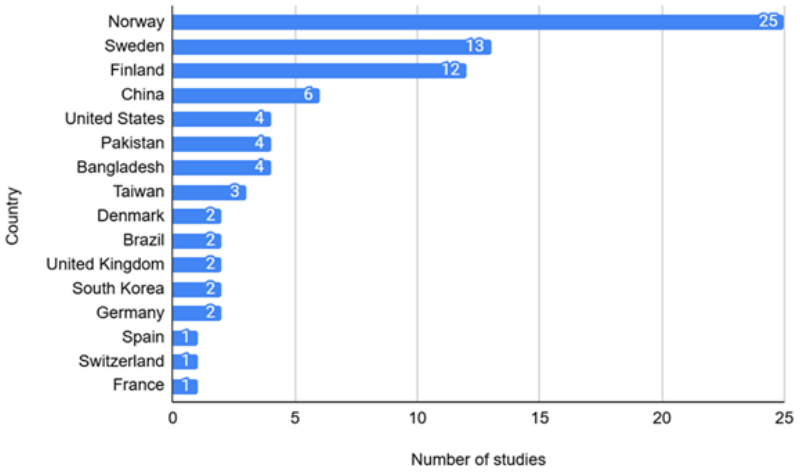

Fig. 2. Number of studies per country reported in the studied literature.

Table 3. Research Design Categories and Descriptions

Research Design Category	Description	# Total	%
Original research	Original research across various topics.	43	(72.9%)
Literature Review	Comprehensive review of existing literature.	12	(20.3%)
Ethnographical Study	In-depth qualitative analysis of cultural context.	1	(1.7%)
Pilot Study	Preliminary study to assess feasibility.	1	(1.7%)
Comparative Study	Comparison of different variables of population.	1	(1.7%)
Scoping Review	Overview of key concepts and gaps.	1	(1.7%)
TOTAL		59	100%

social, organisational, and individual factors influencing welfare and digital transformation.

4.2 Technology Usage Among professional caregivers

To better understand the types of skills that may be needed in the welfare sector by professional caregivers and answer RQ1, we examine the technologies mentioned in the reviewed papers, as summarized in Table 4.

Digital care technologies (8 studies; 14.3%), particularly e-health systems, are designed to integrate client records and improve professional caregivers' access to essential information. Studies highlight their potential, but also point to adoption challenges such as system complexity, lack of seamless integration, and user resistance (Oh and Bae, 2024; Boyle et al., 2022; Ebrahimi et al., 2023; Dugstad et al., 2019). While these tools encourage self-monitoring and patient autonomy, their success depends on professional caregivers overcoming barriers related to digital skills, workload, and technology acceptance.

Multimedia tools (8 studies; 14.3%), including virtual reality and gaming, have emerged as innovative options for rehabilitation and mental health therapy. They offer engaging ways to support cognitive and emotional well-being, especially for people with dementia (White et al., 2023; Jawharieh et al., 2024). However, their implementation remains in an early stage, and further research is needed to assess long-term impacts.

Monitoring technologies: (23 studies; 41.1%)such as alarms, cameras, door sensors, GPS-enabled devices, and digital medication dispensers—play an increasingly important role in safety and health monitoring (Flakk Nordang and Halvorsen, 2022; Sten-Gahmberg et al., 2024; Dugstad et al., 2019; Kleiven et al., 2020). While they are effective in ensuring security, studies suggest that less emphasis has been placed on improving quality of life, social participation, and independence (Glomsås et al., 2022; Gullslett et al., 2022).

Service robots: (9 studies; 16.1%) are gradually being integrated into care settings, assisting with mobility, daily tasks, and nighttime support for people with dementia (Tuisku et al., 2022; Dugstad et al., 2019). They can also support self-diagnosis and introduce novel care practices that promote independence (Pekkarinen and Melkas, 2019; Tuisku et al., 2022). Despite their potential to improve efficiency, their broader adoption remains limited by cost and technological constraints.

Social robots: (4 studies; 7.1%), such as Pepper, Zora, AIBO, and Justo Cat, are designed to provide companionship, reduce loneliness, and support physical care (Isaksen and Rypestøl, 2022; Melkas et al., 2020; Budak et al., 2021). They have been adopted for therapy, exercise, and recreational activities (Turja et al., 2022), though their acceptance varies across care settings. Some studies also note that anticipated time savings for staff have not materialized in practice (Blindheim et al., 2022).

Table 4. Technology usage among professional caregivers

Type	Details	# of studies (n)	Percentage (%)
Digital care technology	E-health databases and other e-health technologies to lessen pressure on healthcare systems.	8	14.3
Multimedia	Use of virtual reality and digital games as tools for supporting elderly cognitive and emotional well-being.	8	14.3
Monitoring technology	Sensors and telemedicine used to gather information about the environment and monitor well-being.	23	41.1
Service robots	Robotic technologies assisting professional caregivers with mobility and daily support tasks.	9	16.1
Social robots	Robots providing physical interaction, companionship, and support, and reducing loneliness.	4	7.1
Telepresence technology	Technologies enabling remote presence and digital communication in caregiving contexts.	4	7.1
Total		**59**	**100%**

Finally, telepresence technologies: (4 studies; 7.1%) enable professional caregivers to remain virtually present with clients, regardless of location (Berg et al., 2024; Boyle et al., 2022; Gates et al., 2019; Turja et al., 2022). These devices help reduce loneliness and strengthen communication, though they require stable connectivity and frequent interaction. Compared to simple video calls, embodied telepresence robots can foster more engaging and meaningful interactions.

The primary purpose of using technology in care homes is to enhance the quality of care, promote independence, and improve residents' overall well-being while supporting staff in their daily responsibilities. Service robots contribute significantly by assisting with mobility, facilitating daily routines, and providing nighttime monitoring and self-diagnostic functions. These features not only reduce staff workload but also empower residents to manage aspects of their own care, thereby fostering greater autonomy and safety. Social robots, on the other hand, play a crucial role in addressing emotional and psychological welfare. By offering companionship, engaging residents in therapeutic and recreational activities, and stimulating cognitive and physical exercise, they help reduce loneliness and enhance social interaction. Telepresence technologies further strengthen emotional and social well-being by enabling professional caregivers and family members to maintain a virtual presence, ensuring continuous communication, and mitigating social isolation—particularly for residents with limited mobility or during staff shortages. Collectively, these technologies enhance the efficiency and quality of care delivery, support residents' physical, cognitive, and emotional health, and help address workforce challenges by supplementing human labor with reliable, responsive systems.

4.3 Required digital competences for professional caregivers

The integration of emerging technologies in the welfare sector is rapidly transforming caregiving practices. These technologies, including e-health solutions, care robots, and digital platforms, hold great potential for improving care outcomes, enhancing efficiency and supporting professional caregivers in their roles. However, the effective implementation of these technologies hinges on the digital competence of professional caregivers. In order to answer RQ1 we identify and discuss the key digital competencies that according to literature enable professional caregivers to implement emerging technologies with the welfare sector.

Digital competence encompasses the knowledge, skills, and attitudes required to successfully engage with and utilize welfare technologies in day-to-day care activities, requiring professional caregivers to possess a broad range of digital competencies (Fjeldheim et al., 2024). Staff must be able to operate service robots, social robots, and telepresence devices, manage connectivity, and troubleshoot technical issues to ensure safety and continuity of care. Strong digital communication skills are also essential to facilitate virtual interactions and guide residents in the use of technology. Awareness of data privacy and ethical considerations is crucial when handling sensitive resident information. Moreover, professional caregivers must be adaptable and committed to continuous learning as technologies evolve, addressing skill gaps that could hinder effective use. Finally, they should be able to integrate digital tools meaningfully into daily care routines, enhancing residents' well-being while complementing human care.

At the same time, the ethics of care is rarely used as a theoretical framework in empirical studies of technology-mediated healthcare practices. Applying an ethics of care perspective in such contexts highlights new dilemmas, relational tensions and vulnerabilities, and requires decision-making that is informed by a higher awareness of business ethics, e-ethics, netiquette and data protection (Ramvi et al., 2023; Sulakatko, 2024). Skills-forecasting tools further support workers and learners in making informed

decisions regarding education, training, and career development opportunities (Cedefop, 2024). Moreover, significant differences persist in how digital competencies are conceptualized and developed across regions, such as between the EU (Novichenko, 2020).

Key factors include recognizing the role of digital technology in both professional and personal contexts and fostering openness to experimentation and change. Building adaptability, encouraging positive attitudes, and promoting digital literacy help reduce fear and resistance toward new technologies. Enthusiasm, commitment, and an understanding of the benefits of digital transformation are essential for enabling professional caregivers to effectively adopt and implement emerging technologies within the welfare sector (Gustafsson and Dannapfel, 2025; Fjeldheim et al., 2024).

One of the foundational skills highlighted in several studies is is basic digital literacy (Bae et al., 2024; Zander et al., 2021; Frennert, 2018; Anthonysamy et al., 2020),

Table 5. Required digital competences for professional caregivers.

Digital Areas	**Competence Focus**	**Author(s)**
Basic Digital Literacy	Foundational IT skills for professional caregivers, including the ability to use digital devices and navigate care management systems, patient information, and communication tools.	Anthonysamy et al. (2020); Bae et al. (2024); Frennert (2018); Zander et al. (2021)
Adaptability to Technology	professional caregivers' ability to learn, adapt, and troubleshoot new digital tools and systems amidst rapid technological changes in caregiving.	Eriksson and Ineland (2023); Sten-Gahmberg et al. (2024)
Data Security and Privacy Competence	Foundational IT skills for professional caregivers, including the ability to use digital devices and navigate care management systems, patient information, and communication tools.	Johansson-Pajala and Gustafsson (2020)
Effective Communication	professional caregivers' ability to use digital platforms for effective communication, including video calls, messaging systems, and collaboration tools to coordinate care.	Eriksson and Ineland (2023); Gustafsson and Dannapfel (2025); Sten-Gahmberg et al. (2024)

which refers to the ability to use digital devices (such as computers, smartphones, and tablets) and navigate various software and applications. This competence is critical for professional caregivers to interact with care management systems, access patient information, and utilize digital communication tools. Another important competence found from studies is technological adaptability, which refers to a professional caregiver's ability to learn, adjust to and troubleshoot new digital tools and systems. Given the rapid

pace of technological advancements in the welfare sector, professional caregivers need to be agile in adapting to new technologies and resolving any issues that may arise during their use (Eriksson and Ineland, 2023; Sten-Gahmberg et al., 2024). As professional caregivers handle sensitive personal and medical data, data security and privacy competence is also essential. professional caregivers must understand privacy regulations (such as GDPR), recognize data security risks, and use secure digital tools to protect patient information (Johansson-Pajala and Gustafsson, 2020). Finally, effective communication skills are crucial for professional caregivers, and digital platforms provide new ways for them to connect with colleagues, patients, and families. This includes using video calls, messaging systems, and collaboration tools to coordinate care and exchange vital information (Eriksson and Ineland, 2023; Gustafsson and Dannapfel, 2025; Sten-Gahmberg et al., 2024).

Table 5 illustrates that digital competence in caregiving extends beyond basic technical skills. It encompasses the ability to adapt to evolving technologies, ensure data protection, and communicate effectively in digital environments. These competencies collectively enable professional caregivers to integrate technology confidently and ethically into daily care practices, supporting both efficiency and person-centred well-being.

However, many professional caregivers lack access to adequate training programs that specifically address the digital skills required for effective engagement with welfare technologies. As the adoption of these technologies continues to grow, addressing these gaps in professional caregiver training will be essential for maximizing the benefits of digital tools in caregiving practices (Frennert, 2018).

4.4 Barriers to technology adoption

To address RQ2, key gaps and barriers faced by professional caregivers in adopting emerging technologies were identified from the reviewed literature. While digital tools have the potential to enhance care delivery, professional caregivers often encounter challenges such as limited training, insufficient organizational support, and resistance to change. Additional difficulties include navigating complex digital systems, balancing technology use with the need for human connection, and ensuring data privacy and security. Understanding these barriers is essential for developing effective strategies that empower professional caregivers to integrate technology seamlessly into their roles, thereby improving both patient care and overall efficiency.

Recurring themes and patterns related to these barriers were identified through open coding and systematic grouping of findings across the reviewed studies. The frequency and context of each barrier were compared to highlight the most prevalent and impactful issues in the literature. Several key challenges identified in these studies are summarized in Table 6, which provides a comprehensive overview of the obstacles that hinder the integration of emerging technologies in caregiving. The following section presents these results in detail, offering a structured analysis of the main obstacles and opportunities for advancing digital transformation within the welfare sector.

The reviewed papers primarily focused on the development of digital competencies among professional caregivers, their effective use of technology in caregiving, and the

Table 6. Gaps and Challenges Identified.

Gaps and challenges identified	Study References
Training and competence: Digital skills, inadequate training, lack of management strategies	Scaramuzzino and Martinell Barfoed (2021); Boyle et al. (2022); ChePa et al. (2023); Batt-Rawden et al. (2017); Elfert (2019); Frennert (2018); Frilund et al. (2023); Glomsås et al. (2020); Gullslett et al. (2022); Gunnes et al. (2024); Haddaway et al. (2022); Isaksen and Rypestøl (2022); Laperche et al. (2018); Melkas et al. (2020); Emilsson et al. (2023)
Legal and ethical issues: Concerns about privacy, ethical considerations, government policy	Ramvi et al. (2023); Gustafsson and Dannapfel (2025); Hvalič-Touzery et al. (2024); Pekkarinen and Melkas (2019); Vuorikari et al. (2022)
Economic and budgetary constraints: Limited budgets for technology, economic models based on physical work	Hvalič-Touzery et al. (2024); Spånt Enbuske (2022); Isaksen and Rypestøl (2022); Rosell Magerøy et al. (2023); Melkas et al. (2020); Novichenko (2020); Zander et al. (2021); Zyzak and Martinussen (2024)
Infrastructure and technological barriers: Lack of infrastructure, technical incompatibilities, integration issues	Cedefop (2024); Jawharieh et al. (2024); Melkas et al. (2020); Talwar et al. (2024)
professional caregiver's input: Absence of worker input on new technology	Mesquita de Carvalho et al. (2018); Glomsås et al. (2020); Parjanen et al. (2021); Pekkarinen et al. (2020); Spann et al. (2022); Parjanen et al. (2021); Pekkarinen and Melkas (2019)

successful adoption of emerging technologies. Several key challenges identified in these studies are summarized in Table 6.

Training and competence represent a critical challenge, encompassing issues such as disparities in digital skills (Gustafsson and Dannapfel, 2025; Boyle et al., 2022; ChePa et al., 2023; Batt-Rawden et al., 2017), and access to technology among users. Inadequate training for professional caregivers has been a recurring theme (Elfert, 2019; Frennert, 2018; Frilund et al., 2023; Glomsås et al., 2020; Gullslett et al., 2022; Gunnes et al., 2024; Emilsson et al., 2023; Scaramuzzino and Martinell Barfoed, 2021), leading to stress and reluctance to adopt new technologies. Additionally, the lack of established management procedures and strategies for using these technologies adds to the challenges professional caregivers face (Haddaway et al., 2022; Isaksen and Rypestøl, 2022; Laperche et al., 2018; Melkas et al., 2020).

Legal and ethical issues—particularly those concerning privacy and broader ethical considerations (Boyle et al., 2022) – have been highlighted across several studies. These

studies emphasize the importance of adhering to ethical standards in the implementation of welfare technologies (Ramvi et al., 2023; Hvalič-Touzery et al., 2024; Pekkarinen and Melkas, 2019; Vuorikari et al., 2022).

Economic and budgetary constraints are significant barriers to the adoption of welfare technologies (Spånt Enbuske, 2022; Hvalič-Touzery et al., 2024), as limited funding for technology procurement often hinders access to essential tools. Furthermore, many organizations continue to operate under traditional, labour-intensive models—systems that rely heavily on human effort and manual processes rather than automation or digital solutions—which complicates the transition to more technology-driven approaches (Isaksen and Rypestøl, 2022; Rosell Magerøy et al., 2023; Melkas et al., 2020; Novichenko, 2020; Zander et al., 2021; Zyzak and Martinussen, 2024).

Infrastructure and technological barriers have been widely documented, with several studies highlighting the lack of necessary infrastructure, technical incompatibilities, and integration issues that hinder the adoption of new technologies. These challenges prevent the seamless implementation of welfare technologies in caregiving settings, where reliable and interoperable systems are essential (Cedefop, 2024; Jawharieh et al., 2024; Melkas et al., 2020; Talwar et al., 2024).

Another critical issue is the lack of sufficient input from professional caregivers regarding the introduction of new technologies (Lindberg et al., 2022; Glomsås et al., 2020; Parjanen et al., 2021; Pekkarinen et al., 2020; Spånt Enbuske, 2022). professional caregivers play a pivotal role in determining the effectiveness of welfare technologies, yet their perspectives are often overlooked in decision-making processes. When professional caregivers are not actively involved in the design and implementation of technological solutions, the resulting tools may fail to address their actual needs and concerns (Parjanen et al., 2021; Pekkarinen and Melkas, 2019).

5 Discussion

The aim of this systematic literature review, was to identify challenges professional caregivers face due to limited digital competencies and to synthesize the barriers to adopting emerging technologies in welfare services. Overall, the findings indicate that the successful adoption of technology in caregiving depends not only on the technological tools themselves but also on professional caregivers' attitudes, organizational support, and broader systemic factors. Successfully integrating new technologies and adapting innovative workflows requires careful planning to ensure that high-quality, person-centred care is not compromised (Ebrahimi et al., 2023). However, professional caregivers often resist technological changes due to perceived threats to stability, predictability, and established practices (Kuoppamäki, 2021). The review identified key challenges professional caregivers face due to limited digital competencies and synthesized the barriers to adopting emerging technologies in welfare services. The findings reveal that technology adoption in caregiving is shaped not only by the technological tools themselves but also by professional caregivers' attitudes, organizational readiness, and systemic support structures. Successful integration of technology therefore requires balancing person centred care with innovative digital solutions (Kuoppamäki, 2021).

Developing professional caregivers' digital competencies is crucial for overcoming resistance, usability issues, and anxiety related to technology use. Core competencies include technical literacy, problem-solving, adaptability, and confidence in managing digital systems. professional caregivers with higher levels of digital competence demonstrate greater readiness to adopt and effectively use new technologies (Berg et al., 2024; Nilsen et al., 2016). Perceived usefulness and relevance of digital tools also play a major role in building positive attitudes toward technology (Parjanen et al., 2021). The literature emphasizes that comprehensive, ongoing training programs—supported by clear strategies for technology use—are vital for developing professional caregivers' digital competencies. Such initiatives help overcome resistance, improve usability, and ensure the sustainable integration of digital tools into person-centred care (Ebrahimi et al., 2023).The literature emphasizes that comprehensive, ongoing training programs—supported by clear strategies for technology use—are vital for developing professional caregivers' digital competencies. Such initiatives help overcome resistance, improve usability, and ensure the sustainable (Elfert, 2019; Frilund et al., 2023).

The review highlights multiple barriers that hinder professional caregivers from adopting digital tools. These include psychological barriers—such as fear of failure, anxiety about causing harm to clients, and resistance to change—as well as practical obstacles like poor usability, outdated systems, and incompatible technologies (Cuesta et al., 2020; Gustafsson and Dannapfel, 2025; Nilsson et al., 2020). Furthermore, organizational challenges, including insufficient management support, lack of clear implementation strategies, and limited opportunities for involvement in decision-making, contribute to techno-stress and resistance (Kuoppamäki, 2021; Ramvi et al., 2023; Nilsson et al., 2020; Scaramuzzino and Martinell Barfoed, 2021; Nilsen et al., 2016). Many projects fail because technologies are introduced before professional caregivers' competencies are adequately developed, or because organizational structures are not prepared to support digital transformation (Mesquita de Carvalho et al., 2018; Frilund et al., 2023).

Technology adoption in caregiving is a multifaceted process influenced by both human and organizational dimensions. Addressing barriers such as limited digital competence, resistance to change, usability challenges, inadequate training, and weak organizational readiness is essential. Early and active involvement of professional caregivers, continuous training, and supportive management structures enhance digital confidence and acceptance. By strengthening professional caregivers' digital competencies (RQ1) and systematically addressing the barriers to adoption (RQ2), welfare services can ensure that technological innovations support rather than disrupt human centred care, ultimately improving both care quality and organizational efficiency.

6 Conclusion

The integration of emerging technologies in the welfare sector is rapidly transforming caregiving practices. These technologies—including welfare technologies, e-health solutions, care robots, and digital platforms—hold significant potential to improve care outcomes, enhance efficiency, and support professional caregivers in their roles. How-

ever, their effective implementation depends heavily on the digital competence of professional caregivers.

This systematic literature review,the review covers publications from 2014 to 2024, focused on 59 papers. These studies examine the challenges and gaps in digital competencies, as well as the barriers faced by professional caregivers in implementing emerging technologies within the welfare sector. One of the foundational skills emphasized in multiple studies is basic digital literacy, which refers to the ability to use digital devices, such as computers, smartphones, and tablets, and navigate various software and applications. This competence is critical for interacting with care management systems, accessing patient information, and utilizing digital communication tools. Technological adaptability is another essential competence, referring to a professional caregiver's ability to learn, adjust to, and troubleshoot new digital tools and systems. Given the rapid pace of technology advancement in the welfare sector, professional caregivers must be agile in adopting new technologies and resolving issues as they arise.

The literature review reveals that professional caregivers require a broad set of digital competencies to effectively engage with welfare technologies. Key areas include data security and privacy awareness, communication skills for digital coordination, and the ability to navigate complex systems. Despite the growing importance of these skills, there is currently no standardized framework guiding their development. Structured training is essential, yet often lacking, and research tends to conflate general digital literacy with caregiving-specific competencies. The European Commission's DigComp framework offers a promising foundation for defining and assessing these skills, though its application in the welfare sector remains limited. Adopting such a framework could support targeted training, reduce technology-related stress, and improve the successful integration of digital tools in caregiving.

Overall, the findings highlight the urgent need for a more structured and strategic approach to digital competency development in the welfare sector. Integrating digital skills training into professional education, promoting organizational support for continuous learning, and aligning national policies with established frameworks like DigComp would strengthen the digital readiness of the care workforce. Such efforts are essential not only for ensuring effective use of emerging technologies but also for promoting equitable, person-centred, and dignified care in an increasingly digital care environment.

Future research should focus on defining sector-specific digital competencies, developing reliable assessment methods, and exploring training approaches that support long-term adoption. Improving these areas would enable professional caregivers to use emerging technologies more effectively, enhancing care delivery and outcomes.

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