Incorporating smart digital and humanoid technologies in older adults care enhancing employee sustainability

Włączanie inteligentnych technologii cyfrowych i humanoidalnych do opieki nad osobami starszymi: zwiększanie zrównoważonego rozwoju pracowników

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STRESZCZENIE

WŁĄCZANIE INTELIGENTNYCH TECHNOLOGII CYFROWYCH I HUMANOIDALNYCH DO OPIEKI NAD OSOBAMI STARSZYMI: ZWIĘKSZANIE ZRÓWNOWAŻONEGO ROZWOJU PRACOWNIKÓW

Cel pracy. Niniejszy artykuł bada potencjalny wpływ integracji DT i robotów w ICE na zdolność do pracy pracowników opieki, koncentrując się na redukcji absencji, wspieraniu nowych pracowników oraz poprawie satysfakcji z pracy wśród opiekunów.

Materiał i metody. Przeprowadzono integracyjny przegląd literatury zgodnie z wytycznymi PRISMA, przeszukując bazy danych, takie jak Web of Science, PubMed i COBISS, używając określonych słów kluczowych związanych z DT i robotami w ICE. Wybrano odpowiednie artykuły na podstawie kryteriów włączenia i wyłączenia.

Wyniki. Przegląd zidentyfikował 48 odpowiednich artykułów, z których 7 spełniało kryteria włączenia. Wyniki sugerują, że integracja DT i robotów w ICE może poprawić satysfakcję z pracy, wspierać naukę i rozwój umiejętności oraz zwiększać wsparcie organizacyjne dla opiekunów.

Wnioski. Badania pokazują, że technologie cyfrowe i roboty mają znaczący wpływ na zdolność do pracy, jednak są niewystarczająco zbadane. Ich integracja może zmniejszyć absencję i zwiększyć zadowolenie z pracy, ale stawia wyzwania takie jak uzasadnienie inwestycji i obawy personelu. Zrozumienie ich wpływu na zdrowie pracowników jest kluczowe. Potrzebne są dalsze badania nad dynamiką zespołów wielokulturowych i trwałością systemów opieki zdrowotnej. Wdrażanie tych technologii napotyka trudności, zwłaszcza w krajach rozwijających się.

Słowa kluczowe: zdolność do pracy, technologie cyfrowe, roboty, opieka instytucjonalna nad starszymi dorosłymi

ABSTRACT

INCORPORATING SMART DIGITAL AND HUMANOID TECHNOLOGIES IN OLDER ADULTS CARE ENHANCING EMPLOYEE SUSTAINABILITY

Aim. This article investigates the potential impact of integrating DT and robots in ICE. By reducing absenteeism, supporting new employees, and improving job satisfaction among caregivers, we aim to highlight the significant benefits these technologies can bring to the workforce in the older adult care sector.

Material and methods. An integrative literature review was conducted following PRISMA guidelines, with searches in databases like Web of Science, PubMed, and COBISS using specific keywords related to DT and robots in ICE. Relevant articles were selected based on inclusion and exclusion criteria.

Results. The review identified 48 relevant articles, with 7 meeting inclusion criteria. Findings suggest that integrating DT and robots in ICE can improve job satisfaction, support learning and skill development, and enhance organizational support for caregivers.

Conclusions. Research indicates that digital technologies and robots can significantly impact work ability, yet much remains to be explored. Their integration holds potential to reduce absenteeism and boost job satisfaction, but it also brings challenges such as justifying investments and addressing staff concerns. Understanding their effects on employee health is essential, and further research is needed on multicultural team dynamics and public health system sustainability. Studying implementation challenges, especially in developing countries, is an ongoing process that requires continued investigation.

Key words: robots, digital technologies, working ability, institutional care of the elderly adults

INTRODUCTION

The number of long-term care beds in nursing and residential care facilities across the EU has increased, reflecting the growing demand for elderly care [1]. However, the sector faces significant challenges, including workforce shortages, quality of care issues, caregiver employment conditions, and financial sustainability [2]. A critical factor in addressing these challenges is ensuring adequate qualified staff in older adult care.

The workforce in institutional care of the elderly (ICE) faces two key demographic challenges: the increasing complexity of care needs among elderly residents and the demographic shifts within the caregiver population. As the need for long-term care rises, there is a growing demand for employees across diverse occupational groups [1]. The ageing of nurses themselves contributes to workforce shortages, with potential staff reductions due to retirement or health-related issues [3]. The prevalence of psychiatric and psychosomatic illnesses among healthcare workers also affects workforce retention [4]. Furthermore, the ageing population within care facilities is increasingly being attended to by ageing caregivers [5]. Employees aged 50 and over with low workability are particularly prone to early retirement, further compounding workforce shortages [6].

Ilmarinen defines workability as the capability to perform work relative to job demands, health, and mental resources, measured by the Work Ability Index (WAI) [7]. The „Work Ability House" model identifies multiple factors influencing an individual's capacity to work effectively, including leadership, appreciation, trust, and social support [8]. Standeker's study emphasises the importance of motivation and health in maintaining workability, even under health challenges, particularly in elderly care settings [9].

Given these challenges, this article explores how digital technologies (DT) and robotics can potentially transform the sustainability of the caregiving workforce. It aims to assess the role of these technologies in reducing absenteeism and early retirement, supporting mentoring for new staff, and enhancing the attractiveness of caregiving professions for future generations.

MATERIALS AND METHODS

Following PRISMA guidelines, a descriptive method using integrative literature review was employed to gather and analyse relevant studies from the Web of Science, PubMed, and COBISS databases [10]. Fig. 1. presents the PRISMA flowchart, illustrating the selection process of articles for this review. The search engines used the keywords: digital technologies and robots in institutional long-term care of the elderly (nursing homes, care homes for the elderly), support of DT and robots in ICE (nursing homes, care homes for the elderly). Boolean operators (AND, OR) effectively combined these keywords. The literature search was conducted on November 1, 2022.

For Web of Science, the search strategy included combinations of the following terms: "digital technologies in long-term care of the elderly" AND "humanoid robots in long-term care of the elderly" OR "robots in nursing homes" OR "humanoid robots in residential care of the elderly". The search included "digital technologies in nursing homes" OR "digital technologies in residential care of the elderly". This strategy yielded 16 results. In PubMed, a similar search was conducted with the same set of keywords: "digital technologies in long-term care of the elderly" AND "humanoid robots in long-term care of the elderly" OR "robots in nursing homes" OR "humanoid robots in residential care of the elderly" AND "digital technologies in nursing homes" OR "digital technologies in residential care of the elderly". This search yielded 11 results. The search in Cobiss was simplified, using the keywords "digital technologies and robots in nursing homes," which yielded 21 results.

We considered the inclusion and exclusion criteria when determining sources suitable for further analysis.

The inclusion criteria required articles to address digital technologies or robotics specifically within the context of residential care facilities, such as nursing homes or long-term care settings. Studies on these topics within public healthcare or hospitals were excluded. In terms of the area of research, only studies that dealt with long-term institutional or residential care of the elderly were included. Articles focusing on community care, home care, acute care, general ageing, or elderly adults, in general, were excluded from consideration. For the population criterion, the review targeted studies involving care workers in institutional or residential care settings for the elderly. Articles that focused on residents, elderly adults in institutional care, family
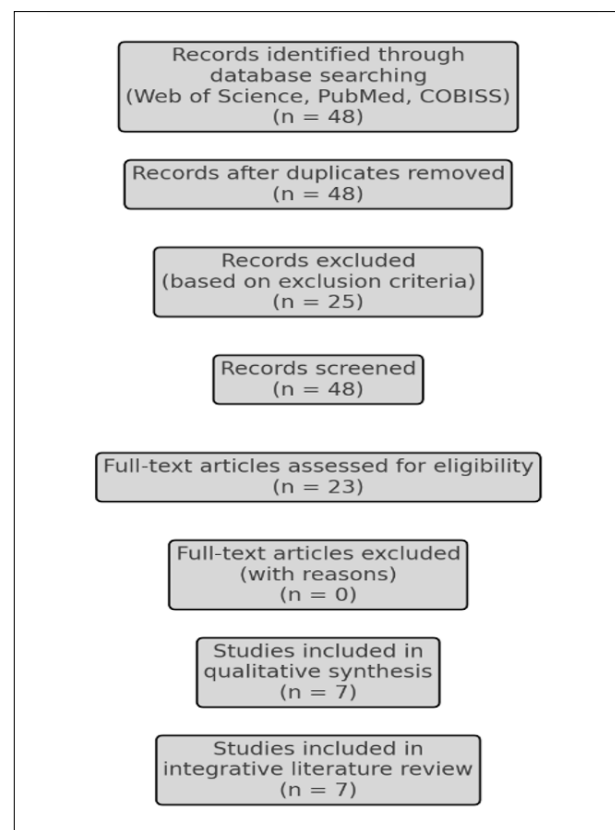

■ Fig 1. PRISMA flow diagram of the literature selection process

members, or doctors were excluded. Regarding access, only full-text, open-access articles were included, while studies available as abstracts or limited-access articles were excluded. Additionally, articles had to be published in journals with an Impact Factor (IF) greater than zero to be considered, excluding those with an IF of zero or lower. The review was limited to articles published from 2017 onward, ensuring the research was recent. Only articles published in peer-reviewed journals were included, excluding other types of publications.

RESULTS

As can be seen in Fig. 1., 48 articles matching the study's topic were identified through searching the Web of Science, PubMed, and COBISS databases. Twenty-five articles have been excluded due to a match with the exclusion criteria. Twenty-three full-text articles have been analysed, and seven have been included in the integrative literature review. All studies were co-authored and published between 2019 and 2022 in scientific journals with impact factors IF (1.987) to IF (4.7). The main findings from the literature review are presented in Tab. 1, detailing the effects and potential benefits of DT and robots on workability.

■ Tab. 1. Results of the integrative literature review

Author, journal and IF	Main findings
Huisman in Kort [11] IF 3.160	Two-thirds of the professionals had more fun at work since they could work with Zora. 79% of professionals were happy when they worked with Zora.
Zhao et al. [12] IF 3.737	HCPs positively accepting innovative technologies, higher educational attainment, a few years of work experience (younger age), and better tech-savviness.
Zamiri et al. [13] IF 4.35	Thirty potential supportive technologies and 15 active, supportive services were identified from the literature and related websites.
Jadan et al. [14] IF 4.7	PCG was positive about the potential capabilities of a digital solution, such as the availability of information that would reduce the need to visit a physician and access trustworthy interventions.
Alexander et al. [15] IF (4.046)	Recommendations in five content areas have been provided: Innovation, Policy, Evaluation, Delivery Systems and Human Resources. Recommendation of future strategies for LTC HIT roadmaps that include 61 emphasis areas in aged care in these content areas and domains.
Casey et al. [16] IF 3.38	For the most part, those who were positive from the outset remained so, and those who were sceptical and believed that social robots had a minimal role in the context of people with dementia continued to do so.
Krick et al. [17] IF 1.987	Organisational support is most pursued by ICT. Sensors are the most explored security support, and robotic systems are most frequently employed to provide support.

IF* – impact factor for the year the article was published

After concluding the scientific review, we have combined the main research findings in three groups according to possible compatibility with the house model of working ability: **health/functional capacities, work experience/ learning, work/work environment/work community/ management**. Following the results of reviewed studies on digital technologies and robots, it is justified to predict their impact on the working ability of employees in the ICE. Thirty potential supportive technologies and fifteen active, supportive services were identified by Zamiri et al. [13]. Furthermore, residential caregivers have identified some positive expectations regarding the potential capabilities of digital solutions, such as the availability of information [14]. DT and robots are also used to provide organisational support [17]. Studies have shown that integrating digital technologies and robots could build correlations with work experiences and learning, which can depend on educational attainment, young age, and tech-savviness [12] [16]. The integration of DT and robots in working processes in the ICE can also impact work itself, work environments, work community and management, as suggested by the recommendations on future strategies for LTC, including innovation, policy, evaluation, delivery systems and human resources [15]. A study of working with the robot Zora showed that two-thirds of professionals had more fun at work and were happy to work with the robot Zora [11].

DISCUSSION

The Impact of Digital Technologies and Robots on Workability

Based on the reviewed studies, the impact of digital technologies and robots on workability, as defined by Ilmarinen, appears significant yet underexplored. Understanding this impact is crucial, as the Work Ability Index (WAI) provides predictive insights that can help mitigate employee absenteeism and job dissatisfaction, thereby reducing turnover rates. Research into the effects of robots and digital technologies on workability is a burgeoning field with substantial potential to enhance our understanding and inform targeted interventions.

Melkas et al. [18] note that integrating robots into institutional elderly care (ICE) settings presents multifaceted challenges. These include the need for management to justify investments while ensuring staff have the time and resources to work with and learn about these technologies. Coco et al. [19] highlight the role of management in addressing employees' fears related to the dehumanisation of caring for older adults. They note that while robots can perform routine tasks, their integration is intended to allow employees to focus more on the individual needs of residents.

Papadopoulos et al. [20] indicate that the current literature remains limited due to a lack of research on healthcare workers' perspectives regarding robot use. As technology rapidly evolves in the care sector, there is an urgent call for more comprehensive studies in this area.

Digital Technologies and Robotics in Elderly Care

Digital technologies and robotics have the potential to influence workability significantly. The Work Ability House model suggests that new technologies and digitisation are among the external factors affecting employees' work ability [8]. Fosen and Sorgner argue that while digitalisation can substitute human labour, it also offers complementary transformative effects [21]. However, there is a contentious debate on whether emerging technologies will displace existing jobs or create new and improved roles within the care sector [22].

Given the persistent global shortage of qualified healthcare personnel, particularly in nursing, optimising work processes and ensuring employee and client safety are paramount to integrating robots and advanced digital technologies in institutional elderly care. However, questions persist regarding how these technologies influence employees' health, functional skills, and overall job satisfaction.

A mobile robotic nurse assistant (RoNA) is highly desired to enhance the efficacy and quality of care nurses and their paraprofessional staff can provide to patients. Such an assistant could improve a nurse's working conditions by off-loading some of their most physically demanding duties, thereby reducing the potential for self-injury or injury to the patient [23]. Bryndal et al. [24] state that neck pain (NP) and low back pain (LBP) are common musculoskeletal disorders and major causes of disability globally.

The impact of integrating robots and digital technologies on multicultural team dynamics and cultural competencies remains an essential area for future research. This exploration is crucial for understanding its broader implications on healthcare settings' workforce dynamics and operational efficiencies.

Broader Policy Implications and Challenges in Digital Health

Ensuring the sustainability and continuity of public health systems in EU member states represents one of the main challenges of current and future European policies. This largely depends on securing sufficient employees, especially nursing staff, including licensed nurses and auxiliary health care professionals (medical technicians, older adults).

The shortage of nursing staff across all profiles currently represents one of the major global problems, which is no longer confined to the developed or the developing world. The migration of health workers will, in the future, constitute one of the major problematic areas on the international political stage and could be a source of potential international conflicts [25].

Digital health encompasses information and communication technologies in medicine and other healthcare professions to manage diseases and health risks and promote wellness. This includes wearable devices, mobile health, telehealth, health information technology, and telemedicine.

However, healthcare organisations often encounter challenges in implementing digital technologies, such as bureaucracy, high technology costs, and difficulty choosing appropriate technological solutions. Key challenges also include training staff to use these technologies.

Despite the emphasis on advanced technologies in healthcare organisations, top managers, clinicians, and healthcare staff have concerns regarding fear, complexity, usability, required time for learning and adaptation, initial investment, and legal implications. Healthcare organisations need specific measures to achieve goals in the digital economy. Still, compared to standard industries like manufacturing, they lag in aligning their actions with a vision and mission of digitalisation, particularly in developing countries.

◼ CONCLUSIONS

This research highlights the promising yet underexplored impact of digital technologies and robotics on workability within ICE. Evidence suggests that integrating these technologies can enhance job satisfaction and reduce absenteeism among care workers, potentially leading to a more sustainable workforce. However, their implementation is accompanied by notable challenges, such as justifying the initial investment, addressing staff concerns about technology adoption, and overcoming fears of depersonalisation in caregiving. Additionally, understanding the long-term effects of these tools on employee health and well-being remains essential.

Further research is crucial, particularly in exploring the dynamics within multicultural teams and the broader implications for public health system sustainability. Implementation hurdles, including high costs, training requirements, and adaptation difficulties, are particularly pronounced in developing regions, where these technologies could make a significant difference. Addressing these challenges is vital for maximising the benefits of digital innovations in elderly care and ensuring they contribute effectively to workforce stability and the overall quality of care.

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