

The impact of digitalization on the physical health of Older Workers: Protocol for a Scoping Review

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Table of Contents

Original Manuscript..... 5
Supplementary Files..... 18
 Multimedia Appendixes 19
 Multimedia Appendix 1..... 19
 Multimedia Appendix 2..... 19
 Multimedia Appendix 3..... 19



The impact of digitalization on the physical health of Older Workers: Protocol for a Scoping Review

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Abstract

Background: Digital technologies have penetrated most workplaces. However, it is unclear how such digital technologies affect the physical health of older workers.

Objective: This scoping review aims to examine and summarize the evidence from scientific literature concerning the impact of digitalization and the utilization of digital tools on the physical health of older workers.

Methods: This scoping review will be conducted following recommendations outlined by Levac et al. and adhere to the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension for Scoping Reviews) guidelines for reporting. Peer-reviewed articles written in English will be searched in the following databases: MEDLINE, Cochrane, Proquest, Web of Science, Scopus, APA PsycInfo and ERIH PLUS. The web-based systematic review platform COVIDENCE will be used to create a data extraction template. It will cover the following items: study and participant characteristics, health measures, digital tool characteristics and usage, research findings, and policy implications. Following the Population, Concept, and Context (PCC) framework, our review will focus on studies involving older workers aged 50 years or above, any form of digitalization (including teleworking and the use of digital tools at work) and how digitalization affects physical health (such as vision loss, musculoskeletal disorders, migraine). Studies that focus only on mental health will be excluded. Study selection based on title and abstract screening (first stage), full-text review (second stage) and data extraction (third stage) will be performed by a group of researchers, whereby each article will be revised by at least two people. Any conflict regarding the inclusion or exclusion of a study and the data extraction will be solved by discussion between the researchers who evaluated the papers; a third researcher will be involved if consensus is not reached.

Results: A preliminary search of MEDLINE, Epistemonikos, Cochrane, Prospero and JBI Evidence Synthesis was conducted and no current or underway systematic reviews or scoping reviews on the topic were identified. The results of the study are expected in April 2025.

Conclusions: Our scoping review will seek to provide an overview of the available evidence and identification of research gaps regarding the effect of digitalization and the use of digital tools in the work environment on the physical health of older workers.

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Original Manuscript

Original Paper

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Abstract

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International Registered Report Identifier (IRRID):

Keywords: Digital tools; digitalization; physical health; older workers; scoping review.

Introduction

Aging is a multifaceted process characterized by extensive intra- and inter-individual differences, often conceptualized within theoretical frameworks as a dynamic balance between physiological advantages and limitations. Despite the inevitable age-related physiological decline, a significant proportion of older workers demonstrate adaptation abilities, facilitating the maintenance of work performance [1]. Moreover, as the global workforce ages and digital technologies increasingly penetrate the occupational landscape, understanding the impact of digitalization on the physical health of older workers has emerged as a critical area of research. According to the latest European Union (EU) data from 2020, the share of older workers aged 55 or more in the total number of employees has increased from 12% to 20% between 2004 and 2019 [2]. At the same time, 21.6% of employees over 55 years of age reported more than two work-related physical health problems [3].

With the global advancement of new technologies and digitalization, especially in recent decades, the labor market and traditional work processes have also undergone changes as new job roles and work

conditions have emerged, potentially introducing new physical and psychological requirements [4]. Considering both of these trends, it becomes vital to comprehensively examine how the digitalization of workplaces (such as working from home, blended work, teleworking, and the use of digital apps) is impacting the health of older workers, who are often suspected to be more affected [5]. On the one hand, digital tools offer flexible arrangements such as working from home and diminishing reliance on physically demanding tasks, thereby reducing the risk of musculoskeletal injuries, but only if workstations are ergonomically prepared and regular breaks are taken [6]. However, counterbalancing any potential benefits, the digitalization of work also introduces a spectrum of challenges that can adversely affect the physical health of older workers, including prolonged screen exposure leading to eye strain and headaches, and stress induced by the expectation of constant connectivity, which might lead to spinal, postural and other type of muscular disorders [6, 7]. Despite some emerging research and reviews in the recent years, especially focusing on understanding the psychological consequences of digitalization of workplaces in terms of techno-stress [8, 9], burnout and mental strain [10-12], there is a strong need for a comprehensive synthesis of current research, especially focusing on understanding the physical health effects of digitalization of the work environment on older workers.

Physical health has always been a concern for older adults, but in the context of extending the working life and retirement age, physical health has also become a major concern for older workers in recent years. Significant changes impacting capabilities in older workers involve sensory function, muscle function, cardiovascular and respiratory function, neurological function, and immune response. For example, a large study analyzing how older workers are more or less prone to work-related health risks compared to their younger colleagues indicates that perceptions of health risks, influenced by work experience, are reported differently by older workers. This perception often differs from their actual risk exposure (i.e., injury; [3]). In another systematic review of workplace health risks, the inability to cope with technological innovation is a health risk that affects the work ability of older workers. Providing continuous training or regular monitoring of biometric and physical health information is therefore recommended to improve the safety and health of older workers [13]. Similarly, digital health coaching programs can assist older employees in maintaining health during the transition to retirement and thereby potentially influence physical health [14].

While there are numerous scoping reviews regarding the use and barriers of use of digital technologies for health and disease management among older people [15-20], to the best of our knowledge, there is no existing systematic or scoping review that focuses on how older workers are affected physically by the digitalization of their tasks and workplaces. In this regard, this scoping review protocol aims to address the existing research gap in understanding the current scientific literature that looks into various physical health consequences (positive or negative) of digitalizing work environments among older workers.

Methods

Guidance Frameworks

Based on the first methodological framework for conducting scoping reviews by Arksey and O'Malley, this scoping review will be conducted following recommendations outlined by Levac et al. [21] to guarantee a systematic and coherent proceeding. Levac et al. advocate proceeding by describing the following stages: (1) identify the research question, (2) identify relevant studies, (3) study selection, (4) chart and collate the data, and (5) summarize and report the results. To report our findings, we also adhere to the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension for Scoping Reviews) guidelines for reporting [22]. The PRISMA-ScR checklist will be reported in an appendix.

Protocol and Registration

This protocol was written before we performed the full electronic literature search (we did search for existing scoping reviews and pilot tested different search terms; see below). The study will be registered at the Open Science Framework after the peer-review process.

Stage I Identifying the Research Question

We posed the research question: How does digitalization in the workplace affect the physical health of older workers? As there are many ways in which digitalization can affect an older worker's health (from vision loss to musculoskeletal disorders) and there are many forms of digitalization (from working online from home to the use of robotics in a car assembly line) we also have the following sub-questions: i) What are the most common physical health issues that older workers have to manage as a result of digitalization at the workplace; ii) What industries most affect older workers health as a result of digitalization?

Based on our research questions, we defined the Population, Concepts, and Context (PCC) criteria of interest to clarify the focus of the scoping study and establish an effective search strategy (see also [21]) (Textbox 1):

To summarize the main points reflecting the PCC criteria: Regarding the population, our review will focus on studies involving older workers aged 50 years or above.

Textbox 1. Definitions of the inclusion criteria regarding PCC in the scoping review.

Population: older workers

- Older workers include study participants employed at the moment of the study
- Study participants must be aged 50 years or older. When only age ranges are analyzed, the age of 50 should be included in the youngest age category (e.g., 45-54). While there are ongoing debates regarding what age defines older workers [23], we have opted to include individuals 50 years or older. This decision is based on the increasing presence of this cohort in the labor market, their likelihood of remaining in the workforce longer than previous generations, and the need to recognize the diversity within this demographic group. People in their 50s may have varying career trajectories, skill sets, and motivations for remaining in the workforce. By defining older workers as those aged 50 and over, organizations can more effectively cater to the unique needs and experiences of this diverse and increasing group of older individuals in the labor market.
- If age is treated as a continuous variable rather than analyzed as categories, the sample also has to have participants aged 50 years or older, i.e. younger ages are only permitted if older ages are also represented in the study.

Concept: digitalization

- Digital technologies refer to data manipulation, storage, transmission, and processing in binary data [24]. It allows for the interaction with stored data using electronic devices (i.e., computers, microprocessors etc.). Digital data can be stored in various digital storage media (i.e., hard drives, solid-state drives, memory cards and cloud storage, etc.) Furthermore, digital technology also refers to enabling the transmission of data over digital communication networks (e.g., internet, local area networks, and wireless networks).
- Digital technologies are defined as any type of digital tool/device that is used in the context of (creative) production, i.e. studies/study results that look at the effect of digital technologies not related to work (e.g. for health management) are excluded.
- Digital technologies include the use of computers at home for work (e.g. teleworking) as well as more recent digital technologies (e.g. apps) but only if they are used for work purposes.
- Studies will be excluded if working from home does not involve digital tools (e.g. only landlines are used).

Context: physical health

- Any physical health outcome is accepted.
- Mental health outcomes are excluded unless mentioned in combination with a physical health outcome.
- Studies will be excluded if the health outcome is not associated with an effect of digitalization in the work sphere.

The concept of interest is the implicit (e.g., working from home) or explicit (e.g., software systems, communication platforms, document management systems, lightning control systems and automated and robotic systems) use of any type of digital technology within the work environment to execute job-related tasks. In terms of context, we are specifically interested in examining how digitalization impacts physical health issues such as vision loss, musculoskeletal disorders, and migraines. Studies focusing solely on mental health impacts will be excluded from this review.

Stage II: Identifying Relevant Studies

We follow the Joanna Briggs Institute Manual for Evidence Synthesis [25] for our search strategy. For the protocol, several team members conducted preliminary searches of the databases MEDLINE, Epistemonikos and Cochrane (see Multimedia Appendix 1-3), as well as Prospero and JBI Evidence Synthesis between 14-3-2024 and 19-4-2024. Upon inspection of the obtained publications no current or underway systematic reviews or scoping reviews on the topic were identified. For the scoping review, we will search for peer-reviewed articles in the following databases: MEDLINE, Cochrane, Proquest, Web of Science, Scopus, APA PsycInfo and ERIH PLUS. The web-based systematic review platform COVIDENCE will be used to import the references and remove duplicates. The search terms to be employed are: *(physical adj (health* OR condition* OR issue* OR impairment* OR fitness OR wellbeing OR (well adj being) OR integrit* OR state* OR stress) OR disease* OR vision OR mobility OR obes* OR overweight OR "Body Mass Index") AND (digital OR app* OR web OR internet OR tech* OR (social adj media) OR chat OR online* OR cyber OR virtual OR computerized OR computerised OR electronic OR ICT) AND ((old* or elder* or ageing or ageing or senior*) adj1 (work* OR employee* OR profession* OR labor OR labour OR colleague* OR staff* OR cowork* OR personnel))*.

In constructing our search strategy, we employed the Boolean operator "OR" to encompass a broad range of related physical health conditions, digital technologies, and terms referring to older workers. Additionally, we used the adjacency operators "adj" and "adj1" to ensure that closely related terms appearing contiguously in the literature are captured, thereby enhancing the specificity of our search results and enabling a comprehensive inclusion of relevant studies.

We restrict our search to articles written in English and we exclude any grey literature.

Stage III: Study Selection and Eligibility Criteria

Once the references (excluding duplicates) are imported onto the COVIDENCE platform, the first phase of the study selection will be title and abstract screening. This is then followed by the full-text review to select the relevant articles for the main and secondary research questions of our scoping review. Finally, during the last phase, a data extraction template will be used for extracting the relevant data from the final article selection. This template, which we developed in advance, encompasses items on participant demographics, the specific digital technology examined, physical health outcome variable(s), fundamental research findings, and policy implications derived from the selected studies.

Given the sheer number of articles likely to be retrieved during the first phase, a group of researchers will be involved in the selecting process whereby each article is revised by two persons. Moreover, when COVIDENCE detects a conflict regarding the inclusion or exclusion of a study, this is then resolved by a third person.

In addition, regular online meetings will be held with the whole team to discuss any issue during the different article selection phases.

The eligibility for an article to be included is based on the PCC and other criteria shown in Textbox 2. Note that there is no inclusion or exclusion criteria regarding the year of publication or the country of study. The former is because no prior scoping review on the precise topic has yet been published in a peer-reviewed journal, while any exclusion of territories would have to be justified.

Textbox 2. Eligibility criteria for the scoping review.

Inclusion criteria

1. Population: older workers (50+ included in study)
2. Concept: digital technologies related to work
3. Context: physical health outcomes
4. Setting: nonclinical and in the work sphere
5. Study type: original studies with any design or data type (quantitative and qualitative)
6. Publication status: published in a peer-reviewed journal
7. Publication language: English
8. Full-text available

Exclusion criteria

1. Population: younger workers (50+ not included in the study)
2. Concept: digital technologies not related to work (e.g. for health management)
3. Context: non-physical health outcomes (e.g. mental health)
4. Setting: Clinical and not in the work sphere
5. Study type: other study types (e.g. protocols, narrative reviews or systematic reviews)
6. Publication status: published without peer-review, dissertations, books, conference papers, letters, editorials.
7. Publication language: written in a language other than English
8. Full-text not available

Stage IV: Charting the Data

The information from each selected publication that will be obtained from the final data extraction phase will be summarized in a table, with the main outcomes of interest being (Table 1):

Table 1. Data extraction

Author (year)	Study type	Country	Type of older workers	Digital tool	Health outcome	Policy implication
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Stage V: Collating, Summarizing, and Reporting Results

In accordance with the recommendations outlined by Levac et al. [21], the fifth stage of our methodology consists of three distinct steps:

1. Analyzing research findings, encompassing both descriptive numerical summary analysis and qualitative thematic analysis.
2. Evaluating the research findings to extract outcomes aligned with the research question, which are then reported narratively.
3. Interpreting and discussing the findings in relation to additional research questions, practical applications, and policy implications.

In addition to narrative reporting, tables will be utilized to provide a structured overview of the key findings. The PRISMA-Scr [22] guidelines will be adhered to ensure systematic reporting of the results.

In addition, we will assess the quality of studies using the Mixed Method Appraisal Tool (MMAT) [26] whereby any discrepancies will be resolved through consensus between the reviewers.

Results

We devised a comprehensive search strategy to identify articles on physical health issues associated with the utilization of digital technologies in the workplace. The outcomes of our inquiry will be disseminated through a scoping review. Consequently, the selection process for publication will be delineated using flowcharts, while the data extracted from our research will be organized in tables and expounded upon in a narrative summary. Subsequently, the summarized findings will endeavor to address the research question: "How does digitalization in the workplace affect the physical health of older workers?" and the sub-questions: i) What are the most common physical health issues that older workers have to manage as a result of digitalization at the workplace; and ii) What industries most affect older workers' health as a result of digitalization?

Discussion

Preliminary findings

The scoping review outlined in this protocol will lay the groundwork for a comprehensive research initiative examining the impact of digitalization on the health of older workers. Building upon the proposed work in the scoping review, there is potential to harness innovative technological solutions and evaluations to promote enhanced well-being and productivity among older workers in various work settings. Moreover, we anticipate that the results of this scoping review will provide methodological insights and direction for exploring the integration of adaptive features for technology in the context of older workers. The findings from the scoping review will be shared through peer-reviewed scientific journals and conference presentations, contributing to the advancement of knowledge in this crucial area.

Limitations

Our selection criteria restrict the inclusion to articles presenting empirical evidence published in English, potentially biasing the study pool towards research from western countries as well as the physical health effects from digital technology used. Therefore, readers should exercise caution when interpreting the findings, considering the varying quality and applicability of the included studies.

The term "digital technology" was chosen as the subject heading for its relevance to our research scope. In developing our search strategy, we worked closely with an information specialist to pilot test a variety of terms, both subject headings and text words, aiming for comprehensive coverage. Subject headings are part of a controlled vocabulary that helps standardize the indexing of articles, while text words can vary greatly depending on the author's choice of language. This variability in text word usage may affect the inclusiveness of the search results. For instance, authors may use different terminology to describe similar concepts, or a term might have different connotations in different regions. Despite a thorough approach and expert consultations, we must acknowledge the possibility of not capturing all pertinent articles due to the dynamic nature of terminology in this rapidly evolving field.

Comparison with Prior Work

Our scoping review focuses on identifying digital technologies that impact the physical health of older workers and discerning which job types are most influenced by the integration of these technologies. The integration of digital technologies into the workplace offers potential benefits by automating physically demanding tasks and optimizing work processes, which could potentially

reduce physical strain on older workers [27, 28]. However, despite the frequent use of technologies like smartphones, laptops, and tablets among older individuals, comprehensive studies exploring the direct links between digital work environments and physical health outcomes among older workers are scarce.

Previous scoping and systematic reviews have predominantly examined the mental impacts of digital technology at work, such as those on mental health outcomes listed in Table 1. The focus was largely on psychotherapeutic interventions using digital tools, with an emerging interest in technologies such as extended reality. A comprehensive overview of the effectiveness of digital and technological interventions in mental health and wellbeing is provided by De Witte et al. (2021) [29]. Similarly, Seberini et al (2022) reviewed the impact of Information and Communication Technologies (ICT) on older workers, particularly focusing on strategies to reduce the digital divide and technostress, and found how the rapid adoption of digital tools during the COVID-19 pandemic increased technostress among older workers as well as feelings of marginalization among older adults with a lack of technological skills, which also impacted their mental and physical health [30]. Li (2023), on the other hand, highlights how digital technologies were effectively used to address mental health issues among older workers during the COVID-19 pandemic, providing support through various web-based and mobile-based platforms [31]. Overall, the reviews collectively suggest that while digital technologies hold significant potential for improving mental health outcomes in workplace settings, they also discussed the dual nature of digital technology in workplaces, where it can either exacerbate stress and mental health issues or be a tool for promoting well-being.

Table 1: Selected systematic reviews on digital technologies for older people's mental health.

Review Citation	Population Age (older people, years)	Digital Technologies	Health Outcomes
Li, J. (2023) [31]	50+	eHealth & Remote Support	Reduction in depression, stress, and anxiety
De Witte et al. (2021) [29]	50-55	Workplace Digital Interventions	Workability, health maintenance
Seberini et al (2022) [30]	60+	Information and Communication Technologies (ICT)	Technostress

While there is extensive research on digital work's mental health impacts, our review focuses on the less explored physical health implications for older workers. Substantial causal evidence is notably scarce regarding how digital technologies affect their physical health.

The anticipated outcomes of our scoping review are therefore expected to elucidate dimensions considered pertinent to health promotion and disease prevention, particularly in supporting and maintaining the physical health of the aging workforce. This review will underscore the significance of mitigating occupational health risks, emphasizing the crucial influence of various factors—including physical, ergonomic, and psychosocial elements—on work-related health outcomes.

Conclusions

This scoping review will be the first to offer a comprehensive overview of physical health effects resulting from the use of digital technologies in the workplace. The research findings of this scoping review will serve as foundational knowledge for understanding the impact of digitalization on the health and well-being of older workers, informing future research directions and potential interventions aimed at promoting the health of this demographic in evolving work environments.

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Author contributions

JS conceptualized the study. JS and CMT developed the methodology. Besides the Research Librarian, JS, DAG and YG also performed preliminary searches in article databases. All authors contributed to the first draft and critically reviewed and revised the submitted manuscript.

Conflicts of Interest

None declared

Abbreviations

PCC: Population, Concept, and Context

PRISMA-ScR: Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews

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Supplementary Files

Multimedia Appendixes

Search results of scoping reviews of the effect of digitalization on the physical health of older workers (no relevant hits).

URL: <http://asset.jmir.pub/assets/d0d4f3cabdfcfdeeed5032f16907c60e.pdf>

Pilot test 1 of search terms of studies on the effect of digitalization on the physical health of older workers using Cochrane, Medline and Epistemonikos.

URL: <http://asset.jmir.pub/assets/159416cd1af2daa298e66a1cd0be2d25.pdf>

Pilot test 2 of search terms of studies on the effect of digitalization on the physical health of older workers using Cochrane, Medline and Epistemonikos.

URL: <http://asset.jmir.pub/assets/e29652ad847185e7dd59d563573b7ef7.pdf>