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# Multidimensional determinants to adoption, use and effectiveness of digital technologies for healthy ageing in migrant populations: a scoping review protocol

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## ABSTRACT

**Introduction** Digital technology can be effective in providing personalised healthcare in contexts of ageing societies and increasing international migration trends. However, the literature is scarce and unsystematic, considering healthy ageing in migrant populations. This knowledge gap delays the development of interventions, policies and technology that are inclusive of the healthcare needs and limitations in older migrants. We aim to map the scientific literature addressing structural, psychological, technical and ethical determinants to adoption, use and effectiveness of digital technology for healthy ageing in migrants. We aim to uncover major challenges, highlight solutions and derive an agenda for future research.

**Methods and analysis** We plan a scoping review of peer-reviewed articles published in English, German and Spanish after 2010 without a geographical limitation. We will perform the review across specialised and interdisciplinary databases (EBSCO, IEEE Xplore, IET Digital Library, PsycINFO, PubMed, Scopus and Web of Science) and manage articles at Covidence.org. Our review will adhere to the Cochrane and Preferred Reporting Items for Systematic Reviews and Meta-Analyses-Scoping Review guidelines for conducting and reporting reviews.

**Ethics and dissemination** No primary data will be collected, and therefore, ethical approval is not required. The results of this scoping review will be published in a peer-reviewed outlet and presented at conferences. A shiny web application will accompany the publication.

## STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The literature search will be carried out in specialised and interdisciplinary databases.
⇒ An age marker for the onset of the ageing process (55+) will be used.
⇒ Diverse first-generation migrant populations, including workers and refugees, will be included.
⇒ Grey literature will not be included to ensure a quality standard of reviewed content.
⇒ No critical appraisal of the reviewed articles will be performed.

## INTRODUCTION

Migrants who settle and grow old in their host countries experience cultural adaptation processes in addition to ageing processes. This results in unique developmental trajectories and health outcomes. For instance, migrant populations are at higher risk than local populations of developing cardiovascular disease[1] and depressive symptoms,[2] while they are challenged by specific barriers to healthcare, such as non-universal health systems.[3] Risk factors accumulate in the lifespan of migrants with detrimental consequences for their healthy ageing.[4]

The WHO defines healthy ageing as the process of developing and maintaining the functional ability (individual capacity, environment and individual-environment interaction) that enables well-being at old age (a resourceful positive state).[4] Healthy ageing in migrant populations is a global priority,[5] and digital technology may offer sustainable solutions.[6] The existing infrastructure, such as the Internet and mobile devices, is leveraged to facilitate timely and cost-effective healthcare in a wide population (digital health technologies). Whereas there is evidence in the literature linking digital technology use and improvements in the well-being of older migrants, thanks to a review by Ekoh and colleagues,[7] there remains uncertainty concerning adoption processes and the effectiveness of digital health technology in this population. For instance, Ekoh and colleagues have highlighted barriers as an impediment to digital health technology uptake; however, they have not systematically addressed them. Moreover, their study was carried out prior to the advent of generative AI, which is an important technological

advancement affecting all areas of research in digital health. This knowledge gap delays the creation of inclusive interventions and policies that rely on digital technology.

Human behaviour has fundamentally changed following the release of the first iPhone in 2007 and the first iPad in 2010. With the help of such technologies, people can connect with others at physically distant locations and have instant information access while being mobile. A rapid Google Scholar search (unsystematic scientific database) shows a significant increase in publications on digital technology at this time: 294 000 articles between 2010 and 2025 compared with 189 000 articles between 1990 and 2009. We will therefore map the recent scientific literature that addresses structural, psychological technical and ethical factors associated with the adoption, use and effectiveness of digital health technology in older migrants. We aim to uncover major challenges, highlight solutions and derive an agenda for future research.

## Healthy ageing in migrant populations

A long and healthy life in migrants involves both healthy ageing and cultural adaptation processes. Ageing is a process characterised by a dynamic exchange between losses and gains throughout the lifespan, while healthy ageing is the attainment of an optimal balance between the two.[8] For instance, whereas some people adapt and modify their expectations successfully, considering physical decline associated with advanced age, others are less successful.[9]

Cultural adaptation is the successful adjustment of skills and knowledge needed to navigate a foreign culture.[10] Cultural adaptation involves processes of preparation and adjustment to country relocation that can be traumatic, no matter the migration reason.[11] Traumatic events are associated with changes in personality and social networks with long-term maladaptive consequences on the state of health in victims.[12] Indeed, there are frequent reports of unsatisfactory health states in migrants.[10] For instance, one unanswered question in the literature is why many older migrants feel displaced in their host countries despite social integration.[13] Notably, cultural adaptation processes unfold in the lifespan; thus, they inform and are informed by ageing processes.[14] Meanwhile, a personally meaningful balance between losses and gains associated with the migration experience allows individuals to pursue a healthy life in a new culture, also at an old age.

Healthy ageing in migrants implies, moreover, that their health limitations and needs are accommodated in a timely and adequate manner. This includes interventions that benefit the person needing healthcare, such as routine medical consultation, prescription of medicine and rehabilitation after a life-threatening injury. Other examples include receiving adequate healthcare in nursing and retirement facilities, as well as self-applied help, such as regular physical activities and a healthy diet.

There are obstacles to timely and adequate healthcare with implications for the healthcare seeker and provider. First, healthcare systems are understaffed and concentrated in mid- to high-income contexts, which makes it difficult for some people to receive timely and adequate healthcare.[15] Second, healthcare workers may lack the language skills and intercultural training that can ensure culturally sensitive healthcare for migrants.[16] Third, migrant individuals may experience barriers to help-seeking behaviour, which are culturally, socioeconomically and structurally caused.[17] Notably, digital health offers an alternative to many of the current barriers.

## Digital health and healthy ageing

Digital health is an umbrella term for hardware and software, as well as practices involving their use to facilitate health at individual and societal levels.[18] Exemplary applications involve information management (digitalised records), personal devices (mobile monitoring), telemedicine (remote consultation) and environmental adjustments (assisted living). The promise of digital health includes healthcare access to a wide population and diagnosis anticipation. Moreover, digital health is expected to significantly reduce healthcare costs while providing sustainable solutions to existing deficits. The benefits of digital health technology have been undeniable since the COVID-19 pandemic, when remote healthcare solutions were the norm.[19] Digital health may further advance to seamlessly integrate machine learning algorithms in providing personalised healthcare.[20]

Indeed, technology has been linked successfully with healthy ageing.[4 6 21 22] The range of health conditions, from neurological diseases to fall propensity, is anticipated through the diagnosis of physical (ECG and gait) and chemical (glucose and pH) signals from wearable devices. Assistive technologies prolong ageing in place, whereas telemedicine expedites cost-effective consultation and treatment. Moreover, technology facilitates contact with significant others and thus helps reduce symptoms of depression and feelings of loneliness frequently observed in older adults.[23] Technologies created for the specific goal of improving healthy ageing are also known as gerontechnologies.[22]

Critical views, however, emphasise limitations due to restricted accessibility, increased affordability burdens and digital literacy deficits.[24–26] Such technology shortcomings add to existing inequalities, putting specific groups at a high risk of being left behind. Older people and migrants are two vulnerable groups because their unique limitations and healthcare needs are insufficiently addressed. For instance, pervasive beliefs of older people as technologically incompetent[27] bias technology development processes,[28] undermine targeted technology use by healthcare professionals[29] and create psychological barriers to technology adoption in older individuals themselves.[30] On the other hand, current digital health technologies are unaccommodating of cultural and language specifics in migrants, limiting their capacity to identify, detect and act on their healthcare needs.[31]

Especially vulnerable are individuals with a life experience at intersections of ageing and cultural adaptation

processes—older migrants. The implications of these intersecting processes for healthy ageing are complex to understand and demand an integrative framework that is currently not available (cf, Schwartz[32]). The literature addressing specifics of this population is still nascent (eg, Fokkema and Ciobanu[13]), whereas an overview of the evidence linking digital technology and healthy ageing in older migrants is missing (but see Ekoh *et al*[7]). The present scoping review sets out to map the existing literature, highlight gaps in our knowledge, and propose an agenda for future research.

## A guiding framework

Old age is a stage in the lifespan starting around 60–65. There is, however, no consensus across countries on what is considered old age,[33] and research has noted that old age is a subjective experience.[34] Meanwhile, ageing is a process whereby biological and psychosocial changes occur in the individual in transitions from young to old age. The threshold in the study of ageing processes is set as early as 50 years in the literature.[35] For the present review, we will use the age of 55 years as a cut-off criterion to accommodate diverse views on old age across countries and findings regarding ageing processes. This age marker is, moreover, used to accommodate both current and future generations of older individuals.

Recently, the WHO has published a life course framework of the health and sociocultural challenges that people face as they grow old.[4] This framework addresses migration as a critical life event with unique implications on people's healthy ageing. Our target population is people who have migrated in their lifespan and grown old in a foreign country—first-generation migrants aged 55 years and older.

Drawing on socioecological models of health,[36] we expect multilevel factors to influence adoption, use and effectiveness of digital health technology in older migrants (also see Matlin *et al*[37]). We will review intrapersonal and interpersonal factors (fundamentally psychological) as well as institutional, community and public policy factors (structural in nature). We will, moreover, consider technical and ethical factors that are specific to digital health. We present below a framework that we will use to organise the results of the review.

## Psychological factors

Psychological obstacles include perceptions and beliefs that inhibit an older person's behavioural intention and disengage him or her from habitually using a digital health technology. Such obstacles are situationally specific, referring to whether a digital technology is deemed useful and easy to use.[38] Psychological obstacles may also be motivated and shaped by a person's trait characteristics and cultural specifics that transcend situations. The family of technology acceptance models describes situationally specific psychological obstacles at length (eg, the Unified Theory of Acceptance and Use of Technology 2) but insufficiently incorporates cross-situational explanations due to, for instance, value ideals and culture.[32 39]

Values are abstract beliefs that motivate action in people.[40] The acceptance and use of digital technologies resonate with the value motivational goals of novelty and growth in people, which, however, become less prioritised with age.[39] With age, social-oriented values such as benevolence and conservatism become increasingly important (also see Löckenhoff and Carstensen[41]). For populations of older people, a socially embedded approach to co-creating technology can alleviate psychological obstacles that are common in the current interventionist agenda, which sees older people as end-users of technology developed without their input.[23]

Culture is an external set of beliefs or rules of action that shape the behaviour of people through processes of learning, resulting in more behavioural similarity within groups than across groups.[32] For instance, Fangerau and colleagues reasoned that extreme cultural individualism hinders technology adoption at an advanced age because the burden of acquiring technological skills is placed primarily on the individual.[42] In return, a shared responsibility between younger and older generations that is common for collectivistic and moderate individualistic societies can expedite the adoption of digital technology in older populations.

## Structural factors

Older generations primarily face structural barriers to benefiting from digital technology. Structural barriers are systemic, meaning that factors intertwine in the fabric of society, limiting the opportunities for support that older individuals would need to become digitally proficient. Two structural factors have a particularly hindering effect: old-age ageism and unaccommodating welfare regimes.

At the core of old-age ageism is the widespread belief that older people are helpless with digital technology.[27] On the job market, for instance, there are incentives to train staff in technologies that can enhance productivity and lower production costs. Companies and public institutions are, however, less incentivised to train older people in digital technologies since older people are seen as inactive members of society.[43]

The welfare regime contributes to a structural exclusion of older people through a disproportionate redistribution of wealth and unaccommodating policies.[44] In sociodemocratic welfare regimes (eg, Sweden), there is a universal coverage of social benefits;thus, the responsibility for individual growth and well-being is partly alleviated by the state. These contribute to older people feeling protected and less burdened by the need to actualise themselves. Meanwhile, in liberal (eg, USA) and postsocialist welfare regimes (eg, Romania), the responsibility of personal growth and well-being rests primarily on the individual and family. Consequently, there are increased burdens on the older individual in dealing with transitions to digitalised societies.

### Technical and ethical factors

Current digital technologies suffer from technological determinism[28] which intertwines with ethical and legal issues.[45 46] A technology can determine future behaviour in people by reinforcing widely held beliefs. For example, developers may operate under the false assumption that older people are unwilling learners who avoid complexity,[25] resulting in a technology that does not attune to the complexity of life in this population. Technology itself is neither good nor bad. Nonetheless, its wide implementation can determine unwanted behavioural modifications in people when it draws on a normative agenda underscoring power imbalances.[47] For instance, digital technology for healthy ageing is on governing agendas that promote a cost-effective approach to person-oriented healthcare.[4 48] This narrative is normative in that (1) ideal ageing standards are prescribed, (2) the viable solution is digitalisation and (3) the mere availability of a technology suffices. Moreover, technologies that fail at accommodating the diverse life experiences and healthcare needs of older populations contribute to increasing socioeconomic inequalities.[45 49] The autonomy of older people is obstructed when they lack the skills to update and upgrade themselves,[45] whereas constant technological progress may result in technological disengagement due to the involved costs.[49]

Furthermore, there are safety and privacy concerns associated with digital technology for healthy ageing. Digital technologies can improve the quality of life of older people by increasing the safety of their environments, for example, for individuals suffering from neurodegenerative disorders like dementia.[50] However, disregarding the supportive roles of family and friends may backfire in the long run, resulting in older people experiencing increased feelings of unsafety.[45 49] Meanwhile, digital technologies promise a person-oriented approach to healthcare.[22] This is possible only if personal data are frequently collected, stored and available to developers. Therein lies a paradox: when older people feel that the promised benefits of digital technologies do not justify the loss of personal privacy, they may choose not to adopt a technology in the first place or discontinue their use.[45]

### Terminological clarifications

There are important terminological differences between adoption, use and effectiveness of digital technology for healthy ageing in older migrant populations. This section clarifies their specifics.

Both adoption and use of digital technologies refer to individual behaviour. Adoption of a technology implies that an individual has never been exposed to, engaged with or used the technology before. Adoption is addressed in the family of technology acceptance models extensively (eg, Venkatesh *et al*[38]) and concerns the initial stage of technology use. This stage involves the experience of novelty and personal growth and prompts values in people that sustain such behaviour.[40] Crucial for technology adoption is the participatory involvement of the target population at all stages of technological development[51] and the institutional involvement in facilitating opportunities for individuals to become autonomous technology users.[44] Adoption and acceptance of a technology may be used interchangeably in the literature to express the individual decision to start using a technology.

The use of technology is an ongoing process involving constant actualisation of goals and the skill set of a person,[45] with societal structures needing to adequately accommodate such adjustments long-term.[44] This behaviour benefits from an accumulation of positive experiences[38] and constant proof that advantages outweigh the limitations associated with prolonged technology use.[49] The use of technology for healthy ageing thrives when embedded in societal institutions that promote social support[42] and draw on an agenda for sustainable societal transformation where no one is left behind.[5] Use of a technology refers to a sustained behaviour where the individual's decision to start using a technology is followed up by attitudinal, emotional and skill-set adjustments needed for it to become a habit.

The effectiveness of digital technology refers to perceived and objective improvements in health outcomes. A digital technology may improve health indicators directly (eg, subsiding depression symptoms) or indirectly (eg, increased individual agency in seeking healthcare), whereas the effects may be short- or long-term. The effectiveness of a digital technology depends on its adoption and use as intended by the developer. Moreover, it depends on the technological integration of adequate evidence of the healthcare needs and life experiences of target populations.[52] An effective digital technology is adopted by the target population, while improvements in health outcomes in the individual user can be traced back to the technology itself.

### Objectives

Adoption, use and effectiveness of digital technologies for healthy ageing face multidimensional obstacles common to all populations of older people. Meanwhile, populations of older migrants have unique limitations and healthcare needs that must be accommodated in digital technologies for their healthy ageing. We will review peer-reviewed articles published after 2010 (state-of-the art criterion) in English, German and Spanish (inclusiveness criterion) that report original research carried out in the quantitative, qualitative or mixed method.

The following research questions are pursued:

1. Which digital technologies, including gerontechnologies, are used to address which components of healthy ageing in which migrant populations?
2. Which methods are used in designing, evaluating and implementing digital technologies, including gerontechnologies for healthy ageing in migrant populations?
3. What are the structural, psychological, technical and ethical factors that influence the adoption and use, as well as the effectiveness of digital technologies, includ-

ing gerontechnologies for healthy ageing in migrant populations?
4. How effective are digital technologies, including gerontechnologies, in contributing to healthy ageing in migrant populations? What works and for whom?

### Expectations

We expect the literature to be scarce, unsystematic, exclusive to a select few populations and regions, and to marginally address cultural adaptation processes that impact the life experience and healthcare needs of migrants throughout their lifespan. Overall, we expect evidence that digital technology, including gerontechnology contribute positively to healthy ageing in migrant populations.

## METHODS

### Protocol and registration

Three reasons justify our choice of method, namely, scoping review. First, the topic of the present research is emergent. We aim to provide an overview of the state-of-the-art scientific literature without a critical appraisal. Second, we do not have (nor can we have) specific hypotheses because the field is nascent. We aim to map the evidence, identify challenges, highlight solutions and propose ways forward for the field. Third, the field is multidisciplinary by nature since it involves elements from the social sciences, health sciences, ethics, and science and technology. Integration of evidence from across disciplines into a systematic review requires adequate theory, which is currently missing. We aim to identify commonalities across disciplines and discuss possible venues for theoretical integration, although we refrain from theory building per se (see reason 2).

The protocol for the present scoping review has been registered using the generalised registration form for reviews at OSF (https://osf.io/dwtby/?view_only=33efb7445e6b4f5da49ba61f0029caf3) and is compliant with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020,[53] including the PRISMA-Scoping Review extension for scoping reviews.[54]

### Operationalisation

Healthy ageing is operationalised multidimensionally as psychological health (eg, absence of depression), physiological health (eg, healthy heartbeat rate at rest ranges from 60 to 100 beats per minute), neuropsychological health (eg, absence or manageable Alzheimer's symptoms) and well-being (eg, life satisfaction).

Adoption and use of digital technology are operationalised through self-reports and observations made by secondary informants (eg, nurses).

The effectiveness of digital technology is operationalised through self-reports, observations made by secondary informants, or determined from data as improvements in health indicators (eg, effect size) in longitudinal assessments or comparisons with control groups.

The target population comprises individuals who migrated to a foreign country at an older age and individuals who migrated to a foreign country at a young age and are now older. There is commonality in the life experience of these individuals, namely, they all define the self and navigate life between multiple cultures for extended periods in their lifespan. This life experience sets them apart from local populations and short-term migrants such as tourists and international students who return to their countries of origin upon completing their stint abroad.[55]

We review digital technologies created specifically to improve health in older migrants, as well as digital technologies created for a generalist purpose, which are applied for improving health in older migrants (eg, instant messaging applications).

### Eligibility

A set of inclusion-exclusion criteria was defined following the SPIDER (sample, phenomenon of interest, design, evaluation, research type) tool.[56] The list is organised hierarchically, meaning that a decision is taken following each criterion.

### Inclusion criteria

1. The article is peer-reviewed and published in English, German or Spanish (no geographical limitation). Note that conference proceedings are the standard in fields of design and computer sciences, which is why these publication types will be considered from these fields.
2. Empirical original research carried out in quantitative, qualitative or mixed-method is reported.
3. The age of study participants can be identified without a doubt as 55 or older, while their migration status can be identified without a doubt as first-generation migrants (work migrants, retirement migrants, refugees or asylum seekers).
4. The article addresses empirically the adoption, use and effectiveness (or any of them) of digital technologies for healthy ageing, including gerontechnologies.
5. At least one of the healthy ageing indicators mentioned above is addressed empirically.

The following inclusion criteria are optional because we expect scarce literature; thus, applying them as must-hold criteria can greatly reduce the otherwise eligible articles. Articles not meeting these criteria are highlighted in the discussion accordingly. Articles that meet at least one of the following criteria are included.

1. At least one of the structural, psychological, technical and ethical factors mentioned above is addressed empirically.
2. Cultural adaptation, including acculturation processes, is addressed empirically.

### Exclusion criteria

1. Unclear, vague, empirically unfounded and theoretical discussion of the role of digital technology,

including gerontechnology for healthy ageing in migrant populations.
2. The use of terms is irrelevant to the present research questions. For instance, the term 'digital immigrants' specifies individuals born before the extensive societal implementation of digital technology and thus does not refer to our target population.
3. Internal migration refers to people relocating within their country of origin.

### Patient and public involvement

None.

### Information sources

The review will be carried out in the following databases and interfaces: EBSCO (SocINDEX, MEDLINE), Ovid (PsycINFO), PubMed, Web of Science, Scopus, IEEE Xplore and IET Digital Library. These databases have been strategically selected, as they cover varying disciplines relevant to the present research topic: Social sciences (eg, SocINDEX), health (eg, MEDLINE) and science and technology (eg, IEEE Xplore). Generalist databases with sources across disciplines are likewise included (eg, Web of Science).

### Search strategy

A set of query strings was created based on the SPIDER tool involving the target population and research questions (see the online supplemental file 1). 25 hits per database will be used for the search strategy validation. A search strategy is validated when the inclusion criteria apply to at least five identified source materials across databases. If fewer hits are the case for a database or no adequate source material is found, the query strings following the SPIDER tool will be adjusted.

A pilot search helped us adjust the query strings such that they can be applied across databases. One search string, including all outcomes of interest, resulted in truncated results: The search algorithm using the Boolean 'AND' and 'OR' cannot disentangle articles that only look at effectiveness outcomes from articles that do not examine either of the outcomes (the hits were considerably lower using this strategy). We decided, therefore, to split the search query strings into two parts, one that focuses on individual behaviour and another that focuses on technology effectiveness (see Box 1).

**Box 1 Piloted query strings.**

Individual behaviour: (old* OR ageing OR ageing OR senior OR elder*) AND (migrant OR immigrant OR asylee OR "asylum seeker" OR refugee) AND ("digital technology" OR "digital platforms" OR "digital care" OR "digital gam*" OR "digital educational gam*" OR gerontechnology OR ehealth) AND (adoption OR behavio* OR intention)

Effectiveness: (old* OR ageing OR ageing OR senior OR elder*) AND (migrant OR immigrant OR asylee OR "asylum seeker" OR refugee) AND ("digital technology" OR "digital platforms" OR "digital care" OR "digital gam*" OR "digital educational gam*" OR gerontechnology OR ehealth) AND (effectiveness OR impact OR consequences OR influence OR benefits OR improvement)

Two additional observations emerged during the pilot search. Scopus and Web of Science platforms are sensitive to hyphens, and thus, we will make the required adjustments for the review. The targeted databases are maintained by varying companies, meaning that there is no standard cross-platform option to export the results of the literature search. Therefore, we will merge all exported metadata into one master file before uploading to the Covidence platform. The merging will be performed after the article DOI, title, author names and abstract. Covidence can automatically link this information with additional article metadata retrieved from the Internet, for instance, the full text where open access is available.

Subsequent searches will be performed. Both descendancy (articles that the reviewed article cites) and ascendency (articles citing the reviewed article) approaches will be used to complement the main search. Furthermore, we will screen and include, if necessary, original articles cited in reviews that are (faulty) retrieved by the algorithm in our search string.

In case of restricted full-text access, searches of main databases will be complemented by searches on online repositories ResearchGate and Google Scholar. If this step is unsuccessful, authors will be contacted (see Moreau and Gamble[57]). The results of contacting authors will be reported in online supplemental file 1. Reporting will be blind for names, titles, abstracts and DOI article identifiable characteristics. The number of attempts and the query strings used to retrieve the source material will be documented. Reasons for denied access to source material will be summarised into categories: journal embargo, financial and conflict of interest.

### Selection and characteristics of sources of evidence

Screening and selection of final source articles will be done in Covidence.org, where duplicates are eliminated.[58] Article screening will follow the recommended standards (Cochrane guidelines[59]). Screening and data extraction will be done by two independent reviewers (AS and AD-R). Disagreements will be resolved through discussions between the original reviewers. Each reviewer will justify their choice, and a final decision will be reached consensually. Remaining disagreements will be resolved by a third independent reviewer (GW). The team of authors is multilingual. Depending on individual cases, we will consider inviting external colleagues to assist in cross-checking the screening of articles if only one of the authors is fluent in the article's language.

Covidence has an inbuilt mechanism for resolving inconsistencies whereby 100% agreement must be reached before proceeding to subsequent steps. An article is first screened for title and abstract. Next, the article is moved to full-text screening contingent on full reviewer agreement. Upon screening the full text, the two independent reviewers must be in agreement that an article is included in the review (data from the article can

be extracted). Articles may still be excluded at the stage of full-text screening if the inclusion criteria are not met.

Results will be reported in a PRISMA flow chart. Metadata of identified sources of evidence and the final selected sources of evidence will be made openly available as .bib files.

### Data extraction

Data will be extracted by two independent reviewers on the Covidence.org platform (AS and AD-R). A custom data extraction template will be created (see the online supplemental file 1) and used by each independent reviewer. A reviewer agreement is necessary to complete the review. The inbuilt mechanism in Covidence requires a 100% agreement rate. Disagreement will be resolved through discussion between the original reviewers. Remaining disagreements will be resolved by a third independent reviewer (GW).

The extracted data attributes are:

1. Publication metadata: year of publication, author names, discipline, purpose of research, and geographical location of the study participants.
2. Target population: description of the migration status and age.
3. Methodology: study design, data collection type, analytical method, key statistics including effect size and study strengths and limitations.
4. Research content: theoretical framework and hypotheses, type of digital health technology, behaviour addressed is adoption and/or use, effectiveness is addressed, health indicators addressed, determinants addressed, main findings and expected findings.
5. Implications: strategy for data collection and research, lessons for participatory co-design of digital technology, and lessons for policy and the practical sector.

### Critical appraisal

We will map the existing scientific literature to highlight gaps in our knowledge. Where available, we will organise reported statistical effect sizes (eg, Pearson's r, Cohen's d; quantitative research) and proof of evidence (single vs multiple reports; qualitative research) in ascending order from low to strong evidence. We will determine the design type in mixed-methods research (convergent, explanatory sequential and exploratory sequential) and then organise the results accordingly (as per single-method studies).[60] Note that this is intended to facilitate information retrieval and carries no critical appraisal on our side.

The grey literature is not peer-reviewed, meaning that minimal research quality standards cannot be confirmed. By including only peer-reviewed articles, we ensure a baseline quality standard of reviewed content. Moreover, we will perform the literature search across specialised and interdisciplinary databases, and thus we aim to be inclusive of schools of thought, paradigms and disciplinary specifics. Publication bias is nonetheless a potential observation in our review. For instance, we might note that the majority of evidence stems from certain contexts and focuses on specific technology features and, moreover, that reported findings are overwhelmingly positive.

### Results synthesis

Extracted data attributes will inform the mapping of reviewed evidence. Mapping will be enhanced visually using tools such as VOSviewer[61] which facilitates bibliometric mapping. An interactive web application (shiny apps) will be created to promote engagement of a wider audience, including the policymaking sector. A narrative integration of results will follow the proposed guiding framework.

## ETHICS AND DISSEMINATION

No ethical approval is required for the present study, as no primary data are collected. The present study is a scoping review of the scientific literature that reports findings based on primary data for which ethical approval was needed. We will highlight accordingly reviewed articles without ethical approval.

Results of the present scoping review will be published in a peer-reviewed journal and presented at international conferences. A shiny web application will be developed to facilitate communication of the present findings to a wider audience, including the policy-making sector and industry. A plain-language summary of key findings will be included in the supplement of the peer-reviewed article and downloadable from the shiny web application. Finally, the metadata of identified and included sources of evidence will be made openly available as .bib files.

## DISCUSSION

Older migrants are vulnerable in terms of digital health. This population faces challenges due to biological and psychosocial changes associated with intersecting ageing and cultural adaptation processes. Digital health technology that accommodates the unique limitations and healthcare needs of older migrants is nascent, and an overview of the existing evidence is missing. This knowledge gap causes delays to inclusive healthcare interventions and policies, as it is still unclear what works, when and for whom. We present the protocol of a scoping review of the scientific literature.

To the best of our knowledge, one other review addresses digital technology and health in older migrants.[7] The present study adds to previous findings. Ekoh and colleagues reviewed evidence on whether digital technology improves well-being in older migrants and reported critical barriers to digital health technology uptake.[7] Our scoping review seeks to answer the question of what determines the adoption, use and effectiveness of digital technology for healthy ageing in this population. Moreover, the present review is more inclusive of contexts, publication language and disciplinary views. In addition to

English, we will also include publications in German and Spanish. We will perform the review in four additional databases, namely EBSCO, IEEE Xplore, IET Digital Library and Scopus. Our study will therefore also consider publications from science and technology. Lastly, the review by Ekoh and colleagues mapped findings published until 2022 that do not account for the most recent technology advancements (see the generative AI revolution since 2022). The present study is a review of research published between 2010 and 2025.

Existing observations highlight the unequal distribution of effort and resources in view of digital health for older populations.[3 4 37] What society and industry concerns, older people are a homogeneous group despite evidence stating otherwise.[62] Inclusive digital health demands coordinated efforts from stakeholders in research, policymaking and the industry. Such efforts involve, among other significant costs and inclusive strategies that are not readily available everywhere and to everyone. We expect, therefore, scarce evidence referring to digital health technologies that accommodate specific life trajectories within the older migrant population. Moreover, we expect the majority of evidence to stem from industrialised, western and individualist countries.

The results of the present scoping review will contribute to advancing the field in three important ways. First, the review will map the existing scientific literature and thus highlight gaps in our knowledge. Drawing on the reviewed contents, we will propose a research agenda, making suggestions on what has priority in future research, in our opinion. Second, the review will organise the evidence on adoption, use and effectiveness of digital technology for healthy ageing in migrants and thus serve as an overview for evidence-based intervention and policy. We will organise the results in an accessible format for the practical sector, in addition to providing a theoretical discussion benefiting fundamental research. Third, the review will include evidence across disciplines and thus contribute to an integrative interdisciplinary paradigm of research and technology development.

Despite our efforts to be inclusive, we cannot rule out shortcomings. First, we might omit important insights from specific contexts due to our spoken language limitations. For instance, none of us speaks Mandarin or Arabic and thus will have limited access to published research in China and Saudi Arabia, which are two countries with an advanced digital health ecosystem according to the WHO.[6] Second, we might uncover a limited set of determinants to adoption, use and effectiveness of digital technology for healthy ageing in migrants because older migrants are a hard-to-reach population.[63] For instance, many older migrants are hard to reach in research due to restricted technology access, social isolation and health limitations, as well as due to legal reasons. Whereas this is not a limitation to our study per se, we recognise it will have consequences on our discussion of results and in devising an agenda for future research.

There are unknown ethical implications to digital health in older migrants. Their identification and discussion at length is not a priority in the present research and is therefore a study limitation. We recognise that ethical concerns are fundamental to inclusive digital health. Loss of data privacy, biased algorithms, unwanted health implications following technology use and data weaponisation are a few instances of hard decisions that policymakers and technology developers face.[64] The present scoping review will highlight ethical discussions in the literature without a detailed examination of their implications. One finding may be that ethical implications are under-addressed in view of vulnerabilities in older migrants, and therefore, the present study can reveal critical ethical gaps needing further attention in the future.

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