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Technology-based group exercise interventions for people living with dementia or mild cognitive impairment: a scoping review protocol

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ABSTRACT

Introduction More than 50 million people worldwide are living with dementia in 2020, and this number is expected to double every 20 years. Physical exercise is a growing field in non-pharmacological interventions for dementia care. Due to public health measures during the COVID-19 pandemic, more people have considered adapting to technology-based exercise via digital devices. This scoping review will explore evidence relating to the use of technology-based group exercise by people with dementia or mild cognitive impairment.

Methods and analysis This review will follow the Joanna Briggs Institute scoping review methodology to review literature published between June and December 2021. This review is designed to identify existing types of technology-based group exercise interventions for people with dementia. The review will provide a synthesis of current evidence on the outcome and impacts of technology-based group exercise. The context of this review will include homes, assisted living facilities and memory care services but exclude hospitals. The review will include a three-step search strategy: (a) identify keywords from MEDLINE and Embase, (b) search using the identified keywords in databases (MEDLINE/PubMed, CINAHL, Web of Science, Embase, Cochrane Library, PsychInfo and Google) and (c) review references from included studies to identify additional studies. Only studies in English will be included. Four researchers will independently assess titles and abstracts and then review the full text of the selected articles, applying the inclusion criteria. The extracted data will be presented in tables and summarised narratively.

Ethics and dissemination Scoping review data will be collected from publicly available articles; research ethics approval is not required. The findings will be disseminated to healthcare practitioners and the public through a peer-reviewed publication and conference presentations.

Strengths and limitations of this study

► This scoping review will follow the Joanna Briggs Institute scoping review manual to ensure scientific rigour.
► Patients and family partners will be involved in the scoping review study.
► The review will be limited to literature published in English.
► Because the focus of this review is on technology-based group exercise for people with dementia or mild cognitive impairment living in the community, exercise programmes provided by acute care services will not be captured.

INTRODUCTION

Dementia is a neurodegenerative condition characterised by progressive deterioration of cognitive function, often affecting memory, thinking, judgement, personality and visuospatial skills, among many other possible deficits.[1] In addition to cognitive impairment, due to its progressive degenerative nature, dementia leads to physical decline in balance, gait and movement coordination, behavioural and psychological symptoms of dementia (BPSD) and social disability.[2 3] Dementia can be categorised based on aetiology. Alzheimer's disease (AD) is the most common type of dementia, followed by other types, such as vascular dementia, Lewy body dementia, frontotemporal dementia and Parkinson's disease. Dementia is a widespread health issue, affecting more than 50 million people globally, with more than 10 million new cases every year.[4] Mild cognitive impairment (MCI) is noticeable decline in cognitive function that is not severe enough to require help with daily activities.[5 6] Although considered to be distinct from dementia, MCI is often a precursor to dementia.[7] It has been estimated that 10%–15% of people with MCI progress to AD.[8] Research on MCI can provide knowledge for preventing progression of MCI into dementia.[9]

Although the number of people with dementia is increasing worldwide, no curative treatment is currently available and effective palliative treatments are lacking. Antipsychotic medications used to manage BPSD in people with dementia, in particular

older adults, can cause adverse events such as oversedation, psychomotor impairment, Parkinsonian symptoms, stroke or falls, all of which can contribute to admission to the emergency department or long-term care facilities and increased healthcare costs.[10 11] Evidence-based, safe and effective non-pharmacologic treatments are needed to relieve dementia symptoms and/or delay progression of the severity of the disease. Group exercise programmes, such as chair yoga and tai chi, have shown positive effects in managing dementia symptoms.[12–15]

Meta-analyses have shown overall benefits of various types of physical exercise on physical function and BPSD in people with dementia.[16–18] However, people with dementia face challenges to participate in exercise groups due to restricted range of motion, declined cognition and balance, and risk of falls.[2 13 14] Major barriers to physical exercise in this population could include lack of accessible opportunities, transportation to community sites where exercise classes are offered and limited support from caregivers.[12 19 20] People with dementia are more likely to experience social isolation and loneliness, which have been linked to increased depression, cardiovascular risk and overall detrimental effects to quality of life.[21 22] Group exercise programmes may not only help to improve mobility and function; they may support social engagement and reduce social isolation and loneliness. Given the rapid growth of technology use by older people, technology-based group exercise interventions offer opportunities for people with dementia to participate in exercise to manage dementia symptoms, improve social connections and enhance their quality of life.[23]

In this scoping review study, technology-based exercise intervention will refer to any exercise intervention in which technology is essential to the activity. Exergames, also known as interactive exercise-based video games or virtual reality exercise games, have been used as an acceptable intervention to increase physical activity in older adults.[24 25] In addition to exergames and virtual reality exercise games, recent technological advances have created the potential for an online exercise intervention with synchronous monitoring through a secure videoconferencing platform (eg, Zoom, WebEx) on a computer or tablet.[23 26] Remotely delivered exercise interventions via video conferencing have been found to be feasible for improving physical activity in persons with disabilities.[23] Group-based exercise interventions could increase physical activity and improve emotional well-being. Synchronous online group exercise could develop social connections via the Internet among people with dementia, who are often isolated from society.[23]

With technology-based interventions, people with dementia and their caregivers can experience socialisation without the need to go to a community centre.[23] Several systematic reviews or meta-analyses have analysed the effects of exergames[23] or virtual reality[25] in people with major cognitive neurocognitive disorder, MCI or dementia.[27–29] However, a preliminary search of MEDLINE, the Cochrane Database of Systematic Reviews

and Joanna Briggs Institute (JBI) Evidence Synthesis was conducted as of July 2021, and no current systematic review, meta-analysis or scoping review has been conducted on the topic of technology-based group interventions that included virtual reality, exergame or other Internet-based intervention (synchronous or asynchronous) to support people with dementia. This gap will be addressed in this comprehensive review of the types of technology-based interventions across dementias and MCI and their effects. The format of the scoping review is specifically appropriate to mapping out the existing evidence and identifying gaps in knowledge on the topic of technology-based group interventions for people with dementia or MCI.[30]

The main objective of the scoping review will be to understand and summarise the extent of evidence with respect to the existence of technology-based group exercise interventions for people with dementia or MCI and the outcome measures studied and reported in the literature.

Review questions
1. What technology-based group exercise interventions exist for people with dementia or MCI?
2. What outcomes and impacts of technology-based group exercise interventions for people with dementia or MCI have been reported in the literature?

METHODS
The proposed scoping review will be conducted in accordance with the JBI methodology for scoping reviews.[31]

Inclusion criteria
Participants
We will include studies that focus on people with all types of dementia (eg, AD, vascular dementia, Lewy body dementia, Parkinson's disease dementia, frontotemporal dementia) or MCI in people of all ages.

Concept
This review will focus on technology-based group exercise interventions for people with dementia. We will include studies that involved at least one group of people with dementia or MCI. A group is defined as any collection of two or more people, including participant-caregiver dyads. Technology-based exercise includes any form of exercise in which technology is integral to the execution of the activity, such as interventions through video-sharing or online platforms, exergaming and virtual reality exercises. We will consider exercise intervention to include any sort of physical activity. Any studies that focus solely on cognitive-based interventions will be excluded. Although MCI is considered to be distinct from dementia, due to the relative difficulty of studying people with higher levels of cognitive impairment, as well as the fact that MCI is often considered a precursor to dementia, studies that focus on technology-based group exercise interventions for people with MCI will be included in this review, as

implications learnt from MCI-focused studies could be relevant for populations with dementia.[7]

Context

We will include studies in which the intervention took place in homes, assisted living facilities or memory care facilities. We will not include studies in which interventions took place in a hospital or research facility.

Types of studies

This scoping review will consider both experimental and quasi-experimental study designs, including randomised controlled trials, non-randomised controlled trials, before-and-after studies and interrupted time-series studies. In addition, analytical observational studies, including prospective and retrospective cohort studies, case-control studies and analytical cross-sectional studies will be considered for inclusion. This review will also consider descriptive observational study designs, including case series and descriptive cross-sectional studies. Qualitative studies and systematic reviews that meet the inclusion criteria will be considered. Text and opinion papers will be considered. Protocols will not be included. Only studies published in English will be included. There will be no limitation based on publication date.

Search strategy

The scoping review will follow the three-step search strategy recommended by the JBI methodology.[31] The search strategy is designed to locate both published and unpublished studies. An initial limited search of MEDLINE, CINAHL and Embase will be undertaken to identify articles on the topic. This preliminary search will use these selected keywords: (Dementia or (Alzheimer disease)) AND ((web-based intervention) OR (exergaming) OR (exergame) OR (virtual reality) OR (technology-based intervention) OR telehealth OR telemedicine) AND (Exercise OR (physical activity)). The text words contained in the titles and abstracts of relevant articles and the index terms used to describe the articles will be used to develop a full search strategy for selected databases such as MEDLINE/PubMed, CINAHL, Web of Science, Embase, Cochrane Library and PsychInfo (online supplemental appendix I). The search strategy, including all identified keywords and index terms, will be adapted for each included database. A full search strategy for MEDLINE/PubMed is included in online supplemental appendix I. The reference lists of all included sources of evidence will be screened for additional relevant studies. We have worked and will continue to work with a medical librarian to refine the search strategy in order to ensure that relevant and key articles are found.

Information sources

The databases to be searched will be MEDLINE/PubMed, CINAHL, Web of Science, Embase, Cochrane Library and PsychInfo. Sources of unpublished studies/grey literature to be searched will be Google, Web of Science and Embase.

Study/source of evidence selection

Following the search, all identified citations will be collated and uploaded into Mendeley and duplicates will be removed. Titles and abstracts will then be screened by four researchers for assessment against the inclusion criteria. Potentially relevant sources will be retrieved in full and their citation details imported into Mendeley. The full text of selected citations will be assessed in detail against the inclusion criteria by two independent reviewers. Reasons for exclusion of sources of evidence at the full text review that do not meet the inclusion criteria will be recorded and reported in the scoping review. Any disagreements between the reviewers at each stage of the selection process will be resolved through discussion with additional reviewers. The results of the search and the study inclusion process will be reported in full in the final scoping review and presented in a Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping review flow diagram.[32]

Data extraction

Data will be extracted from papers included in the scoping review by four independent reviewers using a data extraction tool developed by the reviewers. The extracted data will include specific details about the author(s), year and country of publication, setting, population and sample size, research design and methods, intervention type, outcome measures and impact and results.

A draft charting table is provided (online supplemental appendix II). The data extraction tool will be pilot tested by the two independent researchers by extracting data from three papers and comparing results. The draft data extraction tool will be modified and revised as necessary during the process of extracting data from each included evidence source. Modifications will be detailed in the scoping review. Any disagreements between the reviewers will be resolved through discussion. If appropriate, authors of papers will be contacted to request missing or additional data, where required.

Patient and public involvement

Several family and patient partners will join us for meetings in which we will discuss the data that have been extracted from the articles. The family partners are people who have a family member with dementia and may act as the primary caregiver to the person with dementia, whereas the patient partners are people with dementia. Prior to discussing extracted data in meetings, the patient and family partners may review extracted data and several full-text articles; the number of full-text articles will be determined by each individual partner. We anticipate that each person will review one to three articles. Each partner can choose to be a named co-author in the scoping review paper or remain anonymous (see acknowledgements of this paper for the full names of patient and family partners

who have chosen to be identified). The patient and family partners were recruited from various memory disorder clinics.

Ethics and dissemination

For this scoping review, data will be collected from publicly available articles. Thus, neither informed consent nor research ethics approval is required. The findings will be disseminated to healthcare practitioners and the public through a peer-reviewed publication and presentations at conferences.

Data analysis and presentation

The extracted data will be presented in a table to summarise the evidence. A narrative summary will accompany the charted results and will describe the qualities of the literature on technology-based group exercise interventions for people with dementia. The categories that will be used in the presentation of data are year of publication, author(s), country, setting, population and sample size, research design and methods, intervention type, outcome measures, and impact and results.

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Appendix I: Search Strategy

We have worked with and will continue to work with a medical librarian at the university to alter the search strategy to ensure that relevant articles are found.

We will follow the three-step approach methodology delineated by the Joanna Briggs Institute Scoping Review Guidelines.

Step 1: The preliminary search included two online databases relevant to the topic: PubMed/MEDLINE and Embase.

Example Preliminary Embase Search:

#	Searches	Results
S1	Dementia or (Alzheimer disease)	193,282
S2	(web-based intervention) OR (exergaming) OR (exergame) OR (virtual reality) OR (technology-based intervention) OR telehealth OR telemedicine	46,382
S3	Exercise OR (physical activity)	509, 456
S4	S1 AND S2 AND S3	38

The initial search will be followed by an analysis of words contained in the titles and abstracts of retrieved papers, as well as index terms used to describe the articles.

Step 2: Using identified keywords and index terms, a second search will be undertaken across all selected databases: MEDLINE/PubMed, CINAHL, Web of Science, Embase, Cochrane Library, and PsychInfo.

Example PubMed Search:

#	Search: 7/9/21	Results
S1	(Dementia) OR (Alzheimer) OR (Cognitive impairment) OR (Neurocognitive disorder)	424,743 results

S2	(Online-based intervention) OR (web-based intervention) OR (internet-based intervention) OR (exergaming or exergame) OR (virtual reality) OR (technology-based intervention) OR telehealth OR (remote delivery) OR telemedicine	79,124 results
S3	Exercise OR (physical activity) OR (exercise intervention) OR (exercise therapy)	633,929 results
S4	S1 AND S2 AND S3	241

2a. Search terms and combinations in step 2:

Dementia terms	Technology terms	Exercise terms
Dementia	Online-based intervention	Exercise
Alzheimer	Web-based intervention	Physical activity
Cognitive impairment	Internet-based intervention	Exercise intervention
Neurocognitive disorder	Exergaming	Exercise therapy
	Exergame	
	Virtual reality	
	Technology-based	
	Telehealth	
	Telemedicine	
	Remote delivery	

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2b. Google, Web of Science, and Embase will be used to search grey literature. The Google,

Web of Science, and Embase searches will be performed using the following terms: (dementia

OR Alzheimer OR cognitive impairment OR neurocognitive disorder) AND (online OR web OR

internet OR exergame OR virtual reality OR technology-based OR technology-based OR

telehealth OR telemedicine OR remote delivery) AND (exercise OR physical activity OR

exercise intervention OR exercise therapy)

Step 3: The reference lists of all included studies and articles will be searched for additional

relevant studies. Google Scholar will be used to find published articles and related studies.

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Appendix II: Data Extraction Instrument

Author, Year, Country	Aim	Population, Sample Size, setting	Research Design and Methods	Intervention Type	Outcome Measures	Impact and results