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BMJ Open

Facilitators and barriers to implementing dementia care for staff in long-term care settings by using fully immersive virtual reality: a scoping review protocol

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2023-083724
Article Type:	Protocol
Date Submitted by the Author:	27-Dec-2023
Complete List of Authors:	Hung, Lillian; Vancouver General Hospital, ; Simon Fraser University, Gerontology Zhao, Yong; The University of British Columbia, IDEA Lab Lam, Michelle; The University of British Columbia, IDEA Lab Ren, Haopu; The University of British Columbia, IDEA Lab Wong, Karen Lok Yi; The University of British Columbia,
Keywords:	Virtual Reality, Literature, Dementia < NEUROLOGY, Caregivers

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Facilitators and barriers to implementing dementia care for staff in long-term care settings by using fully immersive virtual reality: a scoping review protocol

AUTHORS

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ABSTRACT

Introduction The rapid growth of aging population underscores the critical need for dementia care training among care providers. Innovative Virtual Reality (VR) technology has created opportunities to improve dementia care training. This scoping review will specifically focus on the barriers, facilitators and impacts of implementing fully immersive VR training for dementia care among staff in long-term care (LTC) settings.

Methods and analysis We will follow the Joanna Briggs Institute's scoping review methodology to ensure scientific rigor. We will collect literature of all languages from CINAHL, MEDLINE, Scopus, EMBASE, Web of Science, ProQuest database until December 31 of 2023. Grey literature from Google Scholar and AgeWell websites will be included. Inclusion criteria encompass papers involving paid staff (Population), fully immersive VR training (Concept), and long-term care settings (Context). Literature only referring to non-paid caregivers, or non-fully immersive VR, or other chronic diseases will be excluded. Literature screening, data extraction, and analysis will be conducted by two reviewers separately. We will present a narrative summary with charting table on main findings.

Ethics and dissemination: This work does not require ethics approval, given the public availability of data for this scoping review. Through a comprehensive overview of the current evidence regarding barriers and facilitators on this topic, potential insights and practical recommendations will be generated to support the implementation of VR training to enhance staff competence in LTC settings. The findings will be presented in a journal article and shared with practitioners in the frontline.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- Comprehensive Exploration - This scoping review will identify the barriers and facilitators to implementing VR training on dementia care in LTC homes. Potential impact of VR training on staff competence and the well-being of residents will be explored.
- Methodological Rigor - This scoping review will adhere to the Joanna Briggs Institute methodology to ensure scientific rigor and robustness of the review process.
- Inclusive Approach - The review will encompass a diverse array of articles, including those with varied study designs and languages, providing an inclusive perspective.
- Exclusion of Informal Caregivers - informal caregivers and students in training will be excluded from this review, potentially limiting the breadth of perspectives.
- Fully Immersive VR Technology only - While this study's focus on fully immersive VR technology ensures depth in analysis, it may restrict the exploration of other types of VR, potentially overlooking valuable contributions from alternative approaches.

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INTRODUCTION

Care providers in LTC settings need support

The challenges faced by Long-Term Care (LTC) staff/ formal care providers in managing dementia are significant, particularly due to limited training resources [1,2]. The demand for healthcare workers including nurses, care aides, housekeeping, rehabilitative workers, and doctors, are increasingly in demand as dementia prevalence rises [3]. This growing need of a well-trained workforce in dementia care strains healthcare resources and contributes to caregiver burnout [4-5]. A significant proportion of residents living with dementia in LTC (40-80 %) have cognitive impairment [6]. Furthermore, more than half of people living with dementia show responsive behaviours (aggression due to frustration with their unmet needs), and 82% require assistance with activities of daily living [6]. When combined with inadequate training and self-efficacy, these factors negatively impact staff members' wellbeing. The physical and emotional injuries as well as moral distress associated with dementia care lead to high turnover rates within LTC homes [7]. The quality of life of residents relies on proper dementia care training and effective resident-staff communication [8]. The staff's ability to deliver quality care hinges on good training and communication, with empathy and skill competency, particularly crucial for quality dementia care [9-10]. Effective training strategies to close the gaps between theory and practice is vital [11]. Implementing innovative training programs tailored to the complexities of dementia care is imperative to equip LTC staff with the necessary skills and resilience. Virtual Reality (VR) technology presents a novel solution to these staff training challenges.

Innovative technology provides opportunities

The origins of Virtual Reality (VR) can be traced back to the 19th century, with significant advancements occurring after major tech companies entered the market in 2014 [12]. VR technology has undergone enormous evolution in recent years, featuring thinner, lighter, and more comfortable designs, clearer resolution, and seamless transition from the real world to the virtual (mixed reality) through intelligent tracking of the eye, hand, and voice. This evolution is exemplified in innovative products like Microsoft HoloLens and Meta Quest [13].

VR's applications in healthcare have expanded, including diagnostics, cognitive training, and caregiver education[14]. The technology's fidelity to real-life experiences is differentiated into non-immersive, semi-immersive, and fully immersive levels, with the latter providing a deeply engaging sense of presence and spatial navigation. Examples of non-immersive equipment may include 2D screens, keyboard, mouse, or joysticks. Semi-immersive images may be shown in larger flat surface displays. A fully immersive experience may involve the use of surrounding projection surfaces or 3D displays like head mounted display (HMD), together with realistic multi-sensorial interaction devices [14]. Fully immersive VR systems develop a sense of presence with enhanced spatial navigation that could not be achieved by non-immersive and semi-immersive set-up [15].

Training programs that utilize VR technology offer risk-free opportunities for care providers to develop proficiency and confidence in their skills [1,16,17]. For example, one experiential dementia training program "myShoes," leveraging fully immersive VR, was reported to improve awareness of the symptoms, and lived experience of people with dementia and increase empathy after simulation [18]. Apart from increased accessibility to dementia care training, VR training is affordable and unrestricted by geographical location, time, or available personnel [1,9,19,20]. VR simulations further provide opportunities for carers to recognize the manners in which dementia impacts daily living and build empathy for the population that they will be caring for [9,21]. Immersion into simulations also allow care providers to gain first-hand experience of how dementia influences their perception of the environment and shapes everyday challenges – ultimately supporting their ability

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to aid patients with dementia in meaningful ways to improve their quality of life [17,21]. Given the exponential innovation in VR technology, it is imperative to evaluate systematically how training programs against health care challenges can capitalize on the advantages offered by these advanced products.

VR training for care providers need to be facilitated

VR training, as an innovative technology aimed at enhancing caregiving competence, has garnered increased attention from researchers in recent years. A preliminary search reveals several systematic reviews on VR training for both incumbent and potential caregivers responsible for residents living with dementia and other chronic diseases. For instance, some reviews focused on VR training programs for medical, nursing, and health professional students [22–24]. Another systematic review, which reported that VR could effectively enhance caregiving competence and empathy among caregivers, encompassed nine studies. Notably, this review included only research related to informal caregivers and studies focused on various chronic diseases such as dementia, stroke, and diabetes [25]. Additionally, a systematic review addressing AR/VR-based training, which demonstrated improvements in knowledge, attitude, and empathy while reducing stigma in people living with dementia (n=5) and other mental illness (n=11) [26]. When comparing VR technologies, a particular review found that Head-Mounted Display (HMD) systems were less used in healthcare training, contrary to more common computer and haptic simulations. The findings revealed that HMD systems were only deployed by 19% of healthcare training programs, which is lower than the usage of computer-based simulators (39%) and haptic simulators (42%) [16]. Although recent years have witnessed an increase in the use of VR nursing training simulations, research utilizing immersive HMD-based VR technology remains scarce [17].

The diversity in equipment and targeted populations may undermine the efficacy of these systematic reviews, particularly in discerning differences between various devices [16]. Unlike informal caregivers and students, staff /formal care providers who have face-to-face contact with residents living with dementia experience more workplace violence and undergo its consequent emotional and physical tolls [27]. Therefore, it is necessary to understand the barriers to implementing immersive VR training and how to facilitate its application in LTC homes for frontline staff. The goal of this review is to examine the barriers, facilitators, and impact of implementing training programs that leverage advanced fully immersive VR technology for frontline care providers in LTC settings.

REVIEW QUESTION

1. What are the barriers and facilitators to introducing a VR training program for care providers in LTC settings?
2. What impact does a VR training program have on the staff competence and well-being of residents in LTC settings?

METHODS

The planned scoping review will utilize the JBI methodology [29] The JBI methodology was chosen due to its comprehensive framework that systematically allows for the inclusion of various study designs and its emphasis on providing practical evidence for healthcare practice and policy development, ensuring a robust and transparent approach to synthesizing available literature. The scoping review is appropriate for our study questions because it enables a broad examination of the emerging VR field and assess the extent of research activity to inform practice and research.

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Inclusion criteria

Participants

This review will include studies that focus on VR training programs for formal care providers (paid employees) in LTC homes, excluding studies related to informal caregivers, such as family and friends, or medical and nursing students. Formal care providers can be defined as trained professionals who deliver medical and health services. This includes nurses, physicians, therapists, and other healthcare workers employed within LTC homes. We will also include LTC residents (with or without chronic conditions such as dementia and other disabilities).

Concept

Our review will consider studies that utilize fully immersive VR technology for training programs, specifically those employing Head-Mounted Display (HMD) systems. We will exclude studies focusing on 2D simulations and virtual environment-based VR programs. The included studies should address barriers and facilitators of VR training program implementation or its impact on care providers' competencies and residents' well-being. Barriers and facilitators will be assessed by leveraging the Consolidated Framework for Implementation Research (CFIR) [28]. CFIR is a framework that evaluates factors influencing implementation success, organized into five domains: innovation, inner setting, outer setting, individuals involved, and the process of implementation. CFIR helps in understanding the complexities of adopting and integrating interventions within organizations. The impact on staff competencies and the well-being of residents will be assessed using the Kirkpatrick Four-Level Training Evaluation Model [22]. The Kirkpatrick Four-Level Training Evaluation Model is a widely used framework for evaluating the effectiveness of training programs. It consists of four levels: reaction, learning, behaviour, and results (specifically, well-being of residents).

Context

Due to the high prevalence of residents living with dementia (69%) in LTC and the impact placed on frontline care providers, we will include studies situated in LTC settings [6]. Other contexts such as assisted living, community, and homes will not be considered in this review.

Types of Studies

This scoping review will encompass a range of study designs, including both experimental and quasi-experimental approaches such as randomized controlled trials, non-randomized controlled trials, before-and-after studies, and interrupted time-series studies. Analytical observational studies, comprising prospective and retrospective cohort studies, case-control studies, and analytical cross-sectional studies, will also be taken into account. Descriptive observational study designs, including case series, individual case reports, and descriptive cross-sectional studies, will be considered for inclusion.

Qualitative studies focusing on qualitative data will be included, employing designs such as phenomenology, grounded theory, ethnography, qualitative description, action research, and feminist research.

Furthermore, systematic reviews meeting the inclusion criteria may be incorporated, depending on the research question. Additionally, text and opinion papers will be considered for inclusion in this scoping review.

Search strategy

The search aims to identify both published and unpublished studies. A preliminary search in CINAHL database was conducted to pinpoint articles related to the topic (refer to Appendix 1). The terms found in article titles and abstracts, along with index terms, will be employed to formulate a comprehensive search strategy for CINAHL, MEDLINE, Scopus, EMBASE, Web of Science, ProQuest

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database, and the AgeWell website (Canada's technology and aging network) [30]. This search strategy, encompassing all identified keywords and index terms, will be customized for each database and information source included. Additionally, the reference lists of all incorporated evidence sources will be scrutinized for potential supplementary studies. As a scoping review, we are intentional about including all potential articles. For example, due to the mixed use of informal caregivers and formal care providers in various research, we will collect articles related to caregivers and scrutinize them manually at the following screening step.

Inclusion criteria encompass studies in any language, with a cut-off date until December 2023. Unpublished studies and grey literature will be explored through sources such as Google Scholar. Conference abstracts will be utilized to establish contact with study authors, potentially facilitating access to full-text studies.

Study/Source of Evidence selection

All identified citations will be gathered and uploaded into the Covidence systematic review tool (Veritas Health Innovation Ltd, AU) [31], with duplicates being removed. Following a pilot test, two independent reviewers will screen titles and abstracts against the inclusion criteria. Potentially relevant sources will be retrieved in full, and their citation details will be imported into the Covidence systematic review tool. Two independent reviewers will thoroughly assess the full text against the inclusion criteria. Exclusion reasons for sources that do not meet the inclusion criteria at the full-text stage will be documented and reported in the scoping review. Any reviewer disagreements will be resolved through group discussion. Outcomes will be comprehensively reported in the final scoping review and depicted in a Preferred Reporting Items for Systematic Reviews and Meta-analyses extension for scoping review (PRISMA-ScR) flow diagram [32].

Data Extraction

The data will be extracted from articles by two or more independent reviewers. The Garrard Matrix method will be employed to input data into a designated spreadsheet, encompassing specific information such as participants, study designs, barriers, facilitators, impacts, and key findings relevant to the review questions [33]. A draft extraction form is provided (see Appendix 2). Following the JBI methodology, we will conduct a pilot test of the extraction tool on three full-text articles to ensure reliability, with results being mapped for consistency. As this scoping review aims to map the existing literature landscape rather than critically evaluate evidence, we will not assess the study and methodological quality. The draft spreadsheet will be adjusted and revised as necessary during team discussions. Any modifications will be documented in the scoping review report. If necessary, authors of studies will be contacted to request missing or additional data.

Data Synthesis

The screening of sources will be depicted in a PRISMA-ScR flow diagram, incorporating exclusion reasons. Extracted data will be mapped in a literature table and accompanied by a narrative summary that will connect results to the study objective and research questions. A narrative mapping summary will accompany the tabulated results, organizing them into themes. Our comprehensive review will include the presentation of both qualitative and quantitative data.

PATIENT AND PUBLIC INVOLVEMENT

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One patient partner, Jim Mann, and one family partner, Lily Wong, will be involved in the scoping review. They have previously collaborated with the first author (LH) in previous a VR study and other scoping reviews [34–36]. They are older adults and long-term patient and family partners in the UBC IDEA lab, contributing valuable insights from lived experiences to research and fostering an inclusive environment to make sure academic research aligns with real-world patient and caregiver needs. In this scoping review, they will actively participate in the study planning and analysis by contributing to group discussions. Their experiences regarding barriers, facilitators, and the impact of VR training for caregivers from the perspectives of patients and families will be shared and communicated to the entire review group. Team discussions will be scheduled according to their preferred times. Additionally, they will be invited to staff huddles and meetings for the dissemination of the main findings. In recognition of their valuable experience and time, they will be provided with gift cards as compensation and invited to be co-authors of the scoping review report article.

ETHICS AND DISSEMINATION

As the data for this scoping review is derived from publicly available articles, research ethics approval is not deemed necessary. The intention is to submit the scoping review for publication in an open-access journal. Additionally, a succinct one-page review brief will be disseminated to enhance accessibility of the findings to a broad audience. This dissemination will involve sharing the results in staff huddles and meetings with local LTC homes. The overarching goal is to provide evidence-based guidance for the implementation of VR training programs for care providers in LTC settings.

ACKNOWLEDGEMENTS

We acknowledge the kind support of UBC librarian Katherine Miller for guiding and supervising the entire search process in the preliminary search.

CONTRIBUTORS

LH and YZ designed the scoping review, developed the protocol and methodology. LH, ML, YZ, KLYW, and LR were all involved in preparing the manuscript. All authors have approved the final version of the submitted protocol.

FUNDING

This scoping review is supported by funding from The Canada Research Chair in Senior Care (Grant number: GR021222).

CONFLICTS OF INTEREST

None declared.

PATIENT CONSENT FOR PUBLICATION

Not applicable.

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APPENDICES

Appendix I: Search strategy

CINAHL database

S14	S3 AND S6 AND S10 AND S13	65
S13	S11 OR S12	2,576,167
S12	AB (Program* OR curricul* OR course* OR educat* OR train* OR teach* OR pedagog* OR learn* OR phenomenograph* OR evaluat* OR haptic* OR touch) OR TI (Program* OR curricul* OR course* OR educat* OR train* OR teach* OR pedagog* OR learn* OR phenomenograph* OR evaluat* OR haptic* OR touch)	1,993,274
S11	(MH "Education+") OR (MH "Learning+")	1,113,593
S10	S7 OR S8 OR S9	1,174,639
S9	TI (caregiver* OR carer* OR "care giver*" OR nurse* OR “care aide*” OR “personal support worker*” OR “medical staff*” OR “health care worker*” OR “healthcare worker*” OR “health care” OR “health employee*” OR “health* staff” OR “home care” OR “home health*” OR “nursing home”) OR AB (caregiver* OR carer* OR "care giver*" OR nurse* OR “care aide*” OR “personal support worker*” OR “medical staff*” OR “health care worker*” OR “healthcare worker*” OR “health care” OR “health employee*” OR “health* staff” OR “home care” OR “home health*” OR “nursing home”)	712,338
S8	(MH "Health Personnel+")	646,888
S7	(MH "Caregivers")	44,019
S6	S4 OR S5	133,852
S5	AB (dementia* OR alzheimer* OR "cognit* impair*" OR memor* N2 los*) OR TI (dementia* OR alzheimer* OR "cognit* impair*" OR memor* N2 los*)	116,116
S4	(MH "Dementia+")	85,002
S3	S1 OR S2	13,257
S2	AB (“virtual realit*” OR vr) OR TI (“virtual realit*” OR vr)	8,081
S1	(MH "Virtual Reality+")	8,468

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Appendix II: Data extraction instrument

Articles (countries)	**Participants** (Sample size)	**Study Designs**	**Barriers**	**Facilitators**	**Impacts**	**Findings**
Author, year						
Author, year						
Author, year						
Author, year						
Author, year						
.....						

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Manuscript ID	bmjopen-2023-083724.R1
Article Type:	Protocol
Date Submitted by the Author:	12-Mar-2024
Complete List of Authors:	Hung, Lillian; Vancouver General Hospital, ; Simon Fraser University, Gerontology Zhao, Yong; The University of British Columbia, IDEA Lab Lam, Michelle; The University of British Columbia, IDEA Lab Ren, Haopu; The University of British Columbia, IDEA Lab Wong, Karen Lok Yi; The University of British Columbia,
Primary Subject Heading:	Nursing
Secondary Subject Heading:	Medical education and training
Keywords:	Virtual Reality, Literature, Dementia < NEUROLOGY, Caregivers

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INTRODUCTION

Care providers in LTC settings need support

The challenges faced by Long-Term Care (LTC) staff/ formal care providers in managing dementia are significant, partially due to limited training resources [1,2]. The demand for healthcare workers, including nurses, care aides, housekeeping staff, rehabilitative workers, and doctors, is increasingly urgent as dementia prevalence rises [3]. This growing need for a well-trained workforce in dementia care places pressure on healthcare resources and adds to the burden experienced by caregivers, leading to burnout [4,5]. A significant proportion of residents living with dementia in LTC (40-80 %) experience cognitive impairment [6]. Furthermore, more than half of people living with dementia show responsive behaviours (aggression due to frustration with their unmet needs), and 82% require assistance with activities of daily living [6]. When combined with inadequate training and self-efficacy, these factors negatively impact staff members' well-being. The physical and emotional injuries, as well as moral distress associated with dementia care, lead to high turnover rates within LTC homes [7]. The quality of life of residents relies on proper dementia care training and effective resident-staff communication [8]. The staff's ability to deliver quality care hinges on good training and communication, with empathy and skill competency particularly crucial for quality dementia care [9,10]. Effective training strategies to bridge the gaps between theory and practice are vital [11]. Implementing innovative training programs tailored to the complexities of dementia care is imperative to equip LTC staff with the necessary skills and resilience. Virtual Reality (VR) technology presents a novel solution to these staff training challenges.

Innovative technology provides opportunities

The origins of VR can be traced back to the 19th century, with significant advancements occurring after major tech companies entered the market in 2014 [12]. VR technology has undergone enormous evolution in recent years, featuring thinner, lighter, and more comfortable designs, more precise resolution, and seamless transition from the real world to the virtual (mixed reality) through intelligent tracking of the eye, hand, and voice. This evolution is exemplified in innovative products like Microsoft HoloLens and Meta Quest [13].

VR's applications in healthcare have expanded, including diagnostics, cognitive training, and caregiver education[14]. The fidelity of the technology to real-life experiences is differentiated into non-immersive, semi-immersive, and fully immersive levels, with the latter providing a deeply engaging sense of presence and spatial navigation. Examples of non-immersive equipment may include 2D screens, keyboards, mice, or joysticks. Semi-immersive images may be shown on larger flat surface displays. A fully immersive experience may involve the use of surrounding projection surfaces or 3D displays like head-mounted displays (HMDs), together with realistic multi-sensorial interaction devices [14]. Fully immersive VR systems develop a sense of presence with enhanced spatial navigation that cannot be achieved by non-immersive and semi-immersive setups [15].

Training programs that utilize VR technology offer risk-free opportunities for care providers to develop proficiency and confidence in their skills [1,16,17]. For example, one experiential dementia training program, "myShoes," leveraging fully immersive VR, was reported to improve awareness of the symptoms and the lived experience of people with dementia and increase empathy after

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simulation [18]. Apart from increasing accessibility to dementia care training, VR training is affordable and unrestricted by geographical location, time, or available personnel [1,9,19,20]. VR simulations further provide opportunities for caregivers to recognize the manners in which dementia impacts daily living and build empathy for the population that they will be caring for [9,21]. Immersion into simulations also allows care providers to gain firsthand experience of how dementia influences their perception of the environment and shapes everyday challenges—ultimately supporting their ability to aid patients with dementia in meaningful ways to improve their quality of life [17,21]. Given the exponential innovation in VR technology, it is imperative to systematically evaluate how training programs addressing healthcare challenges can capitalize on the advantages offered by these advanced products.

VR training for care providers needs to be facilitated

VR training, as an innovative technology aimed at enhancing caregiving competence, has garnered increased attention from researchers in recent years. A preliminary search reveals several systematic reviews on VR training for both incumbent and potential caregivers responsible for residents living with dementia and other chronic diseases. For instance, some reviews focused on VR training programs for medical, nursing, and health professional students [22–24]. Another systematic review, which reported that VR could effectively enhance caregiving competence and empathy among caregivers, encompassed nine studies. Notably, this review included only research related to informal caregivers and studies focused on various chronic diseases such as dementia, stroke, and diabetes [25]. Additionally, a systematic review addressing AR/VR-based training demonstrated improvements in knowledge, attitudes, and empathy of diverse healthcare professionals, alongside a reduction in stigma towards individuals with various mental health conditions, although only a minority of studies (5 out of 11) specifically addressed dementia [[26]. When comparing VR technologies, a particular review found that Head-Mounted Display (HMD) systems were less used in healthcare training, contrary to more common computer and haptic simulations. The findings revealed that HMD systems were only deployed by 19% of healthcare training programs, which is lower than the usage of computer-based simulators (39%) and haptic simulators (42%) [[16]. Although recent years have witnessed an increase in the use of VR nursing training simulations, research utilizing immersive HMD-based VR technology remains scarce [17].

The diversity in equipment and targeted populations may undermine the efficacy of these systematic reviews, particularly in discerning differences between various devices [16]. Unlike informal caregivers and students, staff /formal care providers who have face-to-face contact with residents living with dementia experience more workplace violence and undergo consequent emotional and physical tolls [27]. Therefore, it is necessary to understand the barriers to implementing immersive VR training and how to facilitate its application in LTC homes for frontline staff. Scoping reviews are commonly employed in emerging fields with limited research literature available, aiming to outline a research topic's volume, nature, and characteristics without evaluating the quality of evidence [28]. Given the nascent stage of this particular field and the scarcity of published research, a scoping review was deemed suitable as a framework. This review aims to examine the barriers, facilitators, and impacts of implementing training programs that leverage advanced, fully immersive VR technology for frontline care providers in LTC settings.

REVIEW QUESTION

1. What are the barriers and facilitators to introducing a VR training program for dementia care among care providers in LTC settings?
2. What impacts does a VR training program for dementia care have on the staff competence and well-being of residents in LTC settings?

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METHODS

Design

The planned scoping review will utilize the JBI methodology [29]. The JBI methodology was chosen due to its comprehensive framework that systematically allows for the inclusion of various study designs and its emphasis on providing practical evidence for healthcare practice and policy development, ensuring a robust and transparent approach to synthesizing available literature. The scoping review is appropriate for our study questions because it enables a broad examination of the emerging VR field and assesses the extent of research activity to inform practice and research.

Inclusion criteria

Participants

This review will include studies focusing on VR training programs for formal care providers (paid employees) in LTC homes, targeting care for residents with dementia exclusively, excluding studies related to informal caregivers, such as family and friends, or medical and nursing students. Formal care providers can be defined as trained professionals who deliver medical and health services. This includes nurses, physicians, therapists, and other healthcare workers employed within LTC homes.

Concept

Our review will consider studies that utilize fully immersive VR technology for training programs on dementia care, specifically those employing Head-Mounted Display (HMD) systems. We will exclude studies focusing on 2D simulations and virtual environment-based VR programs. The included studies should address barriers and facilitators of VR training program implementation or its impacts on care providers' competencies and residents' well-being. Barriers and facilitators will be assessed by leveraging the Consolidated Framework for Implementation Research (CFIR) [30]. CFIR is a framework that evaluates factors influencing implementation success, organized into five domains: innovation, inner setting, outer setting, individuals involved, and the process of implementation. CFIR helps in understanding the complexities of adopting and integrating interventions within organizations. The impact on staff competencies and/or the well-being of residents will be assessed using the Kirkpatrick Four-Level Training Evaluation Model [[22]. The Kirkpatrick Four-Level Training Evaluation Model is a widely used framework for evaluating the effectiveness of training programs. It consists of four levels: reaction, learning, behaviour, and results (specifically, well-being of residents).

Context

Due to the high prevalence of residents living with dementia (69%) in LTC and the impacts placed on frontline care providers, we will include studies situated in LTC settings [6]. We adopted the Canadian Institute for Health Information's (CIHI) definition of long-term care (LTC) homes, “also called nursing homes, continuing care facilities and residential care homes, which provide a wide range of health and personal care services for Canadians with medical and physical needs who require access to 24-hour nursing care, personal care and other therapeutic and support services.” [31] Other contexts, such as assisted living, community, and homes, will not be considered in this review.

Types of Studies

This scoping review will encompass a range of study designs, including experimental and quasi-experimental approaches, such as randomized controlled trials, non-randomized controlled trials, before-and-after studies, and interrupted time-series studies. Analytical observational studies, comprising prospective and retrospective cohort studies, case-control studies, and analytical cross-sectional studies, will also be taken into account. Descriptive observational study designs, including

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case series, individual case reports, and descriptive cross-sectional studies, will be considered for inclusion.

Qualitative studies focusing on qualitative data will be included, employing designs such as phenomenology, grounded theory, ethnography, qualitative description, action research, and feminist research.

Furthermore, systematic reviews meeting the inclusion criteria may be incorporated, depending on the research question. Additionally, text and opinion papers will be considered for inclusion in this scoping review.

Search strategy

The search aims to identify both published and unpublished studies. A preliminary search in the CINAHL database was conducted to pinpoint articles related to the topic (refer to Appendix 1). The terms found in article titles and abstracts, along with index terms, were employed to formulate a comprehensive search strategy for English-based search engines, including CINAHL, MEDLINE, Scopus, EMBASE, Web of Science, ProQuest database, and the AgeWell website (Canada's technology and aging network) [32]. This search strategy, encompassing all identified keywords and index terms, will be customized for each database and information source included. Additionally, the reference lists of all incorporated evidence sources will be scrutinized for potential supplementary studies. As a scoping review, we are intentional about including all potential articles. For example, due to the mixed-use of informal caregivers and formal care providers in various research, we will collect articles related to caregivers and scrutinize them manually at the following screening step.

Inclusion criteria encompass studies in any language with abstracts in English, with a cut-off date of December 2023. Only full-text articles in English and Chinese will undergo full-text screening due to the language proficiency of the team members. Unpublished studies and grey literature will be explored through Google Scholar. Conference abstracts will be utilized to establish contact with study authors, potentially facilitating access to full-text studies.

Study/Source of Evidence Selection

All identified citations will be gathered and uploaded into the Covidence systematic review tool (Veritas Health Innovation Ltd, AU) [[33], with duplicates being removed. Following a pilot test in which the review team was assessed to ensure the consistency of evidence selection, two independent reviewers will screen titles and abstracts against the inclusion criteria. Potentially relevant sources will be retrieved in full, and their citation details will be imported into the Covidence systematic review tool. Two independent reviewers will thoroughly assess the full text against the inclusion criteria. Exclusion reasons for sources that do not meet the inclusion criteria at the full-text stage will be documented and reported in the scoping review. Any reviewer disagreements will be resolved through group discussion. Outcomes will be comprehensively reported in the final scoping review and depicted in a Preferred Reporting Items for Systematic Reviews and Meta-analyses extension for scoping review (PRISMA-ScR) flow diagram [34].

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Data Extraction

The data will be extracted from articles by two independent reviewers. The Garrard Matrix method will be employed to input data into a designated spreadsheet, encompassing specific information such as participants, study designs, barriers, facilitators, impacts, and key findings relevant to the review questions [35]. A draft extraction form is provided (see Appendix 2). Following the JBI methodology, we will conduct a pilot test of the extraction tool on three full-text articles to ensure reliability, with results being mapped for consistency. As this scoping review aims to map the existing literature landscape rather than critically evaluate evidence, we will not assess the study and methodological quality. The draft spreadsheet will be adjusted and revised as necessary during team discussions. Any modifications will be documented in the scoping review report. If necessary, authors of studies will be contacted to request missing or additional data.

Data Synthesis

Extracted data will be mapped in a literature table and accompanied by a narrative summary that will connect results to the study objective and research questions. A narrative mapping summary will accompany the tabulated results, organizing them into themes. Our comprehensive review will include the presentation of both qualitative and quantitative data.

PATIENT AND PUBLIC INVOLVEMENT

One patient partner, Jim Mann, and one family partner, Lily Wong, were involved in the conception and planning of the scoping review and will be engaged in the data analysis stage of the scoping review. They have previously collaborated with the first author (LH) in a previous VR study and other scoping reviews [36–38]. They are older adults and long-term patient and family partners in the UBC IDEA lab, contributing valuable insights from lived experiences to research and fostering an inclusive environment to make sure academic research aligns with real-world patient and caregiver needs. In this scoping review, they will actively participate in the study planning and analysis by contributing to group discussions. Their experiences regarding barriers, facilitators, and impacts of VR training for caregivers from the perspectives of patients and families will be shared and communicated to the entire review group. Team discussions will be scheduled according to their preferred times. Additionally, they will be invited to staff huddles and meetings for the dissemination of the main findings. In recognition of their valuable experience and time, they will be provided with gift cards as compensation and invited to be co-authors of the scoping review report article.

ETHICS AND DISSEMINATION

As the data for this scoping review is derived from publicly available articles, research ethics approval is not deemed necessary. The intention is to submit the scoping review for publication in an open-access journal. Additionally, a succinct one-page review brief will be disseminated to enhance accessibility of the findings to a broad audience. This dissemination will involve sharing the results in staff huddles and meetings with local LTC homes. The overarching goal is to provide evidence-based guidance for the implementation of VR training programs for care providers in LTC settings.

ACKNOWLEDGEMENTS

We acknowledge the kind support of UBC librarian Katherine Miller for guiding and supervising the entire search process in the preliminary search.

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CONTRIBUTORS

LH and YZ designed the scoping review and developed the protocol and methodology. LH, ML, YZ, KLYW, and LR were all involved in preparing the manuscript. All authors have approved the final version of the submitted protocol.

FUNDING

This scoping review is supported by funding from The Canada Research Chair in Senior Care (Grant number: GR021222).

CONFLICTS OF INTEREST

None declared.

PATIENT CONSENT FOR PUBLICATION

Not applicable.

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APPENDICES

Appendix I: Search strategy

CINAHL database

S14	S3 AND S6 AND S10 AND S13
S13	S11 OR S12
S12	AB (Program* OR curricul* OR course* OR educat* OR train* OR teach* OR pedagog* OR learn* OR phenomenograph* OR evaluat* OR haptic* OR touch) OR TI (Program* OR curricul* OR course* OR educat* OR train* OR teach* OR pedagog* OR learn* OR phenomenograph* OR evaluat* OR haptic* OR touch)
S11	(MH "Education+") OR (MH "Learning+")
S10	S7 OR S8 OR S9
S9	TI (caregiver* OR carer* OR "care giver*" OR nurse* OR “care aide*” OR “personal support worker*” OR “medical staff*” OR “health care worker*” OR “healthcare worker*” OR “health care” OR “health employee*” OR “health* staff” OR “home care” OR “home health*” OR “nursing home”) OR AB (caregiver* OR carer* OR "care giver*" OR nurse* OR “care aide*” OR “personal support worker*” OR “medical staff*” OR “health care worker*” OR “healthcare worker*” OR “health care” OR “health employee*” OR “health* staff” OR “home care” OR “home health*” OR “nursing home”)
S8	(MH "Health Personnel+")
S7	(MH "Caregivers")
S6	S4 OR S5
S5	AB (dementia* OR alzheimer* OR "cognit* impair*" OR memor* N2 los*) OR TI (dementia* OR alzheimer* OR "cognit* impair*" OR memor* N2 los*)
S4	(MH "Dementia+")
S3	S1 OR S2
S2	AB (“virtual realit*” OR vr) OR TI (“virtual realit*” OR vr)
S1	(MH "Virtual Reality+")

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MEDLINE database

S18	S3 AND S6 AND S13 AND S17
S17	S14 OR S15 OR S16
S16	AB (caregiver* OR carer* OR "care giver*" OR nurse* OR “care aide*” OR “personal support worker*” OR “medical staff*” OR “health care worker*” OR “healthcare worker*” OR “health care” OR “health employee*” OR “health* staff” OR “home care” OR “home health*” OR “nursing home”) OR TI (caregiver* OR carer* OR "care giver*" OR nurse* OR “care aide*” OR “personal support worker*” OR “medical staff*” OR “health care worker*” OR “healthcare worker*” OR “health care” OR “health employee*” OR “health* staff” OR “home care” OR “home health*” OR “nursing home”)
S15	(MH "Health Personnel+")
S14	(MH "Caregiver Burden")
S13	S7 OR S8 OR S9 OR S10 OR S11 OR S12
S12	AB (Program* OR curricul* OR course* OR educat* OR train* OR teach* OR pedagog* OR learn* OR phenomenograph* OR evaluat* OR haptic* OR touch) OR TI (Program* OR curricul* OR course* OR educat* OR train* OR teach* OR pedagog* OR learn* OR phenomenograph* OR evaluat* OR haptic* OR touch)
S11	(MH "Learning+")
S10	(MH "Education+")
S9	(MH "Program Evaluation+")
S8	(MH "Program Development")
S7	(MH "Nursing Research+")
S6	S4 OR S5
S5	AB (dementia* OR alzheimer* OR "cognit* impair*" OR memor* N2 los*) OR TI (dementia* OR alzheimer* OR "cognit* impair*" OR memor* N2 los*)
S4	(MH "Dementia+")
S3	S1 OR S2
S2	AB (“virtual realit*” OR vr) OR TI (“virtual realit*” OR vr)
S1	(MH "Virtual Reality+")

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EMBASE database

1	(dementia or alzheimer* or cognit* impair* or (memor* adj2 los*)).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]
2	exp dementia/
3	1 or 2
4	exp virtual reality/ or exp virtual reality head mounted display/
5	(virtual realit* or vr).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]
6	4 or 5
7	exp education/
8	exp program development/ or exp program effectiveness/ or exp program efficacy/ or exp program evaluation/
9	exp course evaluation/ or exp health care quality/ or exp nursing education/
10	exp learning/
11	(Program* or curricul* or course* or educat* or train* or teach* or pedagog* or learn* or phenomenograph* or lesson* or evaluat* or haptic* or touch).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]
12	7 or 8 or 9 or 10 or 11
13	exp caregiver burden/ or exp caregiver burnout/ or exp caregiver/
14	exp health care personnel/
15	(caregiver* or carer* or care giver* or nurse* or care aide* or personal support worker* or medical staff* or health care worker* or healthcare worker* or health care or health employee* or health* staff or home care or home health* or nursing home).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]
16	13 or 14 or 15
17	3 and 6 and 12 and 16

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Scopus database

TITLE-ABS-KEY ((program* OR curricul* OR course* OR educat* OR train* OR teach* OR pedagog*or AND learn*) AND {virtual reality} AND (dementia* OR alzheimer* OR {cognitive impairment} OR {memory loss}) AND (care* OR health*))

Web of Science

(“virtual realit*” OR vr) AND (dementia* OR alzheimer* OR "cognit* impair*" OR memor* N2 los*) AND (Program* OR curricul* OR course* OR educat* OR train* OR teach* OR pedagog* OR learn* OR phenomenograph* OR evaluat* OR haptic* OR touch) AND (caregiver* OR carer* OR "care giver*" OR nurse* OR “care aide*” OR “personal support worker*” OR “medical staff*” OR “health care worker*” OR “healthcare worker*” OR “health care” OR “health employee*” OR “health* staff” OR “home care” OR “home health*” OR “nursing home”)

ProQuest database

noft(“virtual realit*” OR vr) AND noft(dementia* OR alzheimer* OR "cognit* impair*" OR memor* N2 los*) AND noft(Program* OR curricul* OR course* OR educat* OR train* OR teach* OR pedagog* OR learn* OR phenomenograph* OR evaluat* OR haptic* OR touch) AND noft(caregiver* OR carer* OR "care giver*" OR nurse* OR “care aide*” OR “personal support worker*” OR “medical staff*” OR “health care worker*” OR “healthcare worker*” OR “health care” OR “health employee*” OR “health* staff” OR “home care” OR “home health*” OR “nursing home”)

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Appendix II: Data extraction instrument

Articles (countries)	**Participants** (Sample size)	**Study Designs**	**Barriers**	**Facilitators**	**Impacts**	**Findings**
Author, year						
Author, year						
Author, year						
Author, year						
Author, year						
.....						

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