Review

Technology-Enabled Recreation and Leisure Programs and Activities for Older Adults With Cognitive Impairment: Rapid Scoping Review

Kristina Marie Kokorelias[1,2,3,4], PhD; Josephine McMurray[5], PhD; Charlene Chu[4,6,7], PhD; Arlene Astell[2,4,7,8], PhD; Alisa Grigorovich[7,9], PhD; Pia Kontos[4,7,10], PhD; Jessica Babineau[7], MLIS; Jessica Bytautas[7,10], MSc; Ashley Ahuja[6], BScN; Andrea Iaboni[4,7,8], PhD, MD

[1]Division of Geriatric Medicine, Department of Medicine, Sinai Health System and University Health Network, Toronto, ON, Canada
[2]Department of Occupational Science & Occupational Therapy, Temerty Faculty of Medicine, University of Toronto, Toronto, ON, Canada
[3]National Institute on Ageing, Toronto Metropolitan University, Toronto, ON, Canada
[4]Rehabilitation Sciences Institute, Temerty Faculty of Medicine, University of Toronto, Toronto, ON, Canada
[5]Lazaridis School of Business & Economics/Community Health, Wilfred Laurier University, Waterloo, ON, Canada
[6]Lawrence S. Bloomberg Faculty of Nursing, University of Toronto, Toronto, ON, Canada
[7]KITE Research Institute, Toronto Rehabilitation Institute – University Health Network, Toronto, ON, Canada
[8]Department of Psychiatry, Temerty Faculty of Medicine, University of Toronto, Toronto, ON, Canada
[9]Recreation and Leisure Studies, Brock University, St. Catherine's, ON, Canada
[10]Dalla Lana School of Public Health, University of Toronto, Toronto, ON, Canada

Corresponding Author:
Kristina Marie Kokorelias, PhD
Division of Geriatric Medicine, Department of Medicine
Sinai Health System and University Health Network
600 University Avenue
Toronto, ON, M5G 1V7
Canada
Phone: 1 2899252096
Email: kristina.kokorelias@sinaihealth.ca

Abstract

Background: Recreational and leisure activities significantly contribute to the well-being of older adults, positively impacting physical, cognitive, and mental health. However, limited mobility and cognitive decline often impede access to these activities, particularly for individuals living with dementia. With the increasing availability of digital technologies, there is a rising interest in using technology to deliver recreation and leisure activities for cognitively impaired individuals, acknowledging its potential to provide diverse experiences. The COVID-19 pandemic further highlighted the need for virtual program delivery, especially for individuals in long-term care settings, leading to the development of tools like the Dementia Isolation Toolkit aimed at supporting compassionate isolation. To better support future implementations of the DIT, our rapid scoping review explores evidence-based, technology-enabled recreation programs for older adults with cognitive impairments, which promote well-being.

Objective: We conducted a rapid scoping review of published peer-reviewed literature to answer the following research question: What recreation and leisure programs or activities are being delivered using technology to adults living with dementia or another form of cognitive impairment?

Methods: In total, 6 databases were searched by an Information Specialist. Single reviewers performed title or abstract review, full-text screening, data extraction, and study characteristic summarization.

Results: A total of 92 documents representing 94 studies were identified. The review identified a variety of technology-enabled delivery methods, including robots, gaming consoles, tablets, televisions, and computers, used to engage participants in recreational and leisure activities. These technologies impacted mood, cognition, functional activity, and overall well-being among older adults with cognitive impairments. Activities for socializing were the most common, leveraging technologies such as social robots and virtual companions, while relaxation methods used virtual reality and digital reminiscence therapy. However, challenges included technological complexity and potential distress during reminiscing activities, prompting recommendations for diversified

research settings, and increased sample sizes to comprehensively understand technology's impact on leisure among this demographic.

Conclusions: The findings suggest that technology-enabled recreational activities, such as socializing, relaxation and self-awareness activities, music and dance, exergaming, and art, can positively impact the mood and overall well-being of older adults with cognitive impairment. Future research should embrace a more inclusive approach, integrating design, diverse settings, and a broader sample of older adults to develop technology-driven leisure activities tailored to their unique needs and promote their effective use.

(JMIR Neurotech 2024;3:e53038) doi: 10.2196/53038

KEYWORDS

scoping review; review methods; review methodology; knowledge synthesis; synthesis; syntheses; scoping; rapid review; rapid reviews; gerontology; geriatric; geriatrics; older adult; older adults; elder; elderly; older person; older people; ageing; aging; gerontechnology; technology; recreation; recreational; leisure; hobby; hobbies; cognitive; MCI; Alzheimer; dementia; digital health

Introduction

Background

Participating in recreational and leisure activities is a significant contributor to the health and well-being of older adults [1,2]. Recreation and leisure activities include pursuits such as dancing, walking, singing, or playing a musical instrument, creative pastimes such as painting, pottery or woodworking, and a wide variety of sports and games. Recreation and leisure activities can be enjoyed alone or as part of a group and have been shown to positively benefit older adults' physical and cognitive function and mental health [3].

In later life, a range of factors can reduce opportunities and access to recreation and leisure pursuits including limited mobility [4] and cognitive loss [5]. People living with dementia, for example, face multiple barriers to continued participation in recreation and leisure activities [6-8] due to progressive cognitive decline. Consequently, limited access to recreation and leisure activities negatively impacts people living with dementia or other forms of cognitive impairment through lack of socialization and stimulation [9,10].

Technology-Enabled Delivery of Recreation and Leisure Activities

The use of technology to deliver recreation and leisure activities for people living with impaired cognition, is becoming more commonplace [11-15], with the recognition that technology can facilitate in-person leisure as well as new forms of uniquely digital experiences [16,17]. The rise in interest may reflect the increasing availability of digital technologies, from tablets to robots. Touchscreens, for instance, are particularly accessible for people living with dementia as they provide immediate feedback through touch [13]. As such, touchscreen tablets and larger devices have been successfully used to deliver a variety of recreation activities including games [13], reminiscing activities [18,19], and music [20]. Touchscreens have also been tested in the form of telepresence robots—simple, nonhumanoid frames with a touchscreen that can be controlled to move on flat surfaces [21]. Art is another popular target for technology for people living with dementia including virtual reality [22] and virtual reality tours of art galleries [23], making and viewing art together on tablets [24,25] and art therapy [11,26]. More energetic activities using motion-based game systems such as the Wii [27] and Xbox [28] have been shown to not only promote physical activity but also socialization and enjoyment [29].

COVID-19 Heightened the Need for Web-Based Program Delivery

The impact of a lack of recreation and leisure activities for people living with cognitive disabilities was underscored during the COVID-19 pandemic. Compromised cognitive functioning, language, insight, and judgment associated with dementia impact the ability of individuals to understand and appreciate the necessity of isolation and to voluntarily comply with isolation procedures [30]. The enforcement of isolation protocols to prevent the transmission of the virus during the pandemic drastically reduced recreation and leisure activities for people living with dementia [31]. Long-term care (LTC) home staff faced significant challenges in enforcing these protocols, leading to ethical dilemmas and moral distress as they navigated the balance between ensuring safety and promoting the well-being of residents [31-33]. At this stage of the pandemic, outbreaks of infectious diseases, including COVID-19, remain frequent events in LTC homes, and there is an ongoing need for the delivery of recreation opportunities for residents in isolation.

The Dementia Isolation Toolkit (DIT) was developed to support compassionate, safe, and effective isolation of people living with dementia in LTC settings and contains a series of tools designed to provide ethical, legal, and clinical guidance to support decision-making (34,35). It also includes methods and approaches, including those that are technology enabled, to support safe isolation for individuals living with cognitive impairment, ensuring their dignity and well-being. Given the wide variety of technologies and digital activities being developed and tested for older adults living with impaired cognition [12,15,36], we conducted a rapid scoping review to identify technology-enabled recreation and leisure programs or activities that are being delivered to older adults living with cognitive impairment. Our aim was to identify programs with supporting evidence of efficacy, which might complement the DIT and facilitate its adoption and use in LTC. While reviews exist focusing on technological interventions for individuals

living with dementia, they often focus on loneliness rather than other benefits of recreation [15].

Methods

Research Design

We conducted a rapid scoping review of published peer-reviewed literature. A rapid review was selected to allow us to generate timely results to inform the design of novel digital interventions to deliver recreation and leisure activities for people living with cognitive impairment [37]. However, we combined rapid review methodology with scoping review methodology to allow us to map the key issues or topics in a research area where the literature has not been reviewed comprehensively, and many different study designs may be applicable [38,39]. This review was conducted following Arksey and O'Malley's [40] scoping review methodology and was informed by the Cochrane guidance on rapid reviews [41]. The review is reported following the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews) framework [42] (see Multimedia Appendix 1).

Step 1: Identifying the Research Question

Based on the knowledge and experience of the multidisciplinary DIT team and familiarity with the literature on technology for recreation and leisure for persons living with dementia, we identified the following research question: What recreation and leisure programs or activities are being delivered using technology to adults living with dementia or another form of cognitive impairment?

Step 2: Identifying Relevant Studies

On January 20, 2021, the following health and technology databases were searched using a search strategy developed by the research team, which included an Information Specialist (JB):ACM Digital Library, CENTRAL (Ovid), CINAHL (EBSCO), Embase (Ovid), IEEE Explore, and MEDLINE (Ovid). No limitation was set on publication year. When possible, searches were limited to include only English-language publications and primary research articles.

The searches for CINAHL (EBSCO) and MEDLINE (Ovid) were then updated on April 11, 2024 (see Multimedia Appendix 2), using the same search strategy. The decision for selecting these 2 databases was done by analyzing included studies from the original search to determine from which databases the studies were retrieved. All the studies selected for inclusion were retrieved from these 2 databases, and thus, to expedite the process of the update, an informed decision was made to focus updates on these 2 databases.

In addition to comprehensive database searching, the reference lists of included studies were reviewed for relevant studies.

Stage 3: Study Selection

The study selection process consisted of 2 stages: first by screening titles and abstracts; and second, by full-text screening. To be eligible for inclusion at both stages, the article must have reported on primary research that included an evaluation of a technology and explored the experiences of older adults with cognitive impairment using the technology. The technology must have been used to deliver or enable recreation and leisure programs. Inclusion and exclusion criteria are presented in Table 1.

Inclusion criteria were refined iteratively throughout each stage of the screening process (title and abstract, full text), as recommended by Levac et al [43]. First, all team members screened the same subset of titles and abstracts to calibrate the inclusion criteria. Then, one team member screened approximately 25% of the titles and abstracts [41]. All team members screened another subset of titles and abstracts to further refine the inclusion criteria [41]. Finally, the remaining approximately 75% of the titles and abstracts were divided amongst 5 team members and individually screened.

All team members reviewed an initial subset of full texts to calibrate our inclusion criteria. Twenty percent of the remaining full-text articles were double reviewed, and discrepancies were resolved through discussion.

Table 1. Inclusion and exclusion criteria.

Criteria	Inclusion	Exclusion
Language of the studies	English	Languages other than English
Study design	• Empirical research articles (eg, qualitative, randomized controlled trials [RCTs], quasi-experimental designs, observational studies [eg, cohort studies, case-control studies), cross-sectional studies, longitudinal studies, pre-post studies, mixed methods studies)– reporting on an evaluation focused on older adults. • Must explore experiences of older adults.	• Nonempirical study designs, such as reviews. • Exclude conference abstracts. • The evaluation should not solely be on the technology or the caregivers.
Intervention	• Recreation and leisure (eg, arts-based interventions, music, dance, games, exergaming, recreational activities, recreation, leisure activities, creative, games, exergaming, cognitive stimulation therapy, socializing, and social interactions) "program" or "activity" for adults aged 18 years or older with cognitive impairment.	• The intervention should not focus on the assessment, monitoring or detection of cognitive impairment (if no game component or reference to experience).
Mode of delivery	• Delivered using technology (eg, app, device, platforms, robot). • Technology must have leisure component.	• Technology that is used to monitor or detect cognitive impairment.
Population	• Adults aged 50 years or older with cognitive impairment including (but not limited to) dementia, Wernicke encephalopathy, delirium, amnestic, Alzheimer disease, organic brain disease or syndrome, benign senescent forgetfulness, Binswanger, Korsakoff syndrome, stroke-related cognitive impairment, Wilhelmsen-Lynch disease, aphasia, Benson syndrome, Huntington's disease, mild cognitive impairment or disorder, Creutzfeldt Jacob disease, or Parkinson disease	• The populations cannot be at risk for cognitive impairment prevention (ie, older adults who are not currently cognitively impaired). • Internet gaming disorder and addiction or alcoholism-related disorders are excluded.

Stage 4: Charting the Data

Our data were charted and sorted according to areas of potential relevance to the research questions including (1) country in which the study was conducted; (2) study site; (3) type of activity; (4) sample size; (5) population age range; (6) sex, if available; (7) type of cognitive impairment; (8) research question or aims; (9) study methods; (10) description of technology; (11) outcomes or findings; and (12) feasibility, as described by study authors. Double data extraction was conducted on the final set of articles included in this review. Using Microsoft Excel, 2 research assistant team members charted the data. A third team member reviewed the charting and coded the data extraction into categories, where relevant.

We did not assess the quality of included studies, as quality assessments are neither required nor appropriate for scoping review methodology [39,43].

Stage 5: Summarizing and Reporting the Data

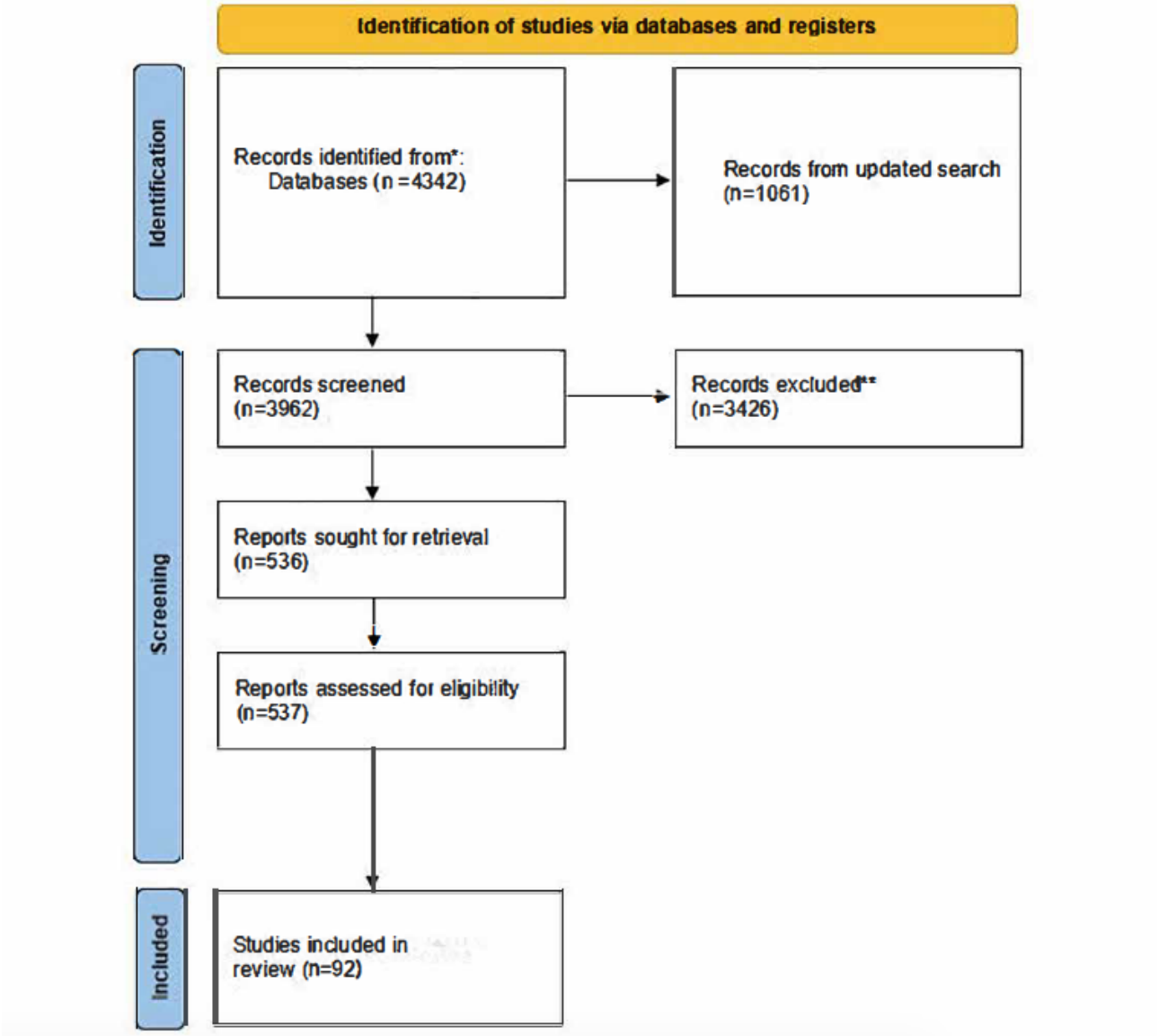
Data were organized numerically using descriptive statistics and summarized using a narrative descriptive synthesis by members of the research team that included gerontologists, nurses, psychologists, and health researchers who provided their perspectives on the findings [44]. The constructs considered for review included age, patient population, technology used, and outcomes.

Results

Overview

Our initial search yielded 4342 results, with a further 1061 results following a search update. Following deduplication, 3962 results were eligible for screening. The screening process resulted in a total of 92 documents, 61 from the original searches, and an additional 31 documents in the updated search. See Figure 1 for the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram [42].

Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram.



Publication dates ranged from 2000 to 2022, with most (57/92, 62%) published between 2016 and 2021, which confirmed an expected interest in the topic over time. Of these 92 documents, 1 paper [45] reported on 3 studies, resulting in a total of 88 studies for analysis. The studies were conducted in multiple countries; mostly in the United States, Canada, and the United Kingdom. Table S2 in Multimedia Appendix 3 outlines the key characteristics of the included studies.

From these studies, 46 employed mixed methods (46/94, 49%), 28 were qualitative (28/94, 30%) and 21 were quantitative (21/94, 22%). Among the qualitative studies, the most common methods for data collection were interviews (9/28, 32%) [45-53] and observational techniques (15/28, 54%) [28,45,47,48,51,54-63]. Among the quantitative studies, the most common methods of data collection consisted of experimental data collection (16/21, 76%) [64-79] and surveys or questionnaires (4/21, 19%) [74,80-82].

Participants Targeted

The sample sizes ranged from 1 [54,81,82] to 139 [84] participants. In total, this review contained 2332 participants. Ages ranged from 50 [85] to 104 [86] years. There were inconsistencies with reporting patient demographics with 11 studies (11/94, 12%) failing to report age range or mean [48,51,56,64,65,71,87-91]. Most studies indicated that they recruited both male and female participants (65/94, 69%). The primary clinical indicator for participants was dementia (unspecified) (60/94, 64%), followed by Alzheimer disease (9/94, 9.5%), and mild cognitive impairment (12/94, 13%). An additional 8 studies (10/94, 11%) reported a mixed form of dementia. Most participants were recruited from either residential care (eg, assisted living) facilities (40/94, 42.5%), day care (eg, senior) centers (19/94, 20%), home (13/94, 14%), hospital inpatients (4/94, 4%) or other health care settings (2/94, 2%), and hospice (1/94, 1%). Only a few studies (14/94, 15%) reported on the ethnicity of participants [24,52,54,57,63,69,83,86,92-97], with mostly White participants participating in all but 1 study [92]. Table S3 in Multimedia Appendix 4 outlines the key characteristics of participants.

Types of Leisure Activities

The types of technology-enabled recreational and leisure activities for older adults with cognitive impairment were categorized as follows: (1) socializing; (2) relaxation and self-awareness; (3) music and dance; (4) exergaming; (5) video or audio (nonmusic) entertainment; (6) playing games; and (7) art. Socializing (46/94, 49%) [48,50,53,58,63,65,66,70-72,76,80,82,84,86,91-94,96,98-114] was the most commonly used recreational and leisure activity; 20 (20/94, 21%) studies used a combination of activities. Examples of how socializing activities were fostered by technology included the use of social (companion [111]) robots (eg, PARO [82,86,102,106,109,110] and MARIO [99,103,113]), online pet companions [101], social recognition watch [93], and Skype on Wheels [87]. According to some articles, these technologies facilitated social engagement as they recognized the gestures, emotions, stimuli, and speech of older adults and engaged them in active conversation [66,98,104,108].

The prevalence of socialization activities was followed by relaxation and self-awareness activities (22/94, 22%) studies [50,52,63-65,68,75,76,81,88,92,94,98,100,102,111,115-121]. These activities were facilitated through various means including virtual reality [65,115,116], computer activities [94], digital life storybooks [121], digital reminiscence therapy [75,111]). Table S4 in Multimedia Appendix 5 outlines the category of activities used in each study.

Types of Technological Delivery

There was a wide range of technology-enabled delivery methods. Most technologies were commercially available. Table S5 in Multimedia Appendix 6 outlines the origin of technology used in each study indicating whether it was obtained commercially (57/94, 61%), developed in-house (17/94, 18%), or a combination of both (20/94, 23%). However, it is important to note that the studies included in the analysis did not provide sufficient information regarding the technological development process.

In addition to robots, as previously mentioned, some studies used game consoles, including those that accurately track the participants' arm, hand, and body movement as well as facial expressions [62,74,84,122,123]. Some interventions were rooted in artificial intelligence to address social and emotional needs by engaging with older adults with speech and touch [46,65,80,98,99,113,124]. Some interventions used tablets [24,49-51,58,60,75,83,85,100,101,105,114,116,119,124-128], televisions [47,49,62,64,68,73,88,120,121], or computers [61,87,90,92,94,95,98,115,116,129,130] to engage participants in auditory and visual activities by stimulating cognition such as through memory stimulation. Other studies used technologies that facilitate simulated and interactive experiences with near-eye displays or touchscreen displays to boost active experience among older adults [85,100,119]. Some of the other tablets included iPads or television sets for software-driven visual interfaces or stimulation, such as creating self-portraits or life stories for older adults [52,58-60,81,87,92,93,96,109,121,131]. The tablets were used to connect residents with friends and family [72,105]. Some researchers delivered musical interventions using devices familiar to older adults, including the radio or MP3 players [45,57,66,87,99,120,131-134].

Outcomes of Interest

The majority of the articles reported positive outcomes (64/92, 69.5%), while a smaller portion had mixed results (28/92, 30%). Table S6 in Multimedia Appendix 7 outlines the measurement of the outcomes, and results. Positive outcome studies generally relied on descriptions of participant experience, such as analysis of interview conversations [50,59,91,135,136], questionnaires [53,78,81,100] and observations [48,49,54,66,68,72,85,97,102,115]. Studies with mixed outcomes tended to rely on the use of measurement tools like physiological tests [87] and observation [47,51,82,94,96,103,124,126,129]. In this context, positive/neutral/negative outcomes refer to the effectiveness and acceptability of the intervention among participants, reflecting both favorable and unfavorable responses.

Mood and Overall Well-Being

In total, 50 articles explored mood and overall well-being (50/94, 53%) [24,28,46-49,51,55,57,61,64,66-68,70,71,74,76,80-82,84,86,87,89,95,96,98,100-102,106-112,114-116,118,119,123,124,126,129,132,137,138]. Platforms such as computers and tablets [87,96,100,119] that helped to deliver virtual reality [115,116,118], exergames [28,74,123], and robotic companions [66,70,71,84,98] overall led to an improvement in mood and overall well-being, including feelings of gratitude [128] and behavioral symptoms of dementia [67]. Mood improvement was primarily measured via techniques such as surveys and questionnaires [46,47,81,98,100,108,112,123] including physiological assessment questionnaires [87] such as the UCLA loneliness scale or Geriatric Depression scale [80]. Improvements in mood were caused by either one or a combination of the following technology-enabled activities: socializing [49,91], music and dance [45,48,49,55,59,61,64,67,76,85,114,129,132], video or audio (nonmusic) entertainment [47,57,101], and art [24,81,124]. Where companionship was a targeted outcome, engagement with technology-enabled activities boosted feelings of excitement and belonging while also decreased feelings of depression, anxiety, and loneliness [80,107,108]. For example, robots or online pets facilitated companionship [101,108]. Online companions were largely pets that provided comfort to older adults that increased mood by allowing them to cuddle, play, or pet them [82,86,106,107,109,110], or watching, touching, or caring for the robot [71,101,138]. One study, however, found an increase in anxiety in individuals with mild cognitive impairment when using robotic pets as companions [101], which was contrary to an intervention which used music [76]. Games and activities with satisfying achievements for completion encouraged high self-esteem and validation among participants, especially when the challenges matched their cognitive abilities [28,61,95,119,125,126] or allowed autonomous art creation or viewing [24,51,124]. Another study which used a mobile-reminiscing therapy app found no change in mood [111].

Cognitive Health

A total of 19 articles (19/94, 20%) explored improvements to cognition facilitated through the use of exergames, tablet and computer applications, and robots or music, which provided stimulation [45-47,52,54-57,59,69,75,81,85,114,121,123,131,132,139]. Technologies that engaged participants in physical activity led to an outcome of improved cognitive health (although this was not defined) as such leisure activities stimulated motor skills often used in athletics [46,54,56]. Exergames were found to increase activity, only if the individual had sufficient cognitive ability (eg, having mild dementia vs severe) [123]. This was measured by a combination of usability testing processes and semistructured interviews [46], or observation combined with field notes ([54,54]. Opportunities to facilitate memories, often facilitated through videos, photos, and music encouraged expressive community engagement and relationship-building through shared experiences [45,47,52,55,57,59,75,85,132,139], provided beneficial cognitive stimuli that helped with conversation, which in turn was believed to be an indicator of improved cognitive health [81,121,131].

Functional Activity

Five articles (5/94, 5%) explored improvements to functioning in daily life. These were facilitated through exercising (via exergames [73,78]), robotic stimulation, and general time management and behavioral strategies [57,73,98,112]. One study classified improved functioning according to the World Health Organization's International Classification of Functioning, Disability and Health [70]. One study found that improved functioning included being able to maintain a schedule [98] and reduce fidgeting [57]. The studies found negative, or no improvement to sleep [57] and memory [93]. There are contrary findings around physical activity through exergames, with 2 studies suggesting negative or no improvement [73,131], and 1 study found that virtual reality cycling improved physical activity [122].

Discussion

The use of technology to deliver recreation and leisure activities for people living with impaired cognition is becoming more commonplace [11-15]. This rapid scoping review identifies and describes the existing literature that describes technologies used in recreation and leisure programs or activities that are delivered to older adults living with cognitive impairment. Our review found a diverse range of activities for older adults with cognitive impairment aged 50 [85] to 104 [86] years old, related to (1) socializing, (2) relaxation and self-awareness, (3) music and dance, (4) exergaming, (5) video or audio (nonmusic) entertainment, (6) playing games, and (7) art. Numerous technologies supported these activities and programs including the use of tablets [24,49-51,58,60,72,75,83,85,100,101,105,114,116,119,124-128], televisions [47,49,52,58-60,62,64,68,73,81,87,88,92,93,96,111,120,121,131], radio and MP3 players [45,57,66,87,99,120,131,132,134] or computers [6,7,61,87,90-92,94,95,98,115,116,129,130]. Touchscreen displays were frequently used to engage older adults in their activities [85,100,119], and some incorporated the use of artificial intelligence [48,49,80]. The technologies focused on obtaining various outcomes, including improving mood [24,28,46-49,51,55,57,61,64,66-68,70,71,74,76,80-82,84,86,87,89,95,96,98,100-102,106-112,114-116,118,119,123,124,126,129,132,137,138] and cognitive stimulation [45-47,52,54-57,59,69,75,81,85,114,121,123,131,132,139]. Many of the included studies reported positive results, supporting the use and effectiveness of some technologies to support recreation and leisure activities. However, study results should be interpreted within the context of their small sample size [56,71,84,92,99-101,107,111,128,131,134] and the lack of consideration for older adults with diverse cognitive and physical disabilities [71,74,84,100].

Technology-Related Challenges Within the Context of Recreation and Leisure Activities for Older Adults Living With Cognitive Impairment

Across the articles, authors raised numerous concerns about the use of technology to facilitate recreation and leisure activities for older adults with cognitive impairment. For instance, authors cautioned that technologies that focus on social interactions are not replacements for human companionship [98,100]. In the context of activities focused on reminiscing, some studies found that older adults may experience distress while observing photographs of deceased family members [99]. Technologies that use multimodal interactions (ie, verbal and visual) may be challenging and confusing for some people living with advanced stages of dementia [49,113]. Likewise, older adults' interest in, and acceptance of Wii and exergames games varied based on their cognitive health; people living with severe dementia were more likely to reject the games; whereas people living with mild dementia enjoyed exergaming but still needed supervision [123]. However, exergaming may not be cost-effective compared to usual treatment [78].

With reminiscence therapy, the process of obtaining relevant artifacts was time-consuming, and required commitment from family members [83]. The use of gaming systems for older adults also raised technical and ethical concerns for some scholars [92,125], as they may perpetuate low self-esteem, insecurity, and annoyance due to a lack of familiarity with the technology and lack of digital literacy [125,126]. Lastly, radios may experience reception issues (eg, static, signal dropping out) that can bother the participants [134]. Beyond the challenges with the technology itself, some studies reported that the technology was expensive, which may present a barrier to wide-spread implementation [78,82,84,109,138].

Many interventions discussed in this review, relied on costly robots, such as PARO [82,86,102,106,109,110], MARIO [99,103,113], and pet companions [101]. While pet companions increase older adults' mood, and robots allow them to care for these robotic pets which in turn increases their enjoyment, robot pets can also cause anxiety in individuals with mild cognitive impairment [101]. These results suggest the need for future research using similar interventions and may provide ideas for testable hypotheses to further investigate the benefits of using robots, including the target population and optimal timing during the illness trajectory. In comparison to tablets, robots can be prohibitively expensive for many older adults and care settings [140-142]. However, robots can often be customized to older

adults' preferences [143,144] unlike other off-the-shelf technologies, and thus might provide broader assistance in their daily lives and overall quality of life. Exploring options to adapt or customize lower-cost technologies like tablets to older adults' preferences may support wider adoption. Moreover, future studies are encouraged to provide more detailed information on how customizations occurred, and the development process for novel technologies. Engaging older adults with cognitive impairments and other stakeholders, such as care partners and health care providers, through a co-design design approach could add value when developing new technologies to support appropriate leisure and recreational activities. This approach helps researchers and technology developers gain in-depth insights into the preferences of different targeted populations [145-147].

Facilitators to Using Technology Within the Context of Recreation and Leisure Activities for Older Adults Living With Cognitive Impairment

Although there were some challenges with the technologies, many studies identified facilitators to their use across a variety of settings, such as having technical support easily accessible to older adults who were not familiar with technology [50]. In addition, hosting the technology in friendly spaces (eg, supportive environment, praise, and freedom to ask questions) helped older adults feel welcome to learn about new technologies [100]. A study found that the technical skills for gaming activities such as Nintendo Wii were learned, retained, and transferred to other leisure activities [54]. The availability of both technical support and emotional support is critical for older people who may not be as comfortable with the technologies as younger people [100]. Moreover, it is important for trainers to know how to communicate with and teach new skills to people living with dementia [28]. For example, certain types of prompts such as verbal prompts might not work well with some older adults [28]. Therefore, trainers must be capable and have a broad range of knowledge translation experience and problem-solving abilities so that people living with dementia will be optimally positioned to learn these new skills [28]. The use of animation and video might also make training processes more effective [81].

One study used robots that included infrared cameras that sent alerts to caregivers and nursing stations in case of emergency, and reminders for scheduled activities [112]. Robots with humanlike characteristics, including variable expressions, helped to engage older adults in recreational activities [108].

Researchers also found that older adults with mild cognitive impairment engage more in computer-based applications if they are provided in a gamified environment [50]. Computer systems with wheels were convenient for residents living in LTC homes as they could be transported from one room to another [92]. One system included a computer, webcam, microphone, speakers, hand or foot pedal for exercise and therapy, joystick, headset, and adjustable height unit for residents to allow play when standing or sitting [92]. Other computer systems could be set up using the existing television in resident rooms [121]. When feasible, setting up a new telephone line specifically for technology can help overcome connectivity and reception issues [134]. It is important to note that when computer activities match the interests and cognitive abilities of residents living with dementia in LTC homes, there is an increase in participation and satisfaction [61]. Verbal encouragement from LTC staff can also facilitate the use of technology [45]. Additionally, technology can help support staff deliver reminiscence therapy without additional training [111].

Few studies in our review reported information about participant ethnicity and comorbid conditions. Studies have shown that the digital divide (ie, the gap between those who have access, knowledge and use of technology, and those who do not [148]) is most pronounced for some racial and ethnic groups [149-151] and older adults [152]. Relying on technology to facilitate connection and belonging, and socialization and enjoyment between residents or with their families, may, therefore, exacerbate existing disparities in the well-being of older adults [153]. To address these disparities and promote inclusivity, research should explore the experiences of diverse older adults when using technology to support social and recreational leisure activities. Other barriers to be overcome include cognition [154], physical ability [154], low research literacy [155], lack of cultural competency [155], and speech- and language barriers [154,155]. These barriers occur in dementia research more broadly and have led to the underrepresentation of certain groups in research [155], limiting the generalizability of existing research.

To overcome these barriers, collaboration with community partners can be instrumental in ensuring inclusive recruitment and data collection strategies [154,156]. Such efforts can increase the representativeness of research samples and improve the translation of research findings to diverse populations and settings, into more effective and equitable technology interventions for engaging older adults in social and recreational leisure activities.

Methodological Recommendations for Researchers

The following 3 recommendations for scientists conducting research in this domain emerged from our analysis of the included articles:

1. Conduct research across settings: Most studies focused on a single setting, but it is suggested that research should be conducted in multiple settings such as home, community care, and health care institutions, because outcomes may vary due to the specific characteristics of each setting [45,99,115]. In addition, including individuals at various stages of cognitive impairment is crucial, as outcomes may vary between early-stage and advanced cognitive impairment [47,115,116]. In fact, few studies recommend prioritizing people with more advanced stages (moderate to severe) of cognitive impairment since there are severe challenges in managing symptoms and improving quality of life [106,115,116].
2. Increase the sample size and representation: Authors emphasized the need to increase sample size, which would allow greater demographic diversity in the research of older adults using technology for leisure and recreation [56,71,84,92,99-101,107,111,128,131,134]. This would include people with various types of disabilities

[71,74,84,100], and a greater number of male participants to gain a better understanding of gender in technology adoption [75]. Furthermore, some scholars have argued for an increase in caregiver samples to help explore how technologies could support them in their caregiving duties and help alleviate their stress, which is often overlooked within existing research [59,100,118].

3. Increase the use of experimental study design: Many studies recommended the use of different research methods, particularly experimental designs that use a control group to understand potential confounding factors [46,82,86,92,99,101,104,129,132]. This will help address questions about the validity of clinical outcomes [101,132]. Additionally, obtaining time series data on adoption and efficacy of technology will also help obtain deeper insights [46,56,57,96,108,118].

This review demonstrates that many existing technologies can support the socialization, relaxation, self-awareness and meaningful recreation and leisure activities of older adults, including playing games and creating art. Existing research has highlighted that engaging older adults living with dementia in meaningful activities can improve their quality of life [157-159]. An existing review explored the use of technology to promote engagement in adults with dementia living in residential aged care [159], whereas another explored technological interventions such as robots, tablets, and computers in the context of loneliness among individuals with dementia [15]. Our review expands on this existing knowledge by incorporating the diverse settings in which older adults engage in social activities, including hospices and community settings. However, a previous review noted that the benefits of engagement are not caused by the technologies themselves but rather in the opportunities the technologies provided to facilitate connection and belonging [159]. Therefore, more research is needed to understand the impact and benefits of technologies to facilitate connection and belonging, in comparison to standard care. Thus, a critical lesson from this review is the need to explore the existing barriers to connection and belonging, as well as the unique functions that technology can provide compared to those that can be provided by individuals such as formal and informal care partners.

In summary, our review confirms the growing interest among researchers in integrating technology into recreational and leisure activities for older adults, with most articles being published in the last 7 years. However, while there is interest in using technologies, there is a lack of large-scale, experimental studies, over time. Several factors may contribute to the limited experimental research in this area including the upfront costs of technology for older adults [160], older adults' training needs [161], and concerns regarding the long-term sustainability of these technology-enabled programs [162,163]. Implementation research is crucial to the scalability of technologies that might support adoption and sustainability [164,165]; its scarcity is notable in the existing body of literature. Additionally, the literature rarely described technologies being used across multiple care settings or the progression of diseases or conditions. Future research with different stages and settings will provide more insight into the diverse perspectives and values that participants bring when considering leisure activities [51].

Limitations

This study had several limitations. First, we only included English-language literature and excluded gray literature and conference abstracts, which may present preliminary findings. Consequently, it is possible that relevant literature was not captured by our search. Lastly, while we ran comprehensive electronic searches and adhered to an established methodology [40], the nature of a rapid scoping review including only 1-screener may have resulted in missed articles.

Conclusions

Technology has continued to emerge as a way to help engage older adults living with dementia in social and recreational leisure activities. Despite the availability of various digital technologies and their evaluation studies in the context of older adults, the literature is very sparse regarding how and how well they are developed, adopted, sustained, and evaluated. Current studies focus on the use of tablets, robots, televisions, computers, exergames, and radios, but little is known about the acceptability and feasibility of them in diverse settings, or about their clinical effectiveness. Moreover, included articles lack discussion on the adaptation of these technologies for older adults living with cognitive impairment and various forms of disabilities. Future research should take a more inclusive approach, incorporating design and development (ie, co-design approaches), testing, and implementation of technologies in diverse settings including home, community care, and health care institutions, and include a more diverse sample of older adults. By considering the specific needs and challenges faced by older adults living with cognitive impairment and other types of disabilities, researchers can develop technology-enabled recreation and leisure activities that are better suited to their unique requirements and promote their effective use in different contexts.

Data Availability

The data sets used in this study are available upon request. Access to these data sets can be requested by contacting KK at kristina.kokorelias@sinaihealth.ca. While not publicly accessible, all reasonable requests for data will be considered in compliance with our institutional policies and regulatory obligations.

Conflicts of Interest

None declared.

Multimedia Appendix 1

PRISMA checklist.
[DOCX File , 35 KB-Multimedia Appendix 1]

Multimedia Appendix 2

Search strategy.
[DOC File , 176 KB-Multimedia Appendix 2]

Multimedia Appendix 3

Characteristics of included peer-reviewed studies.
[DOCX File , 104 KB-Multimedia Appendix 3]

Multimedia Appendix 4

Target and actual sample.
[DOCX File , 109 KB-Multimedia Appendix 4]

Multimedia Appendix 5

Types of activities.
[DOCX File , 67 KB-Multimedia Appendix 5]

Multimedia Appendix 6

Creation of technology.
[DOCX File , 28 KB-Multimedia Appendix 6]

Multimedia Appendix 7

Study outcomes and measurements.
[DOCX File , 54 KB-Multimedia Appendix 7]

References

1. Singh B, Kiran UV. Recreational activities for senior citizens. IOSR J Human Soc Sci. 2014;19(4):24-30. [doi: 10.9790/0837-19472430]
2. Son JS, Nimrod G, West ST, Janke MC, Liechty T, Naar JJ. Promoting older adults' physical activity and social well-being during COVID-19. Leis Sci. 2020;43(1-2):287-294. [doi: 10.1080/01490400.2020.1774015]
3. Sala G, Jopp D, Gobet F, Ogawa M, Ishioka Y, Masui Y, et al. The impact of leisure activities on older adults' cognitive function, physical function, and mental health. PLoS One. 2019;14(11):e0225006. [FREE Full text] [doi: 10.1371/journal.pone.0225006] [Medline: 31703115]
4. Yoon JI, Kyle G, Hsu YC, Absher J. Coping with crowded recreation settings: a cross-cultural investigation. J Leis Res. 2020;52(1):1-21. [doi: 10.1080/00222216.2020.1740630]
5. Genoe MR, Johnstone JL. The impact of COVID-19 on therapeutic recreation practice in long-term care homes across Canada. World Leis J. 2021;63(3):265-280. [doi: 10.1080/16078055.2021.1957011]
6. Stoddart SR, Courtney-Pratt H, Andrews S. Barriers and enablers to leisure provision in residential aged care: personal care attendant perspectives. Ageing & Society. 2022;44(6):1308-1328. [doi: 10.1017/s0144686x2200071x]
7. Innes A, Page SJ, Cutler C. Barriers to leisure participation for people with dementia and their carers: an exploratory analysis of carer and people with dementia's experiences. Dementia (London). 2016;15(6):1643-1665. [doi: 10.1177/1471301215570346] [Medline: 25673650]
8. Telenius EW, Tangen GG, Eriksen S, Rokstad AMM. Fun and a meaningful routine: the experience of physical activity in people with dementia. BMC Geriatr. 2022;22(1):500. [FREE Full text] [doi: 10.1186/s12877-022-03149-6] [Medline: 35689197]
9. Chamberlain SA, Gruneir A, Keefe JM, Berendonk C, Corbett K, Bishop R, et al. Evolving partnerships: engagement methods in an established health services research team. Res Involv Engagem. 2021;7(1):71. [FREE Full text] [doi: 10.1186/s40900-021-00314-w] [Medline: 34627403]
10. Gamito P, Oliveira J, Alves C, Santos N, Coelho C, Brito R. Virtual reality-based cognitive stimulation to improve cognitive functioning in community elderly: a controlled study. Cyberpsychol Behav Soc Netw. 2020;23(3):150-156. [doi: 10.1089/cyber.2019.0271] [Medline: 32031888]

11. Astell AJ. Technology and dementia: the future is now. Dement Geriatr Cogn Disord. 2019;47(3):129-130. [FREE Full text] [doi: 10.1159/000497799] [Medline: 31234175]
12. Lazar A, Thompson HJ, Demiris G. Design recommendations for recreational systems involving older adults living with dementia. J Appl Gerontol. 2018;37(5):595-619. [doi: 10.1177/0733464816643880] [Medline: 27106883]
13. Joddrell P, Astell AJ. Studies involving people with dementia and touchscreen technology: a literature review. JMIR Rehabil Assist Technol. 2016;3(2):e10. [FREE Full text] [doi: 10.2196/rehab.5788] [Medline: 28582254]
14. Evans J, Brown M, Coughlan T, Lawson G, Craven MP. A systematic review of dementia focused assistive technology. Springer; 2015. Presented at: Human-Computer Interaction: Interaction Technologies: 17th International Conference, HCI International 2015, Los Angeles, CA, USA, August 2-7, 2015, Proceedings, Part II 17; 2015 Aug 02; USA. [doi: 10.1007/978-3-319-20916-6_38]
15. Anderson M, Menon R, Oak K, Allan L. The use of technology for social interaction by people with dementia: a scoping review. PLOS Digit Health. 2022;1(6):e0000053. [FREE Full text] [doi: 10.1371/journal.pdig.0000053] [Medline: 36812560]
16. Genoe R, Kulczycki C, Marston H, Freeman S, Musselwhite C, Rutherford H. E-leisure and older adults: findings from an international exploratory study. TRJ. 2018;52(1):1. [doi: 10.18666/trj-2018-v52-i1-8417]
17. Gallistl V, Nimrod G. Online leisure and wellbeing in later life. Perspectives on human-computer interaction research with older people. 2019:139-154. [doi: 10.1007/978-3-030-06076-3_9]
18. Astell AJ, Smith SK, Potter S, Preston-Jones E. Computer interactive reminiscence and conversation aid groups-delivering cognitive stimulation with technology. Alzheimers Dement (NY). 2018;4:481-487. [FREE Full text] [doi: 10.1016/j.trci.2018.08.003] [Medline: 30258977]
19. Tominari M, Uozumi R, Becker C, Kinoshita A. Reminiscence therapy using virtual reality technology affects cognitive function and subjective well-being in older adults with dementia. Cogent Psychology. 2021;8(1):1968991. [doi: 10.1080/23311908.2021.1968991]
20. Dowson B, Atkinson R, Barnes J, Barone C, Cutts N, Donnebaum E, et al. Digital approaches to music-making for people with dementia in response to the COVID-19 pandemic: current practice and recommendations. Front Psychol. 2021;12:625258. [FREE Full text] [doi: 10.3389/fpsyg.2021.625258] [Medline: 33967893]
21. Moyle W, Jones C, Sung B. Telepresence robots: encouraging interactive communication between family carers and people with dementia. Australas J Ageing. 2020;39(1):e127-e133. [doi: 10.1111/ajag.12713] [Medline: 31364792]
22. Rose V, Stewart I, Jenkins KG, Tabbaa L, Ang CS, Matsangidou M. Bringing the outside in: the feasibility of virtual reality with people with dementia in an inpatient psychiatric care setting. Dementia (London). 2021;20(1):106-129. [doi: 10.1177/1471301219868036] [Medline: 31510801]
23. Hendriks I, Meiland FJM, Slotwinska K, Kroeze R, Weinstein H, Gerritsen DL, et al. How do people with dementia respond to different types of art? An explorative study into interactive museum programs. Int Psychogeriatr. 2019;31(6):857-868. [doi: 10.1017/S1041610218001266] [Medline: 30560737]
24. Tyack C, Camic PM, Heron MJ, Hulbert S. Viewing art on a tablet computer: a well-being intervention for people with dementia and their caregivers. J Appl Gerontol. 2017;36(7):864-894. [doi: 10.1177/0733464815617287] [Medline: 26675353]
25. Chauhan S. Dementia and sculpture-making: exploring artistic responses of people with dementia. Dementia (London). 2020;19(2):416-432. [doi: 10.1177/1471301218777446] [Medline: 29783890]
26. Carlock-Russo M. Reaching older adults through virtual art therapy. In: Virtual Art Therapy. London. Routledge; 2022:96-107.
27. Geun-Ho L. Effects of a virtual reality exercise program(Wii) on cognitive function of elderly people with alzheimer dementia. Asian J Kinesiol. 2017;19(1):35-44. [doi: 10.15758/jkak.2017.19.1.35]
28. Dove E, Astell A. The Kinect Project: group motion-based gaming for people living with dementia. Dementia (London). 2019;18(6):2189-2205. [doi: 10.1177/1471301217743575] [Medline: 29192511]
29. Dove E, Astell AJ. The use of motion-based technology for people living with dementia or mild cognitive impairment: a literature review. J Med Internet Res. 2017;19(1):e3. [FREE Full text] [doi: 10.2196/jmir.6518] [Medline: 28077346]
30. Burns A, Lobo A, Olde Rikkert M, Robert P, Sartorius N, Semrau M, et al. COVID-19 and dementia: experience from six European countries. Int J Geriatr Psychiatry. 2021;36(6):943-949. [FREE Full text] [doi: 10.1002/gps.5497] [Medline: 33462849]
31. Rivera-Torres S, Mpofu E, Jean Keller M, Ingman S. Older adults' mental health through leisure activities during COVID-19: a scoping review. Gerontol Geriatr Med. 2021;7:23337214211036776. [FREE Full text] [doi: 10.1177/23337214211036776] [Medline: 34395816]
32. Haslam-Larmer L, Grigorovich A, Quirt H, Engel K, Stewart S, Rodrigues K, et al. Prevalence, causes, and consequences of moral distress in healthcare providers caring for people living with dementia in long-term care during a pandemic. Dementia (London). 2023;22(1):5-27. [FREE Full text] [doi: 10.1177/14713012221124995] [Medline: 36240074]
33. Kirkham J, Shorey CL, Iaboni A, Quirt H, Grigorovich A, Astell A, et al. Staff perceptions of the consequences of COVID-19 on quality of dementia care for residents in Ontario long-term care homes. Int J Geriatr Psychiatry. 2022;37(6):10.1002/gps.5725. [FREE Full text] [doi: 10.1002/gps.5725] [Medline: 35510483]
34. Levy AM, Grigorovich A, McMurray J, Quirt H, Ranft K, Engell K, et al. Implementation of the Dementia Isolation Toolkit in long-term care improves awareness but does not reduce moral distress amongst healthcare providers. BMC Health Serv Res. Apr 18, 2024;24(1):481. [FREE Full text] [doi: 10.1186/s12913-024-10912-5] [Medline: 38637814]

35. Iaboni A, Grigorovich A, Barned C, Rodrigues K, Kontos P, Chu C, et al. Dementia Isolation Toolkit Team. Dementia Isolation Toolkit. Apr 23, 2020. URL: https://dementiaisolationtoolkit.com/wp-content/uploads/2020/09/Dementia-Isolation-Toolkit-Full-1.pdf
36. Ryoo N, Pyun J, Baek MJ, Suh J, Kang MJ, Wang MJ, et al. Coping with dementia in the middle of the COVID-19 pandemic. J Korean Med Sci. 2020;35(42):e383. [FREE Full text] [doi: 10.3346/jkms.2020.35.e383] [Medline: 33140593]
37. Tricco AC, Langlois EV, Straus SE. Rapid reviews to strengthen health policy and systems: a practical guide. Switzerland. World Health Organization; 2017.
38. Tricco AC, Lillie E, Zarin W, O'Brien K, Colquhoun H, Kastner M, et al. A scoping review on the conduct and reporting of scoping reviews. BMC Med Res Methodol. 2016;16:15. [FREE Full text] [doi: 10.1186/s12874-016-0116-4] [Medline: 26857112]
39. Colquhoun HL, Levac D, O'Brien KK, Straus S, Tricco AC, Perrier L, et al. Scoping reviews: time for clarity in definition, methods, and reporting. J Clin Epidemiol. 2014;67(12):1291-1294. [doi: 10.1016/j.jclinepi.2014.03.013] [Medline: 25034198]
40. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Social Res Methodol. 2005;8(1):19-32. [doi: 10.1080/1364557032000119616]
41. Garritty C, Gartlehner G, Nussbaumer-Streit B, King VJ, Hamel C, Kamel C, et al. Cochrane rapid reviews methods group offers evidence-informed guidance to conduct rapid reviews. J Clin Epidemiol. 2021;130:13-22. [FREE Full text] [doi: 10.1016/j.jclinepi.2020.10.007] [Medline: 33068715]
42. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. Ann Intern Med. 2018;169(7):467-473. [FREE Full text] [doi: 10.7326/M18-0850] [Medline: 30178033]
43. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. Implement Sci. 2010;5:69. [FREE Full text] [doi: 10.1186/1748-5908-5-69] [Medline: 20854677]
44. Paré G, Trudel MC, Jaana M, Kitsiou S. Synthesizing information systems knowledge: a typology of literature reviews. Inf Manage. 2015;52(2):183-199. [doi: 10.1016/j.im.2014.08.008]
45. Sixsmith A, Orpwood RD, Torrington JM. Developing a music player for people with dementia. Orig Res. 2010;9(3):421-427. [doi: 10.4017/gt.2010.09.03.004.00]
46. Chu CH, Biss RK, Cooper L, Quan AML, Matulis H. Exergaming platform for older adults residing in long-term care homes: user-centered design, development, and usability study. JMIR Serious Games. 2021;9(1):e22370. [FREE Full text] [doi: 10.2196/22370] [Medline: 33687337]
47. Damianakis T, Crete-Nishihata M, Smith KL, Baecker RM, Marziali E. The psychosocial impacts of multimedia biographies on persons with cognitive impairments. Gerontologist. 2010;50(1):23-35. [doi: 10.1093/geront/gnp104] [Medline: 19592639]
48. Kontos P, Grigorovich A, Kosurko A, Bar RJ, Herron RV, Menec VH, et al. Dancing with dementia: exploring the embodied dimensions of creativity and social engagement. Gerontologist. 2021;61(5):714-723. [FREE Full text] [doi: 10.1093/geront/gnaa129] [Medline: 32909607]
49. Kosurko A, Herron RV, Grigorovich A, Bar RJ, Kontos P, Menec V, et al. Dance wherever you are: the evolution of multimodal delivery for social inclusion of rural older adults. Innov Aging. 2022;6(2):igab058. [FREE Full text] [doi: 10.1093/geroni/igab058] [Medline: 35155836]
50. Scase M, Kreiner K, Ascolese A. Development and evaluation of cognitive games to promote health and wellbeing in elderly people with mild cognitive impairment. Stud Health Technol Inform. 2018;248:255-262. [Medline: 29726445]
51. Lazar A, Edasis C, Piper AM. Supporting people with dementia in digital social sharing. 2017. Presented at: Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems; 2017 May 02; United States. [doi: 10.1145/3025453.3025586]
52. Sweeney L, Wolverson E, Clarke C. Understanding the shared experiences of creating a digital life story with individuals with dementia and their spouse. Dementia (London). 2021;20(5):1791-1813. [doi: 10.1177/1471301220970403] [Medline: 33131329]
53. Van Assche M, Moreels T, Petrovic M, Cambier D, Calders P, Van de Velde D. The role of a socially assistive robot in enabling older adults with mild cognitive impairment to cope with the measures of the COVID-19 lockdown: a qualitative study. Scand J Occup Ther. 2023;30(1):42-52. [doi: 10.1080/11038128.2021.2009560] [Medline: 34871144]
54. Leahey A, Singleton JF. Utilizing therapeutic recreation to empower persons with alzheimer's in a day center. Therapeutic Recreation Journal. 2011;45(2):135-146.
55. Mandzuk L, Jennifer K, Hillier RJ. Personalized music... so simple yet so powerful: a pilot initiative for hospitalized older adults living with dementia in an acute care facility. Perspectives. 2018;40(2):15-18.
56. Merilampi S, Koivisto A, Virkki J. Activation game for older adults? Development and initial user experiences. IEEE; 2018. Presented at: 2018 IEEE 6th International Conference on Serious Games and Applications for Health (SeGAH); 2018 May 16; Vienna, Austria. [doi: 10.1109/segah.2018.8401351]
57. Olsen RV, Hutchings BL, Ehrenkrantz E. “Media Memory Lane” interventions in an alzheimer's day care center. American Journal of Alzheimer's Disease. 2016;15(3):163-175. [doi: 10.1177/153331750001500307]
58. Samuelsson C, Ekström A. Digital communication support in interaction involving people with dementia. Logoped Phoniatr Vocol. 2019;44(1):41-50. [FREE Full text] [doi: 10.1080/14015439.2019.1554856] [Medline: 30739510]

59. Smith KL, Crete-Nishihata M, Damianakis T, Baecker RM, Marziali E. Multimedia biographies: a reminiscence and social stimulus tool for persons with cognitive impairment. Journal of Technology in Human Services. 2009;27(4):287-306. [doi: 10.1080/15228830903329831]
60. Smith L, Argentina V. The Usability of Physical Activity and Cognitive Training Applications in People With Mild Cognitive Impairment. Res Gerontol Nurs. 2020;13(2):64-72. [doi: 10.3928/19404921-20190930-04] [Medline: 31584688]
61. Tak SH, Beck C, Hong SH. Feasibility of providing computer activities for nursing home residents with dementia. Nonpharmacol Ther Dement. 2013;3(1):1-10. [FREE Full text] [Medline: 25343006]
62. Unbehaun D, Vaziri DD, Aal K, Wieching R. Exploring the potential of exergames to affect the social and daily life of people with dementia and their caregivers. 2018. Presented at: Proceedings of the 2018 chi conference on human factors in computing systems; 2018 Apr 19; United States. [doi: 10.1145/3173574.3173636]
63. Park J, Hung L, Randhawa P, Surage J, Sullivan M, Levine H, et al. 'Now i can bend and meet people virtually in my home': the experience of a remotely supervised online chair yoga intervention and visual socialisation among older adults with dementia. Int J Older People Nurs. 2023;18(1):e12513. [doi: 10.1111/opn.12513] [Medline: 36373431]
64. Prieto Álvarez L. Neurologic music therapy with a habilitative approach for older adults with dementia: a feasibility study. Music Therapy Perspectives. 2022;40(1):76-83. [doi: 10.1093/mtp/miab021]
65. Benham S, Trinh L, Kropinski K, Grampurohit N. Effects of community-based virtual reality on daily activities and quality of life. Physical & Occupational Therapy In Geriatrics. 2022;40(3):319-336. [doi: 10.1080/02703181.2022.2033903]
66. Cruz-Sandoval D, Favela J. Incorporating conversational strategies in a social robot to interact with people with dementia. Dement Geriatr Cogn Disord. 2019;47(3):140-148. [doi: 10.1159/000497801] [Medline: 31247627]
67. Dahms R, Eicher C, Haesner M, Mueller-Werdan U. Influence of music therapy and music-based interventions on dementia: a pilot study. J Music Ther. 2021;58(3):e12-e36. [doi: 10.1093/jmt/thab005] [Medline: 33948656]
68. Kim J, Rados R, Kil N, Kono S, Kensinger K. Nature-based video and classical music's effects on tranquility among memory care residents with dementia. Am J of Rec Therapy. 2021;19(4):35-40. [doi: 10.5055/ajrt.2020.0225]
69. Li F, Harmer P, Fitzgerald K, Winters-Stone K. A cognitively enhanced online tai ji quan training intervention for community-dwelling older adults with mild cognitive impairment: a feasibility trial. BMC Geriatr. 2022;22(1):76. [FREE Full text] [doi: 10.1186/s12877-021-02747-0] [Medline: 35078407]
70. Obayashi K, Kodate N, Masuyama S. Measuring the impact of age, gender and dementia on communication-robot interventions in residential care homes. Geriatr Gerontol Int. 2020;20(4):373-378. [doi: 10.1111/ggi.13890] [Medline: 32077237]
71. Perugia G, Diaz Doladeras M, Mallofre AC, Rauterberg M, Barakova E. Modelling engagement in dementia through behaviour. Contribution for socially interactive robotics. IEEE Int Conf Rehabil Robot. 2017;2017:1112-1117. [doi: 10.1109/ICORR.2017.8009398] [Medline: 28813970]
72. Prophater LE, Fazio S, Nguyen LT, Hueluer G, Peterson LJ, Sherwin K, et al. Alzheimer's association project VITAL: a florida statewide initiative using technology to impact social isolation and well-being. Front Public Health. 2021;9:720180. [FREE Full text] [doi: 10.3389/fpubh.2021.720180] [Medline: 34926365]
73. van Santen J, Dröes RM, Twisk JW, Blanson Henkemans OA, van Straten A, Meiland FJ. Effects of exergaming on cognitive and social functioning of people with dementia: a randomized controlled trial. J Am Med Dir Assoc. 2020;21(12):1958-1967. [FREE Full text] [doi: 10.1016/j.jamda.2020.04.018] [Medline: 32651132]
74. Weybright EH, Dattilo J, Rusch FR. Effects of an interactive video game (Nintendo Wii™) on older women with mild cognitive impairment. Therapeutic Recreation Journal. 2010;44(4):271.
75. Moon S, Park K. The effect of digital reminiscence therapy on people with dementia: a pilot randomized controlled trial. BMC Geriatr. 2020;20(1):166. [FREE Full text] [doi: 10.1186/s12877-020-01563-2] [Medline: 32375661]
76. Cheung DSK, Ho LYW, Chan LCK, Kwok RKH, Lai CKY. A home-based dyadic music-with-movement intervention for people with dementia and caregivers: a hybrid type 2 cluster-randomized effectiveness-implementation design. Clin Interv Aging. 2022;17:1199-1216. [FREE Full text] [doi: 10.2147/CIA.S370661] [Medline: 35978943]
77. Gedde MH, Husebo BS, Vahia IV, Mannseth J, Vislapuu M, Naik M, et al. Impact of COVID-19 restrictions on behavioural and psychological symptoms in home-dwelling people with dementia: a prospective cohort study (PAN.DEM). BMJ Open. 2022;12(1):e050628. [FREE Full text] [doi: 10.1136/bmjopen-2021-050628] [Medline: 35074810]
78. van Santen J, Meiland FJM, Dröes RM, van Straten A, Bosmans JE. Cost-effectiveness of exergaming compared to regular day-care activities in dementia: results of a randomised controlled trial in the Netherlands. Health Soc Care Community. 2022;30(5):e1794-e1804. [FREE Full text] [doi: 10.1111/hsc.13608] [Medline: 34657346]
79. Zhu YZ, Lin CF, Yang HL, Jin G, Chiu HL. Effects of exergaming on cognitive functions and loneliness of older adults with cognitive frailty. Int J Geriatr Psychiatry. 2023;38(6):e5944. [doi: 10.1002/gps.5944] [Medline: 37260087]
80. Fields N, Xu L, Greer J, Murphy E. Shall i compare thee…to a robot? An exploratory pilot study using participatory arts and social robotics to improve psychological well-being in later life. Aging Ment Health. 2021;25(3):575-584. [doi: 10.1080/13607863.2019.1699016] [Medline: 31851830]
81. Hashim AHA, Ismail AN, Rias RM, Mohamed A. The development of an individualized digital memory book for alzheimer's disease patient: a case study. IEEE; 2015. Presented at: 2015 International Symposium on Technology Management and Emerging Technologies (ISTMET); 2015 Aug 25; Langkawai Island. [doi: 10.1109/istmet.2015.7359034]

82. Koh IS, Kang HS. Effects of intervention using PARO on the cognition, emotion, problem behavior, and social interaction of elderly people with dementia. J Korean Acad Community Health Nurs. 2018;29(3):300-309. [doi: 10.12799/jkachn.2018.29.3.300]
83. Massimi M, Berry E, Browne G, Smyth G, Watson P, Baecker RM. An exploratory case study of the impact of ambient biographical displays on identity in a patient with alzheimer's disease. Neuropsychol Rehabil. 2008;18(5-6):742-765. [doi: 10.1080/09602010802130924] [Medline: 18609021]
84. Chu MT, Khosla R, Khaksar SMS, Nguyen K. Service innovation through social robot engagement to improve dementia care quality. Assist Technol. 2017;29(1):8-18. [doi: 10.1080/10400435.2016.1171807] [Medline: 27064692]
85. Peeters MMM, Harbers M, Neerincx MA. Designing a personal music assistant that enhances the social, cognitive, and affective experiences of people with dementia. Computers in Human Behavior. 2016;63:727-737. [doi: 10.1016/j.chb.2016.06.003]
86. Kelly PA, Cox LA, Petersen SF, Gilder RE, Blann A, Autrey AE, et al. The effect of PARO robotic seals for hospitalized patients with dementia: a feasibility study. Geriatr Nurs. 2021;42(1):37-45. [doi: 10.1016/j.gerinurse.2020.11.003] [Medline: 33221556]
87. Chidester AS, Sautter S, Aravich P, Ord A. 02 - 12 - 06: Transforming dementia care and quality of life using innovative touch screen computer engagement: a research study - the birdsong initiative. Alzheimer's & Dementia. 2016;12(7S_Part_5):P259-P260. [doi: 10.1016/j.jalz.2016.06.465]
88. Kajiyama BK, Dib LRC, Tymchuk AJ, Boxer AL, Kixmiller JS, Olinsky CJ. Improving the quality of life for caregivers and care recipients with personalized video channels. Clinical Gerontologist. 2007;31(1):95-100. [doi: 10.1300/j018v31n01_07]
89. Kalantari S, Bill Xu T, Mostafavi A, Lee A, Barankevich R, Boot WR, et al. Using a nature-based virtual reality environment for improving mood states and cognitive engagement in older adults: a mixed-method feasibility study. Innov Aging. 2022;6(3):igac015. [FREE Full text] [doi: 10.1093/geroni/igac015] [Medline: 35592668]
90. Lancioni GE, Singh NN, O'Reilly MF, Sigafoos J, D'Amico F, Sasanelli G, et al. Persons with alzheimer's disease engage in leisure and mild physical activity with the support of technology-aided programs. Res Dev Disabil. 2015;37:55-63. [doi: 10.1016/j.ridd.2014.11.004] [Medline: 25460220]
91. Masoud SS, Meyer KN, Martin Sweet L, Prado PJ, White CL. "We Don't Feel so Alone": a qualitative study of virtual memory cafés to support social connectedness among individuals living with dementia and care partners during COVID-19. Front Public Health. 2021;9:660144. [FREE Full text] [doi: 10.3389/fpubh.2021.660144] [Medline: 34055724]
92. Lazar A, Demiris G, Thompson HJ. Evaluation of a multifunctional technology system in a memory care unit: opportunities for innovation in dementia care. Inform Health Soc Care. 2016;41(4):373-386. [FREE Full text] [doi: 10.3109/17538157.2015.1064428] [Medline: 26819070]
93. McCarron HR, Zmora R, Gaugler JE. A web-based mobile app with a smartwatch to support social engagement in persons with memory loss: pilot randomized controlled trial. JMIR Aging. 2019;2(1):e13378. [FREE Full text] [doi: 10.2196/13378] [Medline: 31518270]
94. Tak SH, Zhang H, Patel H, Hong SH. Computer activities for persons with dementia. Gerontologist. 2015;55(Suppl 1):S40-S49. [doi: 10.1093/geront/gnv003] [Medline: 26055780]
95. Topo P, Mäki O, Saarikalle K, Clarke N, Begley E, Cahill S, et al. Assessment of a music-based multimedia program for people with dementia. Dementia. 2016;3(3):331-350. [doi: 10.1177/1471301204045164]
96. Zamir S, Hennessy C, Taylor A, Jones R. Intergroup 'Skype' quiz sessions in care homes to reduce loneliness and social isolation in older people. Geriatrics (Basel). 2020;5(4):90. [FREE Full text] [doi: 10.3390/geriatrics5040090] [Medline: 33187242]
97. Hird N, Osaki T, Ghosh S, Palaniappan SK, Maeda K. Enabling personalization for digital cognitive stimulation to support communication with people with dementia: pilot intervention study as a prelude to AI development. JMIR Form Res. 2024;8:e51732. [FREE Full text] [doi: 10.2196/51732] [Medline: 38227357]
98. Abdollahi H, Mollahosseini A, Lane JT, Mahoor MH. A pilot study on using an intelligent life-like robot as a companion for elderly individuals with dementia and depression. IEEE; 2017. Presented at: 2017 IEEE-RAS 17th International Conference on Humanoid Robotics (Humanoids); 2017 Nov 15; UK. [doi: 10.1109/humanoids.2017.8246925]
99. Barrett E, Burke M, Whelan S, Santorelli A, Oliveira BL, Cavallo F, et al. Evaluation of a companion robot for individuals with dementia: quantitative findings of the MARIO project in an irish residential care setting. J Gerontol Nurs. 2019;45(7):36-45. [doi: 10.3928/00989134-20190531-01] [Medline: 31237660]
100. Chen K, Lou VWQ, Lo SSC. Exploring the acceptance of tablets usage for cognitive training among older people with cognitive impairments: A mixed-methods study. Appl Ergon. 2021;93:103381. [doi: 10.1016/j.apergo.2021.103381] [Medline: 33578065]
101. Demiris G, Thompson HJ, Lazar A, Lin SY. Evaluation of a digital companion for older adults with mild cognitive impairment. AMIA Annu Symp Proc. 2016;2016:496-503. [FREE Full text] [Medline: 28269845]
102. Dinesen B, Hansen HK, Grønborg GB, Dyrvig A, Leisted SD, Stenstrup H, et al. Use of a social robot (LOVOT) for persons with dementia: exploratory study. JMIR Rehabil Assist Technol. 2022;9(3):e36505. [FREE Full text] [doi: 10.2196/36505] [Medline: 35916689]

103. D'Onofrio G, Sancarlo D, Raciti M, Burke M, Teare A, Kovacic T, et al. MARIO project: validation and evidence of service robots for older people with dementia. J Alzheimers Dis. 2019;68(4):1587-1601. [doi: 10.3233/JAD-181165] [Medline: 30958360]
104. Faw MH, Buley T, Malinin LH. Being there: exploring virtual symphonic experience as a salutogenic design intervention for older adults. Front Psychol. 2021;12:541656. [FREE Full text] [doi: 10.3389/fpsyg.2021.541656] [Medline: 34925115]
105. Hoel V, Ambugo EA, Wolf-Ostermann K. Sustaining our relationship: dyadic interactions supported by technology for people with dementia and their informal caregivers. Int J Environ Res Public Health. 2022;19(17):10956. [FREE Full text] [doi: 10.3390/ijerph191710956] [Medline: 36078671]
106. Hung L, Gregorio M, Mann J, Wallsworth C, Horne N, Berndt A, et al. Exploring the perceptions of people with dementia about the social robot PARO in a hospital setting. Dementia (London). 2021;20(2):485-504. [FREE Full text] [doi: 10.1177/1471301219894141] [Medline: 31822130]
107. Jøranson N, Pedersen I, Rokstad AMM, Aamodt G, Olsen C, Ihlebæk C. Group activity with paro in nursing homes: systematic investigation of behaviors in participants. Int Psychogeriatr. 2016;28(8):1345-1354. [doi: 10.1017/S1041610216000120] [Medline: 27019225]
108. Khosla R, Chu M, Khaksar SMS, Nguyen K, Nishida T. Engagement and experience of older people with socially assistive robots in home care. Assist Technol. 2021;33(2):57-71. [doi: 10.1080/10400435.2019.1588805] [Medline: 31063044]
109. Liang A, Piroth I, Robinson H, MacDonald B, Fisher M, Nater UM, et al. A pilot randomized trial of a companion robot for people with dementia living in the community. J Am Med Dir Assoc. 2017;18(10):871-878. [doi: 10.1016/j.jamda.2017.05.019] [Medline: 28668664]
110. Šabanović S, Bennett CC, Chang WL, Huber L. PARO robot affects diverse interaction modalities in group sensory therapy for older adults with dementia. IEEE Int Conf Rehabil Robot. 2013;2013:6650427. [doi: 10.1109/ICORR.2013.6650427] [Medline: 24187245]
111. Yu F, Mathiason MA, Johnson K, Gaugler JE, Klassen D. Memory matters in dementia: efficacy of a mobile reminiscing therapy app. Alzheimers Dement (N Y). 2019;5:644-651. [FREE Full text] [doi: 10.1016/j.trci.2019.09.002] [Medline: 31720365]
112. Obayashi K, Kodate N, Masuyama S. Assessing the impact of an original soft communicative robot in a nursing home in Japan: will softness or conversations bring more smiles to older people? Int J Soc Robot. 2022;14(3):645-656. [FREE Full text] [doi: 10.1007/s12369-021-00815-4] [Medline: 34394770]
113. Kouroupetroglou C, Casey D, Raciti M, Barrett E, D'Onofrio G, Ricciardi F, et al. Interacting with dementia: the MARIO approach. Stud Health Technol Inform. 2017;242:38-47. [Medline: 28873774]
114. Berge LI, Gedde MH, Torrado Vidal JC, Husebo B, Hynninen KM, Knardal SE, et al. The acceptability, adoption, and feasibility of a music application developed using participatory design for home-dwelling persons with dementia and their caregivers. The "Alight" app in the LIVE@Home.Path trial. Front Psychiatry. 2022;13:949393. [FREE Full text] [doi: 10.3389/fpsyt.2022.949393] [Medline: 36061298]
115. Appel L, Appel E, Bogler O, Wiseman M, Cohen L, Ein N, et al. Older adults with cognitive and/or physical impairments can benefit from immersive virtual reality experiences: a feasibility study. Front Med (Lausanne). 2019;6:329. [FREE Full text] [doi: 10.3389/fmed.2019.00329] [Medline: 32010701]
116. Appel L, Appel E, Kisonas E, Pasat Z, Mozeson K, Vemulakonda J, et al. Virtual reality for veteran relaxation (VR2) – introducing VR-therapy for veterans with dementia – challenges and rewards of the therapists behind the scenes. Front Virtual Real. 2021;2:104. [doi: 10.3389/frvir.2021.720523]
117. Evans N, Cheston R, Harris N. Personal message cards: an evaluation of an alternative method of delivering simulated presence therapy. Dementia (London). 2016;15(6):1703-1715. [doi: 10.1177/1471301215574363] [Medline: 25767142]
118. Ferguson C, Shade MY, Blaskewicz Boron J, Lyden E, Manley NA. Virtual reality for therapeutic recreation in dementia hospice care: a feasibility study. Am J Hosp Palliat Care. 2020;37(10):809-815. [doi: 10.1177/1049909120901525] [Medline: 31975609]
119. Givon Schaham N, Vitek H, Donda N, Elbo Golan I, Buckman Z, Rand D. The development and feasibility of TECH: tablet enhancement of cognition and health, a novel cognitive intervention for people with mild cognitive impairment. Games Health J. 2020;9(5):346-352. [doi: 10.1089/g4h.2019.0157] [Medline: 33054487]
120. Nijhof N, van Hoof J, van Rijn H, van Gemert-Pijnen J. The behavioral outcomes of a technology-supported leisure activity in people with dementia. TAD. 2013;25(4):263-273. [doi: 10.3233/tad-140398]
121. Subramaniam P, Woods B. Digital life storybooks for people with dementia living in care homes: an evaluation. Clin Interv Aging. 2016;11:1263-1276. [FREE Full text] [doi: 10.2147/CIA.S111097] [Medline: 27698556]
122. D'Cunha NM, Isbel ST, Frost J, Fearon A, McKune AJ, Naumovski N, et al. Effects of a virtual group cycling experience on people living with dementia: a mixed method pilot study. Dementia (London). 2021;20(5):1518-1535. [doi: 10.1177/1471301220951328] [Medline: 32820955]
123. Ulbrecht G, Wagner D, Gräßel E. Exergames and their acceptance among nursing home residents. Activities, Adaptation & Aging. 2012;36(2):93-106. [doi: 10.1080/01924788.2012.673155]

124. Leuty V, Boger J, Young L, Hoey J, Mihailidis A. Engaging older adults with dementia in creative occupations using artificially intelligent assistive technology. Assist Technol. 2013;25(2):72-79. [doi: 10.1080/10400435.2012.715113] [Medline: 23923689]
125. Astell AJ, Joddrell P, Groenewoud H, de Lange J, Goumans M, Cordia A, et al. Does familiarity affect the enjoyment of touchscreen games for people with dementia? Int J Med Inform. 2016;91:e1-e8. [doi: 10.1016/j.ijmedinf.2016.02.001] [Medline: 26897552]
126. Groenewoud H, Lange J, Schikhof Y, Astell A, Joddrell P, Goumans M. People with dementia playing casual games on a tablet. Gerontechnology. 2017;16(1):37-47. [doi: 10.4017/gt.2017.16.1.004.00]
127. Zamir S, Allman F, Hennessy CH, Taylor AH, Jones RB. Aesthetically designing video-call technology with care home residents: a focus group study. Front Psychol. 2021;12:540048. [FREE Full text] [doi: 10.3389/fpsyg.2021.540048] [Medline: 33708152]
128. Sweeney L, Wolverson E, Clarke C. Understanding the shared experiences of creating a digital life story with individuals with dementia and their spouse. Dementia (London). 2021;20(5):1791-1813. [doi: 10.1177/1471301220970403] [Medline: 33131329]
129. Lancioni GE, Bosco A, De Caro MF, Singh NN, O'Reilly MF, Green VA, et al. Effects of response-related music stimulation versus general music stimulation on positive participation of patients with alzheimer's disease. Dev Neurorehabil. 2015;18(3):169-176. [doi: 10.3109/17518423.2013.802388] [Medline: 23869934]
130. O'Neil-Pirozzi TM, Hsu H. Feasibility and benefits of computerized cognitive exercise to adults with chronic moderate-to-severe cognitive impairments following an acquired brain injury: a pilot study. Brain Inj. 2016;30(13-14):1617-1625. [doi: 10.1080/02699052.2016.1199906] [Medline: 27680422]
131. Cunningham S, Brill M, Whalley JH, Read R, Anderson G, Edwards S, et al. Assessing wellbeing in people living with dementia using reminiscence music with a mobile app (memory tracks): a mixed methods cohort study. J Healthc Eng. 2019;2019:8924273. [FREE Full text] [doi: 10.1155/2019/8924273] [Medline: 31583068]
132. Hebert CA, Hancock K, McConnell ES. Implementation of individualized music in long-term care: application of the PARiHS framework. J Gerontol Nurs. 2018;44(8):29-38. [doi: 10.3928/00989134-20180626-01] [Medline: 30059137]
133. Moon S, Park K. The effect of digital reminiscence therapy on people with dementia: a pilot randomized controlled trial. BMC Geriatr. 2020;20(1):166. [FREE Full text] [doi: 10.1186/s12877-020-01563-2] [Medline: 32375661]
134. Travers C, Bartlett H. An exploratory study of carers' and care staff's perspectives of silver memories—a unique radio program for older people. Activities, Adaptation & Aging. 2010;34(2):135-147. [doi: 10.1080/01924781003793607]
135. Swinnen N, de Bruin ED, Guimarães V, Dumoulin C, De Jong J, Akkerman R, et al. The feasibility of a stepping exergame prototype for older adults with major neurocognitive disorder residing in a long-term care facility: a mixed methods pilot study. Disabil Rehabil. 2023:1-15. [doi: 10.1080/09638288.2023.2182916] [Medline: 36824039]
136. Taylor JR, Milne AJ, Macritchie J. New musical interfaces for older adults in residential care: assessing a user-centred design approach. Disabil Rehabil Assist Technol. 2023;18(5):519-531. [FREE Full text] [doi: 10.1080/17483107.2021.1881172] [Medline: 33784921]
137. Sweeney L, Wolverson E, Clarke C. Understanding the shared experiences of creating a digital life story with individuals with dementia and their spouse. Dementia (London). 2021;20(5):1791-1813. [doi: 10.1177/1471301220970403] [Medline: 33131329]
138. Tamura T, Yonemitsu S, Itoh A, Oikawa D, Kawakami A, Higashi Y, et al. Is an entertainment robot useful in the care of elderly people with severe dementia? J Gerontol A Biol Sci Med Sci. 2004;59(1):83-85. [doi: 10.1093/gerona/59.1.m83] [Medline: 14718491]
139. Kuot A, Barton E, Tiri G, McKinlay T, Greenhill J, Isaac V. Personalised music for residents with dementia in an Australian rural aged-care setting. Aust J Rural Health. 2021;29(1):71-77. [doi: 10.1111/ajr.12691] [Medline: 33591614]
140. Lazar A, Thompson HJ, Piper AM. Rethinking the design of robotic pets for older adults. 2016. Presented at: Proceedings of the 2016 ACM Conference on Designing Interactive Systems; 2016 June 04:1034-1046; United States. [doi: 10.1145/2901790.2901811]
141. Back I, Makela K, Kallio J. Robot-guided exercise program for the rehabilitation of older nursing home residents. Annals of Long-Term Care. 2013;21(6).
142. Manca M, Paternò F, Santoro C, Zedda E, Braschi C, Franco R, et al. The impact of serious games with humanoid robots on mild cognitive impairment older adults. International Journal of Human-Computer Studies. 2021;145:102509. [doi: 10.1016/j.ijhcs.2020.102509]
143. Pino M, Boulay M, Jouen F, Rigaud AS. "Are we ready for robots that care for us?" Attitudes and opinions of older adults toward socially assistive robots. Front Aging Neurosci. 2015;7:141. [FREE Full text] [doi: 10.3389/fnagi.2015.00141] [Medline: 26257646]
144. Krakovski M, Kumar S, Givati S, Bardea M, Zafrani O, Nimrod G, et al. “Gymmy”: designing and testing a robot for physical and cognitive training of older adults. Applied Sciences. 2021;11(14):6431. [doi: 10.3390/app11146431]
145. Treadaway C, Kenning G. Sensor e-textiles: person centered co-design for people with late stage dementia. Working with older people. 2016. [doi: 10.1108/wwop-09-2015-0022]

146. Fox S, Brown LJE, Antrobus S, Brough D, Drake RJ, Jury F, et al. Co-design of a smartphone app for people living with dementia by applying agile, iterative co-design principles: development and usability study. JMIR Mhealth Uhealth. 2022;10(1):e24483. [FREE Full text] [doi: 10.2196/24483] [Medline: 35029539]
147. Chu CH, Nyrup R, Leslie K, Shi J, Bianchi A, Lyn A, et al. Digital ageism: challenges and opportunities in artificial intelligence for older adults. Gerontologist. 2022;62(7):947-955. [FREE Full text] [doi: 10.1093/geront/gnab167] [Medline: 35048111]
148. Campbell BR, Ingersoll KS, Flickinger TE, Dillingham R. Bridging the digital health divide: toward equitable global access to mobile health interventions for people living with HIV. Expert Rev Anti Infect Ther. 2019;17(3):141-144. [FREE Full text] [doi: 10.1080/14787210.2019.1578649] [Medline: 30721103]
149. Choi EY, Kanthawala S, Kim YS, Lee HY. Urban/rural digital divide exists in older adults: does it vary by racial/ethnic groups? J Appl Gerontol. 2022;41(5):1348-1356. [doi: 10.1177/07334648211073605] [Medline: 35196918]
150. Heponiemi T, Jormanainen V, Leemann L, Manderbacka K, Aalto A, Hyppönen H. Digital divide in perceived benefits of online health care and social welfare services: national cross-sectional survey study. J Med Internet Res. 2020;22(7):e17616. [FREE Full text] [doi: 10.2196/17616] [Medline: 32673218]
151. Mitchell UA, Chebli PG, Ruggiero L, Muramatsu N. The digital divide in health-related technology use: the significance of race/ethnicity. Gerontologist. 2019;59(1):6-14. [doi: 10.1093/geront/gny138] [Medline: 30452660]
152. Wavrock D. Canadians' use of the internet and digital technologies before and during the COVID-19 pandemic. Statistics Canada= Statistique Canada. 2022.
153. Chu CH, Yee A, Stamatopoulos V. Poor and lost connections: essential family caregivers' experiences using technology with family living in long-term care homes during COVID-19. J Appl Gerontol. 2022;41(6):1547-1556. [FREE Full text] [doi: 10.1177/07334648221081850] [Medline: 35416076]
154. Engelsma T, Jaspers MWM, Peute LW. Considerate mHealth design for older adults with alzheimer's disease and related dementias (ADRD): a scoping review on usability barriers and design suggestions. Int J Med Inform. 2021;152:104494. [FREE Full text] [doi: 10.1016/j.ijmedinf.2021.104494] [Medline: 34015657]
155. Indorewalla KK, O'Connor MK, Budson AE, Guess DiTerlizzi C, Jackson J. Modifiable barriers for recruitment and retention of older adults participants from underrepresented minorities in alzheimer's disease research. J Alzheimers Dis. 2021;80(3):927-940. [FREE Full text] [doi: 10.3233/JAD-201081] [Medline: 33612540]
156. Fontaine JR. Traditional and multilevel approaches in cross-cultural research: an integration of methodological frameworks, in multilevel analysis of individuals and cultures. Psychology Press. 2015:65-92. [doi: 10.4324/9780203888032]
157. Wenborn J, Challis D, Head J, Miranda-Castillo C, Popham C, Thakur R, et al. Providing activity for people with dementia in care homes: a cluster randomised controlled trial. Int J Geriatr Psychiatry. 2013;28(12):1296-1304. [doi: 10.1002/gps.3960] [Medline: 23637069]
158. Edvardsson D, Petersson L, Sjogren K, Lindkvist M, Sandman P. Everyday activities for people with dementia in residential aged care: associations with person-centredness and quality of life. Int J Older People Nurs. 2014;9(4):269-276. [doi: 10.1111/opn.12030] [Medline: 23590628]
159. Neal I, du Toit SHJ, Lovarini M. The use of technology to promote meaningful engagement for adults with dementia in residential aged care: a scoping review. Int Psychogeriatr. 2020;32(8):913-935. [doi: 10.1017/S1041610219001388] [Medline: 31547900]
160. Haase KR, Cosco T, Kervin L, Riadi I, O'Connell ME. Older adults' experiences with using technology for socialization during the COVID-19 pandemic: cross-sectional survey study. JMIR Aging. 2021;4(2):e28010. [FREE Full text] [doi: 10.2196/28010] [Medline: 33739929]
161. Mitzner TL, Fausset CB, Boron JB, Adams AE, Dijkstra K, Lee CC, et al. Older adults' training preferences for learning to use technology. Proc Hum Factors Ergon Soc Annu Meet. 2008;52(26):2047-2051. [FREE Full text] [doi: 10.1177/154193120805202603] [Medline: 25309139]
162. Morato J, Sanchez-Cuadrado S, Iglesias A, Campillo A, Fernández-Panadero C. Sustainable technologies for older adults. Sustainability. 2021;13(15):8465. [doi: 10.3390/su13158465]
163. Carretero S. Mapping of Effective Technology-Based Services for Independent Living for Older People at Home. Spain. Federal Reserve Bank of St Louis: St. Louis; 2015.
164. Shaw J, Shaw S, Wherton J, Hughes G, Greenhalgh T. Studying scale-up and spread as social practice: theoretical introduction and empirical case study. J Med Internet Res. 2017;19(7):e244. [FREE Full text] [doi: 10.2196/jmir.7482] [Medline: 28687532]
165. Linton JD. Implementation research: state of the art and future directions. Technovation. 2002;22(2):65-79. [doi: 10.1016/s0166-4972(01)00075-x]

Abbreviations

DIT: Dementia Isolation Toolkit
LTC: long-term care
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

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

Edited by P Kubben; submitted 23.Sep.2023; peer-reviewed by SQ Yoong, D Patil, T Liu; comments to author 04.Jan.2024; revised version received 21.Jan.2024; accepted 11.Jun.2024; published 08.Aug.2024

Please cite as:
Kokorelias KM, McMurray J, Chu C, Astell A, Grigorovich A, Kontos P, Babineau J, Bytautas J, Ahuja A, Iaboni A
Technology-Enabled Recreation and Leisure Programs and Activities for Older Adults With Cognitive Impairment: Rapid Scoping Review
JMIR Neurotech 2024;3:e53038
URL: https://neuro.jmir.org/2024/1/e53038
doi: 10.2196/53038
PMID: 41341243