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Opinion

Technology-Driven Physical Activity Research in Care Homes: A Reflective Narrative

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Abstract

Assistive technologies are increasingly promoted to mitigate age-related declines in cognitive and physical function. Given high levels of sedentary behaviour in older adult care-home residents, technologies promoting physical activity may be beneficial. However, there is little evidence concerning their implementation, evaluation, use, and effects in care-home settings. This evidence gap is particularly notable in terms of the perspectives and experiences of care-home staff. This narrative reflects on insights gained from exploring key feasibility factors related to delivering an immersive cycling intervention in residential care homes from the perspective of care-home staff. Contemporaneous field notes, conversations with care-home managers and staff, and a discussion group involving six care-home staff and one care-home management group representative, as part of a workshop event, identified that standard research timescales and designs may be unsuitable for this research type, highlighting the need for comprehensive community engagement. Cultural and sector-wide considerations of risk and sensitivity to staffing and wider resource pressures are needed to determine optimal technology implementation and use. While assistive physical activity-focused technologies have potential benefits for adult care-home residents, especially those with cognitive impairment, their implementation and use in research and practice require careful planning. Flexible data collection and research designs that capture implementation processes and how participants' use varies in dynamic contexts are required. Technologies that require high levels of staff supervision are often impractical. Implications for researchers, developers, and care-home operators are discussed with respect to improved informed decision-making and implementation.

Keywords: assistive technology; ageing; physical activity; research methodology/design; cognition

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Correction Statement: This article has been republished with a minor change. The change does not affect the scientific content of the article and further details are available within the backmatter of the website version of this article.

1. Introduction and Methods

Physical activity (PA) is associated with physical and cognitive benefits, particularly in older adults. Preventing age-related declines in PA levels and increases in sedentary be-

haviour are therefore important [1–3]. Indeed, in individuals aged 70 to 82 years, increasing daily energy expenditure by 287 kcal·d^{-1} (equivalent to 30 min PA) was associated with a 32% mortality risk reduction [4], whilst increased functionality (6 min walk test distance) has been positively associated with daily PA levels in adults aged 90 years or older [5]. It is recommended that PA programmes integrate cognitive tasks and strategies that specifically promote cognitive activity [6].

Prolonged sedentary behaviour may have physiological consequences distinct from those of physical inactivity [7]. This is particularly relevant for older adult care-home residents, a population estimated to be around 460,000 in the United Kingdom alone [8], who may spend up to 79% of their time sitting or lying down [9]. Innovative approaches to promote PA and break up sedentary time could mitigate functional declines, promote social interaction, and enhance overall health and well-being.

Using assistive technologies to facilitate PA and decrease sedentary behaviour in older adults has generated considerable research interest, i.e., Refs. [10,11]. For example, in a meta-analysis of 18 randomised controlled trials in community-dwelling older adults (n = 765), active video games were more effective than conventional exercise for improving functional movement and balance compared to control-group peers [12]. Technology also provides an opportunity to increase social contact and, subsequently, decrease loneliness. During the COVID-19 pandemic, technology catapulted to the forefront of healthcare provision and social interactions for care-home residents [13], challenging previously perceived barriers [14].

Our Work

This opinion details our experiences of implementing an assistive technology-based project, 'Cycling Down Memory Lane', in care homes in South Wales. Specifically, this project sought to combine a stationary bike-based technology with non-immersive virtual reality (VR), allowing individuals to embark on self-selected, virtual journeys across the world from within their care homes. By offering a social interaction platform that can be independently and safely user-controlled, users could converse about the cyclist's journey, thus additionally stimulating cognition through reminiscence and memory discussions.

Initial testing with healthy, community-dwelling older adults showed the activity was comparable to light-to-moderate-intensity activity, with the most common places visited being participants' previous homes, areas they grew up in, and holiday locations [15]. Although the systems employed a non-immersive, screen-based virtual environment rather than a fully immersive VR interface, they could potentially engender physical and mental health benefits via improved relational and emotional health. However, it has yet to be tested in residential care settings, and understanding regarding how to implement similar interventions is limited and has failed to include care-home staff in the co-production and assessment of feasibility. Thus, herein we present an overview of our research with care-home staff reflections and learning about potential barriers and facilitators for this assistive technology to inform future work addressing this (and related) knowledge gap(s).

To produce this reflective piece, we reviewed contemporaneous field notes made after meetings and conversations with care-home staff/managers and a workshop and discussion group with six care-home staff and one management group representative. At the workshop, a virtual cycling prototype provided by Digital Communities Wales was demonstrated and trialled by staff and a resident from a care home, with initial experiences, preferences, and the practicalities and challenges of implementing and utilising this product type in care homes explored and collated to help inform future work. Ethics approval for the data collection was granted by the Institutional Research Ethics Committee (Ref: MM_01-03-2022d).

2. Reflections

2.1. Establishing the Potential Reach and Targeted Approach

Staff felt the concept under investigation could engender enormous benefits for their residents. Recruitment meetings (exploring the likelihood that care homes would be willing to engage with the project) were promising, with wide-ranging support and enthusiasm. However, on sharing our initial study protocol (relating to implementation of the device and assessment of its effectiveness), several limitations or potential barriers were identified by care-home managers, including limited resident numbers with capacity to consent to research participation or the necessary cognitive function level to provide feedback; the facility being a short-term facility for those aged <55 years with learning disabilities; and the facility being a reablement facility where length of stay was only 2–6 weeks. We were specifically targeting the perspectives of long-term residential care homes with residents aged 55 or above.

All care homes approached reported that they were keen to borrow the equipment and could identify individuals who would have thrived given this opportunity. Indeed, staff felt it could provide residents who do not routinely leave the care home with an opportunity to be physically active and/or reminisce and the chance to virtually '*get out and about*' and '*see the leaves on the trees*'. Care-home staff identified additional ways the equipment could be used inclusively, including group activities, fundraisers, and family events. It was suggested that adjusting the focus to make it a group social-inclusion activity, held in communal settings, would help accessibility and increase interaction for residents and staff, facilitating relationship development between residents and mitigating loneliness. Furthermore, staff felt expanding to include additional facilities, such as day centres and short-term rehabilitation units, should be considered to give individuals with cognitive decline more opportunities to be included in, and potentially benefit from, research participation.

2.2. Understanding Accessibility and Usability

Despite initial positive feedback, concerns were raised. Care-home staff were concerned that access restrictions (e.g., for wheelchair users or those with more established cognitive impairments) could generate inequalities. It was considered unrealistic for staff to routinely provide residents with assistance to use the technology, particularly those who were frail and/or had a poor attention span. Thus, to encourage inclusivity and staff buy-in, technology of this type, integrated into care homes, needs to be simple to use and not place additional burden/challenges on staff. It also needs to be designed to be appealing to the end-user, with components that replicate familiar situations (i.e., bike handlebar setup and position of/interchangeable seating options), be wheelchair-user inclusive, and, where transferring on/off equipment is required, be a straightforward and safe process, requiring minimal adjustments.

Some staff expressed concern that immersive technology providing street views or other locations could cause anxiety and disorientation for some residents. However, this could easily be overcome by modifying the manner in which the locations/street views were presented, such as connecting to a flat-screen television or projector screen instead, although it is noteworthy that the immersive experience may then be lost. Whilst the attention span of some older adults may be a concern, it should not necessarily be viewed as a reason to discourage technology engagement or indeed PA. From a PA perspective, even small overall increases can lead to tangible benefits, with those least active benefitting the greatest [16]. Building opportunities for staff education into projects on the behaviours and outcomes being explored may be vital.

In line with findings of Patel et al. [17], staff highlighted that daily fluctuations in care-home residents' cognitive and physical functionality could affect the conduct of evaluation

studies; therefore, flexibility in data-collection methods is needed. Finally, some staff expressed reservations about residents trying new activities, which may inadvertently limit their facilitation of participation. To overcome such reservations, researchers need to embed information for staff about the potential benefits of new activities and opportunities to address concerns into study recruitment strategies.

2.3. Addressing Cognitive and Physical Safety

A key benefit of the stationary bike technology was its ability to facilitate reminiscence; however, there were concerns stemming from fear among care-home staff that residents could become frightened or unsettled by environmental changes and/or confused from being unable to differentiate virtual from actual reality, particularly if the landscape had changed from how they remembered. Conversely, there was hope that repeated engagement and choosing locations wisely would stimulate enough familiarity for positive outcomes. Staff would need to be aware of these possibilities, and researchers would need to be aware that any concerns may inhibit use.

The majority of previous care-home setting interventions have relied on delivery models requiring substantial input from staff and/or additional exercise instructors [18]. We originally proposed that participants would be free to independently engage with the technology, choosing their own session frequency and length. However, care-home staff felt this would not be possible, and for safety-related reasons associated with cognitive impairment and resident frailty, all activity would need supervision. Staff also raised concerns about the equipment size, floor space required for safe setup and use, and risk/insurance concerns related to the risk of falls. When designing stationary physical activity technology for use in care homes, having structural setups that minimise fall risk is paramount. We therefore affirm the need to place a greater focus on working care-home staff and technology developers to co-design products and proposals that reduce the need for restrictive exclusion criteria and promote the ability to explore the impact on those who may benefit most.

3. Conclusions

Technology is an underutilised avenue to counteract the negative effects of physical and cognitive declines in older adult care-home residents. Our reflection highlights the importance of engaging with care-home staff in order to identify challenges and practical factors that need researcher and designer consideration when proposing technology-driven physical activity interventions and their evaluation in care-home settings. To enhance the chance of successfully engaging and recruiting care homes for technology implementation and research studies examining their effectiveness, future work should take the following steps:

- Facilitate co-production with care-home staff during design stages to address perceived limitations/barriers and facilitators.
- Work with technology developers to ensure inclusivity, irrespective of physical or cognitive impairments, from the inception of the product onwards (in an iterative manner).
- Engage in staff education to promote understanding of technology-use benefits for the targeted behaviour(s).
- Design flexible protocols that enable adaptation to delivery venue, care-home staff, and resident needs of specific care homes and residents.

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