Virtual reality, the Covid-19 pandemic and possible rehabilitation opportunities for community dwelling older adults.

Keywords: Covid-19, Virtual reality, older adults, community, falls prevention.

KEY POINTS

- The use of virtual reality (VR) interventions demonstrates potential improvements for slip distance in falls prevention and cognitive outcomes for community dwelling older adults.
- Wherever possible, clinical application of VR as a response to Covid-19 restrictions should be part of a clinical trial for community dwelling older adults.
- Further research should focus on the feasibility, acceptability and tolerability for the auditory and visually impaired within the community dwelling older adult population.
- Further high-quality randomised controlled trials are required to assess the effectiveness of VR in community dwelling adults.

Introduction

With increasing age, people can experience a reduction in physical, psychological and social health (de Mendonça Lima and Ivbijaro 2013; Kemperman et al. 2019; Singh and Misra 2009). This decline in health can affect all aspects of an individual's life with a reduction of mobility (Rantakokko et al. 2013; Rantanen 2013), ability to complete activities of daily living (Royall et al. 2005), social networking (Kemperman et al. 2019), an increased risk of falls (Mahagna et al. 2019), hospitalisation (Nunes et al. 2017) and multi-morbidities (Barnett et al. 2012). There is a growing concern that these common complications in the elderly could be amplified by the current use of lockdowns, curfews, and social distancing being used as a response to the Covid-19 pandemic (Armitage and Nellums 2020; Plagg et al. 2020). It has been suggested that virtual reality (VR) may provide an alternative method of rehabilitation and support during the Covid-19 pandemic (Gao et al. 2020; Singh et al. 2020; Smits et al. 2020). The use of VR may provide some advantages compared to more traditional rehabilitation methods such as enhanced patient reported satisfaction, instant feedback allowing dynamic adjustment of intensity (Mantovani et al. 2020) and opportunity for greater standardisation of rehabilitation (Rothbaum 2009). A recent systematic review by Dermody et al. (2020) examines the effectiveness of VR apps using immersive headsets for this population of older adults living in the community (Dermody et al. 2020).

Aims of commentary: This commentary aims to appraise the methods used in the systematic review by Dermody et al. 2020 and expand upon the findings in the context of the Covid-19 pandemic.

Methods

This systematic review was registered with Prospero prior to the commencing of data extraction. A robust multi-database search was undertaken from 1997 to June 2019. Alongside this primary search strategy, hand searching and screening of included studies' citation lists were undertaken. Both experimental and quasi-experimental studies, which included community-dwelling older adults aged 60 years or older and examined the effectiveness of virtual reality, were included in the review. Studies that did not use VR apps delivered via immersive headsets were excluded. Screening, data extraction and assessment of bias, (Joanna Briggs Institute Critical Appraisal Tools) were carried out by two independent reviewers, with arbitration by a third reviewer. A classification of certainty was undertaken by two independent reviewers using the Grading of Recommendations Assessment, Development and Evaluation (GRADE). Due to limited evidence, the included studies were synthesised using a narrative approach.

Findings

The primary research identified 416 references with an additional 74 references being identified through screening of systematic review reference lists. After title, abstract and full text screening only six studies were included in the review, with three studies focused on falls prevention, one on pain management, one on memory, and one on cognitive ability in dementia. Only one study explicitly assessed visual acuity and four studies excluded participants if they reported uncorrected vision or serious/significant sensory impairment. No studies undertook a hearing assessment. All included studies used an immersive virtual environment intervention with a varying range of hardware, software, and exposure time. The number of sessions ranged from a single session to three times a week for seven weeks. Out of the six small studies: three of the studies were randomised controlled trials (RCTs), one Quasi-experimental, one Mixed-methods exploratory study and one Case study. For this commentary, the findings from the Quasi-experimental study are not reported. This study did not examine the effectiveness of an intervention but aimed to compare compensatory postural adjustments of adults with Alzheimer's disease with and without a history of falling, compared to the control group (Gago et al. 2016). Subsequently, the results from this study should not have been included in this review as they did not directly examine the effectiveness of virtual reality.

For the two studies which examined the use of VR in falls, one RCT demonstrated a statistically significant reduction in two outcomes measuring slip distance when comparing a single session of VR with treadmill compared to treadmill training alone. The second RCT demonstrated a statistically significant reduction in the fear of falling score when comparing the VR exposure therapy to waiting list control.

For the three studies (two RCTs and one Mixed-methods exploratory study) which measured depression outcomes, there was no strong evidence of benefit between groups or from baseline to end of study. One RCT found that there was a clinical and statistically significant reduction in anxiety when comparing VR exposure therapy to waiting-list control.

One RCT demonstrated multiple statistically significant improvements in general cognitive abilities and verbal memory with varying comparisons of pre- and post-test, post-test and end of the booster phase (additional training for three months) and between intervention and control group. When comparing auditory stimulation and VR experiences compared to music therapy, one mixed methods exploratory study demonstrated a clinical and statistically significant reduction in pain scores between baseline to end of study, using an immersive VR intervention for pain management.

One mixed method exploratory study found no strong evidence of benefit for overall health, physical health, social life and psychological health comparing baseline to end of study using an immersive VR intervention for pain management. Similarly, one RCT found no strong evidence of benefit to social and family life scores when using VR exposure therapy for fear of falling. One RCT found no strong evidence of benefit for both instrumental activities of daily living, activities of daily living and spatial/visuospatial abilities when using VR for memory training.

Commentary

Using the Joanna Briggs Institute Critical Appraisal Tools for systematic reviews, eight out of the eleven criteria were judged to be satisfactory for this review (Aromataris et al. 2015). The two criteria which were not achieved were assessment of publication bias, which was not carried out due to the limited number of studies and unsupported recommendations for practice. The recommendations of practice are deemed to be unsupported due to the unclear and inconsistent application of the GRADE criteria. Justification for grading of 'moderate' was only given based on the assessment of bias, with no indication of Imprecision, Inconsistency, Indirectness and Publication bias being considered. Despite these inconsistencies, it was deemed that this systematic review provides an accurate and comprehensive synthesis of the available studies that addressed the question of interest.

Based on the findings from the review there is evidence that VR may be effective in improving fall reactions and reducing fear of falling. These findings of potential benefit are partly supported by previous reviews, with VR being effective in improving balance in Parkinson's disease patients (Dockx et al. 2016) and balance performance, as well as functional mobility outcomes for community dwelling adults (Donath et al. 2016). It is important to note that these two reviews used a broader definition of VR compared to the review by Dermody et al (2020), making these findings less applicable to this review, nevertheless it does support the use of virtually built environments to aid rehabilitation. Similarly, there was some evidence that VR may be effective in improving cognitive abilities, verbal memory, pain scores and anxiety, with previous reviews demonstrating possible potential benefit for memory with stroke patients (Wiley et al. 2020), pain management in adults (Mallari et al. 2019) and reduced anxiety in individuals with anxiety disorders (Carl et al. 2019). Therefore, the evidence is not strong enough to make recommendations to practice, however there is clear potential for further research in the application VR for falls prevention and cognitive outcomes for community dwelling older adults.

As previously highlighted, the use of national lockdowns, curfews, and social distancing restrictions have the potential to exacerbate common complications in the elderly (Armitage and Nellums 2020; Plagg et al. 2020). As noted in this review, VR has the potential to counteract some of the impacts of these restrictions. However, as reported in this review and the reviews identified above, there is a substantial lack of high-quality evidence examining the effectiveness of VR in healthcare. Therefore, future use of VR as a response to Covid-19 restrictions in community dwelling older adults should be, wherever possible, a part of further research in this area. A multidisciplinary, international working group made up of established authors in the use of VR in healthcare have recommended that future VR trials should try to develop their research through a three-tier system (Birckhead et al. 2019). The first-tier should focus on content development, second-tier on feasibility, acceptability, tolerability, and initial clinical efficacy and the third-tier studies on evaluating effectiveness through RCTs. Based on this tiered approach, future research on VR use in community-based older adults should be carried out at tier-two and three. Second-tier studies should focus on the feasibility, acceptability, and tolerability of more complex community-based adult populations such as the visually impaired and the hard of hearing, as these were exclusion criteria in the included studies of this review and

require further examination. Future tier-three research should be an adequately robust and powered RCT focusing on impactful patient outcomes for community dwelling older adults.

CPD REFLECTIVE QUESTIONS

1. From the evidence presented in this review what aspects of older adult care might benefit from VR technology?
2. Do you think that interventions using VR technology would be of benefit to patients in your own service?
3. What are the potential barriers to the use of this type of technology with older adults in the community?

Applied Research Collaboration North West Coast (ARC NWC). The views expressed in this publication are those of the author(s) and not necessarily those of the National Institute for Health Research, the NHS, or the Department of Health and Social Care.

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