# Evaluating the effectiveness of gamification using CardioWall®on mood, participation, and balance in adults with chronic neurological conditions



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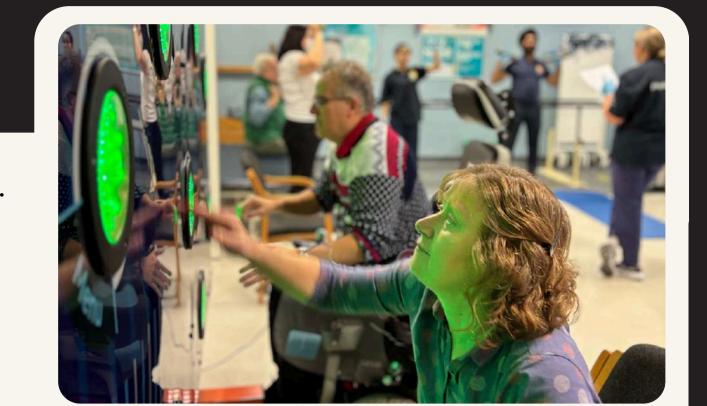
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## Background

This study explores the challenges and benefits of using physical activity interventions with emerging technology for individuals with chronic neurological conditions. These conditions often lead to symptoms including balance issues, fatigue, and mobility problems. Exercise, particularly in group settings, can significantly improve fitness, strength, and quality of life; however, motivation and engagement remain critical factors for participation. This 12-Week CardioWall Impact Study at The Brightwell has shown that regular participation in exercise classes incorporating the CardioWall can have a range of physical, cognitive, and social benefits for people with chronic neurological conditions.

Grace Cupper, Project Lead



## **Study Design**

**Type**: Quasi-Experimental Design

**Duration**: 12 weeks

Participants: 20 adults with chronic neurological conditions Outcome Measures: Modified Fatigue Impact Scale<sup>1</sup>

Function in Sitting Scale/Berg Balance Scale<sup>2</sup>

**Health and Wellbeing Scale** 

## **Participants**

Inclusion Criteria: Diagnosed with conditions including MS, Stroke, PD, ME; adequate upper limb and trunk control; cognitive ability to follow instructions; motivated to improve physical health.

Selection: All eligible attendees of the exercise class were invited to participate.

#### **About The CardioWall**

The CardioWall is an interactive activity wall with 9 lightpods that challenge speed, reaction, and coordination. Two games were used in the study:

Chaser - All lightpods light up green, except 1 red lightpod. Players seek the red lightpod and hit it out to gain 1 point, or -1 point for each incorrect green lightpod. Improves spatial awareness, reaction speed, and hand-eye coordination

ClearOut - All lightpods light up, and players hit them out as quickly as possible. 1 point per lightpod. After all lightpods are 'cleared out', they light up again in a new colour. Tests reactions speed, hand-eye coordination, and agility



## Intervention

Sessions: Once a week, with additional home exercises.

- © CardioWall: 15 minutes per participant
  - Exercise Bikes: 15 minutes
  - **Chair/Mat-Based Exercises**: 15 minutes **■ Upper Limb Dumbbells**: 15 minutes

### Method

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**Blinding**: One therapist designed the plan; two therapists conducted pre and post assessments.

**Data Handling**: Anonymised data was analysed for changes in parameters.

I find the CardioWall really good cognitively and for my balance, with standing - I don't actually realise I'm standing for so long which is good. I've seen improvement in my cognition, my balance, and definitely my peripheral vision with the Chaser game.

- Sheila, Study Participant





**Research Process** 

Research

Questions

**Identified** 

Participants Selected: Patients with chronic neurological conditions were recruited based on inclusion and exclusion criteria

#### **Participant Characteristics**

- Total participants: n = 25
- Non-completers: 5 Gender distribution: a. Males: 9 b. Females: 15
- Average age: 64.7 years
- Coefficient of Variation (CoV): 0.2 • Standard Deviation (SD): 11.82

Informed Consent Obtained, Ethical approval was ensured (The Brightwell trustees), and pre-intervention assessments were completed 

> **Intervention Conducted:** A 12-week circuit training program with a gamification theme using the CardioWall was implemented

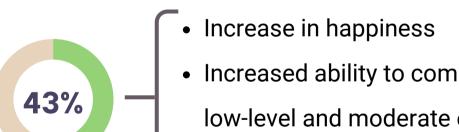
**Results Analysed** Statistical and qualitative **analysis** of the results was conducted.



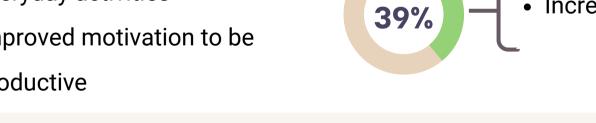
## **Outcome and Discussion**

## Health and Wellbeing

- General Mood and Happiness Participants reported an overall improvement in mood and happiness in their daily lives.
- Exercise and Physical Activity Participants are finding it easier to stay active and daily tasks are more manageable.
- Pain and Comfort Participants are experiencing less pain, and more confidence in group exercise. • Mental and Emotional Wellbeing - Participants have noted improved mental alertness and
- confidence in self and abilities (29%), and confidence socialising with others (30%). Participants are feeling less stressed and anxious, and more motivated.



- Increased ability to complete low-level and moderate exercise Decrease in physical limitations for
- everyday activities • Improved motivation to be
  - productive



Increase in general mood

More comfortable

participants in group activities

# 43% Reduction in stress

50%

**Reduction in pain** 

ratings

and anxiety

## **Modified Fatigue Impact Scale**

**Post-Intervention Outcome** 

**Measures Completed.** Data

was collected after the

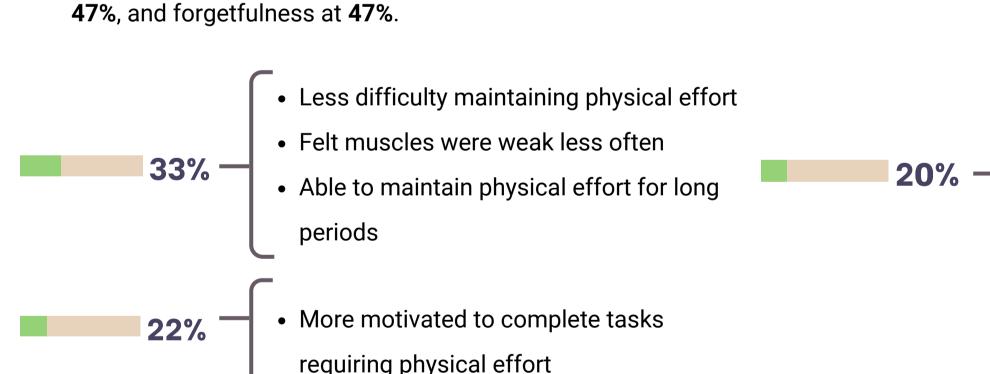
intervention

## **Improvements**

• 47% of participants improved on the Modified Fatigue Impact Scale, with a reduced score following the study. Specific benefits include better motivation to exercise and socialise, mental clarity, and improved ability during physical activity.

## Maintained

Alertness was maintained at 60%, clear thinking at 53%, clumsiness and coordination at



foot on a step or stool and standing

Of participants improved on total MFIS score

47%

Less forgetful

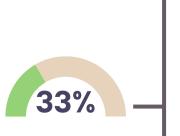
- More able to pay attention for long periods
- Increased motivation to socialise Less need to pace themselves during
- exercise Better able to organise thoughts
- Increased ability to complete task

requiring physical effort

## **CardioWall Survey**

## Improvements Using the CardioWall

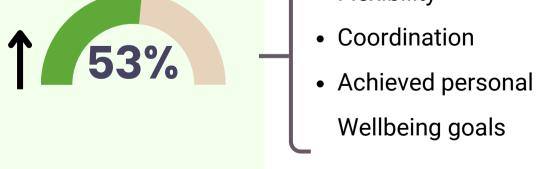
- Participants reported a range of benefits from using the CardioWall regularly during The Brightwell exercise classes. **Additional Benefits of the CardioWall**
- 27% of participants feel the CardioWall helped them achieve physical health goals, whilst improving strength.
- 20% of participants are more encouraged to participate in group activities, and feel more independent.

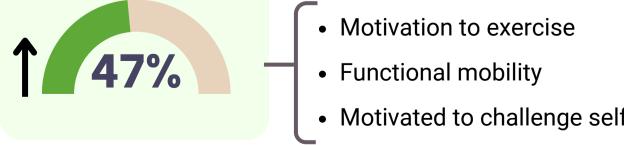


- Found the CardioWall more enjoyable than other equipment
- Noted improved balance confidence
- Reported that the CardioWall helped them build stronger relationships through social exercise.
- Improved personal wellbeing

#### **Survey responses indicated that participants** experienced the following benefits:

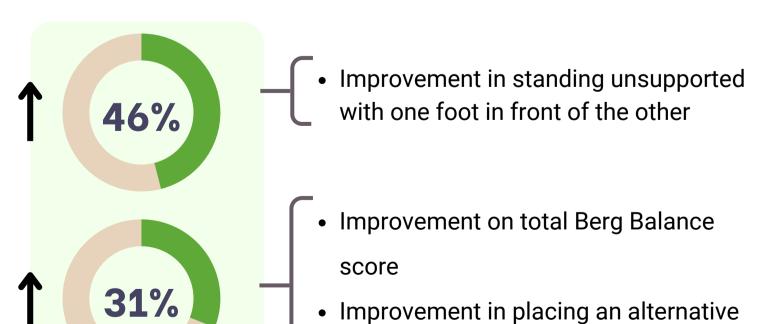
## Reaction speed Reduced stress and anxiety





## **Berg Balance Scale**

(Non-seated Participants)



The main benefits would be that people love the interaction, people love to have fun, and that's how they see it. That's what I like about it because sometimes when you ask people to do any exercise, they're like "It's going to be tiring", but when I ask people to do the CardioWall, they're up for it and say "Yes, I want to have a go!". - Amrik Sidhu, Lead Neuro-Physiotherapist

## Conclusion

This pilot study provided valuable insights into the effectiveness of combining traditional exercises with gamification using the CardioWall. Participants reported a reduction in pain, stress and anxiety, and Modified Fatigue Impact Scores improved (lowered), as well as improved balance. This indicates a better ability to cope with day-to-day symptoms of neurological conditions, and a more positive outlook. Continuous rehabilitation is crucial for maintaining health and wellbeing in individuals with neurological conditions. Future studies should explore increasing the frequency of CardioWall sessions to enhance outcomes.





**Read the Case Report** 

- 1. Modified Fatigue Impact Scale (MFIS), National MS Society, 2024. 2. Berg Balance Testing, National Library of Medicine, 2023 3. National Institute for Health and Care Excellence (NICE), Rehabilitation for Chronic Neurological Disorders, NICE Guideline
- 4. Oxford Academic, Management of Patients with Chronic Neurological Problems in the Community, 2020.
- 5. BMJ, Stroke Rehabilitation in Adults: Summary of Updated NICE Guidance, 2019. 6. Journal of NeuroEngineering and Rehabilitation, Rehabilitation Technologies and Interventions for Individuals with Spinal Cord Injury

7. Journal of NeuroEngineering and Rehabilitation, Factors that

Influence the Adoption of Rehabilitation Technologies, 2021. 8. Neurological Sciences, New Approaches to Recovery After Stroke,

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