DOES CARDIAC REHABILITATION CHANGE PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOUR FOR PEOPLE WITH MILD-TO-MODERATE STROKE IN THE SUB-ACUTE PHASE OF RECOVERY?

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Introduction

- Neurological deficits lead to people post-stroke spending more than 80% of their day sedentary (1) with most of this time accumulated in longer bouts which have been detrimentally associated with cardiometabolic health independent of total sedentary time (2).

- People with stroke also take part in less physical activity (PA) than those without neurological disease (3).

- The physically inactive and sedentary lifestyles of people post-stroke make them susceptible to cardiovascular disease and skeletal muscle deconditioning.

- The integration of post-stroke patients into conventional cardiac rehabilitation (CR) programmes has been advocated (4) with the key aim of CR to improve modifiable risk factors for cardiovascular disease, including PA.

- The extent to which CR may improve the physical behaviours of people post-stroke in earlier stages of recovery, such as the sub-acute phase, is largely unknown.

Aims

- The aim of this study was to assess whether the physical behaviours of people with mild-to-moderate stroke in the sub-acute phase of recovery improve after completing adapted CR.

Methods

Participants

- Participants were recruited from University Hospitals of Leicester NHS Trust, UK within one week to six months (sub-acute) of a mild-to-moderate stroke, defined by a National Institutes of Health Stroke Scale (NIHSS) score 0-15.

- Participants were aged over 18 years and were able to walk 10m with or without an aid.

- Exclusion criteria were based on cardiac contraindications for participating in CR which included: heart disease NYHA class III and upwards, uncontrolled symptomatic arrhythmias, exertional angina and uncontrolled hypertension.

Procedure

- Participants undertook an adapted supervised CR programme, with twice weekly classes for six weeks, delivered by members of the CR team and including a specialist stroke physiotherapist.

Physical behaviour measurement

- Patients were asked to wear an ActiGraph wGT3X-BT accelerometer on the right anterior hip during waking hours for seven days before and after CR.

- Non time-based variables were step count and average movement (counts per minute (CPM)).

- Time-based variables were stationary time (ST) classified as <100cpm, LPA classified as 100-2019cpm, and MVPA classified as ≥2020cpm.

- Daily bouts were derived; 1-9 minutes (short), 10-29 minutes (medium) and ≥30 minutes (long) for ST and 1-4 minutes (short), 5-9 minutes (medium) and ≥10 minutes (long) for MVPA.

- Time-based data were converted to percentages within three compositions: (i) the waking day (ST, LPA and MVPA); (ii) MVPA (short, medium and long bouts); and (iii) ST (short, medium and long bouts).

- Percentage change for each component of the compositions were calculated and used to classify patients into groups of behavioural responses following rehabilitation (increased, decreased or did not change). No minimum threshold for change was used (i.e. ≤/≥0.1%).

Statistical analyses

- Data are reported as arithmetic mean (SD) or frequency (%).

- Within-group comparisons for non time-based behaviour variables were conducted in SPSS (v23.0) using paired t-tests, Wilcoxon signed-rank tests, and one-way repeated measures analysis of covariance controlling for waking wear time.

- Within-group comparisons for time-based behaviour variables were conducted in R (http://cran.r-project.org) using compositional data analysis for each composition.

Results

Participant characteristics

- Of the 32 patients who took part, 26 completed the study (81% of original sample) and 24 provided valid physical activity data at both time points (92% of completers).

- Participants were aged 63.1±14.6 years, predominantly male (58%), had an NIHSS score of 2.6±1.9 and provided 5.9±1.1 valid days of accelerometry for each time point.

- At baseline, patients spent 504±96 minutes stationary, 205±80 minutes in LPA, 11±17 minutes in moderate PA and zero minutes in vigorous PA/day (Fig 1); accumulating 3255±2864 steps/day.

Fig 1 Proportion of the waking day in physical behaviours at baseline
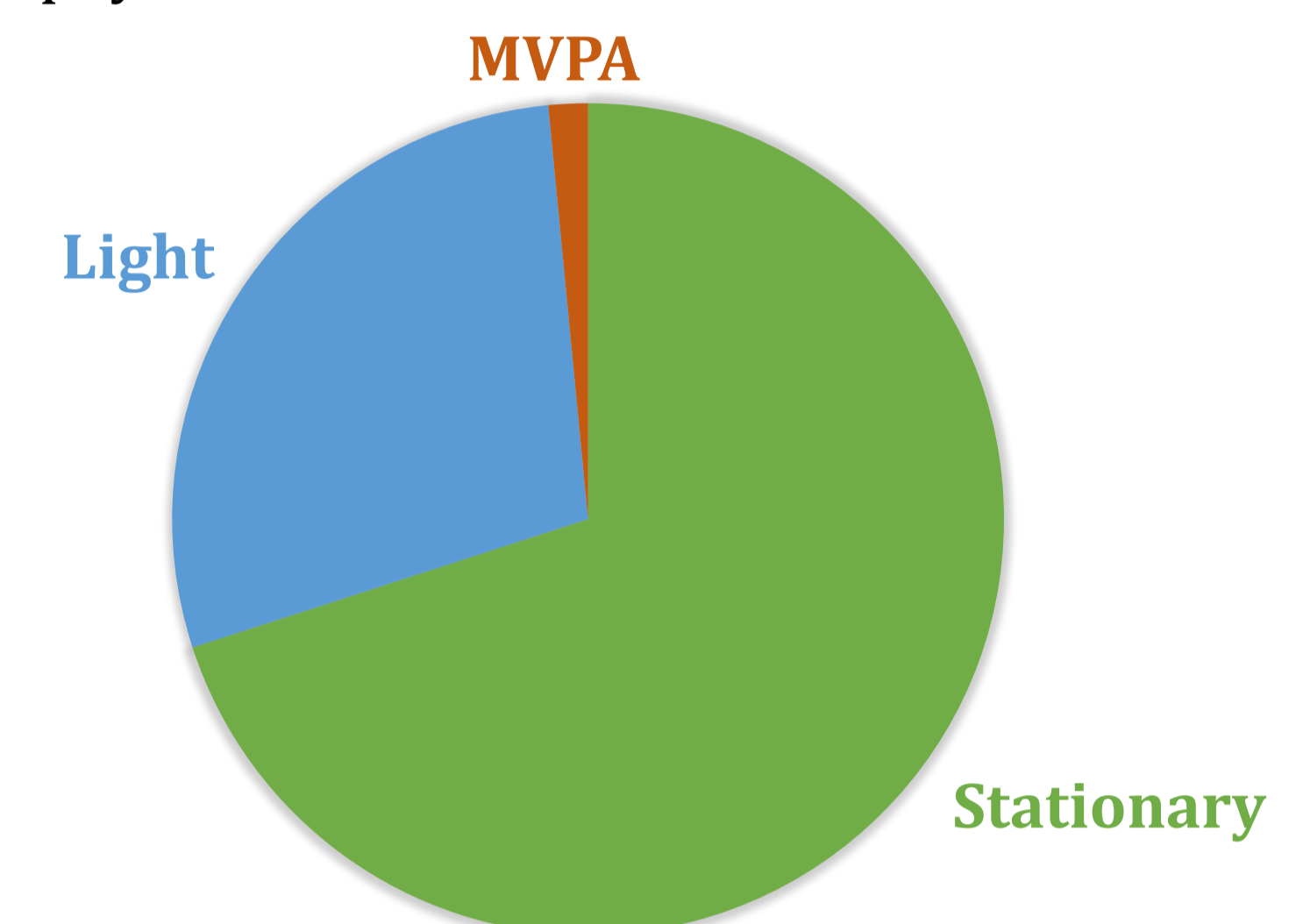
Changes in physical activity following cardiac rehabilitation

- Following rehabilitation, patients took significantly more steps compared to baseline (3255±2864 vs. 3908±3399 steps/day, p=0.004).

- The number of bouts lasting ≥5 minutes (0.7±1.4 vs. 1.2±1.8 bouts/day, p=0.008) and ≥10 minutes (0.3±0.8 vs. 0.6±1.1 bouts/day, p=0.021) increased significantly following CR.

- No change in average movement intensity was observed (188±142 vs. 225±173CPM, p=0.050).

- No significant changes in the composition of the waking day was observed (p=0.679), but patients tended to spend less time sedentary (70±11 vs. 68±11%) at the expense of more time in LPA (28±10 vs. 30±9%) and MVPA (2±3 vs. 2±4%) (Fig 2A). No significant changes in the compositions of MVPA and ST were observed (Fig 2B and Fig 2C).

Fig 2 Percentage change for each component of the three compositions: Panel A: Waking day composition (stationary time, LPA and MVPA); Panel B: MVPA composition (short, medium and long bouts); and Panel C: Stationary time composition (short, medium and long bouts).
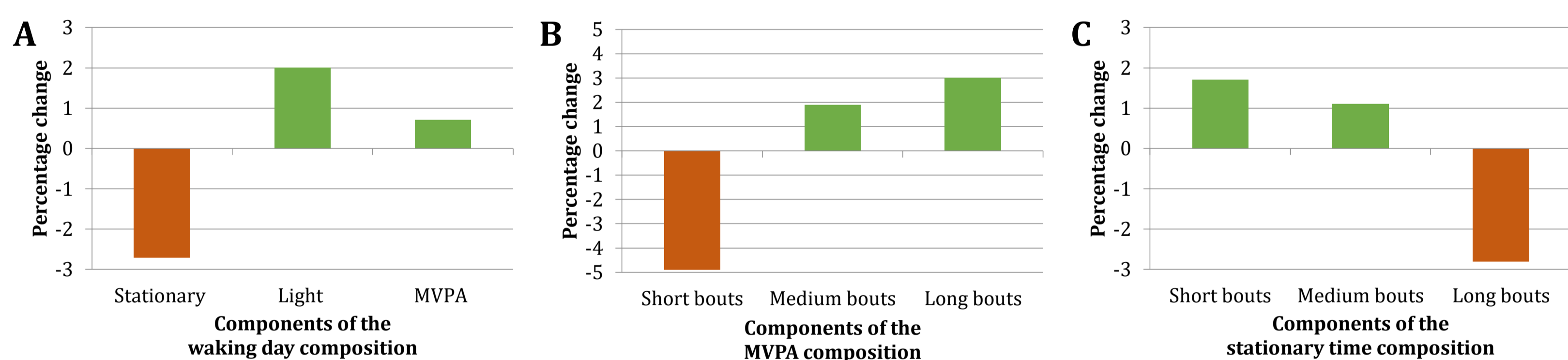
- For the composition of the waking day, 10 people (42%) increased their LPA and MVPA at the expense of ST whilst 3 people (13%) increased their ST at the expense of LPA and MVPA (Fig 3).

- For the composition of MVPA, 3 people (13%) increased their medium and long bouts at the expense of short bouts.

- For the composition of ST, 8 people (33%) increased their short bouts at the expense of medium and long bouts.

Fig 3 Proportion (%) of individuals grouped according to changes in the waking day composition.

- Good response: ↓Stationary; ↑LPA; ↑MVPA — 41.7
- Good response: ↓Stationary; ↓LPA; ↑MVPA — 8.3
- Unclear response: ↑Stationary; ↓LPA; ↑MVPA — 12.5
- Unclear response: ↓Stationary; ↑LPA; ↓MVPA — 25
- Poor response: ↑Stationary; ↓LPA; ↓MVPA — 12.5

Conclusion

- The present study offers encouraging insight into the potential for CR to improve the low levels of PA undertaken by people post-stroke in the sub-acute phase of recovery.

- CR participants took more daily steps and engaged more frequently in longer bouts of MVPA compared to pre-rehabilitation levels.

- However, in the first study to examine the impact of an adapted CR program on PA and sedentary behaviour using a compositional data analysis approach, we observed no significant changes in the composition of people's' waking day (stationary, light and MVPA).
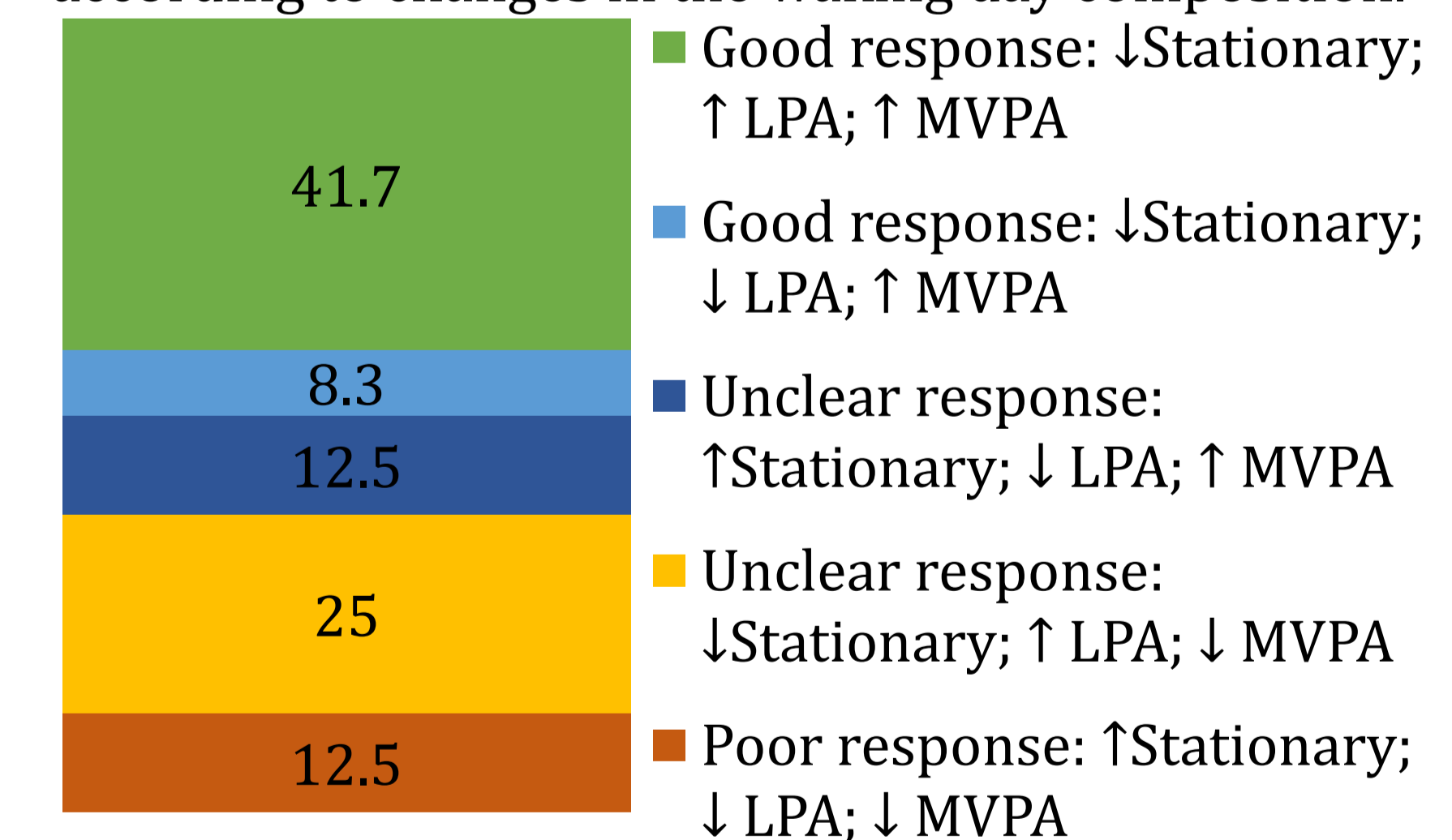
References:
(1) Tieges Z, et al. Arch Phys Med Rehabil. 2015;96(1):15–23. (2) Healy GN, et al. Diabetes Care. 2008;31(4):661–6. (3) Butler EN, Evenson KR. Top Stroke Rehabil. 2014;21(3):246–55. (4) Tang A, et al. BMC Neurol. 2010;10:40.