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Changes in the physical activity of acute stroke survivors between inpatient and community living with early supported discharge: an observational cohort study

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Abstract

Objective To describe and compare patterns of physical activity among stroke survivors during their hospital stay and community living with early supported discharge.
Design Observational cohort study of physical activity before and after early supported discharge.
Setting UK National Health Service stroke units and participants' homes.
Participants Forty-one stroke survivors with a mean age of 69 (standard deviation 11) years, and a median Modified Rivermead Mobility Index of 33.5 [interquartile range (IQR) 25.8 to 35.3].
Main outcome measures The primary outcome measures were time spent in sitting/standing/walking and number of steps taken, as recorded by a physical activity monitor.
Results There were statistical differences ($P < 0.001$) for all categories of physical activity. After early supported discharge to the community, participants took more than twice the number of steps {median 474 (IQR 189 to 773) vs. 1193 (IQR 512 to 2856), median difference 636 [95% confidence interval (CI) 262 to 931]} and spent more than double the time in standing [median 51 (IQR 22 to 128) minutes vs. 100 (IQR 51 to 178) minutes, median difference 28 (95% CI 11 to 68)] compared with their hospital stay.
Conclusion Community living with early supported discharge promoted higher levels of physical activity in medically stable stroke survivors. The near-doubling of activity may serve as a guideline for what is achievable during stroke rehabilitation.
Clinical Trial Registration Number UKCRN 15472.

Keywords: Observational study; Stroke; Rehabilitation; Walking; Physical fitness

Introduction

The physical rehabilitation of stroke survivors is based around movement [1]. This physical activity is central to the recovery of motor skills impaired by stroke, with evidence of the positive relationship between activity and recovery continuing to emerge [2]. Physical activity is also a recognised factor in preventing future health problems, with recommendations of 20 to 60 minutes of moderate-intensity physical activity on 3 to 5 days per week during the rehabilitation period [3]. Furthermore, physical activity is important for the prevention of early medical complications associated with immobility [4]. Recent work, however, has quantified very sedentary behaviours among stroke survivors [5,6]. A recent behavioural mapping exercise categorised 74% of daytime activity as 'sedentary' in stroke patients ($n = 104$) during their stay at a rehabilitation facility [7], and these observations are echoed across the general stroke population [8].

Early supported discharge is now the preferred option for stroke survivors who are medically stable and can be supported at home. A recent meta-analysis produced robust evidence that survivors with mild-to-moderate disability receiving early supported discharge with a co-ordinated

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multidisciplinary team had better functional outcomes at follow-up (median 6 months, range 3 to 12 months) than survivors receiving conventional, inpatient care [9]. What is not known is the mechanism through which this improved response occurs, with possible factors including less dependency on carers and a more tailored care and rehabilitation package [9]. It is possible that, through re-engagement with familiar domestic and social roles, a stroke survivor naturally increases the intensity and frequency of their physical activity, with the consequent positive effect on motor recovery and physical health. On the other hand, early supported discharge may have a deleterious effect on a stroke survivor's physical activity through reduced contact with rehabilitation therapists. Any change in physical activity is likely to be affected by a range of medical and demographic factors, such as severity of stroke, co-morbidities and age.

Technological advances in body-worn sensors, such as accelerometers, provide simple, widely accepted solutions for measuring physical activity in clinical populations such as stroke survivors [10]. The activPal [Paltechnologies, Glasgow, UK] has been validated across a number of healthy (children, adults and older adults) and clinical populations, and has been applied successfully to stroke populations [6]. This instrument categorises physical activity into four behaviours: lying, sitting, standing and walking. The activPal has the capacity to record data over 14 days at 10 Hz. The major advantage of this instrument is that it is small (credit-card sized) and lightweight (<15 g). Being applied to the thigh, it also minimises intrusion for the participant.

In order to better understand the effect of early supported discharge on physical activity, a cohort observational study of stroke survivors before and after early supported discharge was designed.

Primary aim

The primary aim of this study was to quantify the physical activity behaviour of stroke survivors discharged from the acute hospital setting to community living with early supported discharge.

Secondary aims

The secondary aims were: (1) to compare levels of physical activity between inpatients and those living in the community with early supported discharge; and (2) to investigate participant and service factors that may influence physical activity (i.e. changes in mobility levels and time delay to discharge).

Methods

Design

This was an observational cohort study of the physical activity behaviours of stroke survivors before and after discharge from an acute hospital to the community with early supported discharge. The protocol and informed consent process were approved by the West of Scotland Research Ethics Committee (13/WS/0150).

Participants

Potential participants were identified by the clinical team and recruited by a clinical trials nurse from two acute hospital sites within the Lanarkshire Health Board area using the following inclusion criteria: clinical diagnosis of stroke, medically stable and referred for early supported discharge, and a discharge date arranged in the near future but not within the following 48 hours. Patients considered to be lacking in capacity to provide informed consent due to significant language problems or cognitive impairment were excluded. A target sample size of 40 was considered feasible while providing sufficient data to identify and test statistical patterns within the dataset.

Data collection

Following informed consent and during their inpatient stay, a research nurse fixed a single tri-axial accelerometer (PalTechnologies) to each participant's thigh (non-paretic side, for consistency) using waterproof materials. Data were sampled at 20 Hz and categorised, using manufacturer software (PalTechnologies), into four physical activity behaviours: (1) time (minutes) spent sitting or lying; (2) time (minutes) spent standing; (3) time (minutes) spent walking; and (4) number of steps taken. The following baseline data were recorded: (1) mobility, using the Modified Rivermead Mobility Index [11]; (2) stroke type (haemorrhagic or infarct); and (3) demographic data, including age, sex and if they lived alone. After 48 continuous hours of data collection, excluding weekend hours, the accelerometer was removed and the data were downloaded. A follow-up home visit was arranged once the participant had been discharged with the early supported discharge team. At this visit, which was arranged within 1 week of discharge, the Modified Rivermead Mobility Index was recorded and the accelerometer was fixed to the participant's thigh, following the same protocol as above, for a further 48 hours. The number of therapy sessions during each of the observational periods (hospital and early supported discharge) was recorded from the medical notes.

Statistical analysis

Data were first assessed for normality using histogram plots and Ryan Joiner tests. This showed that the data were not normally distributed (Ryan Joiner values ranged between 0.79 and 0.95; $P < 0.01$). Accordingly, to address the primary aim, the data were described using median and interquartile range (IQR). For the secondary aims, the data were tested for significant differences using the Wilcoxon signed rank test. The influence of factors such as time delay (number of days

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