Change in sitting & activity after stroke rehabilitation: the first 3-months home

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Sitting and physical activity

Benefits in shifting activity behaviour from sitting to walking

- Functional retraining, allowing greater task specific practice

- Reduce risk: benefits for BP[1] and cardiovascular & cardiometabolic health[2]

During rehabilitation in hospital

- Sitting time is high, and walking activity limited

- Change in environment (hospital to home) can reduce sitting time[3]

- Limited understanding of factors that influence change in sitting

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[1] English, 2017   [2] Duvivier, 2018   [3] Simpson, 2018

Clinical implications

Predicting change in activity at home may assist clinicians to identify stroke survivors more likely:

- Reduce sitting, increase activity over time - maximise functional gains

- Persistent low activity levels - greater support, behaviour change strategies

Understanding activity once home at certain timepoints

- Identify and treat the factors influencing activity at that time

- 3-months at home: outpatient rehabilitation transition

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Aims

To investigate whether:

1. Sitting and walking activity changes between discharge and 3-months

2. Physical, psychological & cognitive factors at hospital discharge predict any change in activity

3. After 3-months home, physical, psychological & cognitive factors are associated with sitting and walking activity

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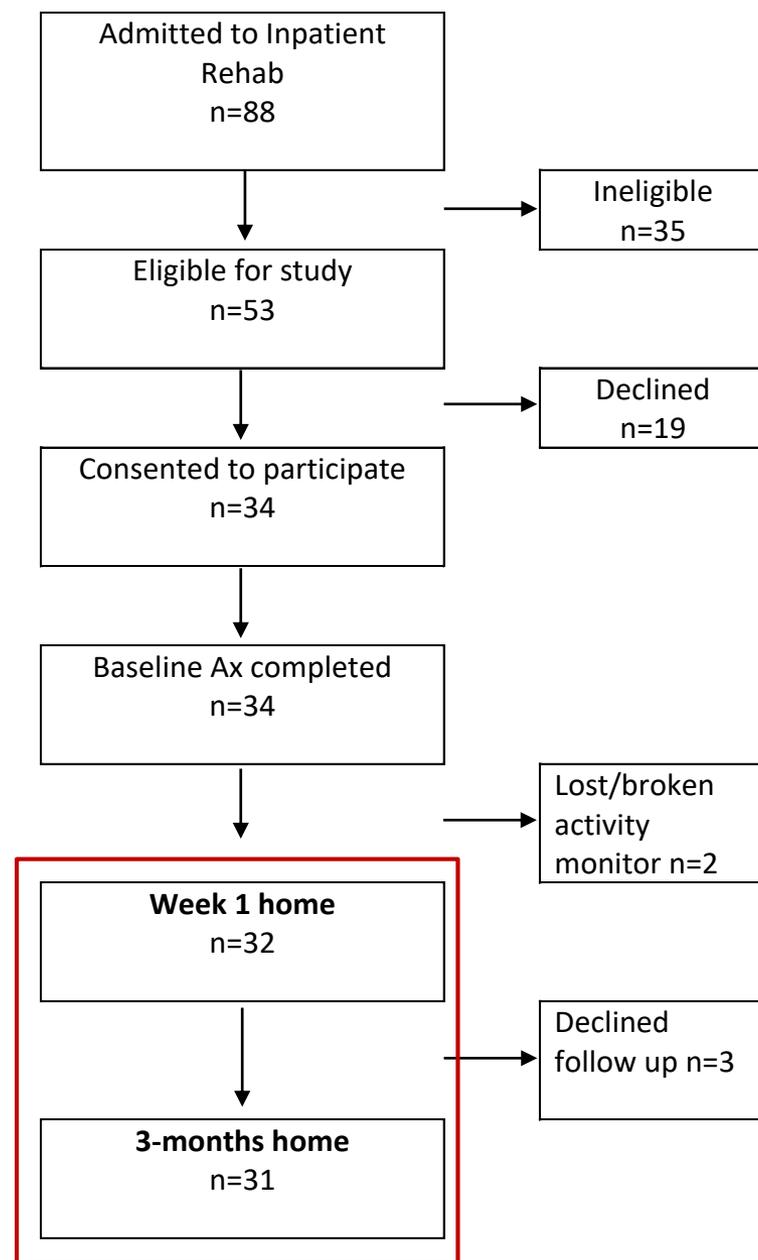
Methods

Observational study (n=34)
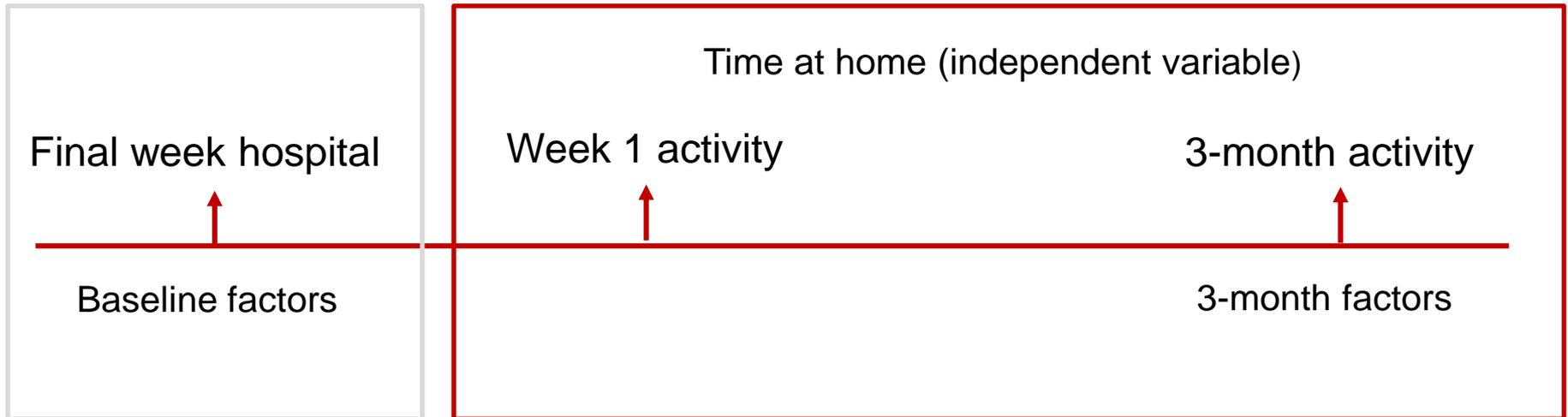
2 subacute rehabilitation units

Inclusion criteria:

- stroke diagnosis
- independent mobility pre-stroke

Exclusion criteria:

- discharge to care facility
- not expected to survive > 3/12

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┌─────────────────────────┐
│ Admitted to Inpatient   │
│ Rehab                   │
│ n=88                    │
└───────────┬─────────────┘
            │          ┌──────────────┐
            │─────────▶│ Ineligible   │
            │          │ n=35         │
            ▼          └──────────────┘
┌─────────────────────────┐
│ Eligible for study      │
│ n=53                    │
└───────────┬─────────────┘
            │          ┌──────────────┐
            │─────────▶│ Declined     │
            │          │ n=19         │
            ▼          └──────────────┘
┌─────────────────────────┐
│ Consented to participate│
│ n=34                    │
└───────────┬─────────────┘
            ▼
┌─────────────────────────┐
│ Baseline Ax completed   │
│ n=34                    │
└───────────┬─────────────┘
            │          ┌──────────────┐
            │─────────▶│ Lost/broken  │
            │          │ activity     │
            ▼          │ monitor n=2  │
┌─────────────────────────┐└──────────┘
│ Week 1 home             │
│ n=32                    │
└───────────┬─────────────┘
            │          ┌──────────────┐
            │─────────▶│ Declined     │
            │          │ follow up n=3│
            ▼          └──────────────┘
┌─────────────────────────┐
│ 3-months home           │
│ n=31                    │
└─────────────────────────┘
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Outcome measures: Physical Activity

Final week hospital	Time at home (independent variable)
Week 1 activity ... 3-month activity	
Baseline factors	3-month factors

Activity monitor continuously for 7-days: (activPAL)

- Sitting time – total duration
- Walking time
- Steps / day

Demographic and clinical factors

Characteristics

- Age, sex, stroke type, severity, carer present

Physical measures

- Gait speed and endurance (10m walk, 6min walk)

- Functional leg strength (5 STS test)

- Pain (VAS)

Psychological measures

- Hospital Anxiety & depression scale

- Fatigue assessment scale

Cognition

- MoCA

Data analysis

Change in activity over time:

- Linear mixed models with timepoint (week 1 or 3-months) as exposure and activity time (sitting, walking) as outcome

Factors associated with change in activity over time:

- Interaction between the time and baseline demographic and clinical factors

Cross-sectional associations between factors and activity at 3-months:

- Linear regression analysis adjusted for waking hours

Participants

Characteristics:	Baseline (n=28)	Range (min, max)
Age (years) mean (SD)	69.1 (12.3)	(32 - 89)
Male (n, %)	14 (50.0)	
Days since stroke mean (SD)	43.3 (26.8)	
NIHSS score at stroke onset mean (SD)	7.4 (5.3)	(1 – 20)
Independent walking (n, %)	22 (78.6)	
Depression score mean (SD)	3.1 (2.4)	
Fatigue score mean (SD)	21.1 (7.0)	
6MW (m) mean (SD)	283 (164)	(60 – 610)
Gait speed (m/s) mean (SD)	1.00 (0.58)	(0.17 – 2.27)
MoCA score mean (SD)	22.4 (5.4)	
Pain present (n, %)	9 (32.1)	
Living with carer (n, %)	19 (67.9)	

Results: Change in activity over 3-months

Activity type (Total mins/day)	β* (95% CI)	p-value	Clinical meaning at 3-months
Sitting time	-39 (-70, -8)	0.01	39 mins **less** sitting
Walking time	21 (2, 22)	0.02	21 mins **more** walking
Steps/day	1112 (268, 1956)	0.01	1112 **more** steps / day

*β adjusted for waking hours, age, sex

n=28 (matched activity monitor data both timepoints)

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Predictors of change in activity

- No statistically significant associations between baseline factors and change in sitting, or walking activity over 3-months

- Simulation of sample size suggests for change in sitting time

sample size	factor	β	(95% CI)	p value
60	Depression	10	(2.5, 17.5)	0.009
	Gait speed	-4.4	(-7.6, -1.4)	0.005
90	Depression	10	(4, 16)	0.001
	Gait speed	-4.4	(-6.8, -2.0)	≤0.001
	Fatigue	2	(0.3, 4)	0.02
120	Depression	10	(5, 15)	≤0.001
	Gait speed	-4.4	(-6.5, -2.3)	≤0.001
	Fatigue	2	(4, 6)	0.006
	Cognition	-2	(-4, -0.1)	0.049

β (95% CI) in minutes

3-months cross-sectional: univariable analysis (n=31)

Factor	Sitting time β (95% CI)		Walking time β (95% CI)		Steps/day β (95% CI)	
Depression	18.8	(48.0, 32.4)			-340	(-674, -5)
Fatigue	8.9	(2.4, 15.0)	-2.3	(-4.2, -0.6)	-189	(-338, -40)
Gait speed (*10cm/s*)	-10.57	(-18.2, 2.9)	4.3	(2.6, 6.0)	379	(245, 513)
Endurance (*m*)			10	(10, 20)	11	(5, 17)
5x STS (*s*)			-1.3	(-2.4, -0.0)	-94	(-180, -8)

$P<0.05$ Time in minutes; 5xSTS: 5-times sit-to-stand test
Individual univariable activity models with adjustment for waking hours

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3-month cross-sectional: multivariable analysis (n=31)

Factors	Sitting time*	Walking time*	Step count
	β (95% CI)	β (95% CI)	β (95% CI)
Depression^	22.3 (7.9, 36.5)		
Mean gait speed# (10cm/s)		4.3 (2.7, 5.9)	378 (246, 510)

*Time (minutes); Models adjusted for waking hours and age; ^ p<0.05, # p≤0.001

Strengths & Limitations

Strengths

- Objective device (activPAL3) high accuracy for sitting and walking time

- Linear mixed models, careful adjustment for waking hours and other covariates

- Stroke population: range of walking speed and stroke severity

Limitations

- Small sample size – under powered to detect factors predicting activity change

- activPAL less accurate for step count at slow gait speeds

- Other factors may influence sitting time and walking activity

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Discussion

Overall activity changed during the first 3-months home after stroke

- Sitting time reduced by nearly 40 mins

- Walking time (21 mins) and daily step count (1112 steps) increased

Predicting change in activity over the first 3-months remains a challenge

- Depression, gait speed and fatigue warrant further investigation

At 3-months after discharge

- Low mood associated with greater time spent sitting

- Faster walking speed associated with greater walking activity

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