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Mahendran, Niruthikha, Kuys, Suzanne S. and Brauer, Sandra G.

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Dr Niruthikha Mahendran, PhD, Professor Suzanne S. Kuys, PhD, Professor Sandra G. Brauer, PhD

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Accelerometer and Global Positioning System measurement of recovery of community ambulation across the first six months following stroke: an exploratory prospective study

Authors: Dr Niruthikha Mahendran PhD[1,2*], Professor Suzanne S Kuys PhD [3,4*], Professor Sandra G Brauer PhD[1]

Affiliations:

[1]Division of Physiotherapy, School of Health and Rehabilitation Sciences, University of Queensland, Brisbane, Australia

[2] Discipline of Physiotherapy, Faculty of Health, University of Canberra, Canberra, Australia

[3] School of Physiotherapy, Faculty of Health Sciences, Australian Catholic University

[4] Griffith Health Institute, Griffith University, Brisbane, Australia

*Author has changed affiliation during the study period

Corresponding Author

To: Niruthikha Mahendran

E-mail: n.mahendran@canberra.edu.au

Address: 226/41 Chandler Street, Belconnen, ACT 2617

Phone: +61 413 656 226

Fax: +61 2 6201 5666

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Abstract

Objectives: To characterise community ambulation and determine if it changes across the first six months following discharge from hospital after stroke.

Design: Prospective, observational study.

Setting: Community setting, Brisbane, Australia.

Participants: 34 subacute stroke survivors with no cognitive impairment or conditions limiting mobility prior to stroke.

Interventions: Nil

Main outcome measures: Community ambulation was measured by an accelerometer, Global Positioning System and activity diary. Measures included: volume (step count; time spent in the community, lying/sitting, standing and walking), frequency (number of community trips; number of and time in short, medium, long duration bouts) and intensity (number of and time at low, moderate, high intensity bouts) and trip type at one, three and six months following hospital discharge.

Results: At one-month, participants took on average one trip per day in the community, lasting 137±113 minutes. Overall, most community ambulation was spread across long duration bouts (>300 steps) lasting 11.3 to 14.1 minutes/day and moderate intensity bouts (30-80 steps/minute). There was no change in community ambulation trip type ($p < 0.302$) or ambulation characteristics over time except for a greater number of and time spent in long ambulation bouts at six-months only ($p < 0.027$).

Conclusions: Total volume and intensity of community ambulation did not change over the first six-months post-discharge after stroke. However, at six months, survivors spent more time in long duration ambulation bouts. Review of stroke

survivors at six-months following hospital discharge is suggested, as this is when changes in community ambulation may first be observed.

Keywords: Stroke, Community ambulation, GPS, accelerometer, activity diary

List of abbreviations

GPS	Global Positioning Systems
10MTW	Timed 10metre walk (comfortable pace)
6MWT	6-minute walk test
SD	Standard Deviation

Returning to community ambulation, that is, independent ambulation outside the home and yard, is regularly reported as a key goal by a majority of stroke survivors[1]. However despite its importance, individuals with chronic stroke complete fewer community trips and walking related activities compared to healthy adults[2]. Further, high scores on clinical measures of gait and function do not predict successful community ambulation outcomes after stroke[1,2]. As community ambulation is a vital precursor to successful community re-integration[3], limitation in this outcome could contribute to further disability and poor health outcomes[1,4-6].

To date, community ambulation after stroke has been measured through self-report diaries and questionnaires[1,2,7]. However, these methods are limited by accurate recall[8], and do not provide objective measures of community ambulation. Recently, devices including accelerometers[9] and global positioning systems[10,11] have shown potential for measurement of community ambulation after stroke[12]. Accelerometers have been used to measure daily walking activity after stroke, with increases in daily step count reported in the first three months after hospital discharge[13-15]. How much of this occurs in the community is unknown. Global positioning systems (GPS) have been used in one case study of a stroke survivor, to investigate life space and components of outdoor mobility[11]. In combination, accelerometers and GPS may allow for isolation of community ambulation measures from daily walking activity[12].

Longitudinal measurement of community ambulation across the subacute phase of stroke is important, as this period is often associated with changes in post-stroke impairments[16], activity limitations[16-18] and personal factors[19,20]. These changes may also contribute to improvements in ambulation characteristics and behaviours within the community, such as trip duration and frequency, steps taken, purpose of trips, and choices around interaction with the physical environments[1,2,21,22]. Understanding recovery across this phase may assist in determining why chronic stroke survivors demonstrate poor community ambulation outcomes[1,2,7]. However, accurate, objective measurement across the subacute phase post-stroke is required.

Thus this study aimed to characterise community ambulation using a combination of accelerometers, GPS devices and self-report activity diaries and determine if the characteristics and purpose of community ambulation changes across one, three and six months following hospital discharge after stroke. It was hypothesised that stroke survivors would increase levels of community ambulation and engage in more social and recreational community ambulation over time.

Methods

This study followed a prospective longitudinal observational design. Institutional ethical approval was obtained and all participants provided written informed consent. This study was conducted in accordance with the Declaration of Helsinki.

Participants

A sample of 42 people who had been diagnosed with stroke was recruited from acute stroke and rehabilitation units of a tertiary referral hospital in Brisbane, Australia. Participants were included if they (1) presented with a stroke within the past 4 months, (2) were aged > 18 years and (3) were discharged into the community to live alone or with a carer or spouse. Individuals were excluded if they: (1) had a diagnosis of another neurological condition (e.g. Parkinson's disease) or co-morbidities that limited ambulation prior to stroke (2) had any unstable medical condition, (3) had chest pain, heart attacks, angioplasty or heart surgery in the previous three months, (4) unable to walk indoors for 10m, (5) were discharged to a residential aged care facility, (6) had moderate to severe expressive or receptive communication difficulties or (7) scored < 24/30 on the Mini Mental State Examination[23].

Procedures

Participants attended four assessments: at discharge from hospital, and at one, three and six months following hospital discharge. At the discharge assessment, general clinical information, demographics and measures of gait and function (Modified Rankin Scale, Motor Assessment Scale, Timed 10 metre walk test, and 6 minute walk test) were collected.

At each follow-up assessment, participants were fitted with an accelerometer, the ActivPAL™, and provided with a Garmin GPS device and activity diary to measure usual community ambulation over four days[8]. The ActivPAL™ was worn continuously over the measurement period. The GPS was switched on by the participant at the commencement of any community trip, defined as any trip 'outside the home and yard'[1], and switched off when

participants returned home. In addition, participants documented details of each community trip via an activity diary.

The ActivPAL™[a] is a uniaxial accelerometer, which records measures at 15 second epochs, and deemed valid and reliable for community ambulation measurement after stroke[12]. The ActivPAL™ was encased in a waterproof covering and affixed to the skin in the middle of the front thigh with a low irritant sticker (hypafix). Measures collected from the device included step counts and activity duration.

The Garmin Forerunner 910XT[b] is a GPS enabled sports watch with a battery life of up to 20 hours and recording frequency of 2.4 GHz. The Garmin GPS operating system was previously deemed valid and reliable for location and duration of trips in a sample of chronic stroke survivors[12]. Participants wore the device on the wrist of their affected arm, to ensure easy manipulation of the device. Data and graphs obtained from the Garminconnect website (www.garminconnect.com.au) provided overall trip summaries which were used to identify location and time spent out of the home and yard.

Participants completed an activity diary that detailed trip time, location, estimated time spent walking, transport choice, purpose of community trips and any issues encountered during trips. The activity diary was used during GPS and accelerometer data cleaning and analysis and to obtain purpose of trips into the community.

Outcome Measures

An 'ambulation bout' (defined as a 15-second epoch with ≥ 2 steps)[15,24] was used to derive

measures of volume, frequency and intensity based on definitions previously used in stroke[9,15]. *Volume* of community ambulation was characterised by measures of total number of steps and time in minutes spent out in the community; as well as time spent sitting/lying, standing, walking and upright in the community per day. *Frequency* of community ambulation was characterised by measures of total number of community trips[2] and ambulation bouts per day, as well as number of and total time in minutes taken at each ambulation bout duration per day[9]. Bout duration was defined as – short: < 40 steps; medium: 41-300 steps; and long: > 300 steps[9]. *Intensity* of community ambulation was determined based on the number of and total time in minutes spent at each ambulation bout intensity per day [15]. Bout intensity was defined as – low: a cadence of < 30 steps/minute; moderate: a cadence of 30-80 steps/minute; and high: a cadence of > 80 steps/minute [15].

Trip purpose was defined based on the purpose reported by the participant for each community trip. Purpose of trips was categorized according to the participation domain of the Stroke Impact Scale (version 3.0)[3] and included: 1) work, 2) social, 3) recreation, 4) essential errands and roles and 5) religious and spiritual. Multipurpose trips were categorized based on main purpose of the community trip confirmed by participants, diaries and GPS maps.

Data Analysis

Measures of community ambulation were obtained by analysing subsets of ActivPAL™ data using start and stop times and location data from the GPS and activity diary. A customised MATLAB[c] program was used to obtain measures. Data were screened for normality. All measures of community ambulation were positively skewed, and were thus square root transformed[25].

Means, standard deviation and range for all raw measures of volume, frequency and intensity were calculated to characterise community ambulation at one, three and six months following hospital discharge. Linear mixed effects modelling (using transformed data), adjusted for age[26] and discharge gait speed[1,27], was used to test for change in community ambulation across the three time points.

Proportion of trips taken, total time in the community and total steps in the community for each trip purpose across the three time points was calculated. Cross-tabulation and Kruskal-wallis testing were used to check for change in number of community trips by trip purpose. Significance was set for $p < 0.05$. SPSS 21.0[d] was used for all statistical calculations.

Results

Participants

Of 225 stroke survivors screened prior to hospital discharge, 42 were recruited. From recruitment at hospital discharge to one month, five participants were lost to follow-up; one participant refused to wear devices and two participants had insufficient GPS data at all three follow-up time points. Data from a total of 34 participants were included in the final analysis. See Figure 1 for flow of participants through the study.

Insert Figure 1

Table 1 details the sample characteristics at hospital discharge. Discharge gait speed and endurance indicated that twenty (60%) participants had met both gait speed and endurance criteria and twenty-four (71%) participants had met gait speed criteria for independent community ambulation[28].

Insert Table 1

Characteristics of community ambulation

Participants recorded a total of 325 community trips across the three time points. Of all community trips, 14% were missing GPS/diary data, and 6% had no purpose reported by participants across all time points. All participants ambulated within the community at least once across the four-day measurement period except for one participant at one month (see Figure 2). Approximately 30-40% of stroke survivors ambulated within their community every day at all time points (see Figure 2).

Insert Figure 2

Volume, frequency and intensity of daily community ambulation across one, three and six months are reported in Table 2. Participants took around 1700 to 2300 steps (range 0-10,495 steps) over on average, 2-3 hours per day in the community across all time points. Most time was spent in sitting positions (1-2 hours per day), with 20-25 minutes (range 0-120 minutes) spent walking in the community per day (see Table 2).

Participants took on average, one trip into the community per day. Community ambulation was spread across a total of 23 to 28 bouts (range 0-78 bouts) each day across one, three and six months. Short ambulation bouts (< 40 steps) were most common at all time points (see Table 2). However, most time was spent in long ambulation bouts (>300 steps) at one and six months and in medium ambulation bouts (40-300 steps) at three months (see Table 2).

Most ambulation bouts and time spent walking in the community were spent at moderate intensity levels (see Table 2). Least time was spent walking in the community at low intensity levels (< 30 steps/minute), despite similar numbers of ambulation bouts per day in moderate intensity ambulation. Only 1-2 bouts of community walking per day were of high intensity (>80 steps/minute) at all time points, with stroke survivors spending 7.8 to 13.2 minutes per day walking at a high intensity within their community.

Insert Table 2

Figure 3 displays the proportion of trips taken for each trip purpose. Most trips and time spent in the community were associated with essential roles and errands at all time points (see Figures 3 and 4a). While most steps were taken for essential errands at one month, by three months most steps were taken during recreational activities (see Figure 4b). Number of trips and time spent out in the community for the purpose of work increased at six months only. Stroke survivors demonstrated a decreased proportion of trips, time and steps in social trips over time. There was minimal change in the trips for the purpose of religious and spiritual practices.

Insert Figure 3

Insert Figure 4

Changes in community ambulation across one, three and six months

Changes in community ambulation over the three time points, adjusted for age and discharge gait speed, are presented in Table 3. Time had a significant effect on number of and time spent in long duration ambulation bouts only ($p < 0.028$) (see Table 3). There were no significant changes in community ambulation over time except for an increase in the number of and time spent in long ambulation bouts at six months following hospital discharge. However, there was a trend towards an increase in total time spent in medium duration ambulation bouts over the six months. The number of community trips for each trip purpose did not change over the six months ($p > 0.302$).

Insert Table 3

Discussion

This study is the first to prospectively characterise community ambulation across the subacute phase of stroke using a combination of tools. Stroke survivors who could walk at hospital discharge did not demonstrate any change in community ambulation until six months after returning home. At this time point, stroke survivors increased the number of and time spent in long duration ambulation bouts, with no other change in characteristics of community ambulation. Stroke survivors most often accessed their community to complete

256 essential errands and in contrast to the study hypothesis, did not engage in more social and
257 recreational community ambulation over time.
258
259 Contrary to our hypothesis, the current sample had limited improvement in community
260 ambulation over the first six months after hospital discharge. This was despite most survivors
261 meeting criteria for independence with community ambulation[1,28], half the sample being
262 referred to community-based therapy after hospital discharge and half the sample having
263 carer support[29]. Further, functional improvements are anticipated across this stage[16,17]. One
264 reason for this could be that the sample had already returned to pre-stroke community
265 ambulation by one month post discharge[28]. However this seems unlikely, as the number of
266 community trips measured at one month in the current study were lower than that reported in
267 studies of healthy older adults[2,22], who on average take 1.5[22] to 1.8[2] trips per day. Further, a
268 study of survivors more than 3 years post-stroke who had a similar number of community
269 trips per day as the current study, demonstrated that stroke survivors had significantly fewer
270 community trips compared to healthy controls. Thus, it is likely that the current sample had
271 decreased community ambulation at all three time points.
272
273 It is likely that a combination of factors across various domains of the International
274 Classification of Function, Disability and Health (ICF) contribute to the recovery of
275 community ambulation after stroke[30]. For example, in people with chronic stroke, mood
276 disorders[30], impaired executive function[31], challenging physical environments[21], lack of carer
277 support[32], or poor self-efficacy[33] are related to reduced self-reported community
278 reintegration, and thus may also affect community ambulation outcomes. Future studies
279 should explore the relationship between factors across all domains of the ICF with
280 community ambulation in people with stroke.

Community ambulation may recover differently, and over a different timeframe to clinic-based measures of function[16,17] and free-living activity after stroke[14,15]. A recent study proposed that recovery of community re-integration after stroke, and thus community ambulation, may be reliant upon successful transition between a series of goals, including gaining physical function, establishing independence, adjusting expectations and physical capacity to engage in meaningful roles[34]. This process may take months to over a year to adjust and manage expectations around a return to activities, roles and responsibilities[34]. In light of this, and the observed change in characteristics of community ambulation at six months in the current study, community ambulation recovery may only begin after six months following hospital discharge post-stroke. Future studies of community ambulation after stroke should consider a longer follow-up period (e.g. > 6 months), and qualitative methods exploring how community ambulation recovers after hospital discharge.

In the current study, the most common purpose for community ambulation at all time points was to engage in 'essential roles and errands' such as spousal and parental duties, shopping, and medical appointments. Essential roles and errands are also the most common purpose for community trips in groups with mobility limitations[10,35], including survivors with chronic stroke[7]. While healthy older adults similarly make trips into the community to visit shopping centres[1,36], they also often make trips for social and recreational activities (35-80% of trips)[1,36]. In contrast, social and recreational community trips made up only 25-35% of all trips in the current study. Thus, stroke survivors may restrict community-based social or recreational engagement early after hospital discharge.

Interestingly, in the current study, most steps were taken during recreational community trips at three and six months. Thus, assistance in increasing engagement in these trip types may be useful in improving overall community ambulation. Increasing ambulation within community environments may increase the proportion of daily ambulation that occurs over long bouts and moderate to high intensities, as distance and speed requirements are often higher for community environments than for household-based ambulation[1,28,37,38]. Even in the current study, a high proportion of ambulation occurred across long duration bouts and moderate to high intensities – ambulation characteristics associated with health benefits[39]. Thus, encouraging return to recreational activities should be considered during future management of stroke.

Study Limitations

One limitation of the current study is the small study sample. Further, findings are limited to those able to walk at hospital discharge. Another limitation concerns the use of chosen devices. While devices selected demonstrated potential for measurement of community ambulation over four days, GPS requires stroke survivors to start and stop recordings and charge the device daily, which could result in variable engagement with the device over multiple days. In addition, while the accuracy of accelerometers at slow gait speeds has been queried[40], the ActivPAL™ demonstrated good agreement with direct observation of steps at gait speeds below 0.42m/s in people with stroke[12]. Only two participants in the current sample walked at gait speeds <0.42m/s, thus this is unlikely to have impacted study findings. However, rapid advances in GPS technology and wearable devices have been made recently. In future, devices that can measure location over 24 hour periods, are accurate at slower speeds, have a long battery life, simple user interface, are unobtrusive and require little user

input would be ideal for community ambulation measurement after stroke if determined reliable and accurate in this population.

Conclusions

Stroke survivors access their community regularly following hospital discharge. Changes in community ambulation across the first six months after hospital discharge are only observed at six months, through an increased number of and time spent in long duration ambulation bouts. Total volume and intensity of community ambulation after stroke, and purpose of community trips remains unchanged over the first six months following hospital discharge. It would be beneficial to consider follow-up of stroke survivors at six months after hospital discharge, as change in community ambulation may only be first observed at this time point.

Suppliers

[a] ActivPAL™

PAL Technologies Ltd©

50 Richmond Street

Glasgow G1 1XP

Scotland, UK

[b] Garmin Forerunner 910XT

Garmin Ltd.

Garmin Australasia

30 Clay Place

Eastern Creek, NSW 2766

[c] MATLAB

Mathsworks

3 Apple Hill Drive

Natick, MA

United States 01760

[d] SPSS

IBM Australia Ltd

Level 13, IBM Centre

601 Pacific Highway

St Leonards

NSW 2065

Figure Legends

Figure 1: Flow of participants through study.

Figure 2: Proportion of the sample who took a trip out into the community on one, two, three, four or no days across the measurement period at one, three and six months.

Figure 3: Proportion of trips taken for each purpose at 1, 3 and 6-months.

Figure 4: Proportion of (a) time spent and (b) steps taken in the community for each trip type at 1, 3 and 6-months.

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Table 1: Sample characteristics at hospital discharge

	n = 34
Demographics	
Age (years)	71.6 ± 13.8
Rehab stay (days)	23.6 ± 21.3
Gender (n, % males)	24, 70.6
Employed prior to stroke (n, %)	12, 35.2
Returned to work by six months (n, %)*	5, 42.0
Carer (n, % with)	16, 47.1
Hemiplegia (n, %)	
Nil	7, 20.6
Left	6, 17.6
Right	20, 58.8
Bilateral	1, 2.9
Modified Rankin Scale score / 6 (median, IQR)	2, 1
Motor Assessment Scale score at discharge	
MAS item 1 score / 6 (median, IQR)	6, 0
MAS item 2 score / 6 (median, IQR)	6, 0
MAS item 3 score / 6 (median, IQR)	6, 0
MAS item 4 score / 6 (median, IQR)	6, 0
MAS item 5 score / 6 (median, IQR)	6, 2
MAS item 6 score / 6 (median, IQR)	6, 0
MAS item 7 score / 6 (median, IQR)	6, 1
MAS item 8 score / 6 (median, IQR)	6, 2
Aphasia (n, % with)	9, 26.5
Received therapy on discharge (n, %)	18, 52.9
Independent with outdoor walking at discharge (n, %)	32, 94
Used a gait aid at hospital discharge (n, %)	15, 44
Measures of walking capacity	
10MTW (m/s)	1.0 ± 0.4
6MWT (m)	334.7 ± 139.7

10MTW: Timed 10 metre walk (comfortable pace), 6MWT: 6-minute walk test, MAS: Motor assessment scale, *of those who were working prior to stroke.

Table 2: Mean (SD) of volume, frequency and intensity of community ambulation per day at 1, 3 and 6-months following hospital discharge (raw scores)

	1-month	3-months	6-months
Volume			
Step count, counts	1859 ± 1880	1700 ± 1380	2298 ± 2605
Time spent out in community, minutes	137.0 ± 113.2	120.0 ± 66.9	176.9 ± 148.8
Time spent sitting/lying, minutes	84.8 ± 84.1	70.9 ± 43.1	115.6 ± 116.8
Time spent standing, minutes	30.9 ± 29.2	29.0 ± 21.7	35.7 ± 28.2
Time spent walking, minutes	21.3 ± 20.1	20.1 ± 14.7	25.5 ± 26.6
Time spent upright, minutes	52.2 ± 45.6	49.1 ± 31.5	61.2 ± 50.0
Frequency			
Total number of trips, counts	1.2 ± 0.8	1.1 ± 0.7	1.1 ± 0.6
Number of bouts, counts	23.8 ± 20.9	24.2 ± 17.6	27.8 ± 22.6
Number of short bouts, counts	16.3 ± 15.4	16.8 ± 13.6	19.0 ± 16.2
Number of medium bouts, counts	6.3 ± 5.6	6.4 ± 5.5	7.3 ± 6.9
Number of long bouts, counts *	1.1 ± 1.5	1.0 ± 1.2	1.5 ± 1.8
Duration of time in short bouts, minutes	7.4 ± 7.1	7.8 ± 6.6	8.5 ± 7.3
Duration of time in medium bouts, minutes	10.6 ± 9.6	11.0 ± 9.3	11.9 ± 12.2
Duration of time in long bouts, minutes *	11.3 ± 14.9	9.5 ± 11.2	14.1 ± 21.3
Intensity			
Number of low intensity bouts, counts	10.1 ± 9.4	11.2 ± 10.5	11.1 ± 9.9
Number of moderate intensity bouts, counts	11.9 ± 11.2	11.3 ± 8.7	14.3 ± 13.2
Number of high intensity bouts, counts	1.7 ± 1.9	1.7 ± 1.9	2.4 ± 2.6
Duration of time in low intensity bouts, minutes	4.9 ± 4.6	5.9 ± 6.1	5.3 ± 4.7
Duration of time in moderate intensity bouts, minutes	14.0 ± 12.9	14.7 ± 12.2	16.1 ± 15.9
Duration of time in high intensity, minutes	10.3 ± 13.8	7.8 ± 10.7	13.2 ± 21.2

* indicates that time had a significant effect on measure of community ambulation when adjusted for age and discharge walking capacity ($p < 0.05$)

Table 3: Changes in community ambulation across 1, 3 and 6-months (values are transformed and adjusted for age and discharge gait speed)

	Month 1 to month 3			Month 1 to month 6		
	Mean change	**95% confidence interval**	**p-value**	**Mean change**	**95% confidence interval**	**p-value**
Volume						
Step count	19.1	-78.7 to 116.8	0.688	116.0	1.2 to 230.7	0.048
Time spent out in community	11.3	-14.2 to 36.8	0.366	12.7	-27.9 to 53.3	0.524
Time spent sitting/lying	10.4	-12.7 to 33.5	0.353	-0.5	-39.9 to 38.8	0.978
Time spent standing	4.6	-12.9 to 22.2	0.590	9.5	-8.6 to 27.7	0.290
Time spent walking	1.8	-8.9 to 12.5	0.731	12.7	0.0 to 25.3	0.050
Time spent upright	4.0	-14.7 to 22.7	0.664	15.6	-6.1 to 37.2	0.151
Frequency						
Total number of trips	0.6	-1.5 to 2.7	0.583	0.3	-1.4 to 2.0	0.686
Number of bouts	8.2	-6.2 to 22.5	0.247	8.0	-8.4 to 24.4	0.323
Number of short bouts	7.1	-5.7 to 20.0	0.262	4.2	-10.1 to 18.4	0.552
Number of medium bouts	4.9	-3.6 to 13.4	0.245	8.4	-1.1 to 17.9	0.080
Number of long bouts *	-0.2	-3.6 to 3.3	0.914	4.7	1.7 to 7.7	0.003
Duration of time in short bouts	4.7	-4.2 to 13.5	0.287	3.0	-6.5 to 12.5	0.522
Duration of time in medium bouts ^	6.8	-4.2 to 17.8	0.210	12.1	-0.1 to 24.4	0.052
Duration of time in long bouts *	0.3	-10.3 to 10.8	0.957	13.1	3.5 to 22.7	0.010
Intensity						
Number of low intensity bouts	4.1	-7.2 to 15.4	0.460	1.8	-9.3 to 12.9	0.742
Number of moderate intensity bouts	6.4	-4.7 to 17.5	0.244	8.7	-4.3 to 21.6	0.179
Number of high intensity bouts	1.5	-2.8 to 5.8	0.482	3.7	-0.7 to 7.2	0.104
Duration of time in low intensity bouts	4.4	-3.8 to 12.5	0.277	2.1	-5.5 to 9.7	0.579
Duration of time in moderate intensity	6.5	-7.3 to 20.3	0.340	11.0	-2.6 to 24.6	0.108
Duration of time in high intensity bouts	3.3	-8.9 to 15.5	0.580	10.1	0.6 to 19.7	0.038

* indicates significant effect of time on measures (overall change $p < 0.05$), ^ indicates trend towards time having an effect on measures (overall change p: 0.05 to 0.99), p-values are presented for univariate analyses only.

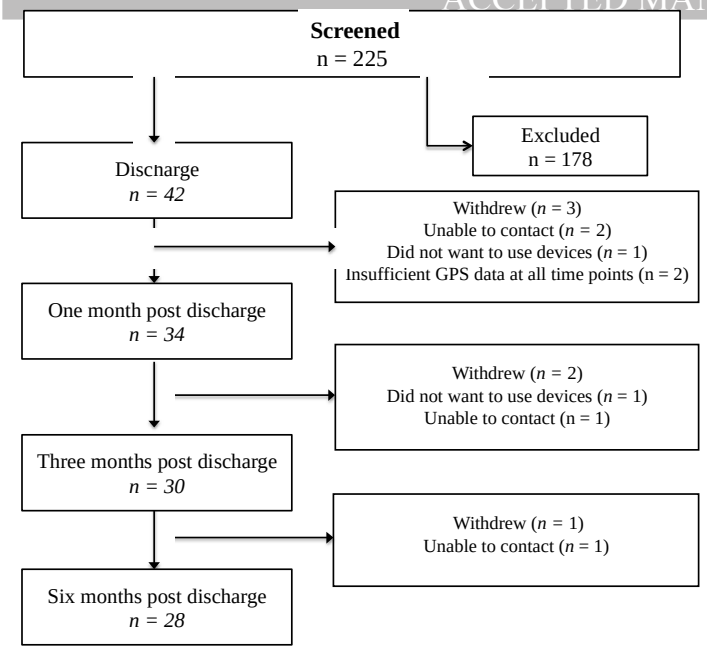

Figure 1: Flow of participants through study

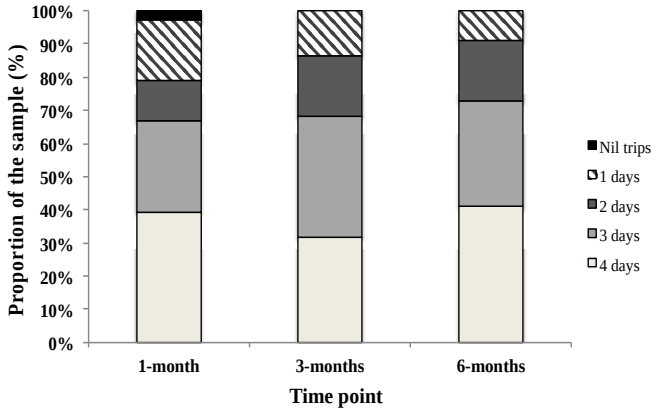

Figure 2: Proportion of the sample who took a trip out into the community on one, two, three, four or no days across the measurement period at one, three and six months

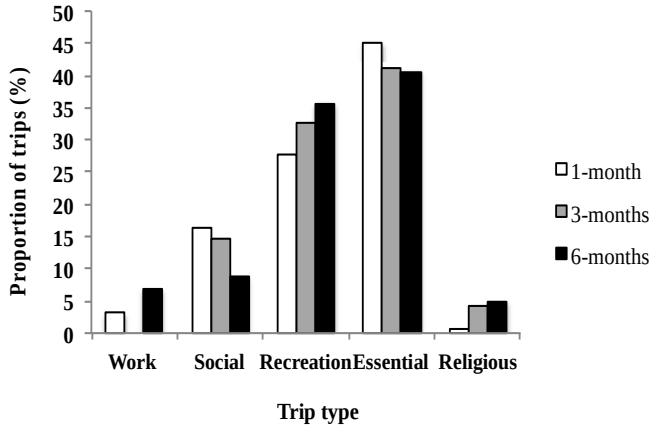

Figure 3: Proportion of trips taken for each purpose at 1, 3 and 6-months

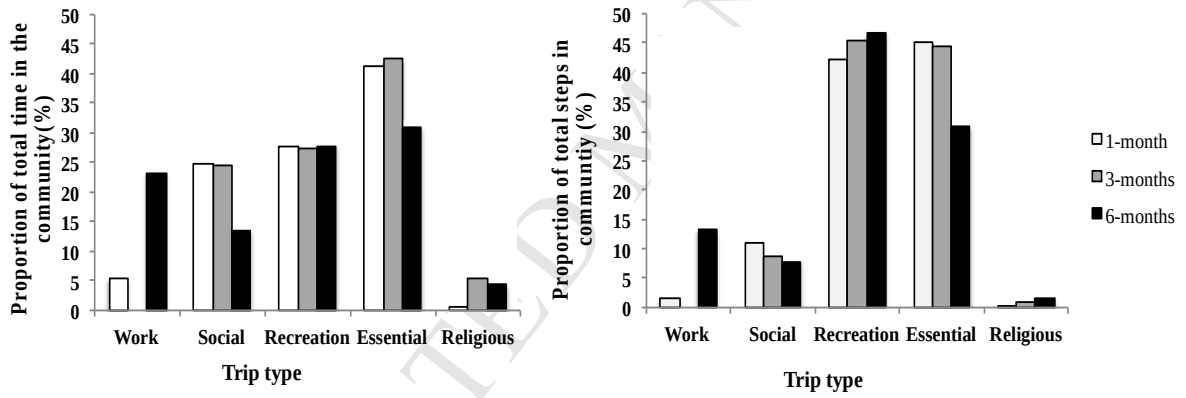

Figure 4: Proportion of (a) time spent and (b) steps taken in the community for each trip type at 1, 3 and 6-months.