

Measuring continuous patient activity post stroke using a novel sensor based computerised system

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Introduction

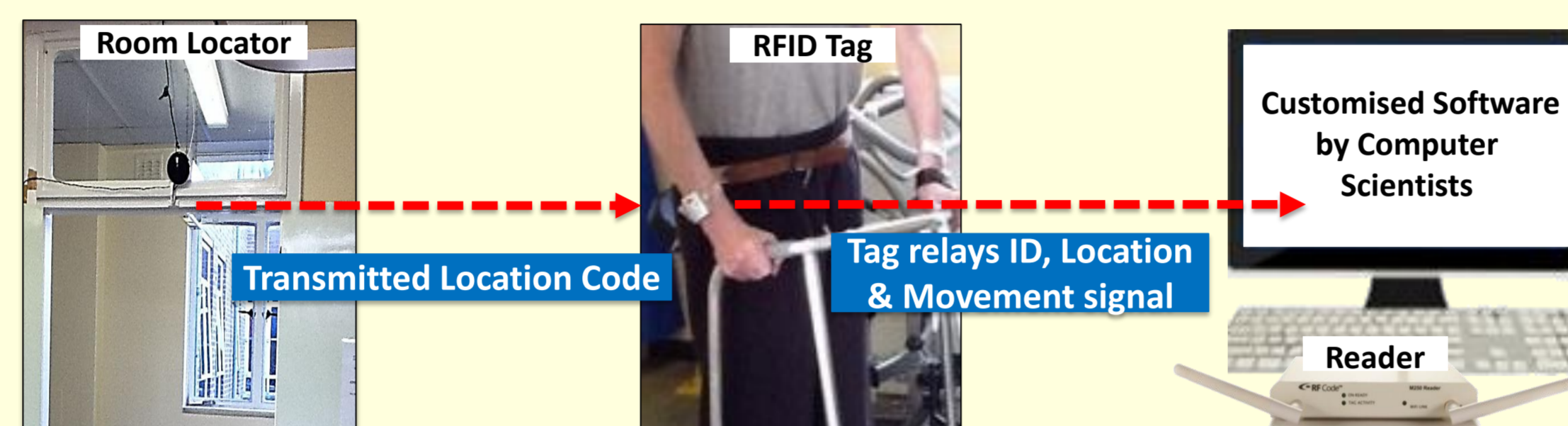
To be able to measure patient activity continuously and unobtrusively a new system has been developed using Real Time Location Technology¹. Previously excellent reliability (Intraclass Correlation Co-efficient ≥ 0.90) for this system has been established. Moreover on validation with Observation Behaviour Mapping technique, a high level of agreement between the two systems has been obtained^{2,3}.

The aims of this study were:

1. To measure activity levels of hospitalised stroke patients from admission to discharge.
2. To compare the activity level at discharge with that measured at home.
3. To study walking recovery patterns of individual patients based on their duration of walking per week and use of walking aid.

Methods

Data was collected continuously over a 24 hour period for all patients recruited in the Regional Stroke Unit, (RSU) Cardiff. Room locators were installed in all rooms accessed by patients. Participants wore a Radio-Frequency Identification (RFID) tag on their unaffected wrist. The tag has an in-built motion sensor and receives infra-red location signals from the room locator. The movement signal and location signal from the tag were transmitted to a computer. Customised software programmes were used to collect and process data based on the tag location and movement status.



The time period selected for data processing was 7:00 am to 9:00 pm i.e. 14 hours.

Weekly averages were calculated for the following parameters:

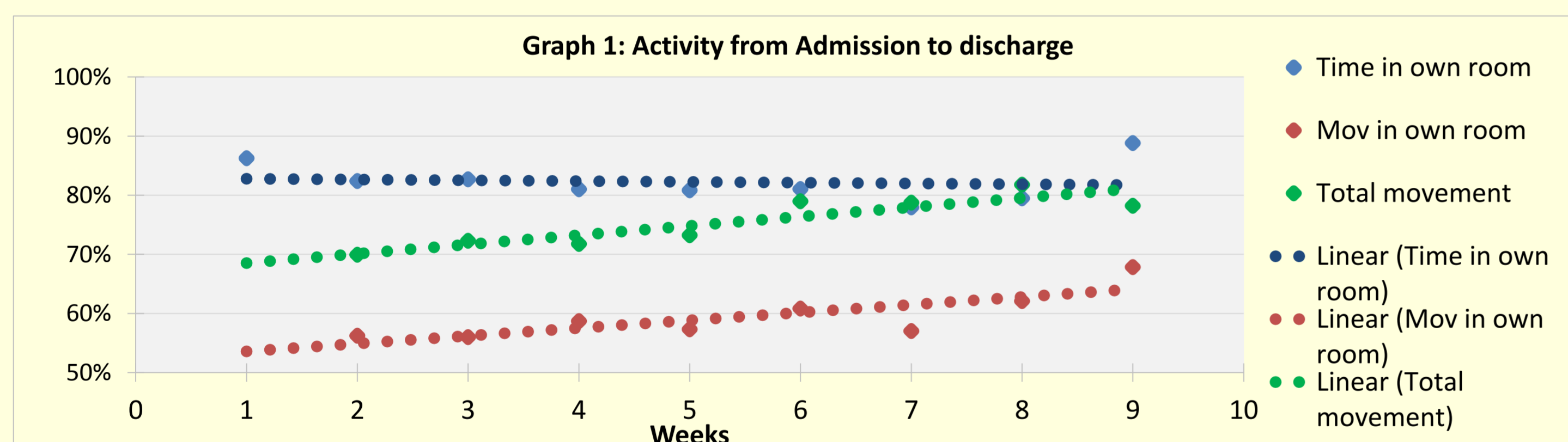
- Percentage of time and of movement in own room.
- Percentage of total time spent moving in RSU.
- Percentage of time spent moving at home.
- Duration of walking in RSU in HH:MM:SS.

Descriptive statistics and graphs were used.

Results

1. Activity during stay in RSU

Twenty five patients (7 male; 18 female) with a mean age of 77 years were measured from admission to discharge. The average weeks for data collection was 4 weeks (min = 6 days, max = 9 weeks).



As seen in graph 1, there is a clear tendency of patient activity levels to increase over time.

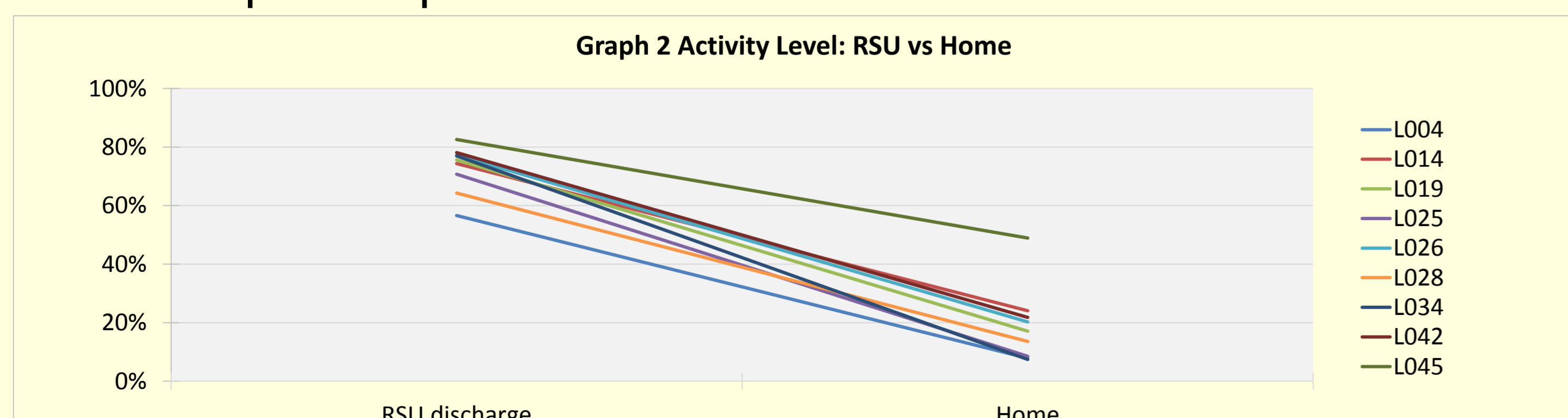
The movement in own room increases from 56% at admission to 68% at discharge. The overall movement increases from 70% at admission to 78% at discharge.

However the amount of time patients spend in their own rooms tends to remain fairly constant; 86% at admission, 89% at discharge.

2. Activity level comparison: RSU vs Home

Nine patients (2 males; 7 females) with a mean age of 76 years were measured at home for 2 weeks using the same system. The average number of weeks post discharge when home measurements were undertaken was 23 weeks (min = 8 weeks, max = 42 weeks).

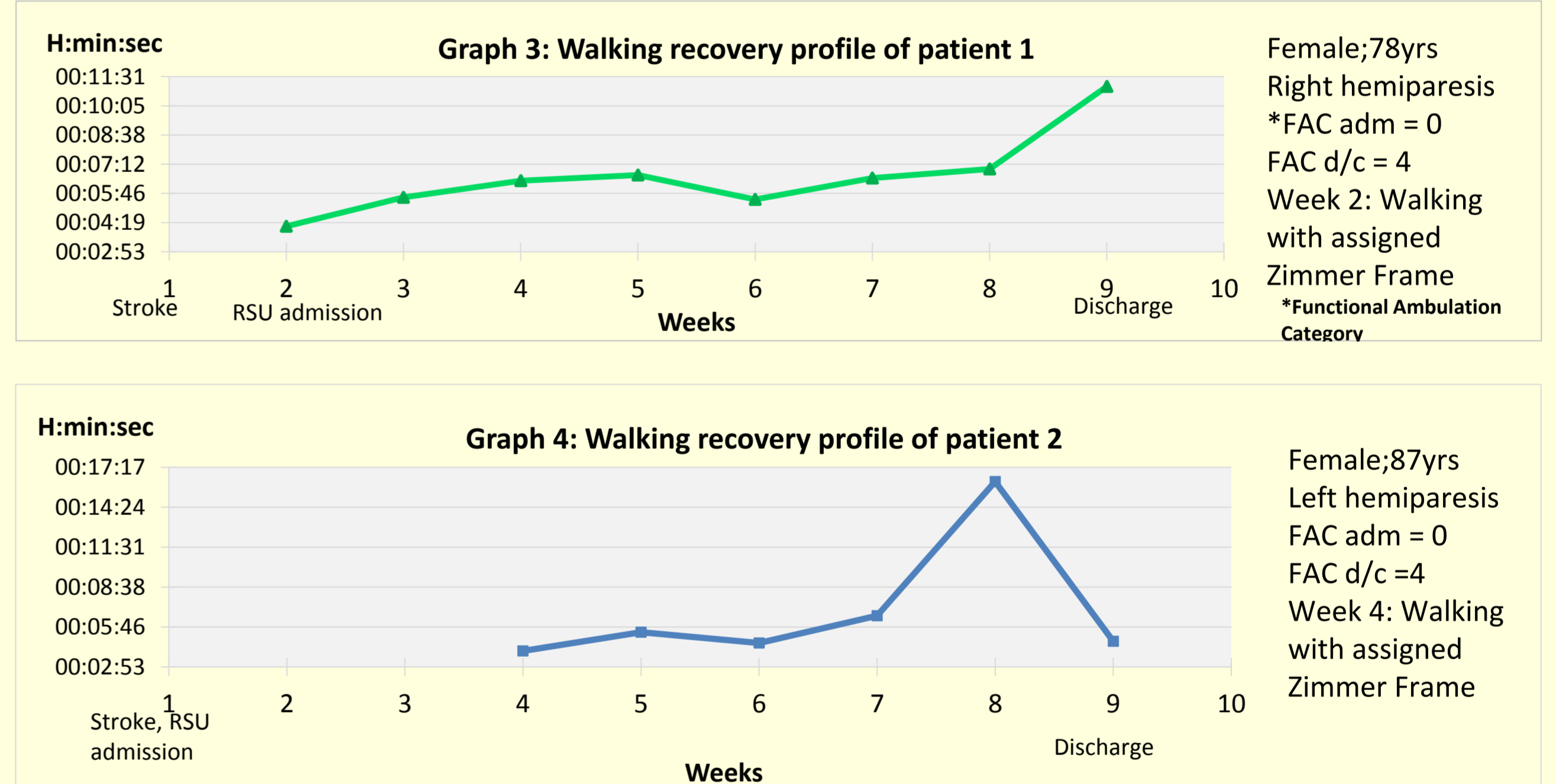
The average activity level at discharge was 73% and at home was 19%. The average decrease in the activity levels of patients was 54%. Graph 2 depicts the individual measurements.



Results (continued)

3. Individual walking recovery profiles

Graphs 3 and 4 depict the walking profiles of two patients. Each patient had their distinct characteristics in terms of weekly walking duration and the week post admission when they were able to walk.



Discussion

So far interesting aspects of early, functional recovery post-stroke have been effectively revealed using this automated system.

Based on the results, ongoing work focuses on 3 main areas:

1. Measurement of intensive purposeful activity undertaken during stay in the rehabilitation unit.
2. Exploration of potential factors affecting changes in patients' activity levels from admission to discharge and at home.
3. In-depth analysis of gait recovery such as walking outside of therapy hours, transport using steady and wheelchair mobility for individual patients.

Ultimately, the aim is to develop a comprehensive system that can provide activity feedback to patients, carers and clinicians.

This could function as a motivational strategy to further improve patient activity levels in a rehabilitation unit and at home.

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References

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