MEASURING SOCIAL INTERACTION BETWEEN PATIENT AND CARER

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Method: Data collection platform

This wearable platform comprises a *sensor bracelet* and *environment beacons* that can measure a patient's social interaction with a carer as well as sleep and activities.

The bracelet listens to the beacon transmissions and labels the bracelet sensor values with the signal strength of each beacon and the values of the environment sensors. The system has a battery life of approximately 15 days.

Method: Data analysis

The combined data is analysed to calculate:

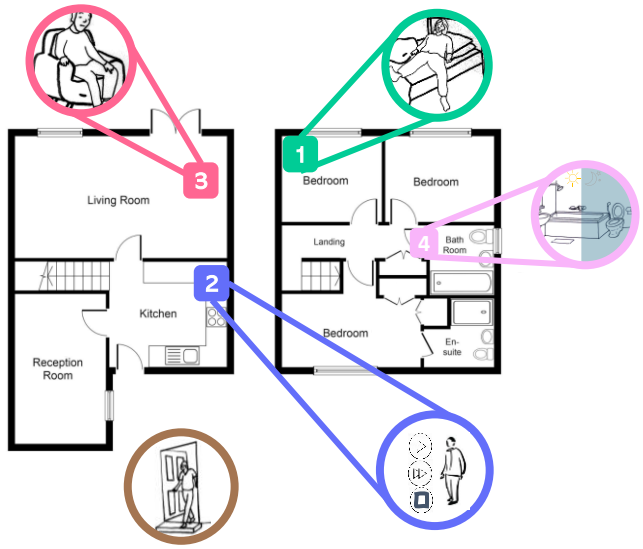
- Step count [1]
- Sleep time and daytime activity levels [2]
- Location of the wearer throughout the day

Where a **patient** and **carer** both wear a bracelet*, their relative location* is determined, and used to calculate measures of social interaction e.g.: how much time per day the patient is in the same room as their carer, in the same house but different room, either away from home or both away from home.

Method: Clinical study in control group

Pairs of participants (without dementia) are being enrolled for 7 days of data collection (UCL research ethics ID Number: 26129/001).

Participants place the environmental beacons where they spend most of their time (e.g.: bedroom, living room, kitchen, bathroom) and each wear a bracelet.



Method: Location calculation

The location of the bracelet wearer is determined from the received signal strength intensity (RSSI) of the received beacon signals. The location of the wearer is assigned to the location of the beacon with highest RSSI. Where no beacons are visible, the wearer is considered to be away from home (outdoors).

Results

Figure 1. Displayed are the primary ("raw") data generated from two people in the same home, received signal strength (RSSI) between beacons and bracelet, annotated with calculated periods of sleep and location within the home (or outside).

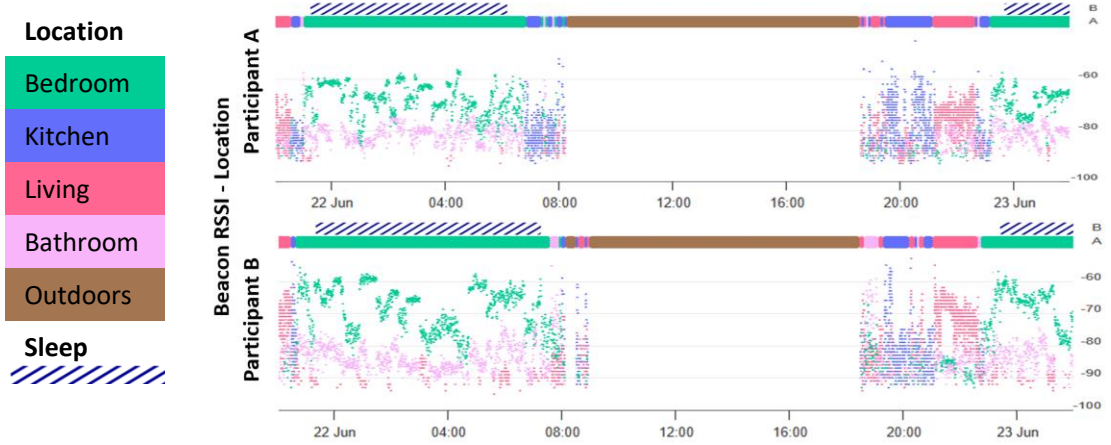
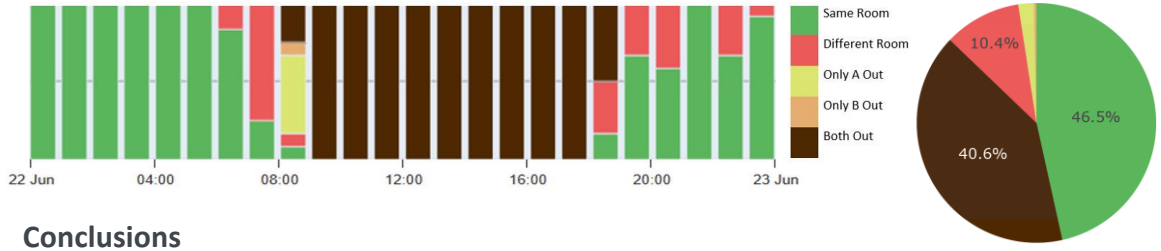


Figure 2. Displayed are processed data of the participants interactions by proportion of time spent together or apart both in and out of the home summarized by hour of the day and summarized in a pie chart over 24h.



Conclusions

We presented a method for measuring social interaction, as well as activity and location, using a wearable bracelet and environment beacons. It can provide a more detailed assessment of functioning of AD/PD patients and care partners or co-residents in the home setting. A pilot clinical study using this technology in control subjects is on-going.

[1] Small, S. R. *et al.* Development and Validation of a Machine Learning Wrist-worn Step Detection Algorithm with Deployment in the UK Biobank. *medRxiv* 2023.02.20.23285750 (2023) **[2]** Doherty, A. *et al.* GWAS identifies 14 loci for device-measured physical activity and sleep duration. *Nat. Commun.* **9**, 5257 (2018)

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