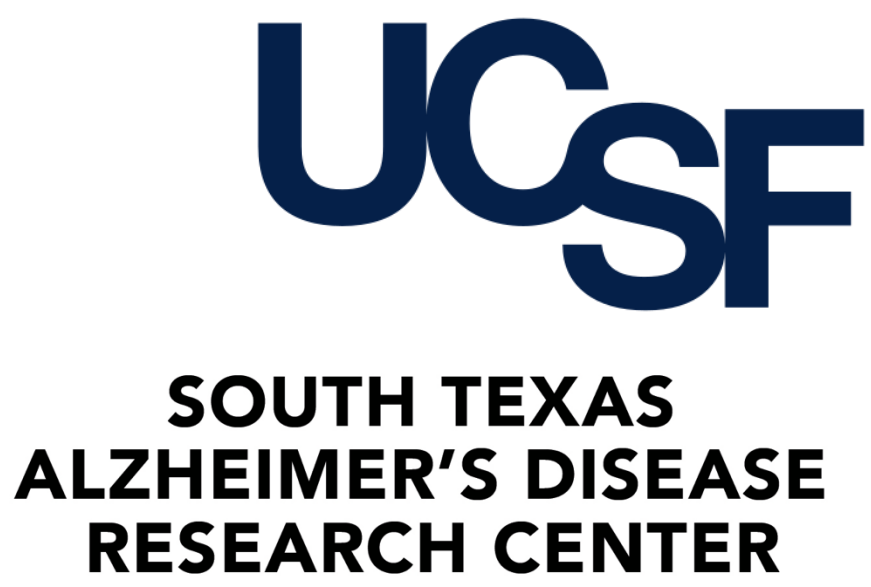


From Activity to Function: Combining Wearable and Environmental Sensors Provides New Insights into Peoples Lived Experience of Dementia



SOUTH TEXAS
ALZHEIMER'S DISEASE
RESEARCH CENTER



Panoramic Digital Health

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Monday-0530

Combining wearable and environmental sensors transforms digital biomarkers from simple activity measures into rich, context-aware insights of daily life in dementia.

INTRODUCTION

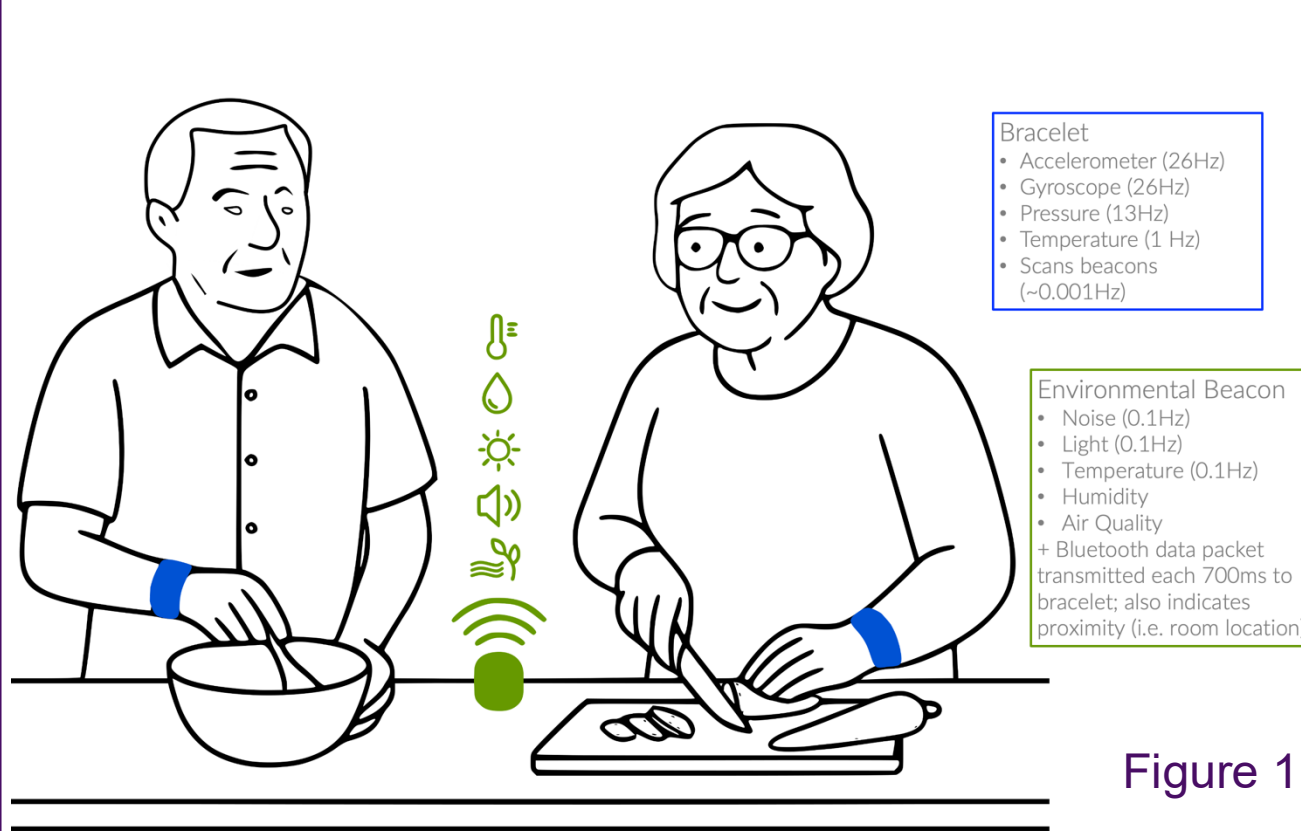
Home-based digital sensing can detect changes in activity but often lacks **contextual meaning** for research or care

Current systems may not capture **variability in the physical and social home environment**

We need **scalable, low-burden technologies** that reflect the **real-world lived experience** of people with dementia

Combining wearable and environmental sensing may provide **richer, context-aware insights**

We combine wearable sensors and environmental beacons shown in figure 1.



CLINICAL STUDY

EFFECT-AD “Digital Health Pilot” in 30 homes/60 study participants

- Three cohorts
- MCI due to AD (Oregon)
 - Early/prodromal Lewy body dementia (Texas)
 - Frontotemporal dementia (California)
 - Dyad design (person with ADRD & study partner)
 - 12 months per participant (Data collection ongoing)

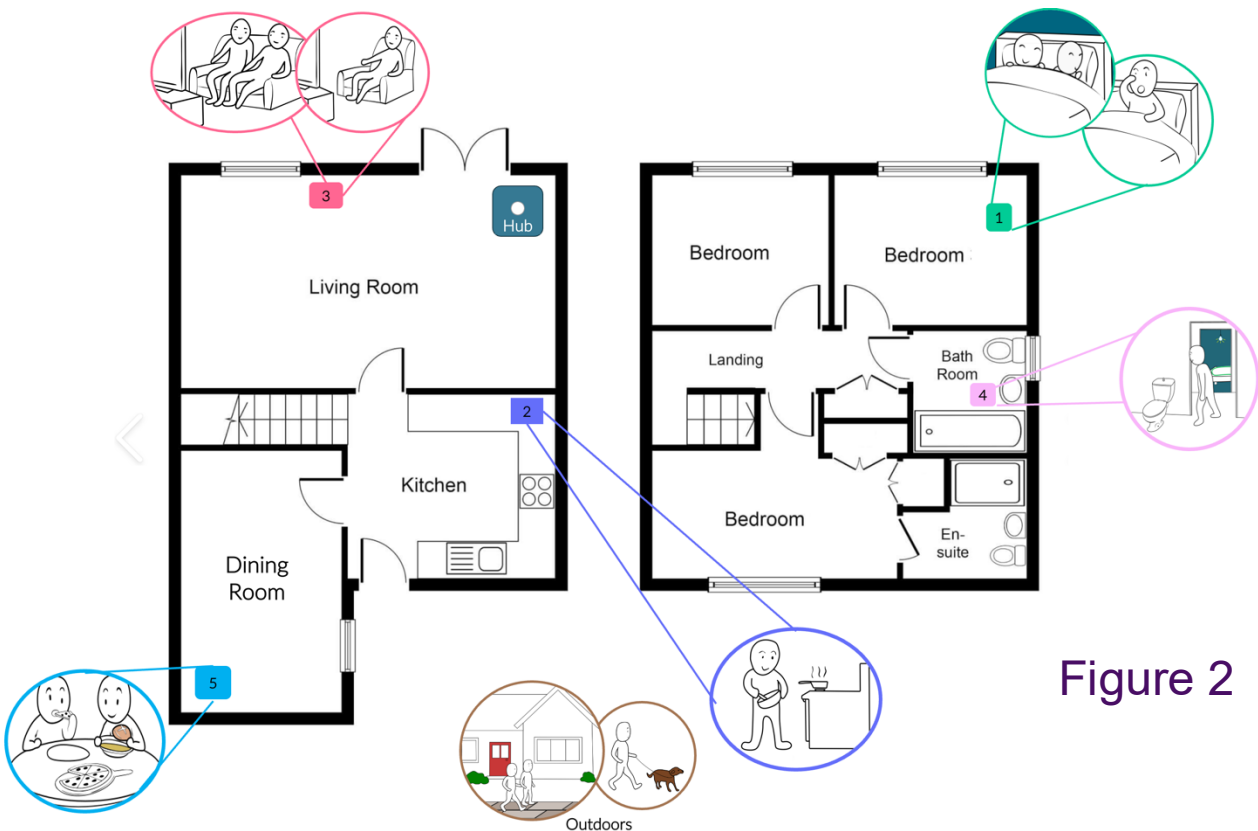
Beacons are set up in participants’ homes during technical visit (figure 2)

Real time visibility of compliance and device health

Bracelets recharged and raw data remotely transmitted weekly

Analysis pipeline combines data from wearable sensors and environment beacons. Step count and activity level algorithms from UK Biobank^{1,2}.

Project goals include NACC data integration.



PRELIMINARY RESULTS

Successfully collected **multi-person, concurrent data** in shared home environments.

- Enables:
- Linking activity and sleep to **specific locations and environments**
 - Measurement of **time away from home and co-presence**

- Environmental data allows:
- Assessment of **contextual influences on behavior**
 - Exploration of **differences across demographic groups**

- Operational findings:
- Real-time monitoring improved **data quality and issue resolution**
 - **Good compliance** with weekly charging.

Example from Dyad in the **MCI due to AD** cohort: interim analysis after 50 days of data collection shown in figures 3-5.

Figure 3 (below): one week (out of 50 days) of data showing location and physical activity data. On night 7, in accordance with study design, devices were charging so no data collected (yellow). Data collection ongoing.

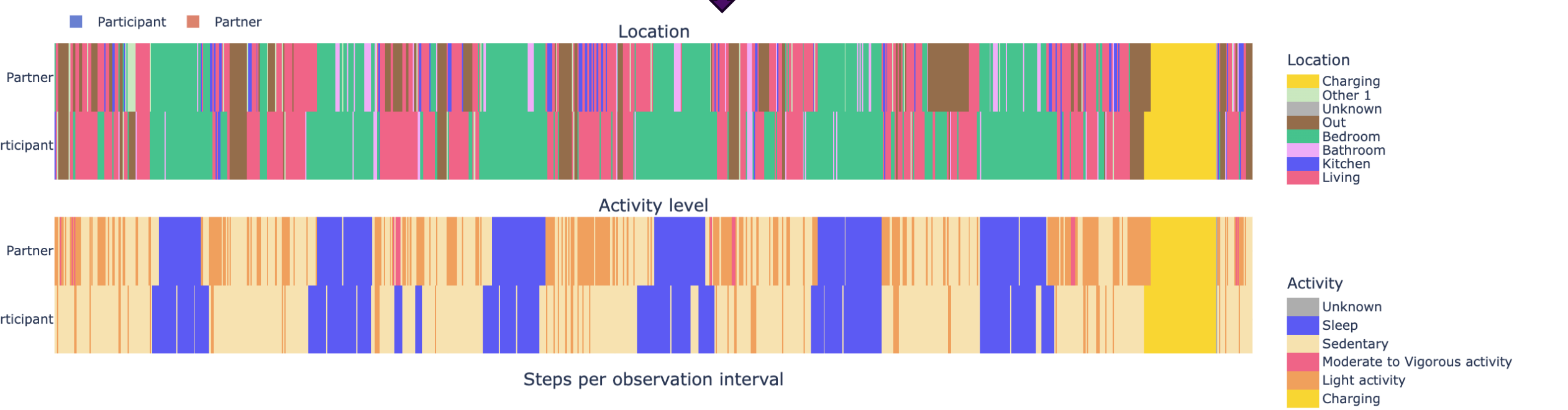


Figure 4: co-presence of participant with MCI due to AD and study partner over 3 months

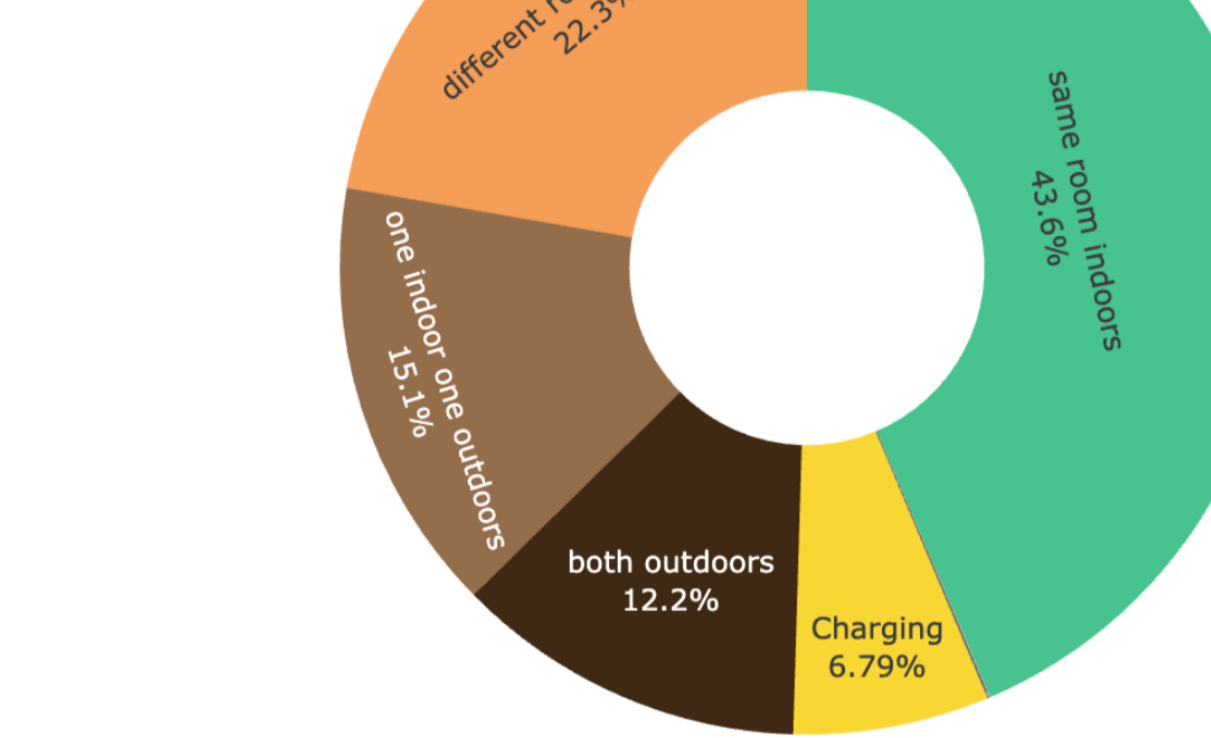


Figure 5: Step count by room location for participant and study partner.



CONCLUSIONS

Integrated wearable + environmental sensing enables:

- **High-resolution, continuous measurement** of daily function
- **Context-aware understanding** of behavior in real-world settings
- Platform **successfully deployed** in diverse ADRD cohorts
- When combined with clinical and patient-reported outcomes, it provides **powerful insights into lived experience**

REFERENCES

1. Small SR, Chan S, Walmsley R, et al. (2024) *Self-Supervised Machine Learning to Characterize Step Counts from Wrist-Worn Accelerometers in the UK Biobank*. Medicine & Science in Sports & Exercise. DOI: 10.1249/MSS.0000000000003478
2. Walmsley R, Chan S, Smith-Byrne K, et al. (2021) *Reallocation of time between device-measured movement behaviours and risk of incident cardiovascular disease*. British Journal of Sports Medicine. Published Online First. DOI: 10.1136/bjsports-2021-104050

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