Tracking cognitive fluctuations in ADRD using the Lucidity platform: demonstrating feasibility

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Abstract

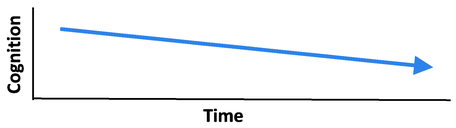
Alzheimer's disease and related dementias (ADRD) are thought to result in a progressive, irreversible decline in cognitive abilities, but moment-to-moment fluctuations in cognitive capacity have been noted in patients. The prevalence and features of these fluctuations have been difficult to study as they occur at unpredictable moments, including the paradigmatic case of lucid intervals.

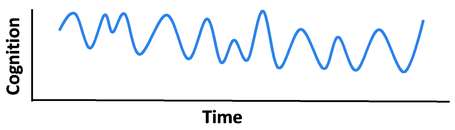
We built the Lucidity technology platform to gather quantitative data 'in context' from game-ified cognitive tests, caregiver reports, and wearable sensors. Here, we present initial data from eight caregiver-patient dyads who participated over 8-week periods, **demonstrating the feasibility of our approach and opportunities for further refinement**.

Potential for insight: cognitive fluctuations in ADRD

Lucidity provides a platform to study cognitive fluctuations through gamified tests, caregiver reports, and physiologic data

Most models of dementia assume decline is a slow, progressive process





However, memory, attention, and executive control fluctuates over time.

Feasibility of in-home cognitive testing

Eight participants have completed the study to-date, with recruitment ongoing

ID	Age	Gender	Diagnosis	# Tests
1	82	M	Mild mixed dementia	113
2	72	F	Severe dementia	18
3	80	M	Mild AD	18
4	81	M	MCI	61
5	78	M	MCI	84
6	75	F	MCI	23
7	83	M	Dementia	75
8	80	F	MCI	46

*A **highly-engaged** participant with **strong caregiver** support*

Participant input will shape next version

Participant feedback will be used to simplify user experience and improve compliance

Level of baseline cognition

- Full participation in games was not possible for severely impaired patients
- Compliance with using the Fitbit health tracker was limited in more impaired patients

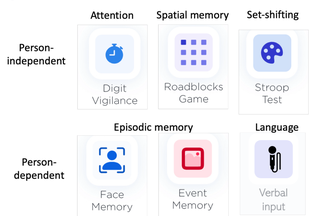
Technology literacy

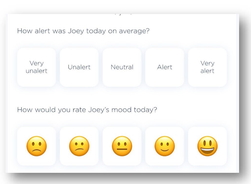
- One caregiver did not understand how to use tablet, felt overwhelmed, temporarily discontinued the study
- One dyad's participation was made possible through the help of their grandchild
- Charging and wearing the Fitbit was challenging

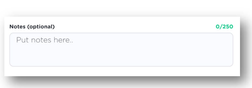
Caregiver satisfaction with Lucidity

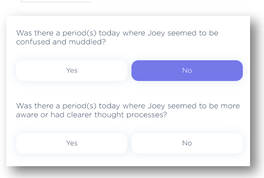
Reports from weekly phone check-ins with caregiver demonstrate satisfaction with the Lucidity platform

- Dyads participate over 8-weeks
- Patients enjoy the cognitive games
- Caregivers find value in the daily logs:
  - Organize habits, develop routine
  - Log changes in loved one
  - Increased attention to changes



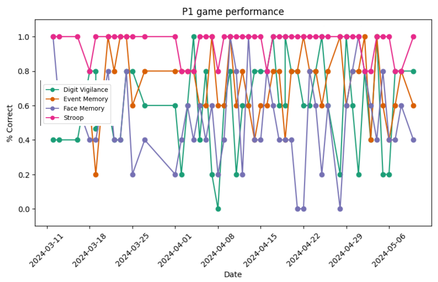




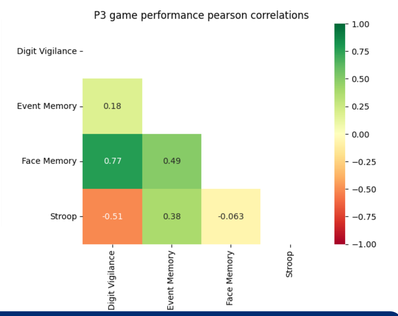


Game-ified tests capture fluctuations

Daily and task-specific fluctuations in performance

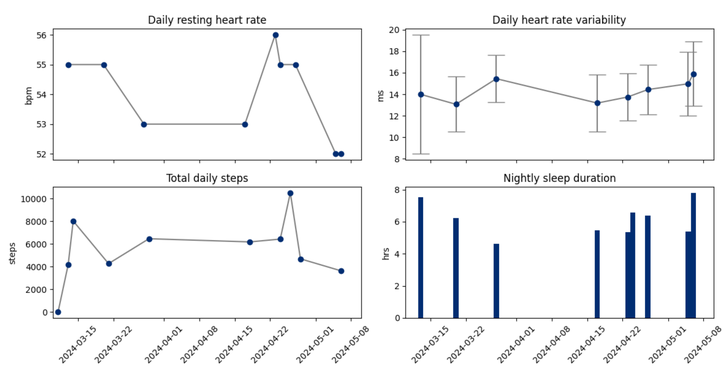


Within-subject correlations between games



Real-time fitbit integration

Fitbit measures of internal state can help contextualize cognitive tests scores and performance variability



Upcoming changes to Lucidity platform

+ Offline mode

Allows cognitive games to continue running in absence of wifi or cellular connectivity

+ FAQ documentation

Includes screenshots to aid in dyad comprehension of the tablet and Lucidity app

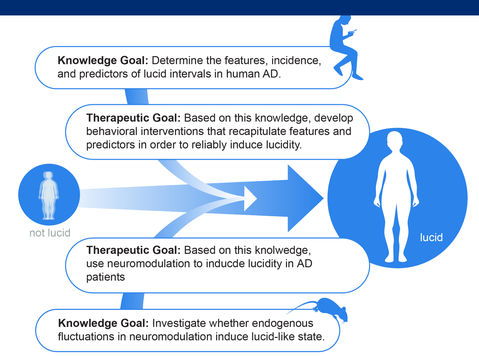
- Strict daily limits

More flexible code-base to minimize daily limits on caregiver diaries

+ More games

Introducing new games to test visuospatial working memory

Long-term mission and vision



Funding: National Institute on Aging P30AG073104, JHU Institute for Data Intensive Engineering and Science Pilot Award