Mobile technology as a cognitive biomarker of Alzheimer's Disease

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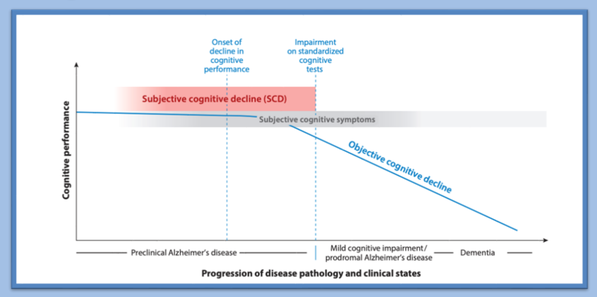
PennAITech AD/ADRD Focus Pilot Core

Introduction

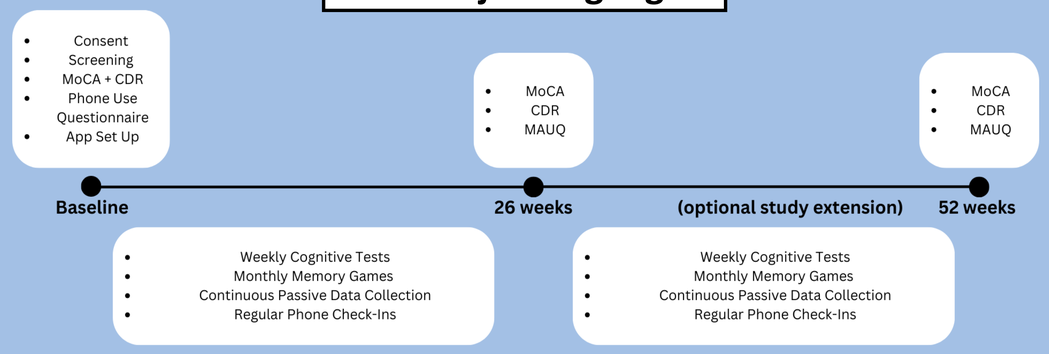
- Alzheimer's diagnosis currently reliant on clinician-administered pen and paper exams, but due to time to administer they cannot be used as routine or screening examinations.
- Cognitive changes over short periods of time may not be picked up by pen and paper exams.
  - Measures acquired daily, weekly, or monthly may improve sensitivity to disease progression.
- Use of technology allows for more fine-grained analysis of cognitive tasks that cannot be taken from pen and paper exams.
- Passive data may be used as personalized health markers and can be collected alongside active data cognitive tasks to detect progression of Alzheimer's disease.

Objectives

- To develop and refine pop-up cognitive tasks within our smartphone app, mindLAMP 2, that captures active and passive data.
- To identify the ecological data that **best identifies cognitive impairment** caused by Alzheimer's disease.
- **To determine how this ecological data changes over time.**

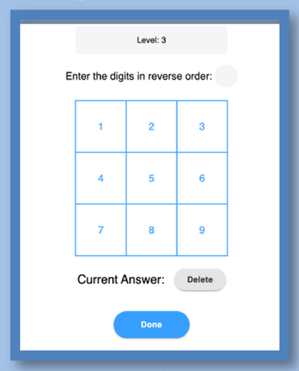


Pilot Project Highlights

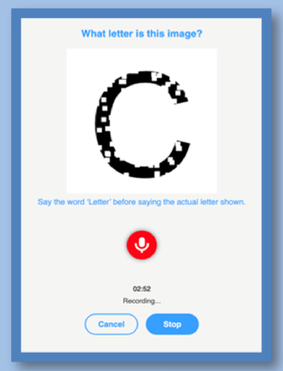


- ~15 cognitively impaired participants complete 4-5 cognitive assessments and memory tasks on mindLAMP 2 app on phones for 6 months (optional extension up to 12 months)
  - Passive data on screen usage, device motion, etc. continuously collected
- MoCA and CDR administered at Baseline, 6-month and optional 12-month in person visits as comparison points for cognitive decline

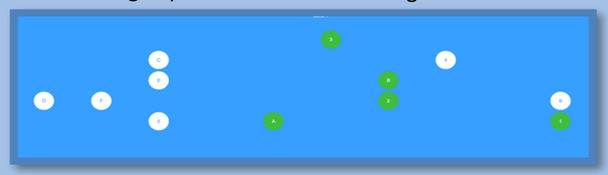
Patients recruited from BIDMC Cognitive Neurology Unit (CNU) Clinic
Ages 50-90
MCI/early AD or Cognitively Normal Controls
"Tech savvy" and ability to connect to Wi-Fi at home
Able to read, write, and speak in English



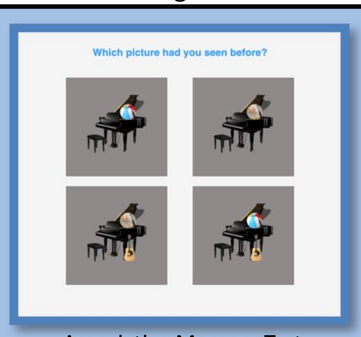
Digit Span



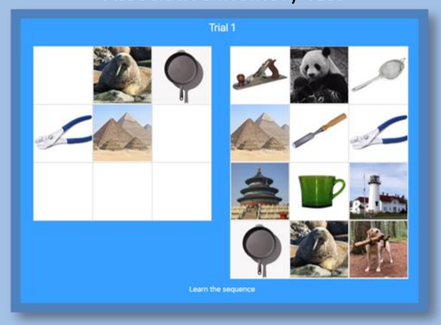
Fragmented Letters



Touch Trails B



Associative Memory Test



TicTacToe Memory Game

Conclusions

- Pilot testing of TicTacToe feasible but somewhat confusing to participants in CNU Clinic
  - Adding optional instructional video prior to game per PennAI Tech suggestion
- Can adjust features on each game such as animation interval and persistence to allow for better comprehension of tasks
- Patients in CNU Clinic eager to join study
  - They report games have potential utility and do not present a significant burden on participants or caregivers
- Analysis Plans:
  - ML to be used to enhance the information collected from each game, using overall performance as the "goal" of learning
  - Longitudinal performance on cognitive tasks to be compared to performance on MoCA and CDR
  - Cluster analysis to identify combination of active and passive components that differentiates best between AD and controls

Acknowledgements + References

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