



Remote App-Based Monitoring of Cognition in Patients Receiving Amyloid-Targeting Therapies

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Introduction

With the growing use of amyloid-targeting therapies (ATTs), mobile, valid, and engaging cognitive assessments will be essential for monitoring benefits and risks of therapy. This study aims to determine the feasibility, usability, and preliminary validity of an at-home, app-based cognitive assessment tool, the mobile cognitive app performance platform (mCAPP), including 3 gamified tasks, to remotely collect cognitive performance data in patients with Mild Cognitive Impairment (MCI) or mild dementia due to Alzheimer's disease (AD) receiving ATTs.

Methods

AAT Participants

- Forty-nine older adults (57% female; age=72.2±6.9, years of education=16.1±2.7) with MCI (N=38) or mild dementia (N=11) due to AD used mCAPP at infusion visits only (N=16) or in-clinic and at home for up to three months (N=33) during ATT treatment.
- Participants were amyloid positive and approved for treatment by a multi-disciplinary ATT consensus panel at the University of Pennsylvania. They also completed paper and pencil neuropsychological tests and questionnaires about their use of technology and mCAPP usability.

Cognitive Measures

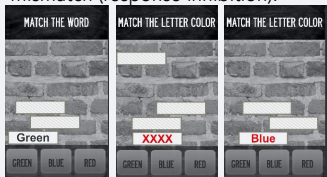
- MoCA (global cognition), CERAD word list (list learning and memory), Verbal Fluency (language & executive functioning), Trail Making Test A (attention & processing speed) and TMT B (executive functioning)
- Free and Cued Selective Reminding Test, Stroop Color-Word Test, and Digit Symbol Substitution Test (processing speed and executive function)

mCAPP Games

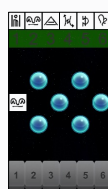
Concentration Memory Game: Cards are shown face-up to reveal the objects and then immediately turned over. Difficulty (load) increases as participants progress to higher levels. Includes learning and then matching hidden card pairs and incorporates increasing memory load, pattern separation features (lure vs. non-lure), and spatial memory (moving target cards).



Brick Drop: Stroop-like task with 3 blocks (1) word matching, (2) color identification, and (3) color identification for color-word mismatch (response inhibition).



Space Imposters: Symbol-number coding task with 3 blocks of increasing target pairs (4, 5 and 6 targets).



Results

AAT Participant Phone Use & mCAPP Experience

All participants used a smartphone regularly and 55% played games on their phones.

	Too Easy	Just Right	Too Difficult
Concentration Memory Game	10%	70%	20%
Brick Drop Game	0%	74%	26%
Space Imposters Game	0%	85%	15%

mCAPP Usability

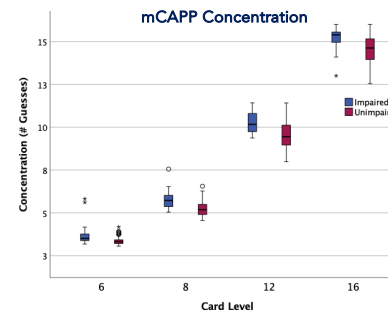
IBM rating 7.1±1.4 (0-9 scale)

At-home use:

Number of sessions: 23.2±10.5 sessions over 3 months

mCAPP Performance

All tasks showed lower performance when comparing low and high cognitive load blocks ($p < .001$) and when performance was compared to a cohort of unimpaired participants ($p < .001$).



Case Example: Longitudinal Brick Drop performance comparison between patients receiving ATTs and an unimpaired cohort.

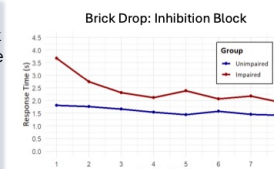
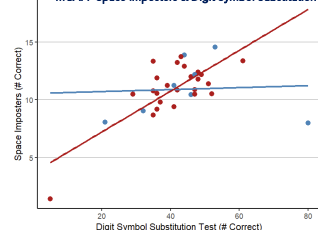


Figure 2. Performance across sessions on mCAPP Brick Drop by impairment status.

mCAPP Space Imposters & Digit Symbol Substitution Test

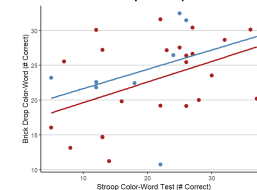


Participants with MCI and Dementia show different relationships between mCAPP performance and paper and pencil tests.

Results (cont.)

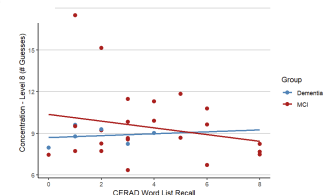
AAT Participant mCAPP & Neuropsychological Test Data

mCAPP Brick Drop & Stroop Color-Word Test



mCAPP measures correlated with some, but not all, paper and pencil measures from analogous domains.

mCAPP Concentration & CERAD Word List Recall



Case Examples: Brick Drop performance during ATT treatment for patients who developed ARIA.

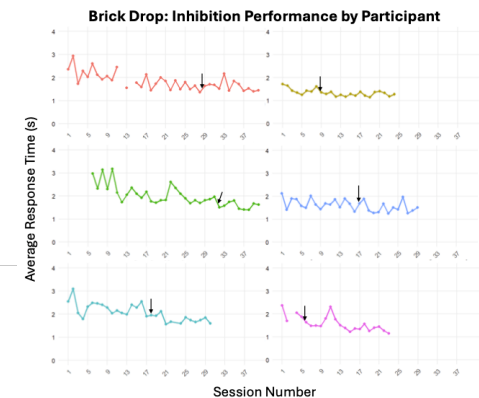


Figure 3. Performance across completed sessions in participants who developed ARIA during ATT treatment. Arrows indicate the onset of ARIA.

Discussion

- This pilot study shows mCAPP's usability for both in-clinic and at-home use in a cohort of patients undergoing ATT.
- Performance across measures indicate initial reliability and validity of mCAPP.
- Future analyses will include the evaluation of mCAPP performance across the full course of ATT treatments, including multiple timepoints, practice effects compared to participants with unimpaired cognition, and during episodes of ARIA.
- Remote, accessible, and reliable cognitive assessment has the potential to reduce barriers to research participation and clinical care.

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