

TEACHING HOSPITAL

# Characterizing and Stratifying Cognitive Impairment Using Cognitive & Speech Al Shifali Singh, PhD\*, Raquel Norel, PhD, & Katelin Curtis, BA\* McLean Hospital | Harvard Medical School | IBM Digital Health JH AITC AD/ADRD Focus Pilot Core





### Background

Cognitive impairment affects 7.1% to 28.3% of the population in North America<sup>1</sup> and can progress to Alzheimer's Disease and Alzheimer's Disease Related Dementia (AD/ADRD)

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- **Early diagnosis** is challenging<sup>2</sup> since current diagnostic tools often capture cognitive functioning later in the course of the disease
  - Traditional neuropsychological assessments evaluate cognitive
  - function at a <u>single time point</u>, which may not fully capture daily fluctuations in cognitive functioning
- Scalable and sensitive digital tools are needed to track <u>real-time</u> cognitive changes
  - Digital tools such as cognitive ecological momentary assessment (cognitive EMA)<sup>3</sup>, speech artificial intelligence (speech AI)<sup>4</sup>, and actigraphy monitoring<sup>3</sup> capture continuous, real-time cognitive data

### Objectives

- Improve diagnostic accuracy of cognitive impairment by integrating <u>cognitive</u> <u>EMA, speech AI, and actigraphy</u> <u>monitoring</u> with traditional neuropsychological assessments
- **Develop a scalable** and **sensitive** *digital battery* to use in clinical and research settings that accurately characterize risk for developing AD/ADRDs

- Over **one month**, 25 residents from assisted or independent living facilities complete:
  - A neuropsychological assessment
  - Six (6) <u>digital cognitive EMAs</u> to track cognitive fluctuations
  - Six (6) <u>speech AI EMAs</u> to track language patterns
  - <u>Continuous actigraphy</u> <u>monitoring</u> to track activity levels



### Pilot Project Highlights



## Conclusions

- Research on cognitive and speech changes in AD/ADRD using <u>both EMA</u> and <u>neuropsychological testing</u> in assisted-living settings is **limited**
- Integrating digital tools (*cognitive EMA*, *speech AI*, and *actigraphy monitoring*) with traditional assessments improves the ability to accurately characterize and stratify degrees of cognitive impairment
- This novel battery can be administered and scaled entirely remotely, promoting accessibility

#### Future directions:

- Expand the use of this digital battery beyond Assisted Living Facilities to capture greater diversity
- **Refine** *algorithms* using machine learning (ML), natural language processing (NLP), and AI that can be commercialized

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### Contact

Shifali Singh, PhD Digital Neuropsychology & Brain Health Laboratory digitalbrainhealthlab@mgb.org