ISCTM 2020 poster abstract

Title: Tracking changes in cognition in Mild Cognitive Impairment and Alzheimer's Disease over a 6-month period using a speech-based digital biomarker

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The Methodological Question Being Addressed

We seek to determine whether a novel digital biomarker, based on linguistic and acoustic analysis of speech, may be more sensitive than existing gold-standard assessments for detecting subtle changes in cognition in participants with MCI or mild AD.

Introduction (Aims)

A lack of precision in quantifying cognitive performance is a key pillar in the overwhelmingly negative results obtained from clinical trials in Alzheimer's Disease (AD). Language may provide sensitive insights into cognitive function and is a low-cost, non-invasive, naturalistic measure. In AD, changes have been reported in the acoustic and linguistic characteristics of speech, which may be detectable years before a clinical diagnosis is made. The objective of this study was to compare how language and cognition changed over a 6-month period in a sample of individuals with mild cognitive impairment (MCI) and mild AD, using a novel speech-based digital biomarker and current gold standard cognitive assessments.

Methods

Participants were 24 older adults with a clinical diagnosis of MCI and mild AD, recruited from communities within the greater Toronto area in Canada. Participants completed a tablet-based speech assessment which included two picture description tasks at Baseline, 1 month and 6 month timepoints. At baseline and 6 months, a neuropsychological assessment including digit span (forwards and backwards), symbol digit modalities test, Hopkins Verbal Learning Test, Judgement of Line Orientation and the Montreal Cognitive Assessment (MoCA) was administered by a trained psychometrist. Verbal responses were recorded, transcribed and analyzed to produce more than 500 individual speech and language markers. From these markers, composite measures pertaining to discourse, information units, word finding difficulty, syntax, lexical complexity, coherence (global and local), and sentiment were calculated. Baseline to endpoint changes were evaluated using non-parametric, within-subjects t-tests with Bonferroni correction. We compared changes in speech features with changes in neuropsychological assessment scores, and examined the relationships between our novel speech-based biomarker and traditional cognitive assessment tools.

Results

Preliminary results in a subset of the sample (N = 10) demonstrate declines over the 6-month period in speech feature composites including the coherence of picture descriptions and the number of information units described per picture. These results are consistent with previous findings in healthy older adults, who also demonstrate significant decreases in these aspects of speech over a 6-month period. On average, MoCA scores decreased as well, but this effect was small compared to the changes in speech feature aggregates. Ongoing data analysis of neuropsychological scores will help to further relate these speech changes to changes in cognition as measured by conventional paper and pencil testing.

Conclusions

This study demonstrates that reductions in aspects of language previous associated with AD severity (coherence and information units) may be detectable over a 6-month period in those with MCI and AD. Preliminary results suggest that the effect size of these changes may be larger than existing brief measures of cognition such as the MoCA. These data provide support for the exploratory use of speech-based digital biomarkers for detecting subtle changes in cognition within clinical trials. Further research is needed to replicate these results in a larger sample and better understand the time course of changes to language and cognition in neurodegenerative disorders.

Disclosures* if applicable

Jessica Robin, William Simpson and Liam Kaufman are employees of Winterlight Labs.