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BIOMARKERS

POSTER PRESENTATION

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Validation of the ki:e SB-C a Novel Digital Speech Biomarker for Cognition in a Dutch Memory Clinic Population

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Abstract

Background: Progressive cognitive decline is the cardinal behavioral symptom in most dementia-causing diseases such as Alzheimer's disease. Whereas classic neuropsychological tests often have excellent psychometric properties to measure cognitive decline in dementia, there are scenarios in which they are less suitable. Speech-based digital biomarkers can be deployed remotely and extracted in a highly automated fashion allowing solutions to scale. We present the validation of a novel digital Speech Biomarker for Cognition (SB-C) in a Dutch memory clinic population containing patients with Mild Cognitive Impairment (MCI) and age- as well as education-matched participants with Subjective Cognitive Decline (SCD).

Method: The ki:e SB-C is a novel speech-based cognitive composite score. The presented validation results are based on a sample that was not used when developing the SB-C. Validation data has been collected from two age- and education-matched groups: Normal Cognition but subjective cognitive decline (SCD; n = 48, 15 F), MCI (n = 48, 18 F). We automatically extract the SB-C from SVF and AVLT speech recordings using our proprietary speech analysis pipeline including automatic speech recognition and feature extraction. Recordings were collected from a Dutch memory clinic population containing MCI and SCD participants. We performed (1) analytical and (2) clinical validation. For (1) we performed Spearman rank correlation between SB-C score and anchor score Mini Mental State Examination (MMSE) to show that the algorithm is correctly measuring the concept of interest cognition. For (2) we performed a non-parametric Kruskal-Wallis test to compare SB-C scores of both NC and MCI groups.

Result: The biomarker score SB-C and MMSE were strongly correlated ($r = 0.61$, $p < 0.001$), such that lower MMSE scores are reflected in lower biomarker scores (compare also figure 1). Additionally, there was a very significant group difference for the SB-C biomarker score between the NC and MCI group (NC > MCI; $\chi 2 = 26.461$ (1), $p < 0.001$).

Conclusion: The ki:e SB-C is a reliable score for cognition, showing convergent validity with the MMSE and separating well between MCI and SCD populations. The availability of valid digital speech biomarkers for cognition has great potential for decentralized clinical trials in dementia aetiologies and beyond.

Table 1: Demographics summary of validation data. Group differences were computed using the non-parametric Kruskal-Wallis test. Abbreviations: SCD=Subjective Cognitive Decline, MCI=Mild Cognitive Impairment, MMSE=Mini mental State Examination, CDR-SB=Clinical Dementia Scale-Sum of Boxes.

Variable	SCD	MCI	*p*
n	48	48	
Age	67.04 (7.77)	70.25 (8.86)	0.07
Education	low (15) average (19) high (14)	low (18) average (15) high (15)	
Gender	Male (33) Female (15)	Male (30) Female (18)	
MMSE	28.60 (1.30)	26.96 (2.07)	< 0.001
CDR-SB	0.85 (0.87)	1.66 (1.24)	< 0.001
CDR-TOTAL	0.41 (0.25)	0.47 (0.19)	0.15

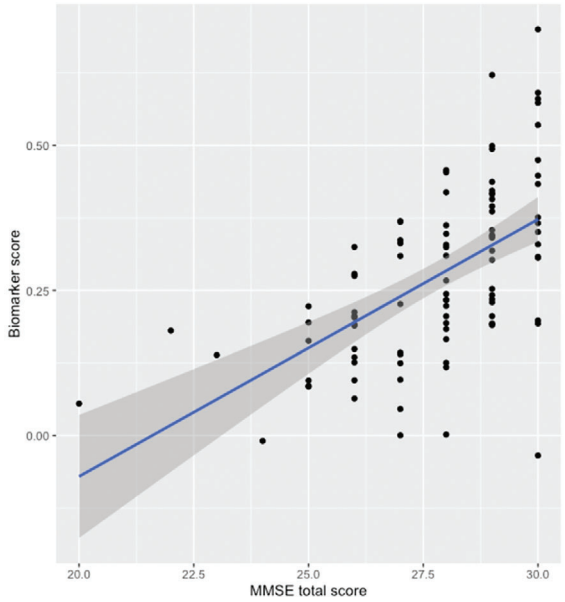

Figure 1: Correlation between biomarker score and MMSE.

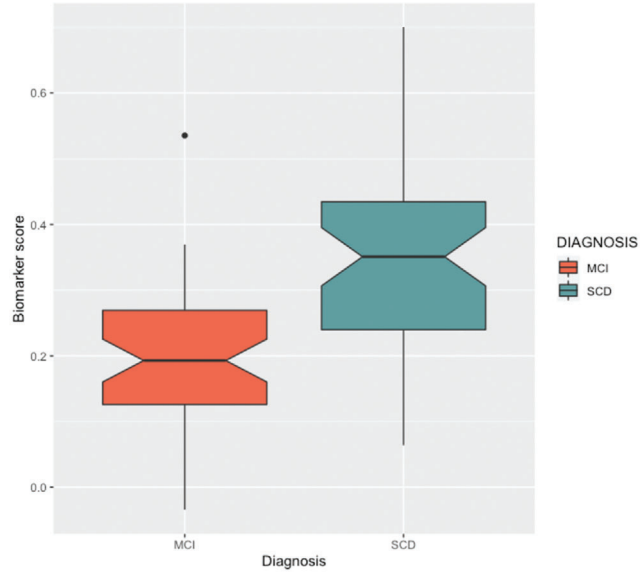

Figure 2: Group comparison discriminating between MCI and SCD.