Association of Speech and Language features with Biomarkers in Early Stage Alzheimer patients

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Introduction

Future AD trials on new disease-modifying drugs will require a shift to very early identification of individuals at risk of dementia. Subtle changes in speech and language are early features of Alzheimer's disease (AD) and consequently, analysing speech performance may be a promising new digital biomarker for detecting AD[1]. Digital markers of language and speech may offer a method for screening of at-risk populations that are at the earliest stages of AD. To this end, a screening battery was developed consisting of speech-based neurocognitive tests (Semantic verbal fluency and Verbal learning test) from which, next to classical scores, additional features such as temporal clustering, semantic switching or mean utterances are extracted. The automated test performs a remote primary screening using a simple telephone and chatbot technology. The study aims to validate speech biomarkers for identification of individuals with early signs of AD by comparing them to clinical gold standard measures such as neurocognitive tests and biomarker data[2].

Methods

Speech samples and clinical data were collected from 78 participants (45 females) from the German DESCRIBE and DELCODE cohorts[3]. 16 participants present a Mild Cognitive Impairment (MCI) and 62 are considered cognitively unimpaired. Spearman rank correlations were performed between the speech biomarkers and the MMSE and CDR scores as well as with CSF p/t-tau and abeta42 levels (only for 28 participants available). Group differences between diagnostic groups were calculated using Mann-Whitney test.

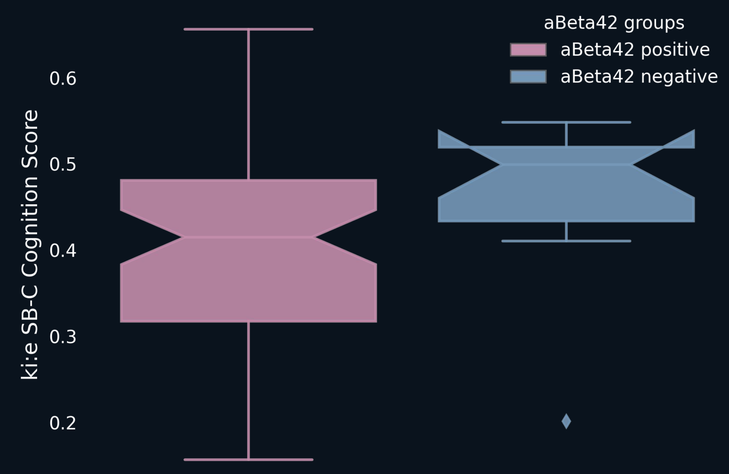

*Fig. 1: Comparison of ki:e SB-C Cognition Score between **aBeta groups***

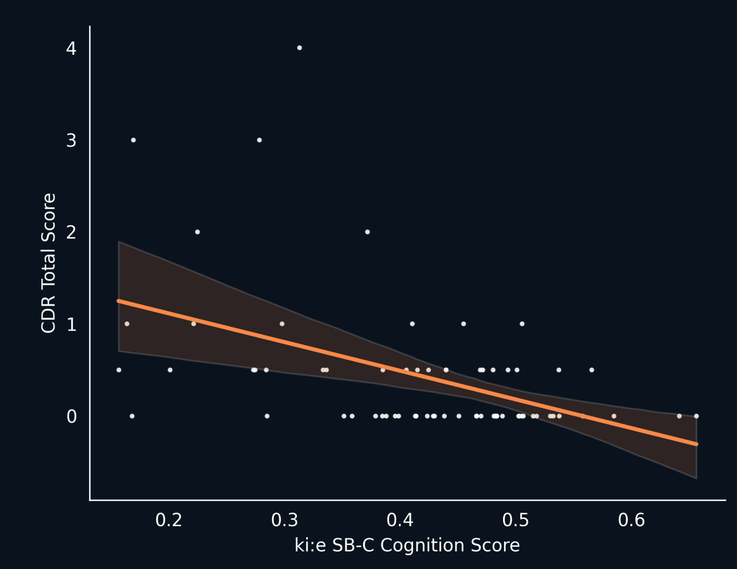

*Fig. 2: Correlation between **CDR Total Score** and ki:e SB-C Cognition Score*

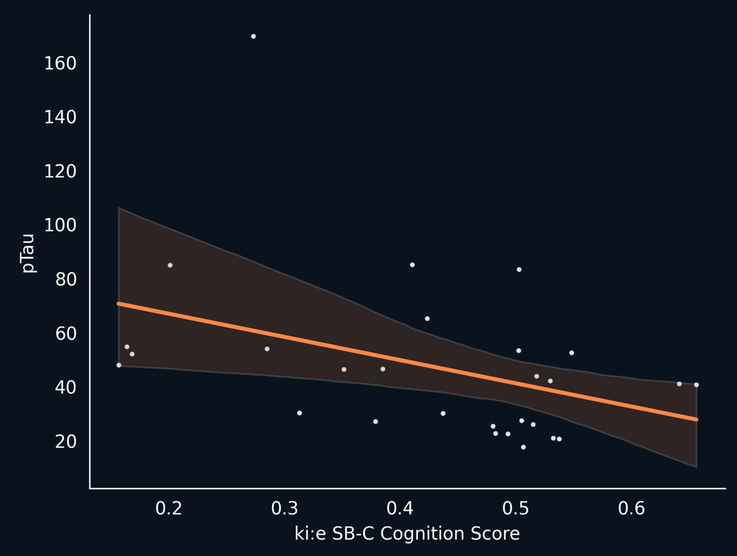

*Fig. 3: Correlation between **pTau** and ki:e SB-C Cognition Score*

Results

Only mild to moderate correlations were found with both MMSE score ($r = 0.23$, $p < 0.105$) and CDR score ($r = -0.45$, $p < 0.001$) which may be due to ceiling effects in this early stage population. However, stronger correlations were found between the TMT B and mean transition times between words in SVF ($r = 0.35$, $p < 0.001$) and the count of words ($r = -0.44$, $p < 0.001$). Strongest correlations were found between the speech biomarkers for cognition composite score (ki:e SB-C) and t-tau ($r = -0.52$, $p < 0.01$) and memory related speech features and p-tau ($r = 0.57$, $p < 0.01$). Speech features from the Verbal learning test such as mean utterance distances and temporal clustering correlated significantly with Abeta 42 ($r = -0.53$, $p < 0.01$). Abeta group comparisons was significant with ki:e SB-C memory score ($p = 0.007$) .

Conclusion

Strongest associations were found between the speech biomarkers and p-tau and t-tau levels in an early AD stage cohort population. The results are in line with other biomarker findings showing that tau-related pathology contributes to cognitive decline. Results are encouraging and point towards potential application of speech biomarkers in future pharmaceutical research in AD[4] .

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