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CLINICAL MANIFESTATIONS

PODIUM PRESENTATION

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Associations Between Speech-based Biomarkers of Cognition and Traditional Neuropsychological Assessments in a Preclinical AD Cohort

Zampeta-Sofia Alexopoulou[1,2] | Stefanie Köhler[3] | Johannes Tröger[4] | Elisa Mallick[4] | Nicklas Linz[2] | Josef Priller[5,6,7,8] | Anja Schneider[9,10] | Klaus Fließbach[11,12] | Björn Falkenburger[13,14] | Jens Wiltfang[15,16,17] | Inga Zerr[15,18] | Frank Jessen[19,20,21] | Thomas Klockgether[20,22] | Emrah Düzel[23,24,25] | Annika Spottke[20,26] | Michael Wagner[20,27] | Christoph Laske[28,29] | Valeria Manera[30] | Stefan Teipel[31,32] | Alexandra König[2,33]

[1]CoBTeK (Cognition-Behaviour-Technology) Research Lab, Université Côte d'azur, Nice, France

[2]ki:elements GmbH, Saarbrücken, Germany

[3]German Center for Neurodegenerative Diseases (DZNE) - Rostock/Greifswald, Rostock, Germany

[4]ki elements UG, Saarbrücken, Germany

[5]Department of Psychiatry and Psychotherapy, Technical University of Munich, Munich, Germany

[6]University of Edinburgh and UK DRI, Edinburgh, United Kingdom

[7]German Center for Neurodegenerative Diseases (DZNE), Berlin, Germany

[8]Department of Psychiatry and Psychotherapy, Charité, Charitéplatz 1, Berlin, Germany

[9]Department of Neurodegenerative Diseases and Geriatric Psychiatry, University of Bonn Medical Center, Bonn, Germany

[10]German Center for Neurodegenerative Diseases (DZNE), Bonn, Venusberg-Campus 1, 53127 Bonn, Germany, Bonn, Germany

[11]Department for Neurodegenerative Diseases and Geriatric Psychiatry, University Hospital Bonn, Bonn, Germany

[12]German Centre for Neurodegenerative Diseases (DZNE), Bonn, Germany

[13]University Hospital Carl Gustav Carus, Technische Universität Dresden, Dresden, Germany

[14]German Center for Neurodegenerative Diseases (DZNE), Dresden, Germany

[15]German Center for Neurodegenerative Diseases (DZNE), Goettingen, Germany

[16]Department of Psychiatry and Psychotherapy, University Medical Center, University of Goettingen, Goettingen, Germany

[17]Neurosciences and Signaling Group, Institute of Biomedicine (iBiMED), Department of Medical Sciences, University of Aveiro, Aveiro, Portugal

[18]University Medical Center, Georg August University, Goettingen, Germany

[19]Department of Psychiatry, Medical Faculty, University of Cologne, Cologne, Germany

[20]German Center for Neurodegenerative Diseases (DZNE), Bonn, Germany

[21]Excellence Cluster on Cellular Stress Responses in Aging-Associated Diseases (CECAD) University of Cologne, Cologne, Germany

[22]University Hospital Bonn (UKB), Clinic for Neurology, Bonn, Germany

[23]German Center for Neurodegenerative Diseases (DZNE), Magdeburg, Germany

[24]Institute of Cognitive Neuroscience, University College London (UCL), London, United Kingdom

[25]Institute of Cognitive Neurology and Dementia Research (IKND), Otto-von-Guericke University, Magdeburg, Germany

[26]Department of Neurology, University of Bonn, Bonn, Germany

[27]Department of Neurodegeneration and Geriatric Psychiatry, University Hospital Bonn, Bonn, Germany

[28]German Center for Neurodegenerative Diseases (DZNE), Tuebingen, Germany

[29]Section for Dementia Research, Hertie Institute for Clinical Brain Research and Department of Psychiatry and Psychotherapy, University of Tuebingen, Tuebingen, Germany

[30]Université Côte d'Azur, Cognition Behaviour Technology Lab (CoBTeK), Nice, France

[31]University Medical Center Rostock, Rostock, Germany

[32]Deutsches Zentrum für Neurodegenerative Erkrankungen e. V. (DZNE) Rostock/Greifswald, Rostock, Germany

[33]CoBTek (Cognition-Behaviour-Technology), Université Côte d'Azur, Nice, France

Correspondence
Zampeta-Sofia Alexopoulou, CoBTeK (Cognition-Behaviour-Technology) Research Lab, Université Côte d'azur, Nice, France.
Email: sophia.alx97@gmail.com

Abstract

Background: Speech and language impairments are associated with cognitive decline in neurodegenerative dementias, particularly Alzheimer's Disease (AD), where subtle speech changes may precede clinical dementia onset. As clinical trials prioritize early identification for disease-modifying treatments, digital biomarkers for timely screening become imperative. Digital speech-based biomarkers can be employed for screening populations at the earliest AD stages. An automated phone-based screening battery has been created, encompassing speech-related neurocognitive tests (Semantic Verbal Fluency and Verbal Learning Test). This allows the extraction of speech-based biomarkers alongside classical cognitive scores. This study aims to validate digital speech biomarkers in early-stage AD by comparing them to traditional evaluation methods.

Method: Within the PROSPECT-AD project, speech and gold-standard clinical data were obtained from the German DELCODE and DESCRIBE cohorts. We used data from N = 14 healthy controls (HC), N = 75 participants presenting with Subjective Cognitive Decline (SCD) and N = 18 participants presenting with amnestic Mild Cognitive Impairment (aMCI). Spearman rank correlations were computed between speech biomarkers and gold-standard clinical measures. Kruskal-Wallis test assessed group differences and regression analysis adjusted for age, sex and education, associated domain-specific speech biomarkers and cognitive assessment scores.

Result: There was a significant difference in the speech biomarker for cognition composite score (ki:e SB-C) between diagnostic groups ($x2(2) = 18.06$, $p < 0.001$). Significant correlations were found between ki:e SB-C and all global anchor scores including MMSE ($r = 0.48$, $d = 0.97$, $p < 0.001$), CDR-SoB ($r = -0.49$, $d = -0.98$, $p < 0.001$) and PACC5 ($r = 0.56$, $d = 1.12$, $p < 0.001$) (Figure 1). All domain-specific biomarker composite scores (memory, executive function, processing speed) significantly correlated with CDR, with strongest correlations found with the memory biomarker. All correlations remained significant when controlling for age, sex and education. Finally, based on the regression analysis results, domain-specific biomarkers were significantly associated with respective domain-specific anchors (Clock Drawing, TMT-A/B, Digits Span, Figure Drawing, ADAS-Cog, Verbal Fluency) (Table 1).

Conclusion: Findings support prior research, emphasizing speech biomarkers as a promising tool for remote early-stage AD screening, with potential implications for scalable screening in research trials and healthcare.

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Figure 1. Significant correlations between the ki:e SB-C cognition biomarker and global anchor scores.

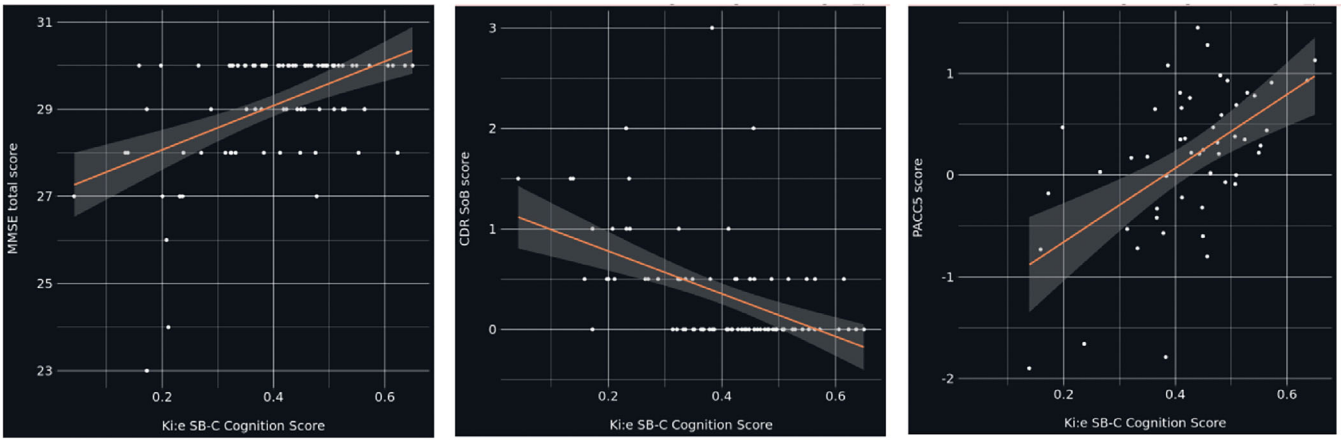

Table 1. Significant regression analysis results. Speech biomarker composite scores were used as predictor variables.

Biomarker x Cognitive Test	B (SE)	Adjusted R^2	*P* Value
Ki:e-SBC Executive Function			
Verbal Fluency	14.239 (3.928)	0.243	<0.001
TMT-B	-67.412 (31.112)	0.157	0.033
Ki:e-SBC Memory			
Digits Span Forward	3.725 (1.516)	0.147	0.016
Digits Span Backward	4.764 (1.705)	0.137	0.006
Digits Span Sum	8.489 (2.804)	0.187	0.003
TMT-A	-42.840 (13.408)	0.212	0.001
ADAS-Cog 13 Word List Recall	12.401 (1.402)	0.520	<0.001
ADAS-Cog 11 Sum	-18.265 (3.428)	0.411	<0.001
ADAS-Cog 13 Sum	-31.293 (4.593)	0.540	<0.001
Ki:e-SBC Processing Speed			
TMT-A	-72.781 (19.074)	0.247	<0.001
TMT-B	-136.585 (49.556)	0.185	0.007

*Adjusted for age, sex, education years