Speech Pause and speech rate for evaluating Alzheimer's and Mild Cognitive Impairment: A Meta-analysis

Submitter Alex Cohen

Affiliation Louisiana State University, Department of Psychology

SUBMISSION DETAILS

I agree to provide poster pdf for attendee download. Yes

I have used the poster abstract template to develop my abstract. Yes

Methodological Issue Being Addressed To what degree do speech characteristics distinguish people with Alzheimer's disease and Mild Cognitive Impairment from cognitively healthy older adults?

Introduction Evaluating speech characteristics presents a promising strategy for improving reliability, validity, and efficiency of cognitive assessments for people with Mild Cognitive Impairment (MCI) and Alzheimer's Disease (AD). Speech can be assayed directly from a variety of tests, interviews and ecologically valid sampling methods, which is advantageous for providing highly reliable speech estimates, and for sampling across a range of contexts.

This meta-analysis focused on two aspects of speech: Pauses (i.e., involving response times related to verbal information – for example, in the pause times separating words, ideas and responses) and speech rate (i.e., involving the speed at which verbal information is conveyed). We evaluated to what degree automated analysis of these aspects of speech differentiate individuals with Alzheimer's disease and Mild Cognitive Impairment from healthy aged.

Methods We conducted a quantitative meta-analysis of studies employing automated speech analysis, identifying 13 studies evaluating pause measures in MCI (n=276), AD (n=170), and healthy controls (n=492), and 8 studies evaluating speech rate (MCI=109, AD=81, controls=231). Speech was analyzed across standard neuropsychological, reading, and free/conversational tasks. Random-effects models were used, with heterogeneity assessed via I^2 statistics.

Results People with AD exhibited substantially longer pauses than controls (d=1.20), while individuals with MCI showed moderately longer pauses (d=0.62). Speech rate differences were smaller between AD and controls (d=0.66) and between MCI and controls (d=0.27). Substantial heterogeneity was observed, particularly for pause measurements. Memory-demanding tasks elicited the largest group differences. Pause metrics generally demonstrated larger group differences compared to speech rate metrics.

Conclusion Of the many ways that speech can be objectified, pauses appear particularly important for understanding cognition in AD. Pause analysis has the benefit of being face valid, interpretable in ratio format as a reaction time, tied to known socio-cognitive functions, and relatively easy to measure, compute and interpret. Automation of speech analysis can greatly

expand the assessment of AD and potentially improve early identification of one of the most devastating and costly diseases affecting humans.

Co-Authors

Alex Cohen[1], Ross Divers[1], Matthew Calamia[1], Michael Masucci[1], Ole Edvard Granrud[1], Aubree Corporandy[1], Kiara Warren[1], Brita Elvevag[2], Chelsea Chandler[3], Catherine Diaz-Asper[4]

[1] Louisiana State University, Department of Psychology

[2] Norwegian Center for Clinical Artificial Intelligence, University Hospital of North Norway, Tromsø, Norway

[3] Institute of Cognitive Science, University of Colorado Boulder, Boulder, CO, United States of America

[4] Marymount University, Department of Psychology

Keywords

Keywords
speech
dementia
alzheimers
mild cognitive impairment
language

Guidelines I have read and understand the Poster Guidelines

Disclosures Supported by funding from the Coins for Alzheimer’s Research Trust fund. Alex Cohen is part owner of Quantic Innovations, which provides digital phenotyping solutions for clinical research/care.