LATENCY DISTRIBUTIONS IN SPEECH DURING STRUCTURED PSYCHIATRIC INTERVIEWS OF PATIENTS WITH BIPOLAR DEPRESSION: AUTOMATED SPEECH ANALYSIS MAY PROVIDE A SIMPLE COGNITIVE BIOMARKER

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ABSTRACT

What is the Methodological Question Being Addressed?
Can we extract an objective measure of psychomotor slowing from latency-to-respond to questions during a structured clinical interview?

Introduction: Cognitive assessments are often used as secondary endpoints but can be costly and burdensome to perform in CNS clinical trials employing multiple outcome measures, several of which may require clinician-administered scales to be performed utilizing a structured psychiatric interview. Here we sought to take advantage of the standardized nature of the structured interview, and utilize automated speech analysis of the recorded interview to derive a measure of psychomotor slowing, and depression severity, based on patient response-time latencies.

Methods: Speech data was obtained from 274 subjects with a diagnosis of bipolar I depression enrolled in a randomized, double-blind, 6-week Phase 2 clinical trial. Fully automated speech analysis was carried-out on a total of 1,369 available audio recordings of structured Montgomery–Åsberg Depression Rating Scale (MADRS) interviews at Baseline, and across up to 6 weeks of study treatment. Automated speech analytics extracted pause-related parameters during the interviews. In this work, we focused on distributions in speech-latencies between the interviewer's question and the subject's answer. Speech-latency distributions, from individual subjects, obtained during each interview session were plotted in order to examine their shape for eventual modeling.

Results: Individual subjects' speech-latency distributions were successfully constructed for all 1,369 interviews. The mean (SD) number of speech-latencies that occurred per interview was 61 (25); 90% of interviews produced between 24 and 104 measurable speech-latencies. Speech-latency distributions for individual subject-interviews were right-skewed with values for mode, median, and mean of 0.74, 1.4, 1.9 seconds (0.8, 0.70, 1.0 sd), respectively. Speech-latency distributions exhibited a 0.5 second slowing (effect size, 0.6) between sessions during remission (MADRS ≤12) compared to not in remission (MADRS >12).

Conclusions: The present findings reveal that neurophysiological speech parameters with face-validity can be derived from audio recordings of psychiatric interviews without the added patient burden of a dedicated neuropsychological test. The integration of these measures into traditional clinical interviews may potentially serve as cognitive biomarkers, with potential relationships to functional status, that may hold valuable insight into a person's cognitive function and wider mental and physical well-being. Measures of speech slowing might be included as secondary outcome measures in analysis plans of future clinical trial protocols evaluating novel treatments for depression.

INTRODUCTION

- Cognitive assessments are often used as secondary endpoints but can be costly and burdensome to perform in CNS clinical trials employing multiple outcome measures, several of which may require clinician-administered scales to be performed utilizing a structured psychiatric interview
- Here we sought to take advantage of the standardized nature of the structured interview and utilize automated speech analysis of the recorded interview to derive a measure of psychomotor slowing, and depression severity, based on patient response-time latencies

METHODS

- Speech data was obtained from 274 subjects with a current diagnosis of bipolar I depression enrolled in a randomized, double-blind, 6-week Phase 2 clinical trial
- Fully automated speech analysis was carried-out on a total of 1,369 available audio recordings of structured Montgomery–Åsberg Depression Rating Scale (MADRS) interviews at Baseline, and across up to 6 weeks of study treatment
- Automated speech analytics extracted pause-related parameters during the interviews. In this work, we focused on distributions in speech-latencies between the interviewer's question and the subject's answer
- Speech-latency distributions, from individual subjects, obtained during each interview session were plotted in order to examine their shape for eventual modeling
- All sessions were examined in this study. Approximately 1,348 recordings were available for 274 participants over baseline, screening, and 3 post-randomization sessions from 7 recruitment countries (19% of data was unusable due to technical issues)

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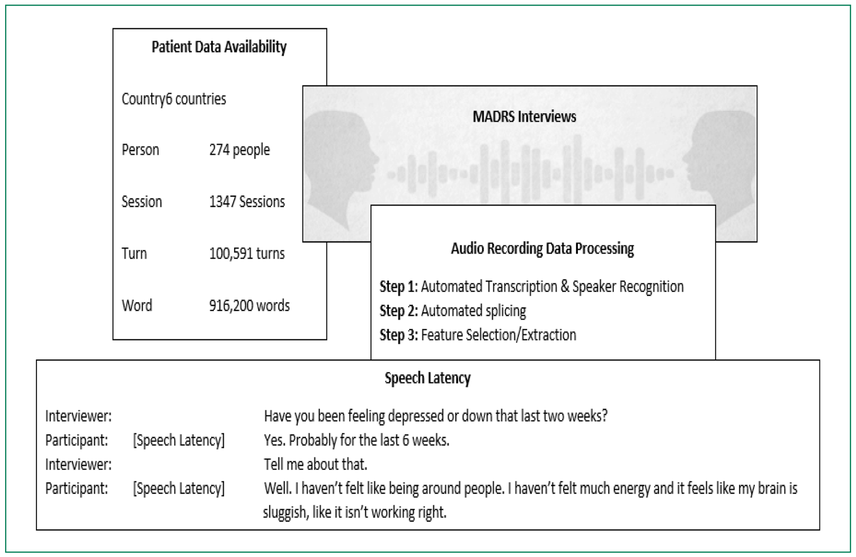
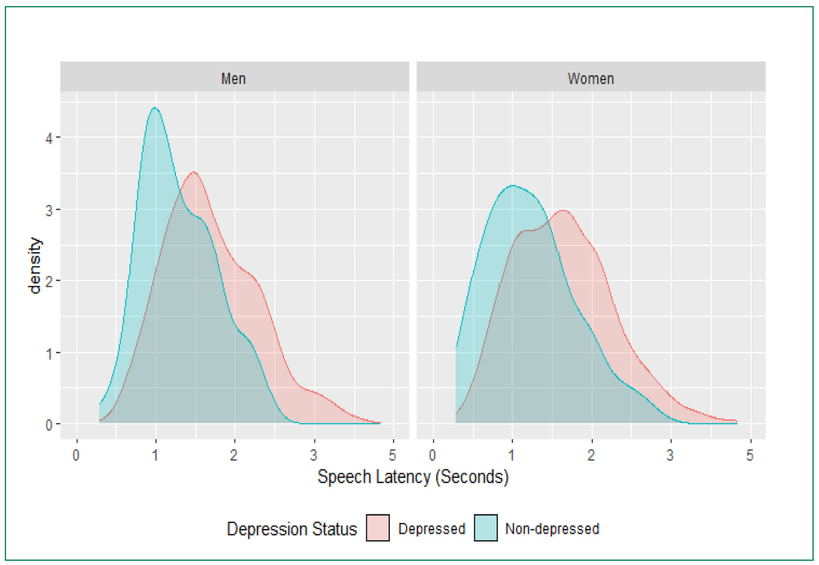
SPEECH ANALYSIS PIPELINE



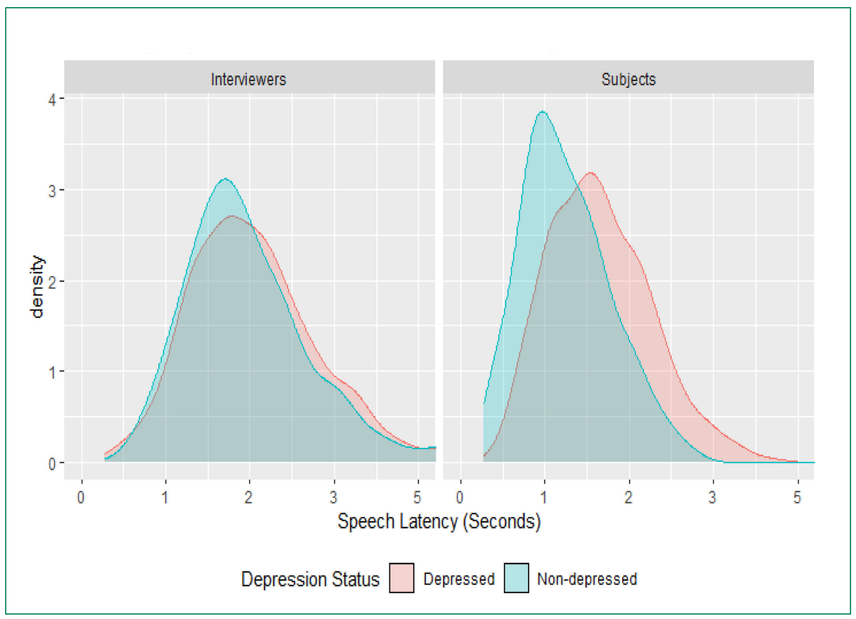
RESULTS

Predicting Depression Status in Men and Women

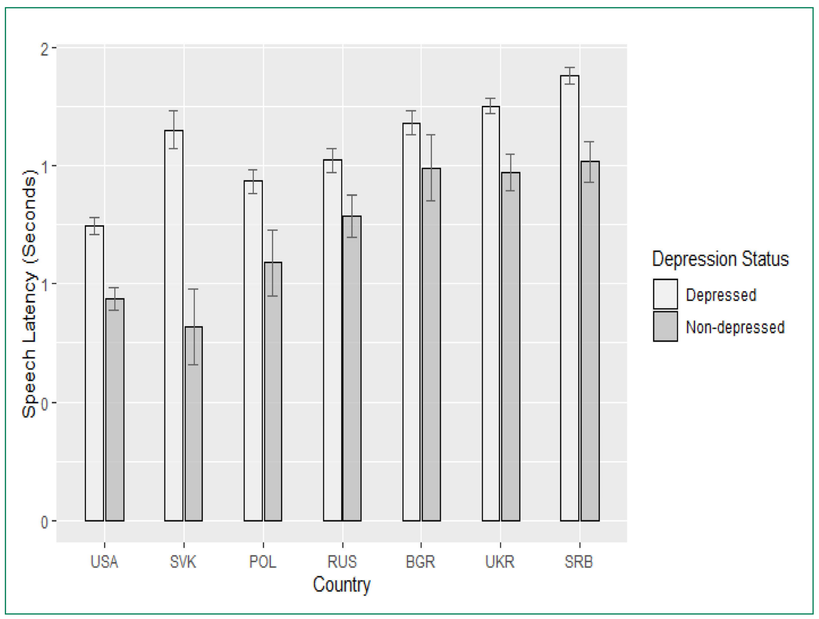


RESULTS

Predicting Depression Status in Interviewers and Subjects



Speech Latency as a Function of Country



CONCLUSIONS

- The present findings reveal that neurophysiological speech parameters with face-validity can be derived from audio recordings of psychiatric interviews without the added patient burden of a dedicated neuropsychological test
- The integration of these measures into traditional clinical interviews may potentially serve as cognitive biomarkers, with potential relationships to functional status, that may hold valuable insight into a person's cognitive function and wider mental and physical well-being
- Measures of speech slowing might be included as secondary outcome measures in analysis plans of future clinical trial protocols evaluating novel treatments for depression