

Longitudinal tracking of speech changes in ALS using a novel remote assessment

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Background

Remote speech technologies show great promise for detecting and tracking bulbar ALS. We sought to longitudinally validate a novel speech assessment platform, at both individual and group levels, with respect to the current clinical gold standard of Speaking Rate.

Hypotheses

- 1. We could capture group and individual changes over time.
- 2. Patterns of acoustic changes would relate to clinical indices of change.

Methods





Evaluated repeated measures correlation (**R_{RM})** between longitudinal changes in Winterlight speaking rate (SR_{wL}) and SIT SR (SR_{sIT}).





- Univariate BHM of SR_{WL} (BHM_{sR-WL})
- Multivariate BHM (BHM_{MV}) captured group and individual changes over time.
- Changed in any articulatory feature measured using BHM_{MV} (BHM_{MV-AA}).
- Changes benchmarked with SR_{SIT} minimum detectable change (MDC_{SR-SIT}) = -36.57 WPM [1].



Repeated measures correlation between SR_{SIT} and SR_{WL} was 0.63, suggesting a relationship between longitudinal changes in features.





Discussion

Clinically-relevant, individual change over time in a cohort of ALS patients could be tracked using an acoustic analysis pipeline via hierarchical modeling. MV models will continue to be developed that mitigate effects of multicollinearity.

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References

- 1. Stipancic, K. L., Yunusova, Y., Berry, J. D., & Green, J. R. (2018). Minimally detectable change and minimal clinically important difference of a decline in sentence intelligibility and speaking rate for individuals with amyotrophic lateral sclerosis. Journal of Speech, Language, and Hearing Research, 61(11), 2757–2771. https:// doi.org/10.1044/2018_JSLHR-S-17-0366
- 2. Tomik, B., & Guiloff, R. J. (2010). Dysarthria in amyotrophic lateral sclerosis: A review. In Amyotrophic Lateral Sclerosis (Vol. 11, Issues 1–2, pp. 4–15). https:// doi.org/10.3109/17482960802379004





MDC_{SR-SIT} and BHM_{SR-WL} identified 13 and 18 individuals as changers. Of 13 MDC_{SR-SIT} changers, 10 (77%) were identified by BHM_{SR-WL}