

A PILOT STUDY OF SPEECH ACOUSTICS AND PLACEBO RESPONSIVENESS

Submitter Dan Begel

Affiliation AP Systems

SUBMISSION DETAILS

What is the Methodological Question Being Addressed? High placebo response rates contaminate clinical trials. Excluding likely placebo responders would enhance signal detection. Can analysis of speech acoustics predict who is likely to respond to placebo?

Introduction The aim of this pilot study is to explore the potential for a novel method of speech analysis to identify likely placebo responders.

Methods Twenty subjects were enrolled in a study advertised as a clinical trial for depression. Subjects satisfied clinical criteria for depressive illness and scored greater than 24 on either the HAM-D or MADRS. Enrollees were randomized in double blind fashion to receive either placebo (N=10) or bupropion sr 100 mg (N=10) for three weeks.

Prior to the administration of drug or placebo, two minute recordings of subjects responding to an open ended question were obtained. Specimens of 20 seconds of continuous speech were extracted, without regard to content. In the PRAAT, multiple acoustic features, including pitch, intensity, and formant frequencies and bandwidths were measured at 10ms intervals throughout each 20 second specimen.

Feature measurements were processed in MATLAB. Measurements derived from phonated speech were extracted. Deltas (differences) at successive 10ms intervals were computed for each feature. Simultaneous deltas of pairs of features were located within neighborhoods containing those paired values that occurred most often--core values-- and those that occurred infrequently--border values. Descriptive computations generated many candidate acoustic variables for possible analysis.

Subjects were assessed weekly. At three weeks, placebo-treated subjects were classified as placebo responder(PR) if they reported clinical improvement and scored ≤ 15 on the HAMD/MADRS. Those who reported no clinical improvement and scored ≥ 20 on the HAMD/MADRS were classified as non-responder(PNR).

A principal component analysis was performed in MATLAB to reduce the number of candidate variables to those correlating at $>60\%$ within both the PR and PNR distributions. Tests of significance across all resulting candidate variables, totalling 97, were carried out in MATLAB.

Results All ten placebo treated subjects completed the study. Four were placebo responders(N(PR)= 4). Six were non-responders(N(PNR)=6). Initial HAMD/MADRS scores were similar between the two groups: mean(SD)PR= 31.5 (2.6), mean(SD)NPR= 31.8 (7.5). Final

HAMD/MADRS scores were robustly distinct: mean(SD)PR=12.3(2), mean(SD)PNR=25.8 (4.5).

Two candidate variables satisfied tests for normality and met a threshold of significance.

Variable 1 is the "inverse of the covariance of phonated pitch and phonated intensity core deltas." This may be thought of as a measure of how tightly a speaker routinely binds pitch and intensity together, with higher values representing looser binding.

Variable 2 is the "inverse of the covariance of phonated pitch and phonated intensity border deltas," a measure of pitch and intensity binding in less frequent activity, with higher values also representing looser binding.

For variable 1, mean(SD)PR=154.5 (102.3), and mean(SD)PNR= 39.6 (51.7). $p < .045$. Cohen's $d = 1.42$.

For variable 2, mean(SD)PR=211.8(143.2), and mean(SD)PNR=54.6(62.8). $p < .043$. Cohen's $d = 1.42$.

Conclusion This study demonstrates the possibility of using a novel method of speech acoustic analysis to predict likely placebo responders prior to a clinical trial. With larger sample sizes and segmented data extraction this method lends itself to machine learning methods offering greater predictive power.

Co-Authors

* Presenting Author

First Name	Last Name	Affiliation
Dan *	Begel *	AP Systems
Chase	Love	University of La Verne

Keywords

Keywords
placebo response
speech acoustics
signal detection

Guidelines I have read and understand the Poster Guidelines

Disclosures if applicable nothing to disclose

Related tables <blank>