Cell Phone Data as a Potential Predictor of Depression Severity: A Pilot Study

Lisa M. Sangermano,[1] Asma Ghandeharioun,[2] Rosalind Picard,[2,3] Jonathan E. Alpert,[1,4] Chelsea F. Dale,[1] Szymon Fedor,[2,5] Dawn F. Ionescu[1,4]

[1]Massachusetts General Hospital, Boston, MA, USA [2]Massachusetts Institute of Technology Media Lab, Cambridge, MA, USA

[3]Empatica, Cambridge, MA, USA [4]Harvard Medical School, Boston, MA, USA [5]University of Cambridge, Cambridge, UK

Introduction

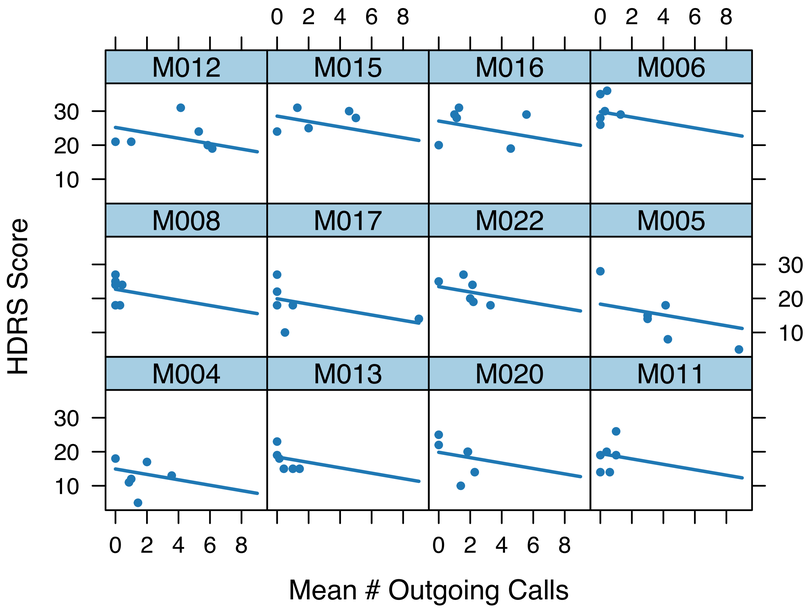
Major depressive disorder (MDD) is a serious and prevalent disease with an unpredictable course. Cell phone technology can assist doctors by monitoring patients' symptoms, and may eventually be useful in the prediction of depressive episode time courses. However, the extent to which the course of depression can be predicted with cell phone data remains unknown. The quantitative measurement of communication patterns (i.e., number of text messages and phone calls) between depressed patients and their contacts may be useful for the prognostication of the course of depression. We predicted that more communication with social contacts via texts and phone calls would correlate with lower depression scores.

Methods

Between April 2016 and March 2017, patients with MDD (N=12) completed an 8-week protocol that involved tracking depressive symptoms and mobile phone usage. All patients were assessed at 2-week intervals for depression symptoms as measured with the Hamilton Depression Rating Scale (HDRS). Movisens (an Android application) was used to measure incoming and outgoing SMS (text messages) and phone calls, and missed calls.

Results

There was a statistically significant negative relationship between the average number of outgoing calls (p=.014) and HDRS total scores (M1 model).



Model Selection

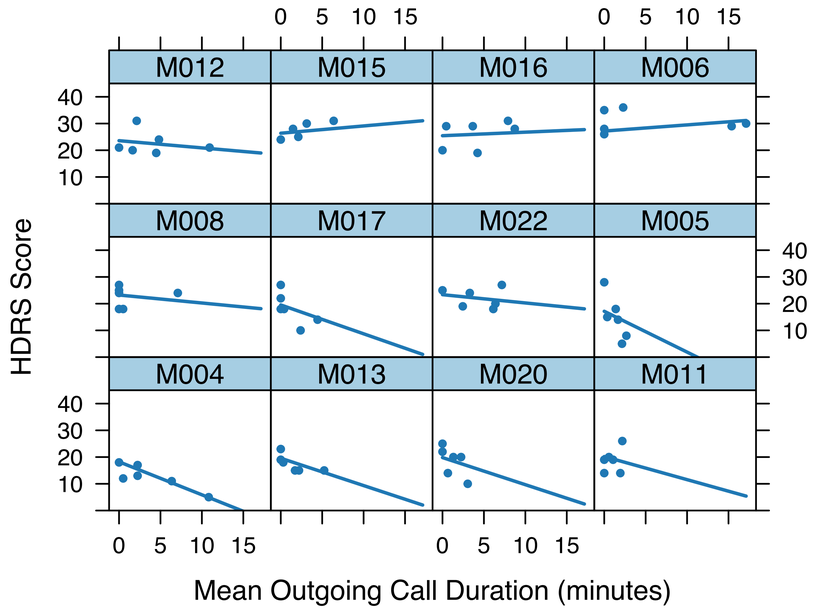
To asses the relationship between the HDRS total score and the number of calls/texts in the week prior to clinical assessment while accounting for individual differences, we used linear mixed-effect (LME) models. We developed two models:

M1: LME with random intercept

M2: LME with random intercept and slope

We selected the model with a better balance between complexity and good fit based on Bayesian Information Criterion (BIC).

Furthermore, there was a statistically significant negative relationship between the average duration of outgoing calls (p=.047) and HDRS total scores (M2 model).



No significant relationship was observed between other hypothesized parameters (the number of incoming calls, texts, or the duration of the incoming calls in the week prior to the assessment) and HDRS total scores.

Conclusion:

Our results showed a significant negative relationship between number and duration of outgoing calls and subjective reporting of depression severity. Participants who were feeling less depressed may have been more inclined to reach out socially. Or, initiating more social interaction may have caused participants to feel less depressed. Longer interactions may be more meaningful and supporting and thus alleviating depressive symptoms.