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## **Smartphone Data as an Electronic Biomarker of Illness Activity in Bipolar Disorder**

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### **Introduction**

There is a lack of objective methods for continuous monitoring of illness activity in bipolar disorder. Smartphones offer novel and unique opportunities for monitoring of symptoms and collection of real-time data.

### **Objective**

To test the hypothesis that automatically generated objective data and self-monitored correlate with clinically rated depressive and manic symptoms in patients with bipolar disorder.

### **Methods**

Software for smartphones (the MONARCA system) was developed by our group. This system allows for continuous collection of automatically generated objective data and self-monitored data. A total of 61 patients with bipolar disorder aged 18-60 years used the MONARCA system for a six months period. Patients were rated, by a researcher blinded to smartphone data, once a month for six months using Hamilton Depression Rating Scale 17-item (HDRS-17) and Young Mania Rating Scale (YMRS).

### **Results**

Data showed significant correlations between automatically generated objective data (the number of incoming and outgoing phone calls/ day, the duration of incoming and outgoing phone calls/ day, and the number of outgoing text messages/ day) and depressive and manic symptoms according to HDRS-17 and YMRS, respectively. Data showed significant correlations between self-monitored data (mood, sleep, activity level and stress level) and depressive and manic symptoms according to HDRS-17 and YMRS, respectively.

### **Conclusions**

Automatically generated objective data and self-monitored data collected using the MONARCA system correlate with clinically rated depressive and manic symptoms in patients with bipolar disorder. Smartphone apps reflect an easy and objective way to continuously monitor illness activity with real-time data.