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‘Did You Get My Text?’: Commentary on ‘Objective smartphone data as a potential diagnostic marker of bipolar disorder’

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Maria Faurholt-Jepsen and Colleagues (2018) at the University of Copenhagen have conducted an innovative examination of smartphone use metrics to increase diagnostic precision in bipolar disorder. The authors compared healthy adult volunteers to adults with bipolar disorder, the latter of whom were followed over 12 research visits, allowing a comparison of use metrics across patients who were in depressive, manic/mixed or euthymic states. The bipolar patients sent and received a greater number of text messages per day than the healthy controls, and had longer durations of phone calls than controls, regardless of mood state. Interestingly, patients with bipolar disorder in euthymic states averaged less time per day with their smartphone screens on than controls. The authors conceptualize these findings as evidence for ‘diagnostic behavioral digital markers’ of bipolar disorder that may supplement diagnostic interviews.

Identifying behavioral markers that can be collected from mobile devices (smartphones and sensors such as accelerometers, activity trackers and cardiac monitors) is an important direction for research in bipolar disorder given the automatically generated and presumably objective nature of these measures compared to clinical interviews. Psychiatry lacks comparative longitudinal studies of patient groups whose moods, sleep, or social behaviors are assessed daily or even more frequently. One UK study (Tsanas et al., 2016) showed that the degree of variability in daily-rated moods helped distinguish patients with borderline personality disorder from age-matched patients with bipolar disorder.

For the proposed smartphone use metrics to inform diagnoses in community care settings, patients would have to contribute up to 12 weeks of data to determine if their pattern of usage matches the behavior of bipolar reference groups observed in various clinical states. In that vein, I would have liked to have seen evidence of the *incremental validity* of smartphone usage metrics—how much diagnostic accuracy is improved by adding usage metrics onto results obtained from clinical and historical interviews.

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Without comparison samples of patients with schizophrenia, major depressive disorder or attention-deficit/hyperactivity disorder, we do not know whether we are observing illness-specific digital behavioral markers. In the study by Faurholt-Jepsen et al., sensitivity for the bipolar versus healthy control comparison was high (0.92), but specificity was low (0.39), suggesting that a significant proportion of healthy individuals were mis-classified by the machine learning algorithm as having bipolar disorder. Within the bipolar subsample, distinguishing patients with depressive versus euthymic states yielded a sensitivity value of 0.36 (specificity = 0.68), suggesting that a high proportion of individuals classified by the algorithm as euthymic actually had bipolar depression. This hit rate is below what one would hope to see for a supplemental diagnostic test.

A further limitation of this study is the assumption that healthy controls have very stable moods and are consistent over time in their mobile phone usage. Clinical status and smartphone use metrics were obtained from the 29 bipolar patients every 2 weeks for 12 weeks, leading to 182 sets of ratings; the 37 controls were only evaluated once, at baseline. Thus, the full longitudinal variation in patients' moods was captured and analyzed, whereas any day-to-day mood variability in the controls was assumed to be insignificant. An important question that often plagues differential diagnostic decisions, especially in settings with adolescent and young adult patients, is how often 'normal' moods transition into the sub-syndromal or pathological ranges. Reference rates of mood and behavioral variability in healthy populations over fixed periods of time are an important consideration when defining behavioral markers of diagnosis, risk or treatment response in psychiatric populations.

Despite these limitations, the observed patterning of mobile phone usage may define groups of patients that only partially overlap with groups defined by *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM-5) or International Classification of Disease, 11th Revision (ICD-11) criteria. Patients who have longer durations of phone calls, more incoming or outgoing text messages, or turn their phones on or off frequently may be distinguishable from patients with shorter call durations and fewer mobile phone interactions on variables such as the course of their mood symptoms, psychosocial functioning or treatment response. Defining patient groups in terms of objectively observable behaviors—even if these behaviors don't neatly fit into the clinical profiles we're used to—may take us further in characterizing mental illness along behavioral dimensions. Moreover, automatically generated metrics of social behavior may be reliable indices of clinical change, allowing greater opportunities to compare clinical populations undergoing different treatments across settings.

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References

- Faurholt-Jepsen M, Busk J, borarinsdottir H, et al. (2018) Objective smartphone data as a potential diagnostic marker of bipolar disorder. *Australia and New Zealand Journal of Psychiatry*. Epub ahead of print 2 November. DOI: 10.1177/0004867418808900.

Tsanas A, Saunders KE, Bilderbeck AC, et al. (2016) Daily longitudinal self-monitoring of mood variability in bipolar disorder and borderline personality disorder. *Journal of Affective Disorders* 15: 225–233.

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