Objective vs. Subjective Reports of Sleep Quality in Major Depressive Disorder: A Pilot Study

A. Ghandeharioun[1#], L. Sangermano[2], R. Picard[1, 3], J. Alpert[2, 4], C. Dale[2], D. Ionescu[2], S. Fedor[1, 5*]

[1] Massachusetts Institute of Technology Media Lab, Cambridge, MA, USA [2] Massachusetts General Hospital, Boston, MA, USA [3] Empatica, Cambridge, MA
[4] USA Harvard Medical School, Boston, MA, USA [5]University of Cambridge, Cambridge, UK #asma_gh@mit.edu *sfedor@mit.edu

Hypotheses

- There is variability in sleep regularity and patterns among individuals with Major Depressive Disorder (MDD).
- There is a strong correlation between subjective self-reported sleep ratings and objective accelerometer-based measurements.
- Objective sleep measurement could detect differences among individuals with MDD.

Conclusions

- There are discrepancies between Individuals' subjective sleep ratings and objective data from the E4 sensors.
- Irregular sleep is associated with depression.

Background

- Sleep patterns in MDD are heterogeneous: both insomnia and hypersomnia are symptoms of depression.
- Assessment of sleep patterns in MDD is often limited by clinicians' reliance on subjective self-reported ratings of sleep.
- Objective measures, such as sleep regularity measured by accelerometer data, may provide a more accurate prognostication.

Methods

- Recruitment:
  - *n*=11 MDD and *n*=4 healthy controls (HC) completed the protocol
- We developed an algorithm to calculate objective sleep based on accelerometer data.
- We calculated sleep regularity indices (SRI) for both objective and subjective sleep.

$$Sleep \quad regularity \quad index = \frac{1 + \frac{1}{T-\tau}\int_0^{T-\tau} s(t)s(t+\tau)dt}{2}$$

$$Where \quad s(t) = 1 \quad during \quad wake \quad and \quad s(t) = -1 \quad during \quad sleep$$

Study Protocol

- Randomized Control Trial Protocol:
  - 8 weeks
  - Tracking depressive symptoms
  - Wearing Empatica E4 wristbands 23 hours a day that record accelerometer data
  - Biweekly clinical assessment for depression symptoms using Hamilton Depression Rating Scale (HDRS).

Fig. 1: Study measurements

Results

- Totally, the accelerometer-based (objective) and self-reported (subjective) sleep/awake time periods matched 60.94% of the time.
- Specifically for MDD patients, the algorithm overestimated accelerometer-based sleep epochs that were reported as awake.

HC Total Accuracy: 63.38		Obj.	
		Awake	Sleep
Subj.	Awake	**49.28**	**18.86**
	Sleep	17.76	14.10

Tab. 1: Objective vs. subjective sleep/awake epochs for HCs

MDD Total Accuracy: 59.32		Obj.	
		Awake	Sleep
Subj.	Awake	**44.49**	**24.63**
	Sleep	16.05	14.84

Tab. 2: Objective vs. subjective sleep/awake epochs for MDD patients

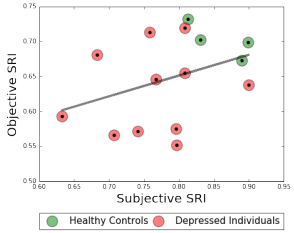

Fig. 2: Objective vs. subjective SRI and regression line

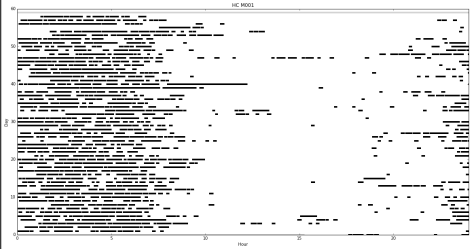

Fig. 2: Objective sleep from a sample HC.
Black: sleep, white: awake, grey: missing.

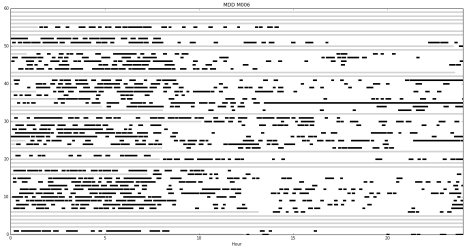

Fig. 3: Objective sleep from a sample MDD patient.
Black: sleep, white: awake, grey: missing.

- Based on t-statistics, MDD patients had a lower objective (t=3.09, p=0.012) and subjective SRI (t=3.37, p=0.005) compared to HCs.
- A trend toward positive Pearson correlation between objective and subjective SRI did not reach statistical significance in this small sample (r=0.37, p=0.17).