Relationship between missing data and bipolar disorder (BD) symptom severity in digital phenotyping

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Introduction

- Digital phenotyping involves moment-to-moment quantification of the individual experience using data from personal digital devices such as Fitbits and smartphones.[1,2]
- This method has been growing in popularity as a way to better understand disease trajectory across a range of mental and behavioral health concerns.[3]
- Because this method relies on participants wearing their devices continuously, data loss is common and this can complicate analysis and limit the conclusions that can be drawn.[4]
- **Our aim was to examine whether periods of noncompliance (missing data) were associated with increased severity of either manic or depressive symptoms.**

Methods

Participants: 29 adults with bipolar disorder (BD-I and BD-II) recruited from Brigham and Women's Hospital. Diagnostic eligibility confirmed using SCID-V.

Procedure:

- Participants given Fitbit devices to wear during a 9-month data collection period
- Participants completed biweekly self-report ratings of mood during the 9-month period: Patient Health Questionnaire (PHQ-8) to measure depressive symptoms, Altman Self-Rating Mania scale (ASRM) to measure manic symptoms

Analysis:

- Each participant's data was assessed to determine periods of non-compliance per study criteria (i.e., wearing the Fitbit less than 75% of a given biweekly period).
- 12 out of the 29 participants had at least one period of noncompliance.
- Average mood ratings for compliant periods and noncompliant periods were calculated for each of the 12 participants
- Paired sample t-tests were conducted to assess associations between mood (mania or depression assessed separately) and Fitbit protocol compliance

Results

Table 1. Demographic characteristics

Characteristic	N	%
Age		
18-33	6	50
34-48	3	25
49-63	3	25
Sex		
Female	11	92
Male	1	8
Race		
White/Caucasian	7	58
Black/African American	2	17
Asian	1	8
Other	2	17
BD-I	10	83
BD-II	2	17

Figure 1. Compliant (C) versus noncompliant (NC) PHQ-8 scores

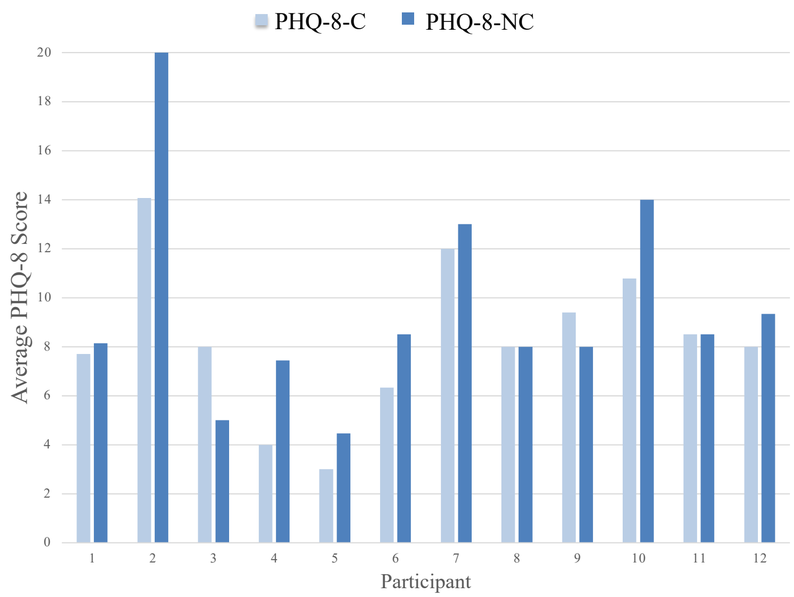
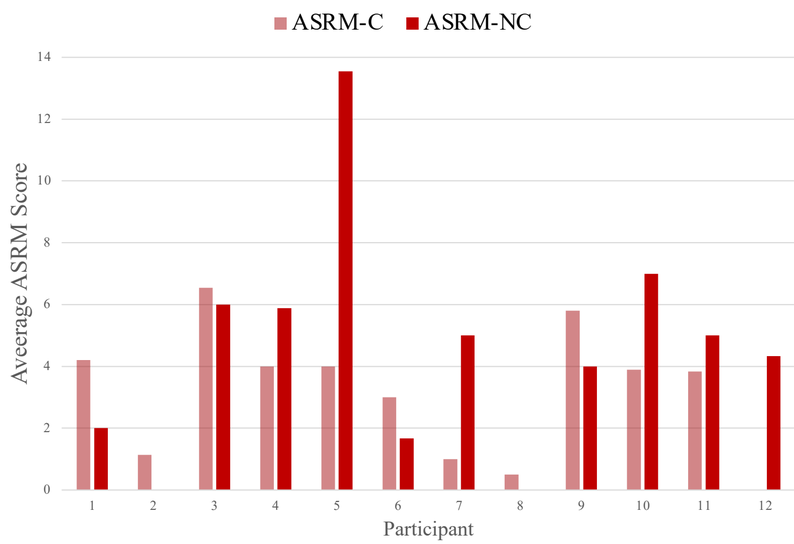


Figure 2. Compliant (C) versus noncompliant (NC) ASRM scores



*Note: if bar appears missing, average score = 0

Table 2. Average group self-report mood ratings in BD sample

	Group Average
PHQ-8-C	8.3
PHQ-8-NC	9.5
ASRM-C	3.2
ASRM-NC	4.5

Table 3. Relationship between mood symptom severity and Fitbit noncompliance

Paired T-Test	T	P-value
Depression	-1.80	0.05
Mania	-1.39	0.1

Results Summary

- Neither depression or manic symptom severity were significantly related to protocol non-compliance, but findings with regard to depression trended toward significance, even with our small sample size.

Limitations

- Results are preliminary due to small sample size (n=12), similar evaluations with larger sample sizes are necessary.
- Findings reflect a sample of patients who were euthymic at baseline and, therefore likely do not represent the full spectrum of bipolar illness.

Discussion and Future Directions

- Analyses fail to reach significance at the $p<0.05$ level. However, trends observed indicate that missing data may not be at random.
- Although not significant in our small sample, findings suggest that there may be a relationship between higher self-reported ratings of depression and missing Fitbit data.
- Further studies should evaluate the relationship between symptom severity and missing data.

References

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