# Usability and Adherence to Remote, Longitudinal Assessment of EEG, Cognition, Mood and Sleep in Borderline Personality Disorder

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## Introduction

- BPD trials often fail to show efficacy because participants improve across all arms, regardless of treatment.
- The added clinical attention during trials may itself be therapeutic, masking treatment effects (Benedetti et al., 2016).
- In BPD, high symptom variability further undermines designs built on infrequent clinic visits.
- Remote, repeated assessment is therefore an attractive alternative for capturing patient experience - But success depends on sustained participant adherence and highly usable tools.
- We tested the usability and feasibility of such an approach.

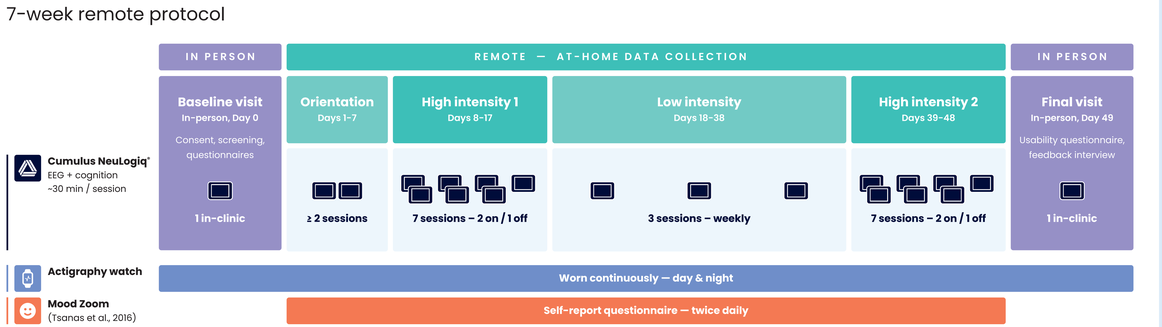

**Figure 1:** From left to right, The NeuLogiq headset and tablet (Cumulus Neuroscience); NeuLogiq DSST "Symbol Swap"; and MotionWatch 8 (CamNtech)

## Methods

- N = 51 (31 participants with BPD – screened using SCID-5, 20 healthy volunteer participants - HV)
- 7-week longitudinal observational study with at-home data collection (1-week orientation; 6-week collection).

**Participant Journey**

7-week remote protocol




Actigraphy and mood requirements are uniform throughout; NeuLogiq recording intensity varies by phase.

**Each NeuLogiq® session included:**

- Resting State EEG
- Symbol Swap (Digital DSST)
- Go with the Flow (Gamified Flanker)

## Patient Insights

Patients provided their thoughts on the technology and study design on their final visit to the clinic, in a semi-structured qualitative interview. This is a selection of their quotations.

(On NeuLogiq) **"So when I wake up tired, the activities will be more difficult. Or when I'm like in a low mood, activities are more difficult for me. When I'm like energetic, they're like really easy, you know? So I think the task depends on my moods, basically."** (BPD)

(On NeuLogiq) **"I thought the session length was actually fine and like** […] **the more I became used to the set up like the quicker it was."** (HV)

(On NeuLogiq) **"I found it really easy to use. I mean, there's not a huge amount of things to press."** (BPD)

(On the headset) **"I did find it quite easy to use** […] **The instructions were clear when putting it on and connecting it and everything."** (BPD)

(On scheduling) **"I think it would have to be a matter if you got like almost like a calendarish thing in the app itself** […] **so it's easier to keep track of than the list of days that I was given."** (BPD)

(On Mood Zoom) **"I didn't mind the frequency because it was so quick to do."** (HV)

(On the watch) **"I sort of just forgot that it was there."** (HV)

**"I did it before bed which worked quite well** […] **because I've got BPD I find routine helps me immensely."** (BPD)

**"The high intensity was, yeah, like full on just because I work full time as well."** (BPD)

## Results: Usability and Feasibility

One participant (BPD) withdrew from the study during the low intensity phase and was replaced. Adherence statistics are calculated up to the point of withdrawal.

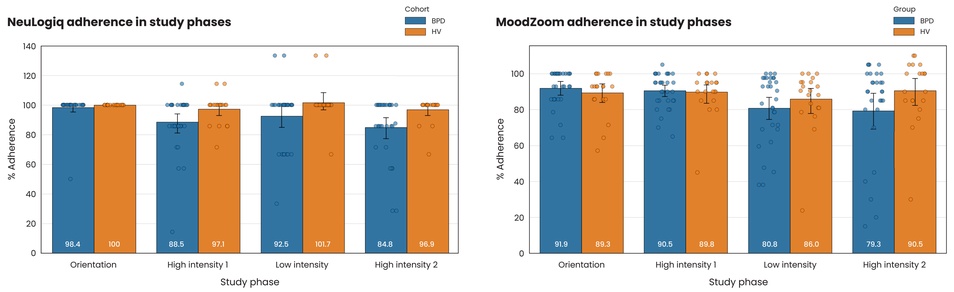
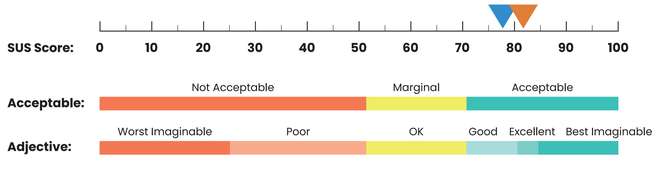



**Figure 2:** Adherence scores for NeuLogiq cognition/EEG (left) and MoodZoom assessment (right) across the study phases. Scores are means, error bars are 95% confidence intervals.



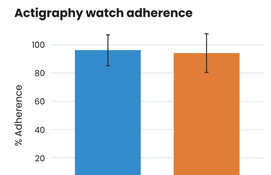
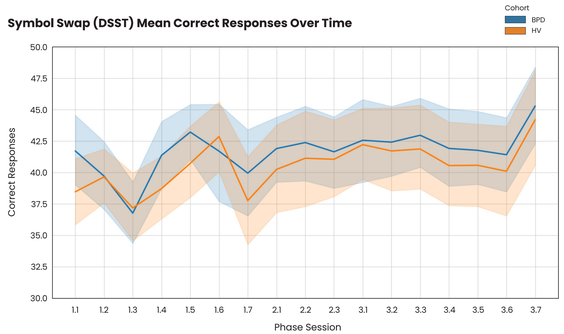




**Figure 3:** (left) System usability scale (SUS - Bangor, Kortum and Miller, 2009) scores for NeuLogiq at the end of the study for BPD participants (blue arrow) and HVs (orange arrow).

**Figure 4:** (right) Adherence scores for days of actigraphy watch use. Adherent days are those on which there was no gap in wear time >3hrs consecutively. Scores are medians and error bars are IQR.

## Sample Outcome Measures



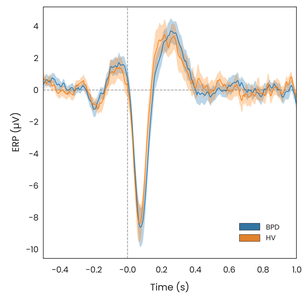




**Figure 5:** Left - DSST scores over time for BPD participants (blue) and HVs (orange), starting from High Intensity Phase 1. Right – Study grand average ERN for participant groups. Error bars are 95% confidence intervals. Data are preliminary and presented to demonstrate feasibility outcomes only.

## Conclusions

Although HVs adhered better than BPD participants on most measures, primarily in the later phases, the combined digital approach showed broad acceptability and usability. BPD patients still reached high adherence (>84% for NeuLogiq and Actigraphy watch; 79% for MoodZoom, across all phases) and reported "good" usability — meeting a key prerequisite for trials with less clinical contact and more frequent measurement.

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## References

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