Remote Assessment of Disease and Relapse-Major Depressive Disorder (RADAR-MDD): Preliminary data from King's College London

Ivan A[1], White K[1], Julie J[1], Matcham F[1], Dobson R[1], Eriksson H[2], Folarin A[1], Kerz M[1], Ranjan Y[1], Rashid Z[1], Simblett S[1], Hotopf M[1], on behalf of the RADAR-CNS consortium[3]

[1] **King's College London**, Institute of Psychiatry, Psychology and Neuroscience, UK
[2] **H. Lundbeck A/S**, Valby, Denmark
[3] https://www.radar-cns.org/

For correspondence, please email **radar-mdd@kcl.ac.uk**.

Background

Major depressive disorder (MDD) affects 7% of the European population and it has a typical trajectory of relapse and remission. Symptoms include disrupted sleep, reduced sociability, physical activity, changes in mood, prosody, and cognitive function. **Remote Measurement Technologies (RMT)**, including smartphones, apps, and wearable devices may be useful in tracking MDD symptomatology and aiding symptom management. Clinically useful RMT biomarkers could assist in **the early identification of relapse or deterioration**, which **can be translated into health services**. The Remote Assessment of Disease and Relapse in Major Depressive Disorder (RADAR-MDD) study focuses on using RMT to measure and predict symptoms of major depressive disorder (MDD). Symptoms are measured via apps delivering surveys and cognitive games and recording passive data streams.

Aims and Methods

The aims of RADAR-MDD are, in a sample of people with a history of MDD, to:
  1) determine the usability, feasibility and acceptability of RMT;
  2) improve and refine clinical outcome measurement using RMT to identify current clinical state;
  3) determine whether RMT can provide information predictive of depressive relapse and other critical outcomes.

Here we report on the first of these aims. **Data monitoring, usability questionnaires and qualitative interviews** have assessed the acceptability and usability of the system in the first 15 participants enrolled in London between November 2017 and January 2018. These data provide valuable **insight into the requirements for long-term engagement with the study protocol, as well as the integration of RMT into daily life.**

Preliminary results
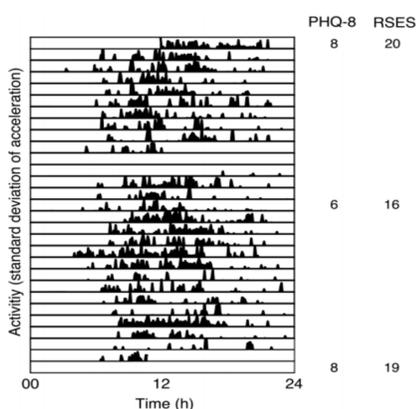### Data monitoring

Fig. 1. Each row reflect daily participant activity measured with the phone accelerometer, illustrating high levels of movements activity. PHQ-8 and RSES scores illustrate depressive symptoms and self-esteem questionnaire data respectively, measured over two weeks, suggesting low MDD symptoms.
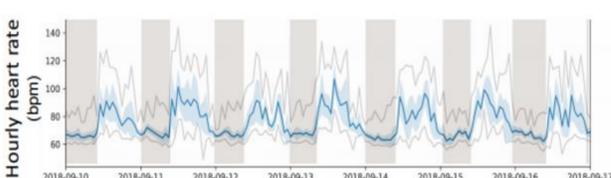

Fig. 2. Example of FitBit heart rate scores and sleep patterns over a week. The blue line indicates hourly FitBit heart rate scores, the grey lines and blue shades indicating the associated std. and range. These data have been used to calculate sleep duration marked in the shaded areas.
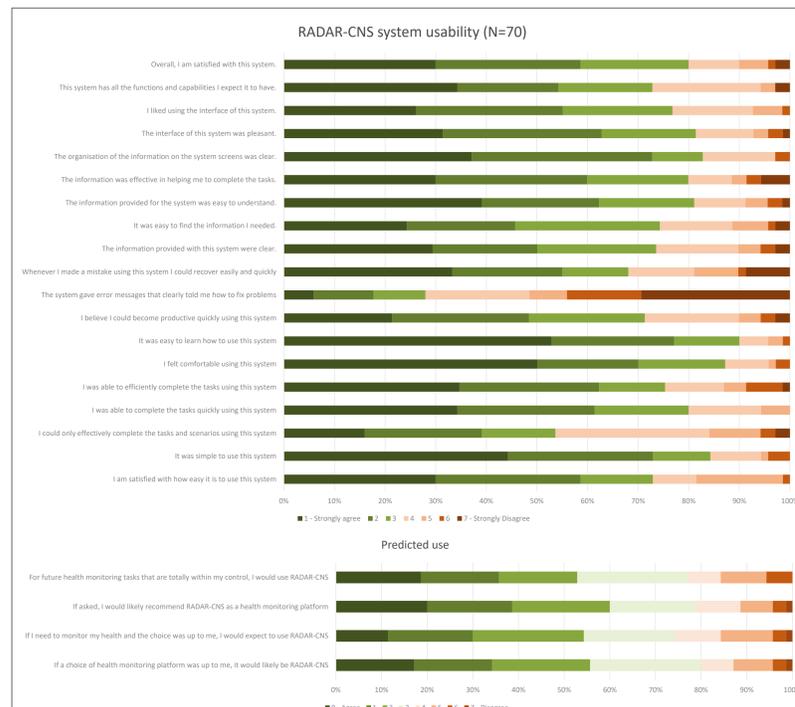
Usability questionnaires

Fig. 3. System usability data in the first three months of the study suggests high satisfaction with the overall system, most notably in the easiness of system use. Future improvements should relate to the usefulness of error messages in dealing with technical difficulties. On average, participants were likely to recommend RADAR-CNS as a health monitoring platform.

Qualitative interviews

"The FitBit really inspired me to be more proactive, do things, to get back to where I want to be before all these started, that really took my life over for the past 4 years."

"Looking at the questionnaires sometimes, I can reflect on what went well what didn't go well, on how I can do something to make it better for me."

Fig. 4. Qualitative data has informed refinements in different aspects of the study, including:

• increased participant support, both through *direct contact* to ensure clear understanding of the different questionnaires expected and *indirectly* through monthly study summaries covering updates and technological tricks;
• phrasing of questions and apps interface design and user experience;
• frequency of passive data uploads to improve phone battery life;
• separate reseach conducted to examinine the clarity of error messages and terms and conditions.

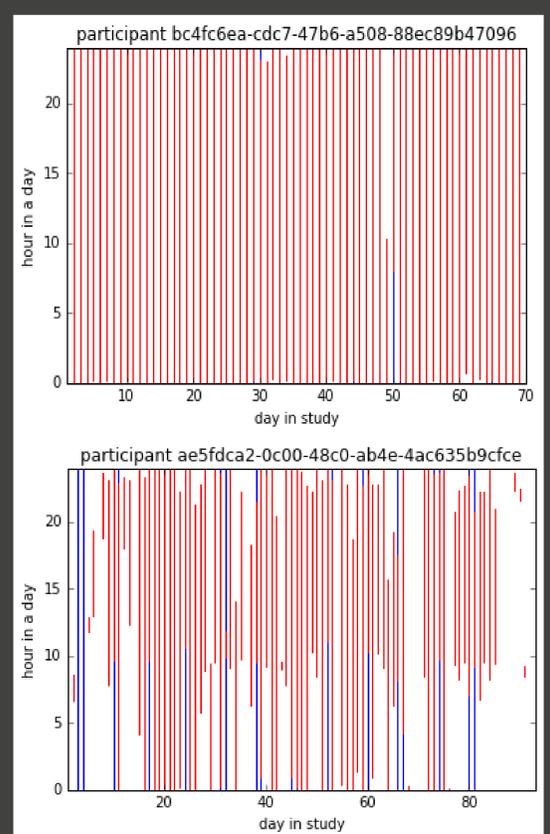## Passive data stream completeness

Fig. 5. GPS data from recorded from two participants over approximately three months. Vertical lines correspond to time intervals in the study days when GPS data was received. Red lines indicate weekdays, while blue lines indicate weekends (Saturday and Sunday). Data indicate variability in data completeness, possibly reflective of variable data collection from phone sensors or data transmission in the different Android phones used in the study.

Discussion

Work is underway to evaluate the feasibility and acceptability of the system. Preliminary data illustrates good participant adherence to the study protocol and high participant satisfaction with the overall system. Individual variability exists between the completeness of passive data received, reflecting technical challenges which have informed system improvements. Ongoing research is essential to ensure large scale integration of digital technologies into the healthcare system.

www.radar-cns.org
info@radar-cns.org