

Predicting symptom course in individuals with obsessive-compulsive disorder using data from mobile and wearable technology

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Abstract

Obsessive-compulsive disorder (OCD) is a common mental health condition characterized by obsessions and/or compulsions. Obsessions are repetitive unwanted thoughts, images, and urges, while compulsions are repetitive behaviors or mental rituals. OCD symptoms cause distress and anxiety and fluctuate throughout life. The use of technology in psychiatry to improve care for people with mental health conditions including OCD is growing. Our lab is dedicated to both general OCD research and the intersection of technology and OCD diagnosis, treatment, and care. The following is a list of ongoing projects in the lab in which I was involved:

1. The qualitative study focuses on understanding how individuals with OCD feel about the use of technology such as mobile and wearable devices and artificial intelligence (AI) in diagnosing and treating OCD
2. The Fitbit study is a longitudinal study that aims to find correlations between behavior, physiology and OCD symptoms using data from wearable technology, daily surveys, and brain imaging
3. The scoping review aims to examine the existing literature to identify factors associated with delay in diagnosis and treatment of OCD

Qualitative Study

- The objective is to understand opinions on technology use in mental healthcare from individuals with OCD
- Our specific focus will be on the use of mobile and wearable devices to track activities and predict mental health conditions
- An additional focus will assess attitudes towards AI/ML in psychiatry for diagnosis and treatment and data privacy issues
- We use the Grounded Theory approach, in which a general theory is formed based on patterns in participants' responses from semi-structured interviews



Fitbit Study

- This study uses Fitbit devices to track behaviors (sleep, step count, and exercise) and physiology (heart rate, body temperature, and oxygen saturation) in individuals with OCD
- Ecological momentary assessment (EMA) questions are sent out daily to participants on their smartphones to report daily activities and levels of stress, depression, anxiety, and OCD symptoms
- Passive data from Fitbit devices and active data from EMAs is collected over an extended period of time (10 weeks)
- Resting state functional magnetic resonance imaging (fMRI) data will be collected at study enrollment and study end
- We will use machine learning (ML) to analyze this data and create individualized modeling that will:
 - 1) Predict how individuals' OCD symptoms change over time using mixed-effect random forest models
 - 2) Identify physiologic and behavioral features that track personalized self-report OCD symptoms longitudinally

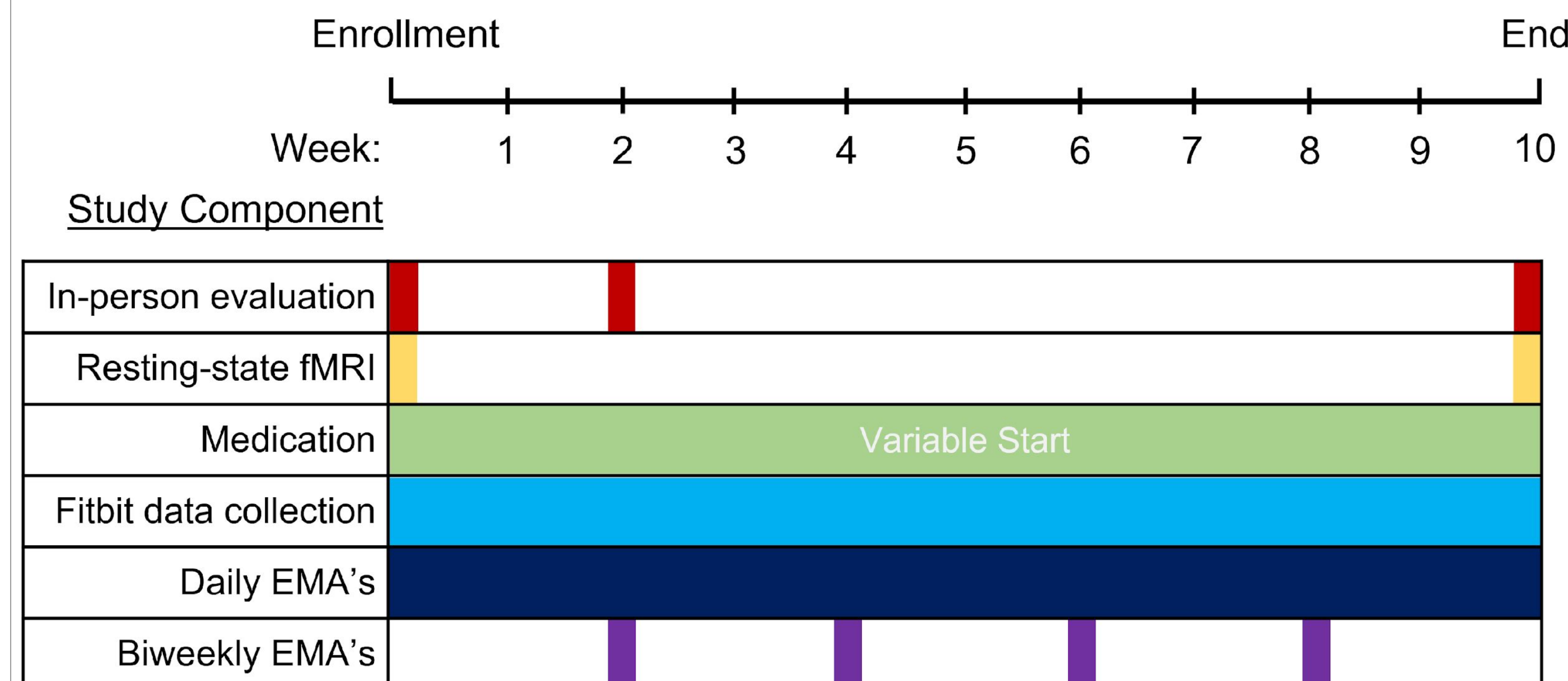


Figure 1. Study design and timeline. The study duration is 10-weeks. In-person evaluations occur three times over the course of the study: at study enrollment, at 2-weeks, and at study end. Resting state fMRI imaging occurs at enrollment and study end. Pharmacotherapy treatment with SSRI medication begins as clinically indicated by the treating psychiatrist. Fitbit data is collected continuously throughout the study. Daily EMA's are collected throughout the study period. Bi-weekly EMA's are collected 4 times. EMA's are delivered at semi-random times during the day so that over the course of 10-weeks, data is sampled throughout the full course of a day.

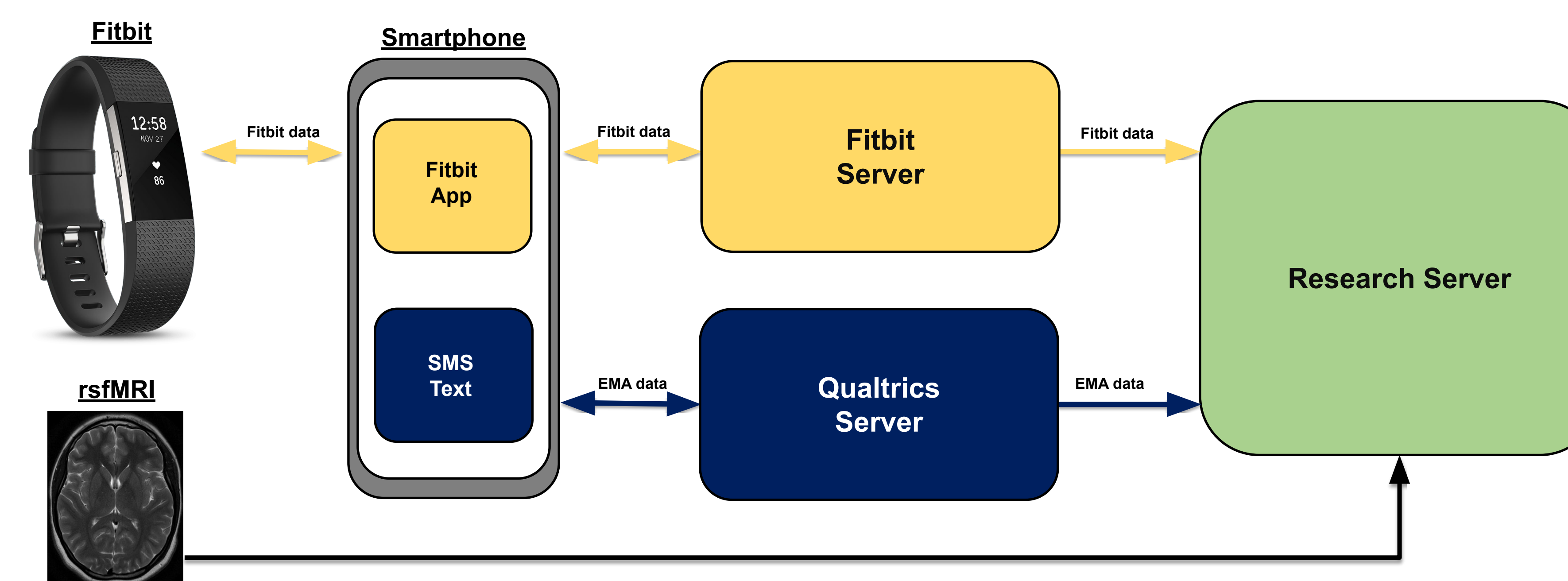
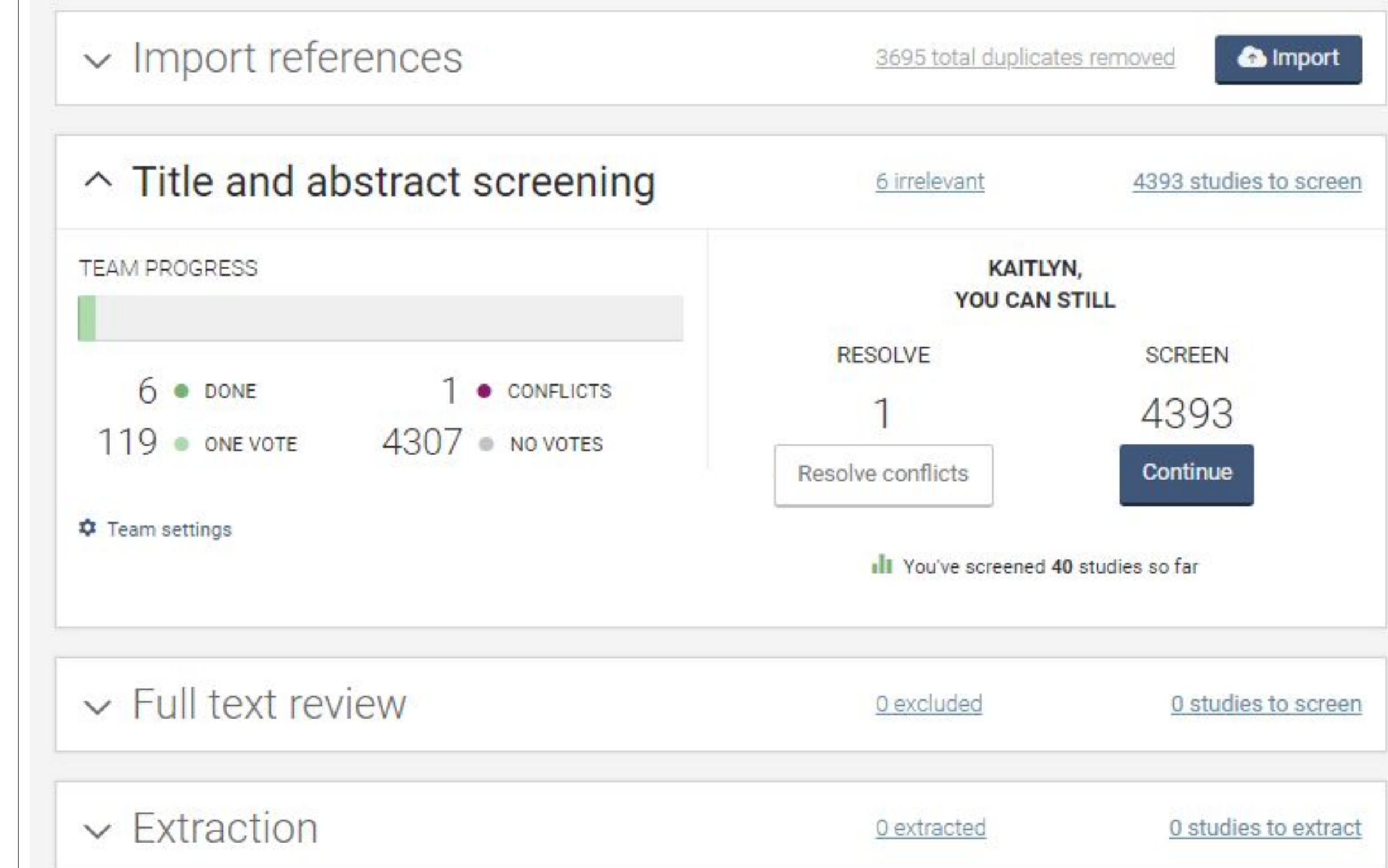


Figure 2. Data collection. Fitbit data is sent to participants' smartphone and then to Fitbit servers. Self-report EMA data flows through Qualtrics servers to our research server. Daily API calls collect Fitbit data to the research server. rsfMRI data is loaded directly to the research server after imaging.

Scoping Review

- A scoping review is a systematic process of identifying all existing literature on a topic. This literature is used to map themes and provide a framework for understanding concepts
- In "Factors associated with delays in assessment and treatment of obsessive-compulsive disorder: A Scoping Review" we are collecting studies that will address the question: what contributes to delays in assessment and treatment of OCD
- A search strategy was developed and used to query 4 biomedical databases with 4,433 references identified and downloaded
- References were imported into Covidence for Title/Abstract screening



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References

- Ben-Zeev D, Brenner CJ, Begale M, Duffecy J, Mohr DC, Mueser KT. Feasibility, acceptability, and preliminary efficacy of a smartphone intervention for schizophrenia. *Schizophr Bull.* 2014;40:1244-1253. doi: 10.1093/schbul/sbu033
- Eisen JL, Sibrava NJ, Boisseau CL, Mancebo MC, Stout RL, Pinto A, Rasmussen SA. Five-year course of obsessive-compulsive disorder: Predictors of remission and relapse. *J Clin Psychiatry.* 2013;74:233-239. doi: 10.4088/JCP.12m07657
- Mak S, Thomas A. Steps for Conducting a Scoping Review. *J Grad Med Educ.* 2022 Oct;14(5):565-567. doi: 10.4300/JGME-D-22-00621.1. PMID: 36274762; PMCID: PMC9580325.
- Obsessive-compulsive disorder (OCD) [Internet]. Mayo Foundation for Medical Education and Research; 2020

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