Predicting Optimal Treatment Outcomes for Patients with Complex Anxiety Disorders

M. S. Heimvik, M. A. Helmich, K. M. Pålerud, R. Hagen, A. Hoffart, S. U. Johnson

University of Oslo, COPE, Modum Bad

ABSTRACT

This study aims to investigate the efficacy of cognitive behavioural therapy (CBT) and metacognitive therapy (MCT) in treating complex anxiety disorders. Despite the availability of group-level effective treatments for anxiety disorders, many patients exhibit limited improvement due to the inconsistent suitability of treatments. Aptitude-by-treatment interactions suggest that the effectiveness of psychological therapies depends on specific patient characteristics (Nye et al., 2023). Recent advancements in machine learning (ML) have facilitated the personalization of anxiety disorder treatments by allowing for individual predictions of treatment responses.

Building on DeRubeis et al.'s (2014) personalized advantage index (PAI), our study aims to generate individualized treatment outcomes. Our study will analyze real-world data to identify the most beneficial therapy for individual patients, aiming to refine clinical decision-making and improve treatment outcomes.

OBJECTIVE

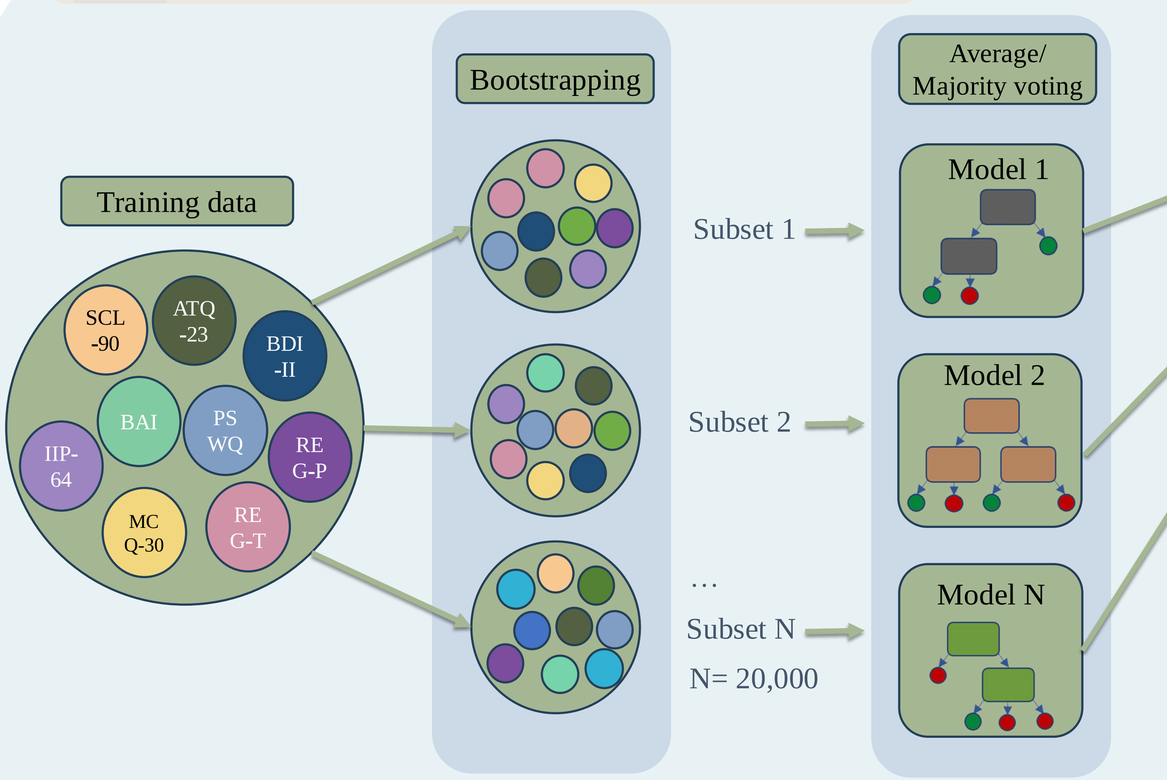
To use routinely collected clinical data to determine which treatment—CBT or MCT—is most effective for individual patients with complex anxiety disorder.

Research question: Can routinely collected baseline measures be utilised to predict treatment outcomes in complex anxiety disorders, using ML to enhance the process of optimal treatment selection?

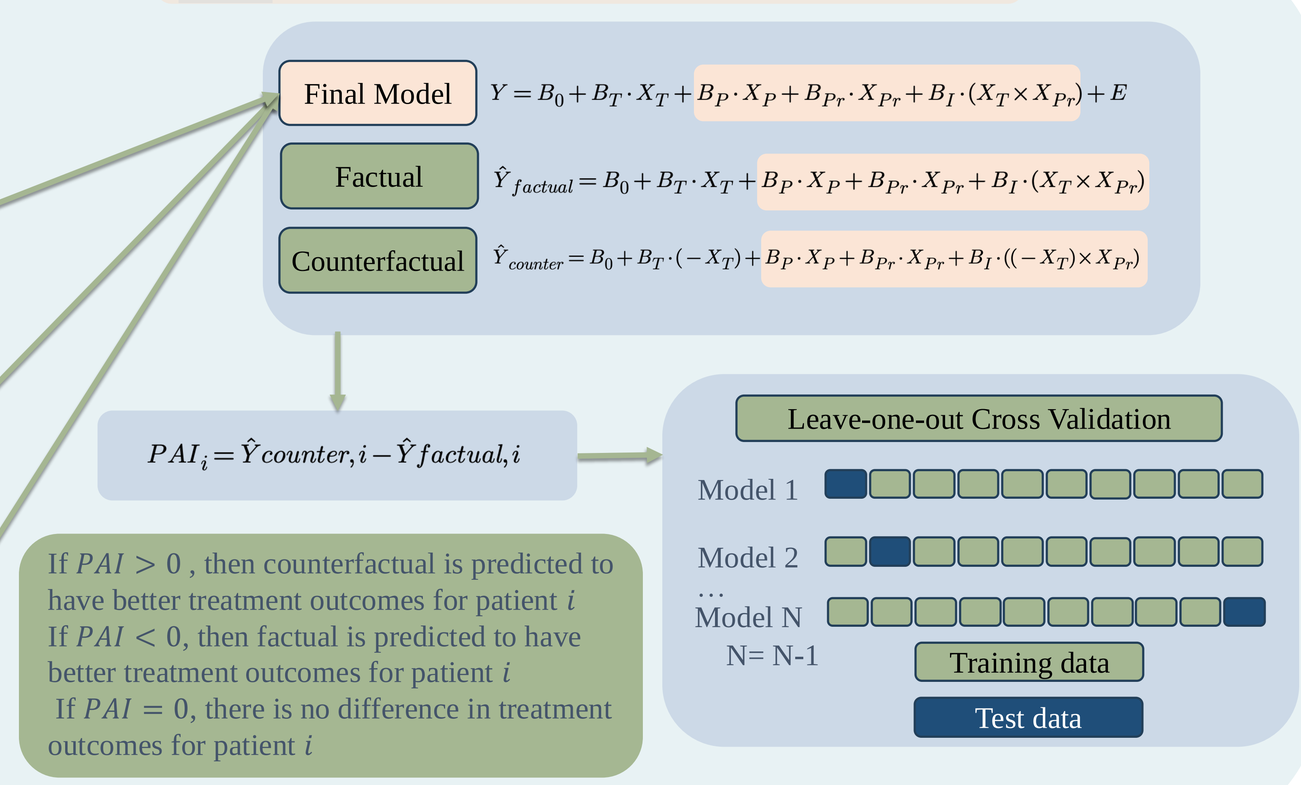
Primary hypothesis: Patients who received their optimal treatment based on their PAI prediction would have reduced anxiety measures at the end of treatment compared to those who received their non-optimal treatment.

Secondary hypothesis: Patients with more complex clinical presentations will have MCT assigned as their optimal treatment, and their PAI scores will indicate a greater advantage in terms of treatment outcomes in MCT.

METHODS: STAGE ONE



METHODS: STAGE TWO



The study replicates established methods to analyze treatment benefits for individuals (Keefe et al., 2018; van Bronswijk et al., 2021; Zilcha-Mano et al., 2016).

A two-stage ML method will be conducted, which includes:

Stage 1: Variable selection using a random forest algorithm for model-based recursive partitioning (mobForest analysis by Garge et al., 2013).

- The final model includes main effects for “treatment”, prognostic and prescriptive variables, and terms representing the interactions between “treatment” and the prescriptive variables.

Stage 2: PAI modeling to determine treatment advantage (DeRubeis et al., 2014).

- PAI Calculation: Defined as the difference between predicted scores for treatment actually received (factual) and alternative treatment (counterfactual).
- Optimal treatment identified by lower (better) PAI score.
- Cross-validation techniques to ensure unbiased predictions (each individual's scores are predicted by models from which they are excluded; Abdi et al., 2010).

Study preregistration: scan the QR code or follow this link
https://doi.org/10.17605/OSF.IO/TNKZY

CONCLUSION

- Focused on a data-driven approach to refine clinical decision-making.
- Holds potential to significantly advance personalized treatment in anxiety disorders.
- Aimed at a deeper understanding of treatment allocation and outcome impact.
- Offers predictive insights on patient responses to unadministered alternative treatments.
- Exploratory research due to limited sample size (approx. 500 patients receiving treatment in an inpatient facility).

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