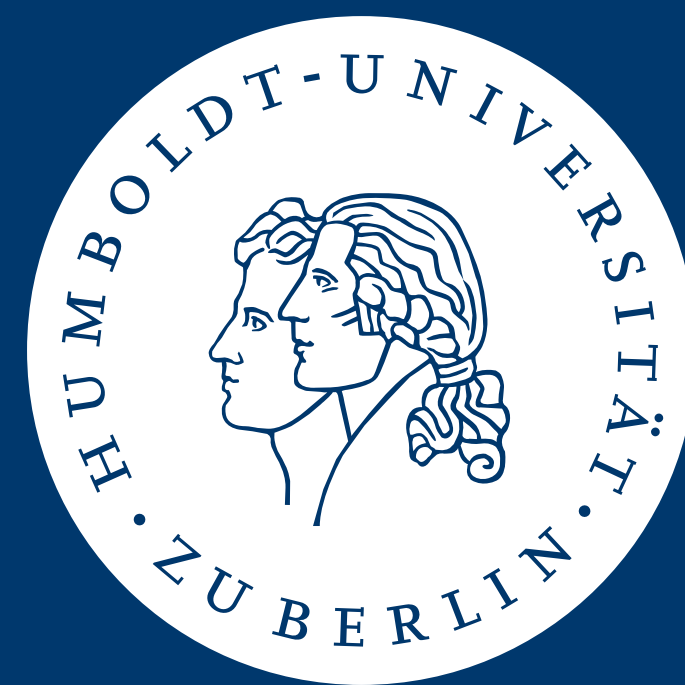


# Advancing the *Personalized Advantage Index (PAI)*: a Systematic Review and Application in Two Large Multi-Site Samples in Anxiety Disorders



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## BACKGROUND

- The **Personalized Advantage Index (PAI)**<sup>1</sup>, which estimates the advantage of one treatment option over another for each patient, is a promising way to perform personalized treatment selections. Its **utility** is retrospectively evaluated by **comparing the symptom severity** of those patients that have received their PAI-indicated treatment (“**lucky patients**”) to those that have not (“**unlucky patients**”).
- The implication of the PAI relies on **predictive modelling**, which is prone to bias from unsuitable methodological choices<sup>2</sup>, such as inappropriate **cross-validation (CV) schemes** and **data leakage**.
- Aim: Examine the **impact of different CV-schemes and data leakage** on the PAI’s utility in **previous studies (1.)** and in **two original datasets (2.)**.

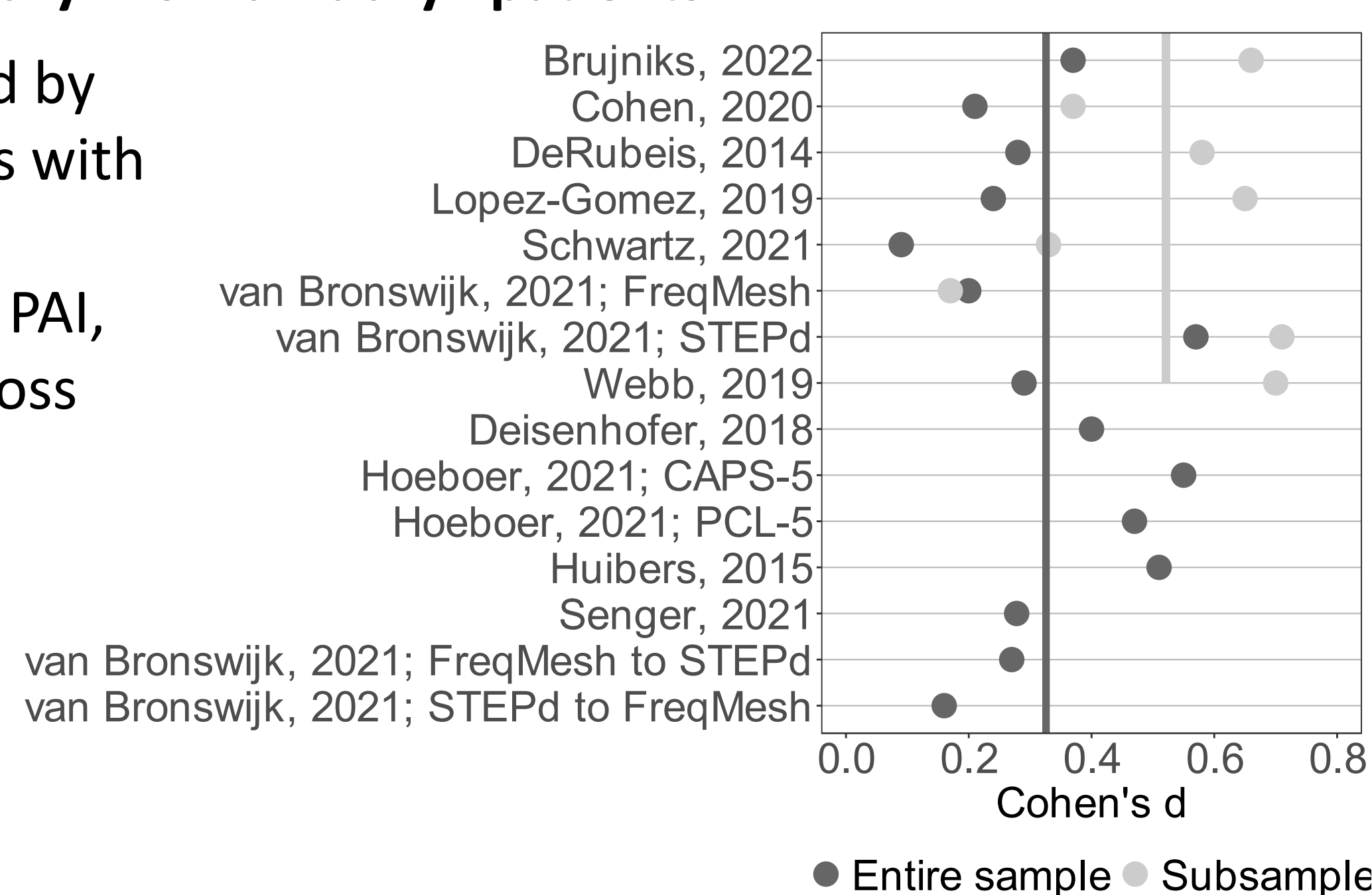
## METHODS & RESULTS

### 1. SYSTEMATIC REVIEW

Search for „personalized advantage index“ in Scopus, Pubmed, and psycArticles (result:  $n = 14$  studies)

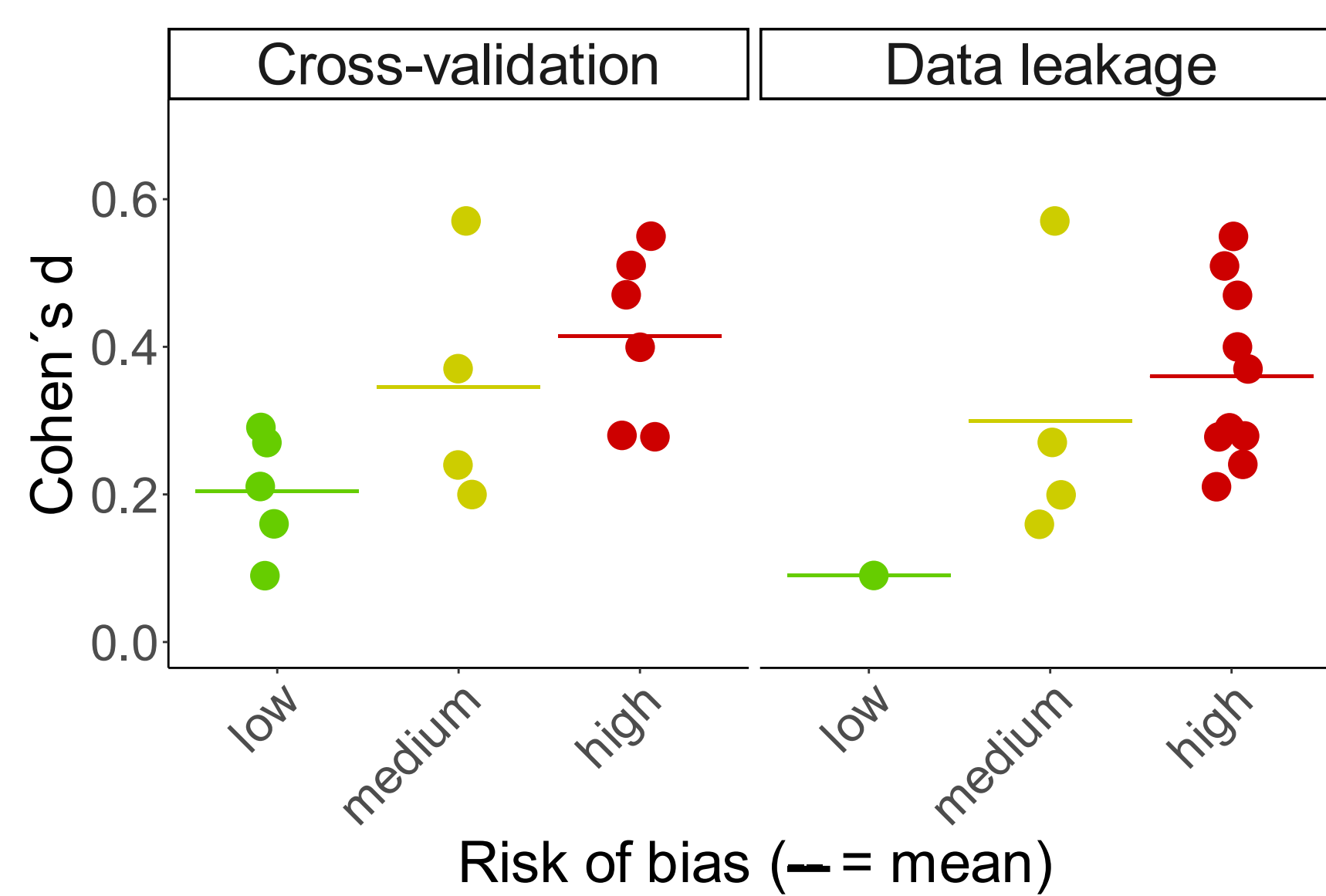
#### The PAI’s utility across studies and settings: low to medium effect sizes for the comparison “lucky” vs. “unlucky” patients

Subsamples were build by analyzing only subjects with a particularly high PAI (e.g. 50 % with largest PAI, definitions varying across studies)



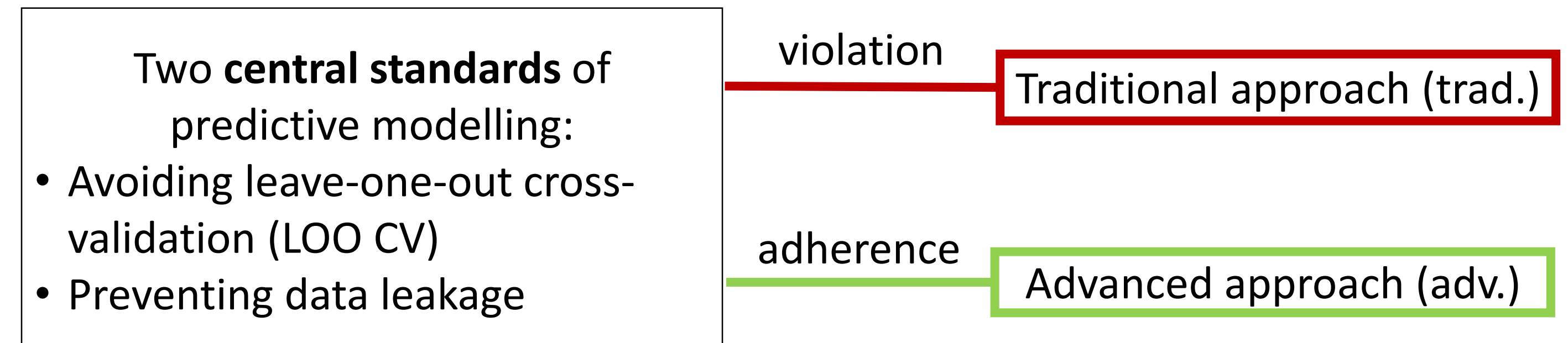
#### Risk of bias (introduced by CV and data leakage) and its relation to the PAI’s utility (measured as Cohen’s d): Higher ROB – Higher Cohen’s d

Only 1 analysis had a low bias rating in both categories



### 2. EMPIRICAL STUDY

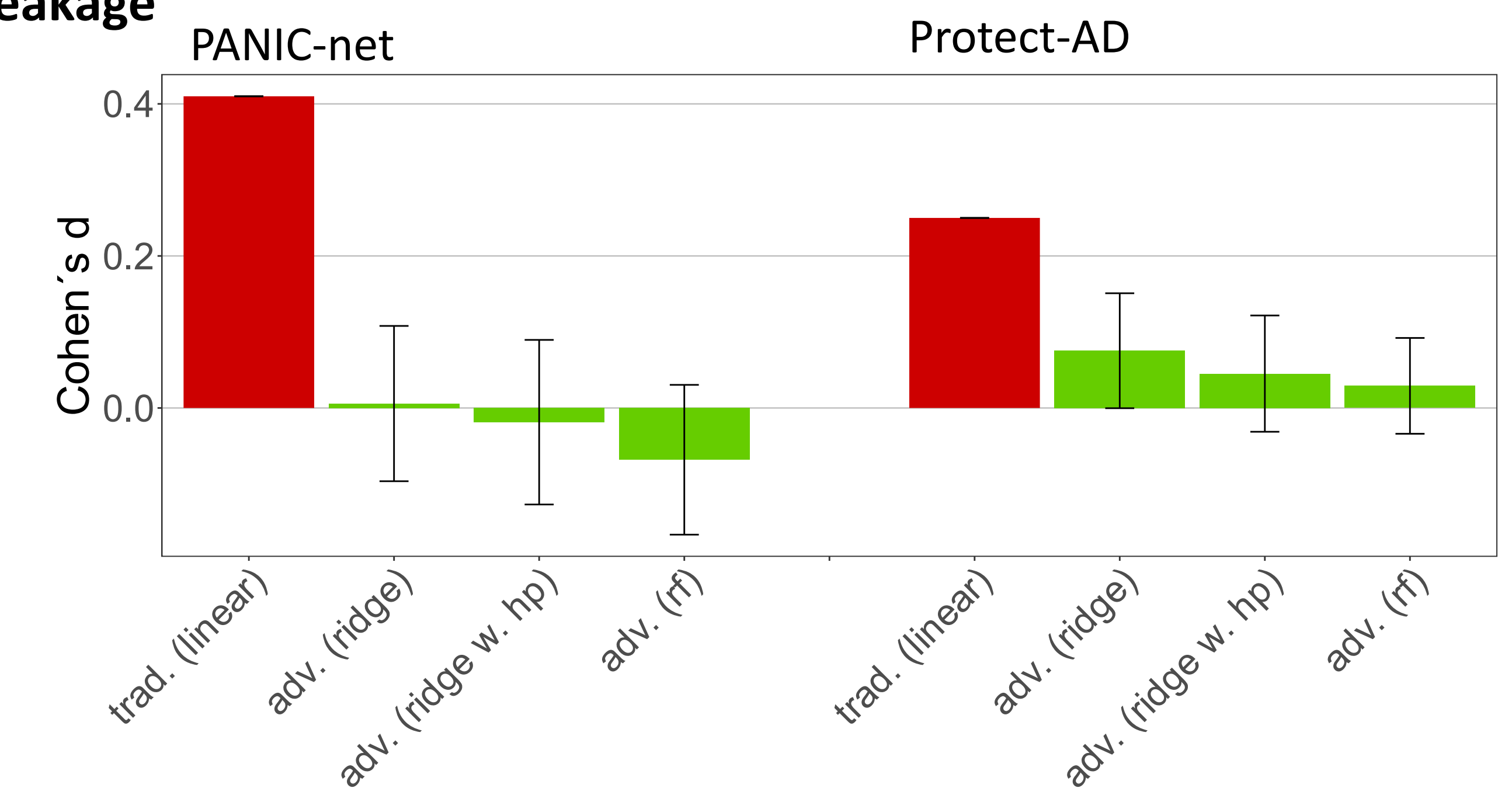
#### Comparing two approaches...



#### ... in two datasets

	PANIC-net (n = 261)	Protect-AD (n = 614)
Disorders	panic disorder with agoraphobia	panic disorder, agoraphobia, social anxiety disorder, specific phobia
Treatment options	therapist-guided vs. self-guided exposure	non-intensified (1 session/week) vs. intensified (3 sessions / week) exposure

#### The positive effect of the PAI detected in the traditional high-ROB-approach disappeared in all advanced approaches, which avoided LOOCV and data leakage



hp = hyperparameter tuning, rf = random forest

## DISCUSSION

- Many studies did not follow current predictive modelling standards such as avoiding LOOCV and data leakage, amplifying the risk of bias.
- Our empirical investigations show that a lack of these standards **might systematically overestimate** the utility of the PAI and should thus be avoided in future studies.
- To facilitate the implementation of a low-bias approach, we provided a **beginner-friendly pipeline on github**.

FIND OUR  
LOW- BIAS-  
PIPELINE HERE!



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The authors declare no conflict of interest.

Presented on “Jahrestreffen des Deutschen Zentrums für Psychische Gesundheit” (25. – 27. September) and the FOR5187-Symposium (9. – 11. October)

- This work was funded by the Deutsche Forschungsgemeinschaft - FOR5187 (project number 442075332).
- PANIC-net is part of the German multicenter trial “Mechanisms of Action in CBT (MAC)”. The MAC study is funded by the German Federal Ministry of Education and Research (BMBF; project no. 01GV0615) as part of the BMBF Psychotherapy Research Funding Initiative.
- PROTECT-AD (Providing Tools for Effective Care and Treatment of Anxiety Disorders) is one out of nine research consortia in the German federal research program Research Network on Mental Disorders, funded by the Federal Ministry of Education and Research ([www.fzpe.de](http://www.fzpe.de)), PROTECT-AD P1 grant number: 01EE1402A. The presented work was derived from project P1. Contact: [charlotte.meinke@hu-berlin.de](mailto:charlotte.meinke@hu-berlin.de)