Predicting Preventable Hospital Readmissions with Causal Machine Learning

PRESENTER:

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BACKGROUND

Many systems-level and population health management interventions rely on predictive algorithms to identify and prioritize patients at highest risk.

However, these approaches fail to account for potential risk-based heterogeneous treatment effects (or *rHTE)* which can be substantial in some settings.

METHODS

- Data from before and after deployment of readmission prevention intervention linked to EHR-based predictive algorithm (*n* = 1,539,285 hospital discharges, 2010-2018)
- Goal: Characterize extent of rHTEs and estimate marginal gains wit.
- Causal forest analysis: Estimate conditional average treatment effects (CATEs) using causal forest on set of patient-level features

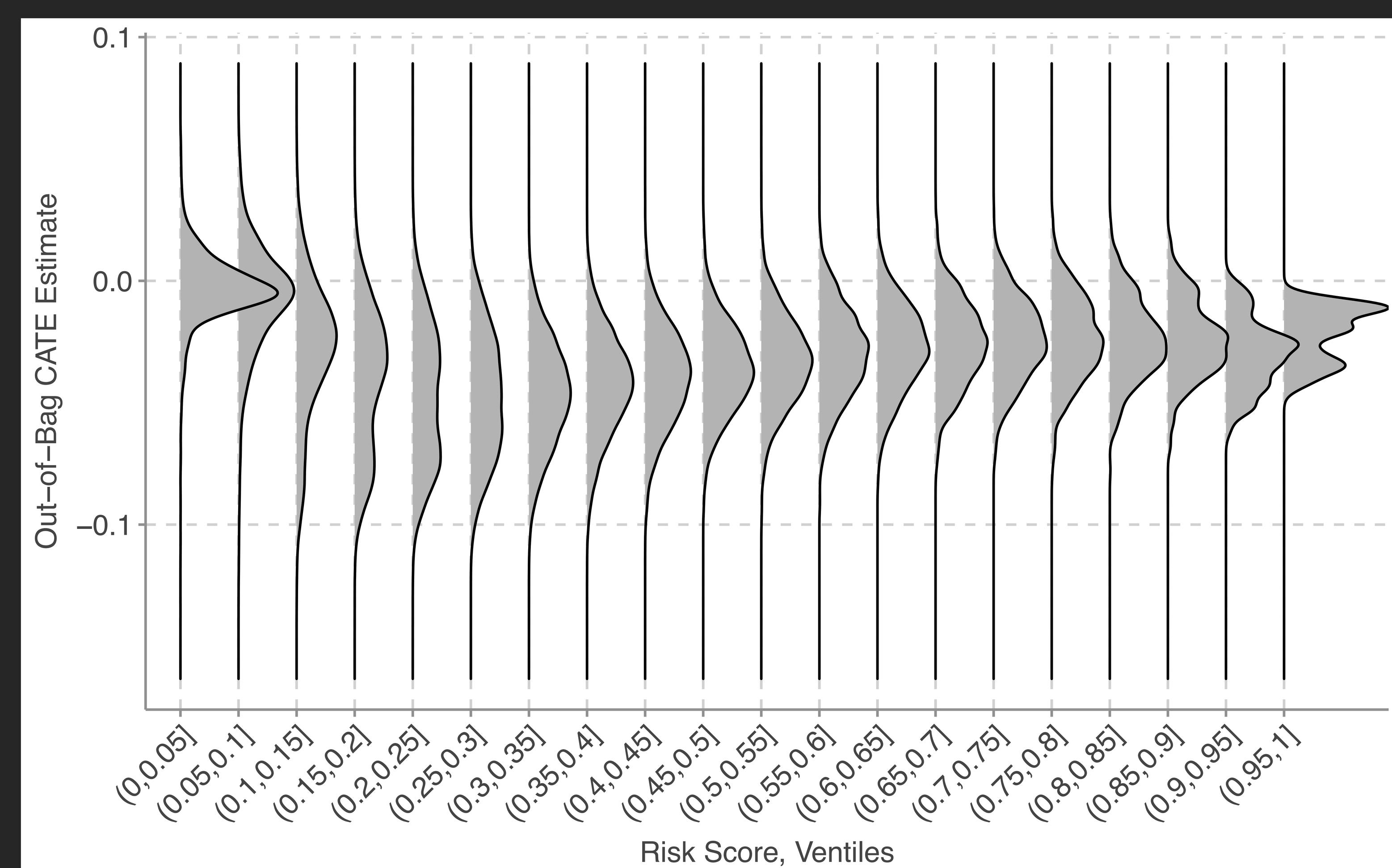
RESULTS

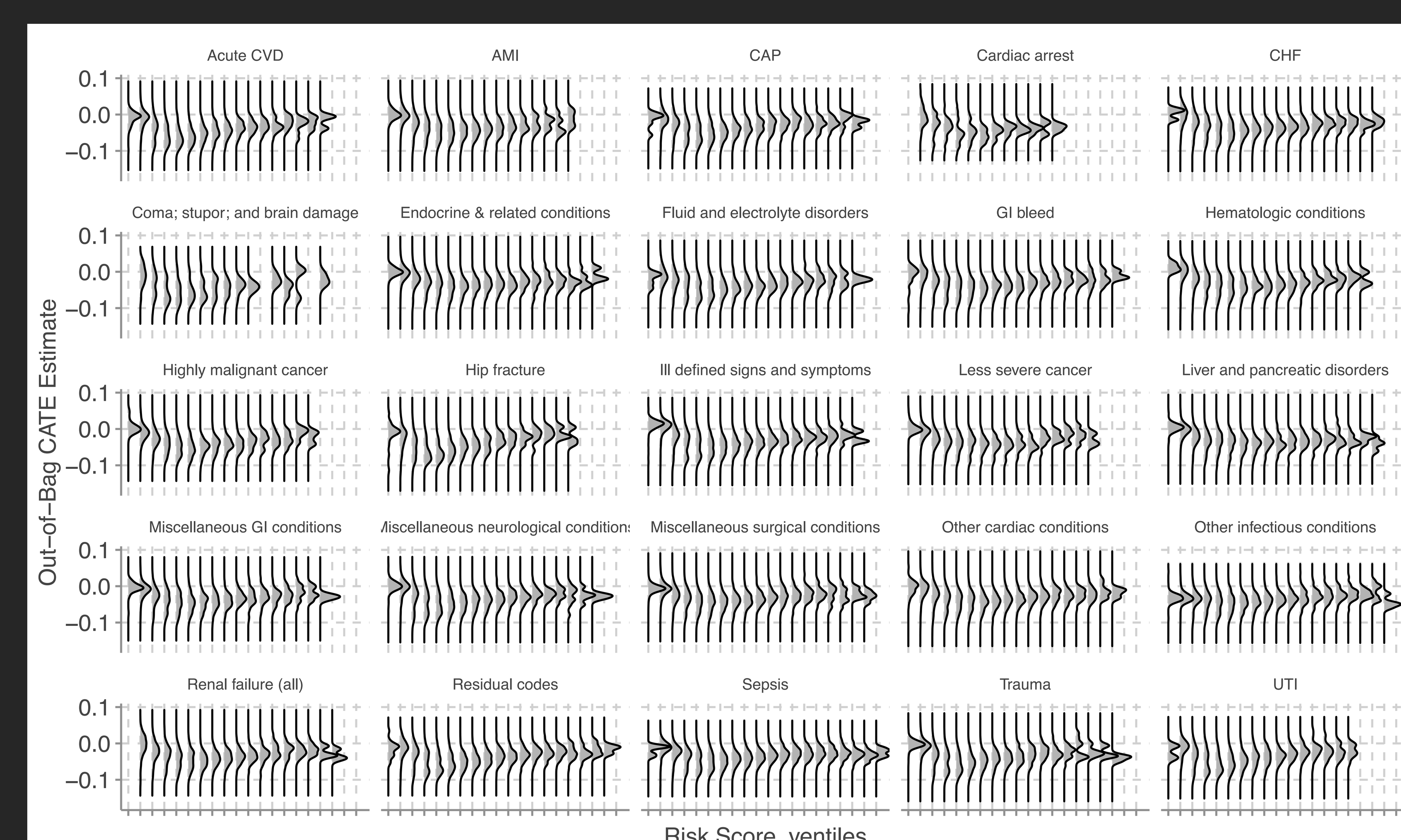
- Substantial rHTE (see figure) with moderate and lower-risk patients experiencing largest treatment effects compared to those at higher risk.
- Notional estimates: possible to prevent ~4x as many readmissions annually with CATE-based vs. risk-based targeting
- Predicted CATEs were generally well-calibrated

For more details, see our preprint: https://arxiv.org/abs/2005.14409

Risk-treatment effect mismatch

may blunt the impacts of clinical deployments of predictive algorithm-linked interventions.





Conclusions and Recommendations

- Practitioners should be aware of **risk-treatment effect mismatch** in deployments of predictive-algorithm linked interventions.
- In particular, prioritizing patients at highest risk may not yield best ROI in terms of clinical impact.
- Instead, should attempt to prioritize based on estimated treatment effects.
- But to do so, may need to rethink deployment processes & practices.
- Pilot RCTs are one starting point for obtaining these estimates
- Alternatively: bespoke trial designs which estimate rHTE directly (*under development by our team*)

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