MSR20

A data-informed quantitative bias analysis framework for causal estimates from real-world evidence using simulated observational data

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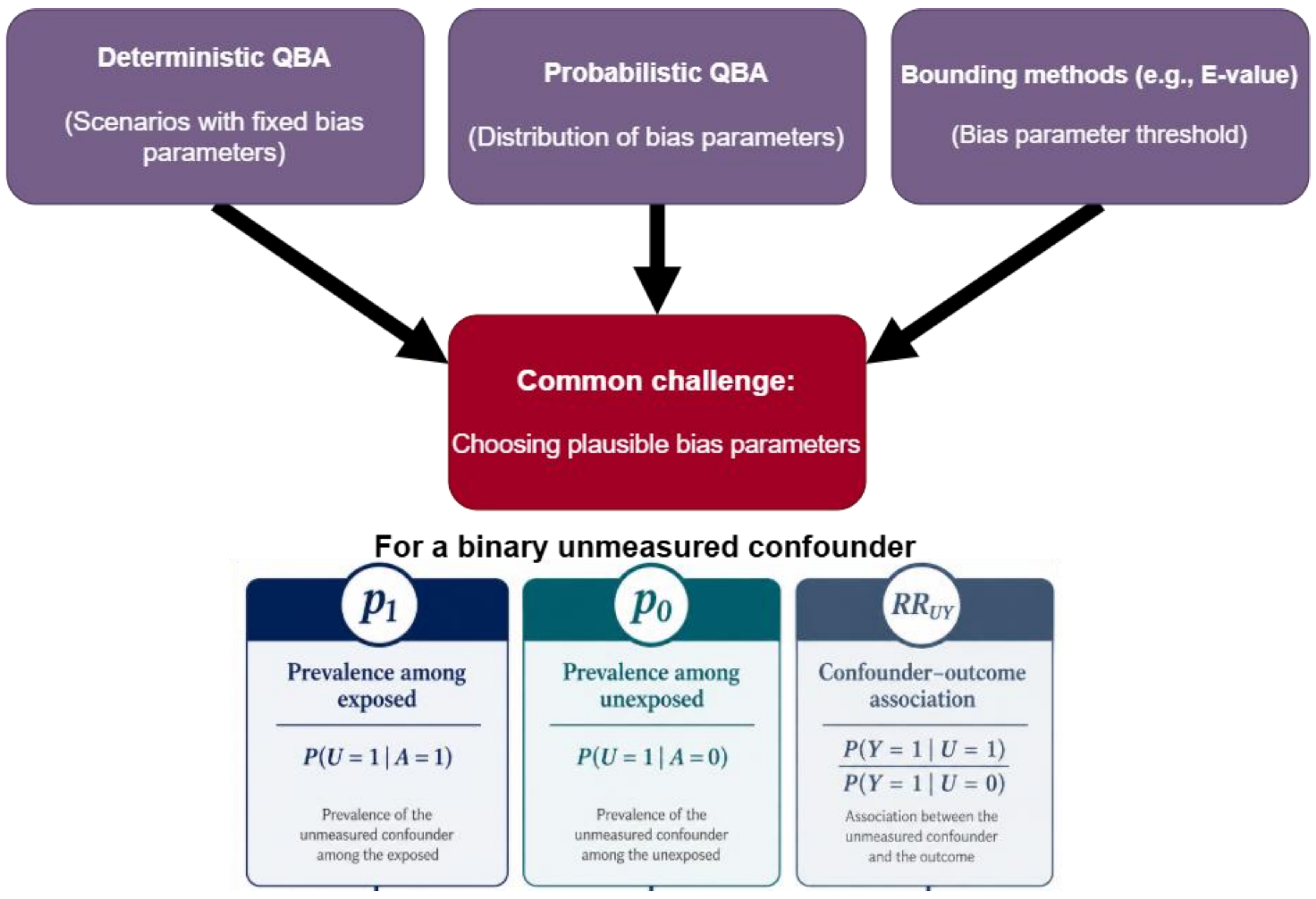
Background

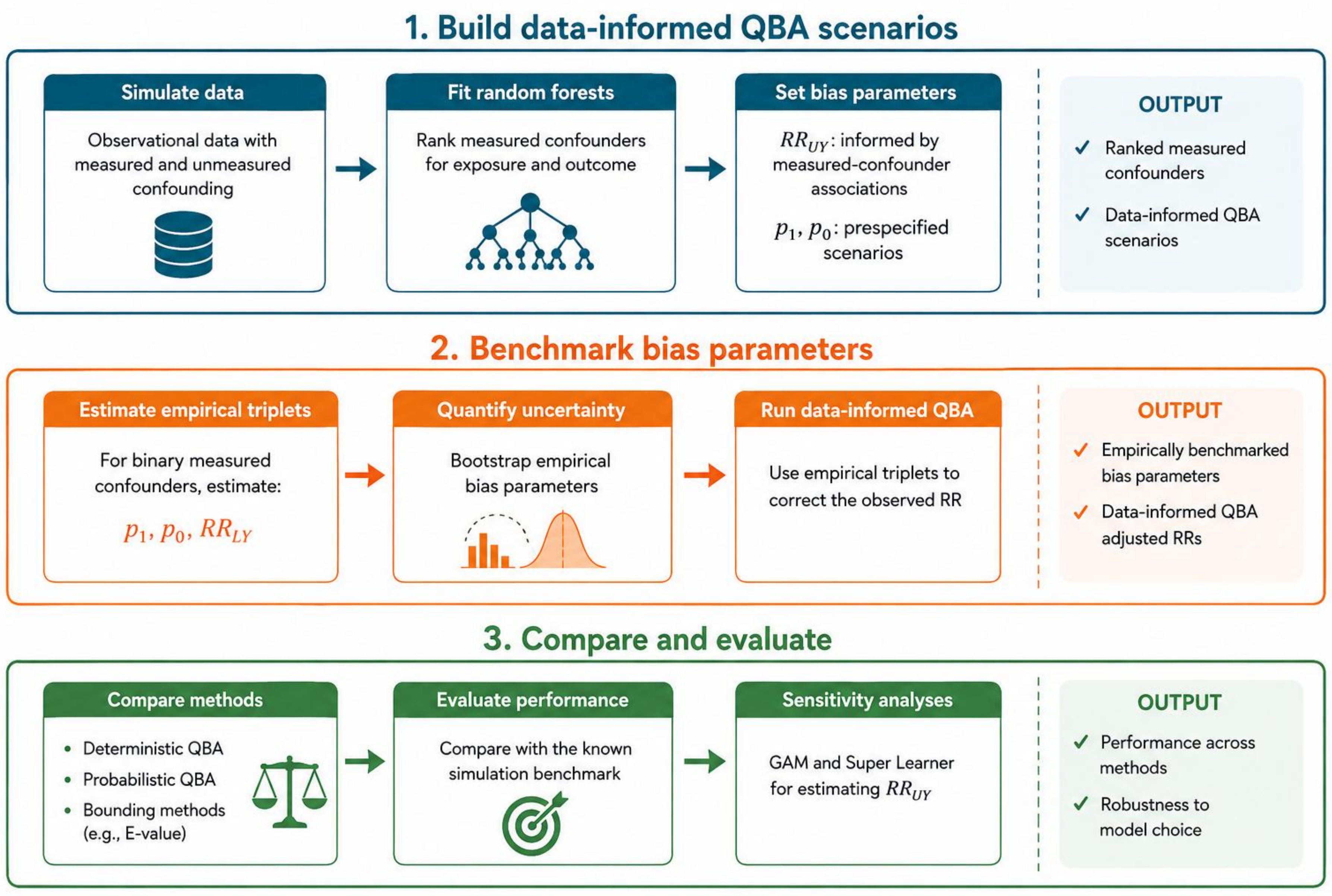
- Real-world evidence (RWE) informs clinical and policy decisions, but causal estimates from observational data can be biased due to unmeasured confounding
- Quantitative bias analysis (QBA) can assess the potential impact of unmeasured confounding, but results depend heavily on the bias parameters assumed
- A key challenge is choosing plausible parameter values



Objectives

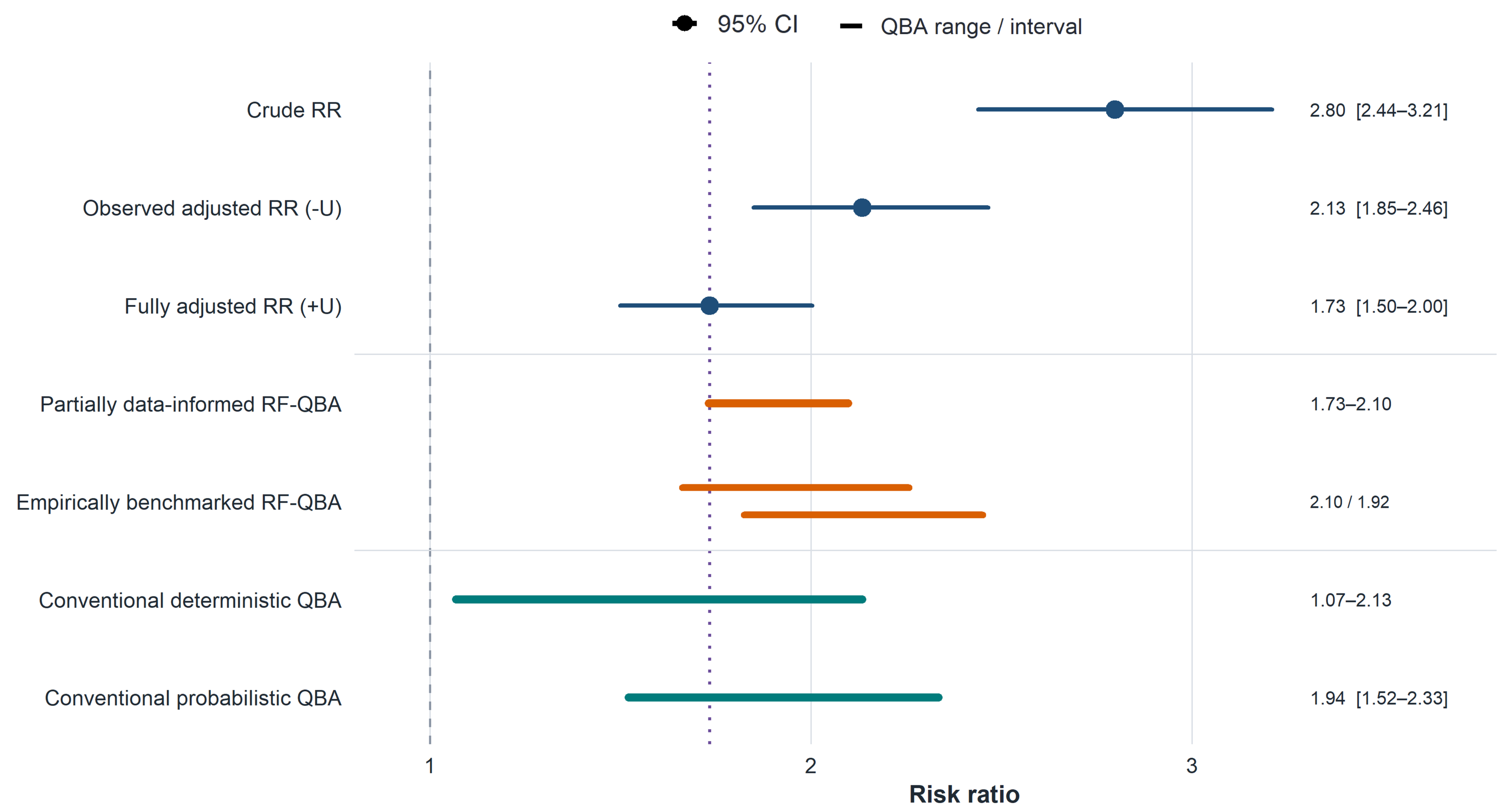
1. Develop a data informed QBA approach that benchmarks bias parameters against measured confounders
2. Compare data-informed QBA with deterministic QBA, probabilistic QBA, and the E-value
3. Evaluate performance against the known data-generating causal estimate and assess robustness to model specification

Methods



Results

Figure 1. Risk ratio estimates across causal effect and quantitative bias analyses: Data-informed QBA attenuated the observed RR toward the fully adjusted estimate



E-value: 3.69 to explain away the observed RR; 3.10 to shift the lower 95% CI limit to the null

Figure 2. Empirical confounder space: Stronger measured-confounder benchmarks produced greater bias correction

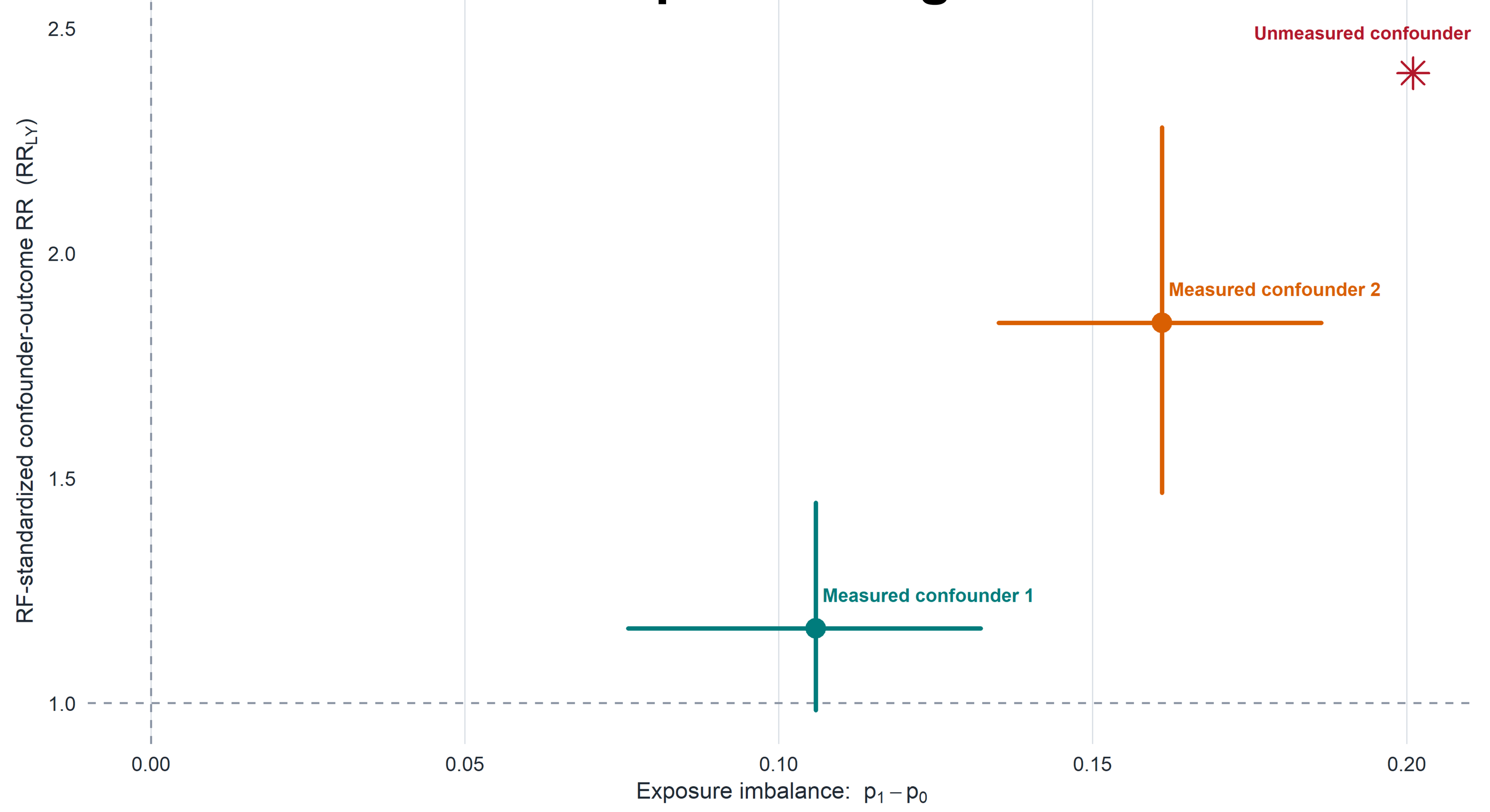
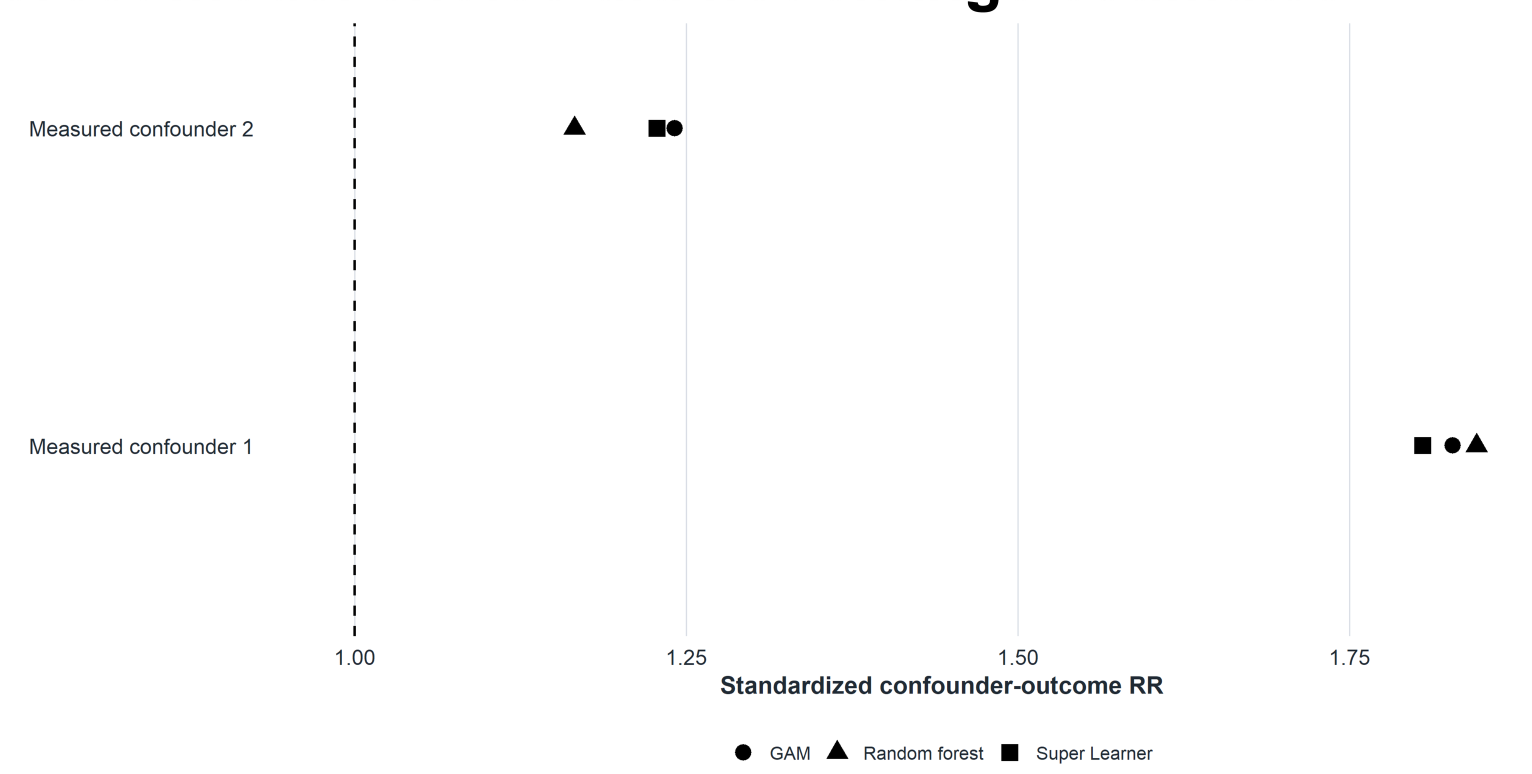


Figure 3. Model robustness check on empirically benchmarked confounder–outcome risk ratios: Random Forest model choice did not change estimates



Conclusion

- Data-informed QBA moved estimates closer to fully adjusted RR
- Empirical benchmark estimates were robust to model specification
- **Future work**: integrate with external evidence and expert elicitation, including Bayesian bias analysis approaches, and evaluate the framework in real-world causal analyses

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