



IDENTIFYING DIRECT CAUSAL EFFECTS UNDER UNMEASURED CONFOUNDING

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Introduction

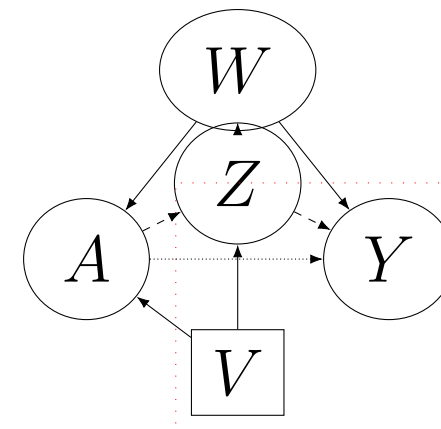
This is the background.

Statistical Problem

State the causal and statistical models, and estimand.

Identification

- (A1) Treatment–outcome randomization
- (A2) Treatment–mediator randomization
- (A3) Mediator–outcome randomization
- (A4) No unmeasured endogenous pathways
- (A5) Conditional expectation equivalence



Theorem

Consider the following causal target parameter,

$$\Psi^F(P_{U,X,0}) = \int_{w,z} \mathbb{E}[Y(1,z) - Y(0,z) \mid W = w] p_Z(z \mid A = 0, w) p_W(w) dz dw .$$

Under the assumptions above, the corresponding statistical estimand may be expressed

$$\begin{aligned} \Psi(P) &= \int_w \int_z \{ \bar{Q}_Y(w, A = 1, z) - \bar{Q}_Y(w, A = 0, z) \} p_Z(z \mid A = 0, w) dz p_W(w) dw \\ &= \mathbb{E}_P \mathbb{E}_P \{ \mathbb{E}_P(Y \mid W, A = 1, Z) - \mathbb{E}_P(Y \mid W, A = 0, Z) \mid A = 0, W \} . \end{aligned}$$

Inference

Statistical inference is possible using standard methods.

Simulation Results

Here are the results of our simulation study.

Conclusions

Here are the important takeaways.

References

List of references.

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Thank you for paying my bills.

* indicates shared first-authorship