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.
The causal target parameter is

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

Identification

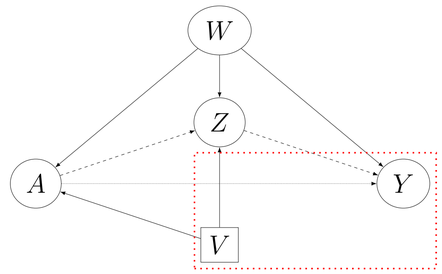
(A1) Treatment–outcome randomization

(A2) Treatment–mediator randomization

(A3) Mediator–outcome randomization

(A4) No unmeasured endogenous pathways:
$f_Y(Z, A, W, V, U_Y) \equiv f_Y(Z, A, W, U_Y)$.

(A5) Conditional expectation equivalence:
$\mathbb{E}(Y \mid Z, A = 1, W, V) \equiv \mathbb{E}(Y \mid Z, A = 1, W)$



Theorem

Under these assumptions, the corresponding statistical estimand is

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

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*

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