23. Measurement error

Ian Lundberg
Cornell Info 6751: Causal Inference in Observational Settings
Fall 2022

10 Nov 2022

Learning goals for today

At the end of class, you will be able to:

1. Present measurement error in a DAG
2. Formalize when measurement error undermines identification
3. Apply these ideas in a hypothetical research design

Broad issue: Measurement error

This lecture closely follows

Hernán, M. A., & Cole, S. R. (2009).
Invited commentary: Causal diagrams and measurement bias.
American Journal of Epidemiology, 170(8), 959-962.

Plan for class: Your own example

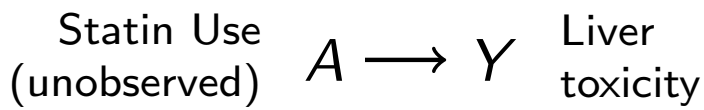
We will discuss ideas using an example from Hernán & Cole 2009.
For each idea, each group will apply it to their own example.

Task: In pairs or triples, construct your own running example

Each unit (e.g., person) in your study should report

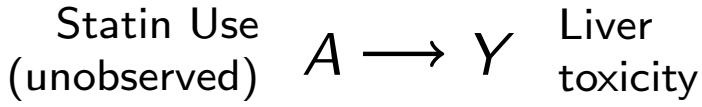
- A treatment A, reported with error
- An outcome Y, reported with error

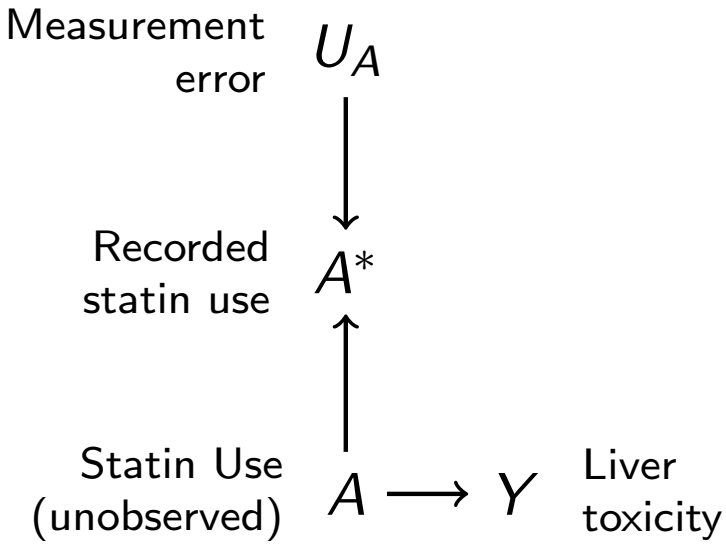
You choose how to define A and Y


Statin Use
(unobserved)
A ⟶ Y
Liver
toxicity

Augment this DAG

Recorded statin use A^* has haphazard errors





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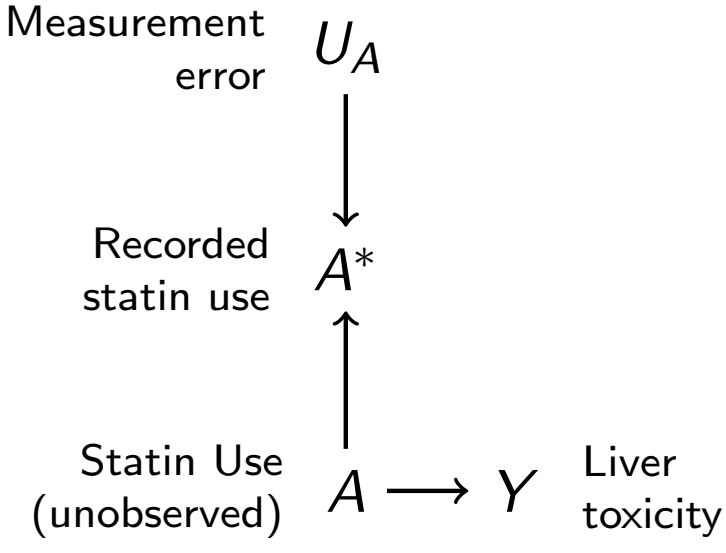

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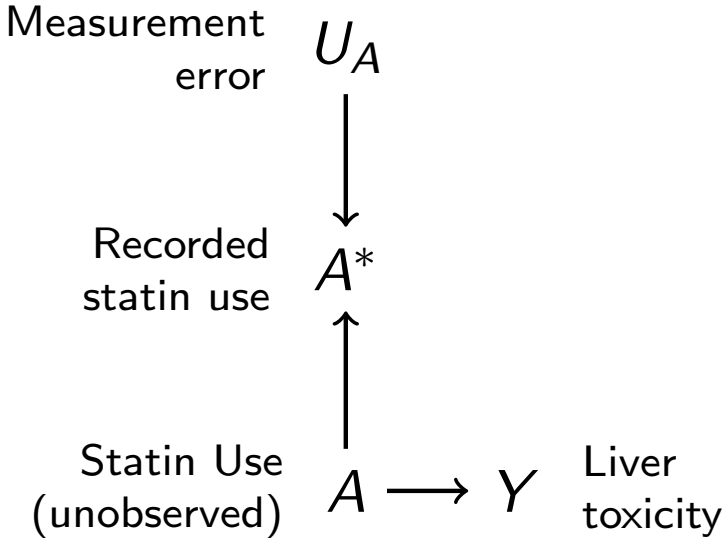

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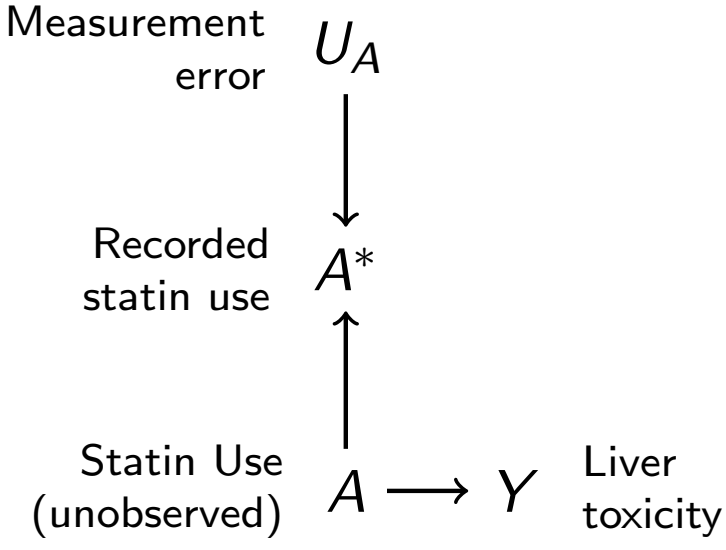

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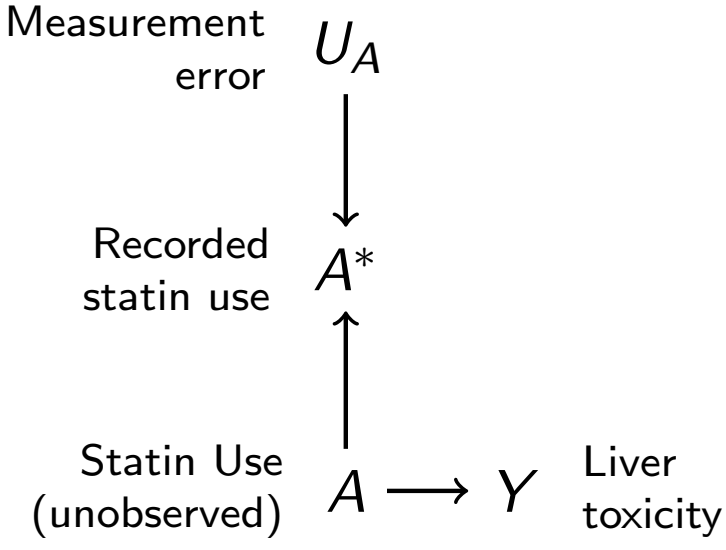

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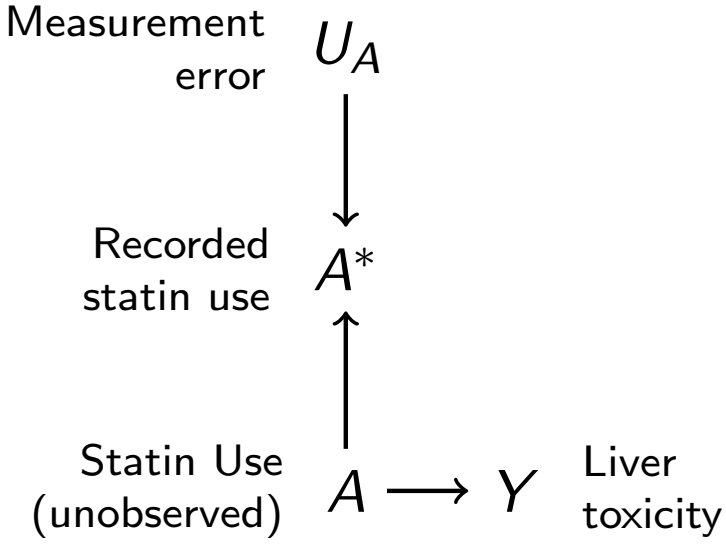

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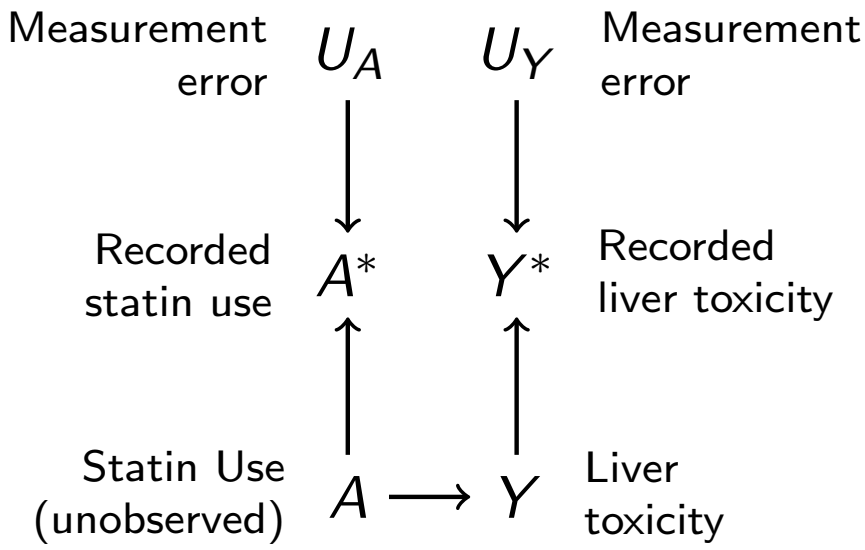

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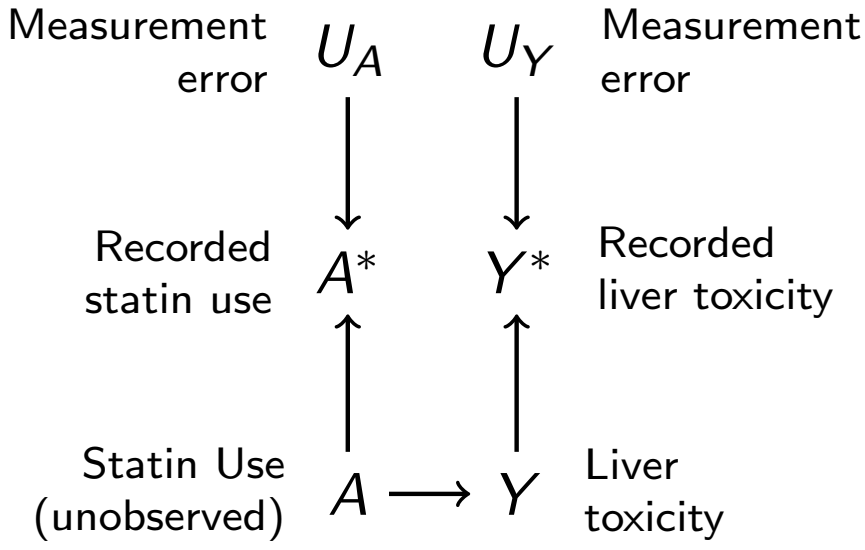

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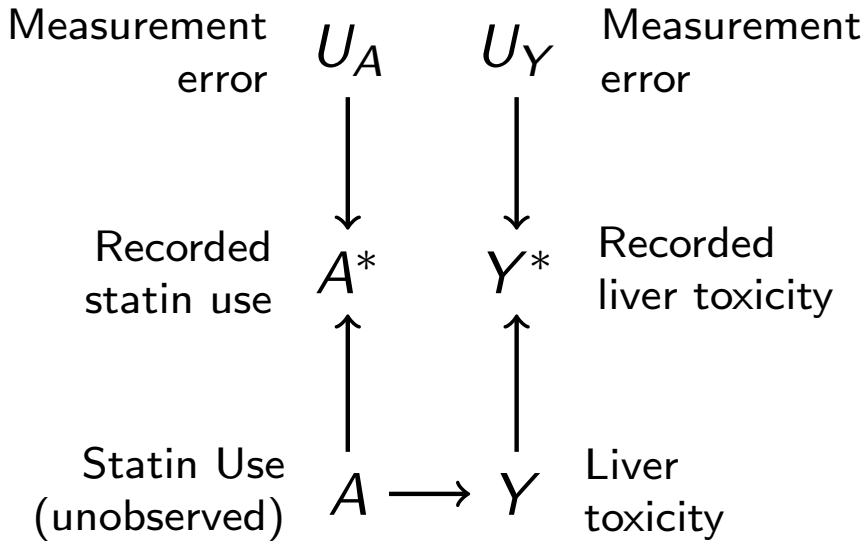

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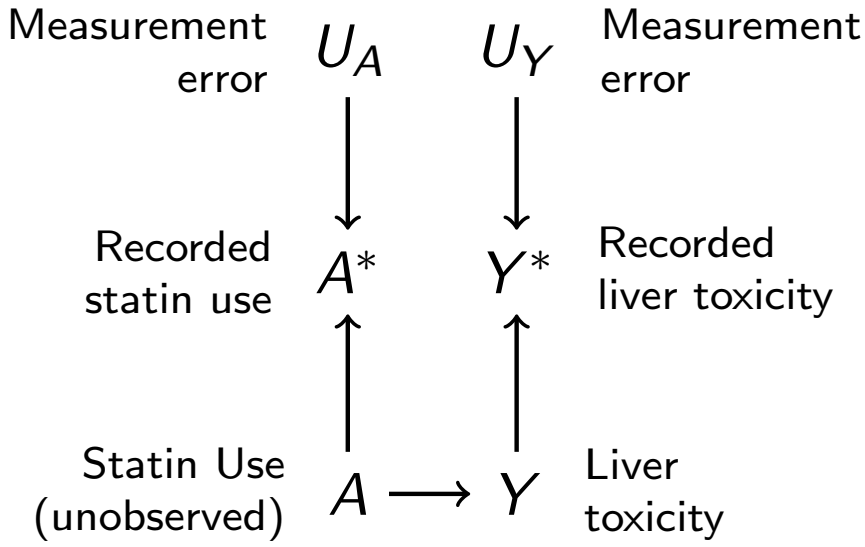

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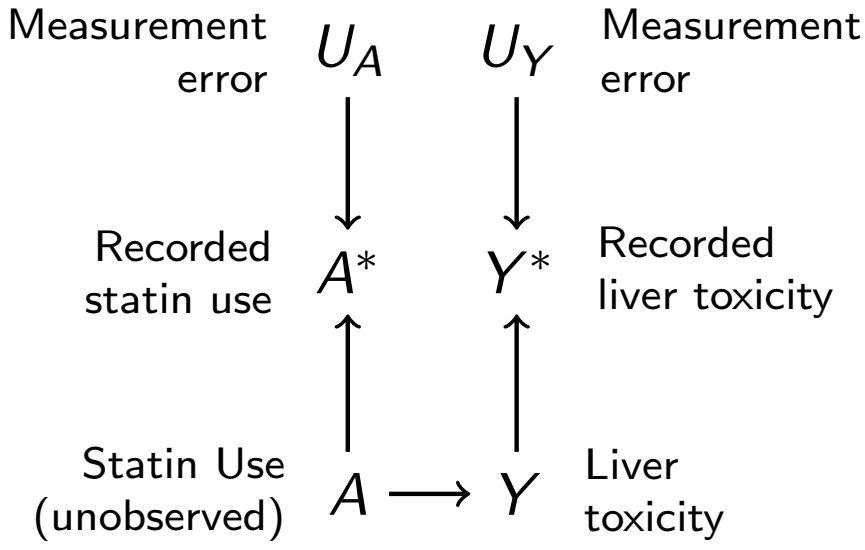

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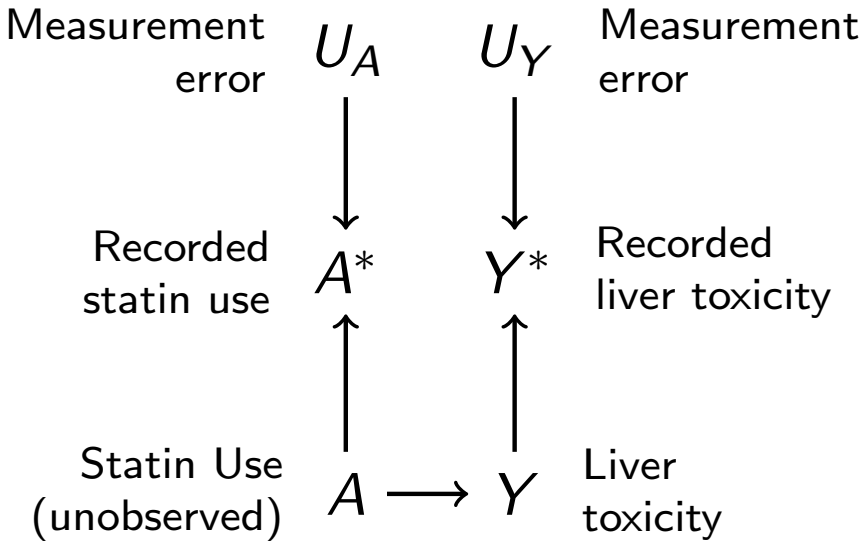

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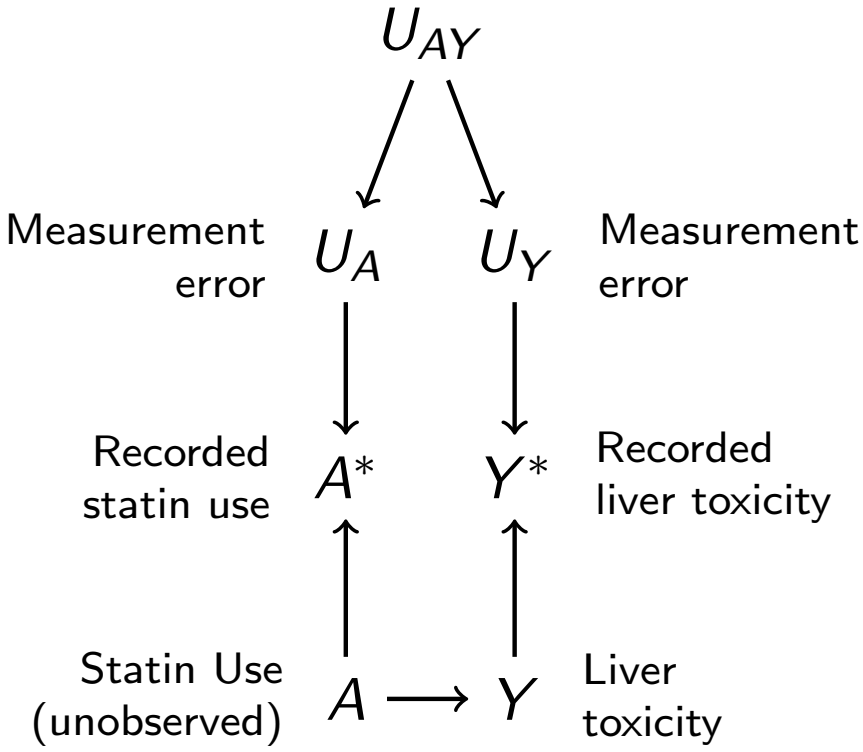

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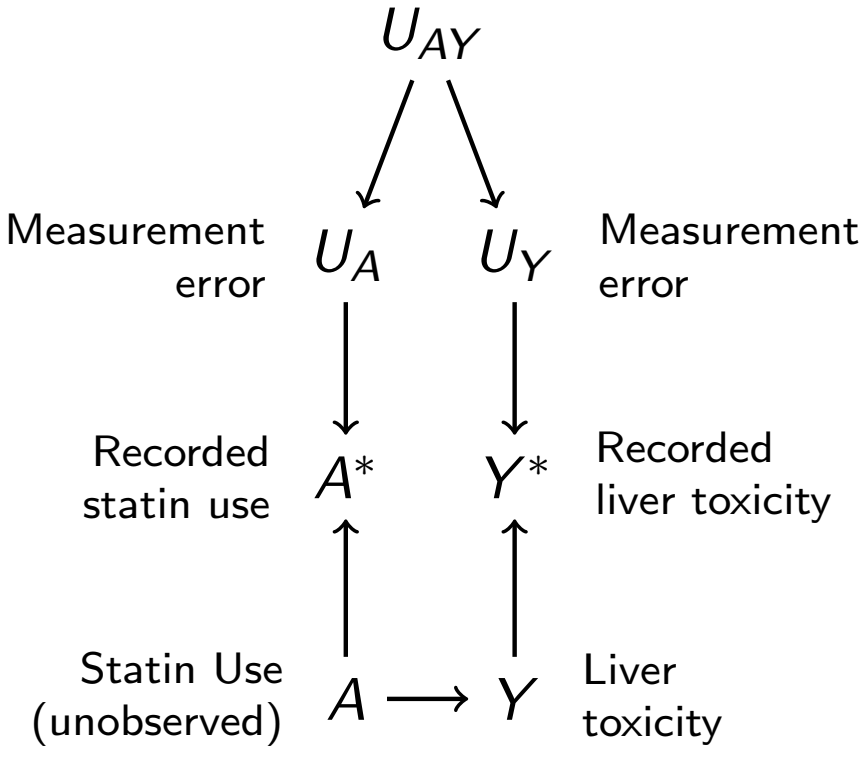

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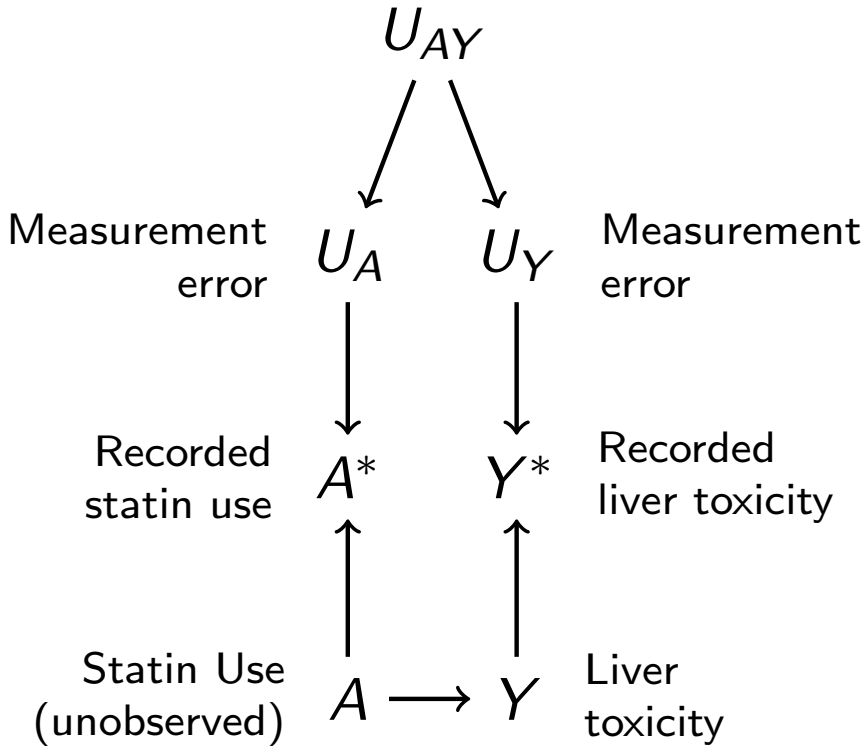

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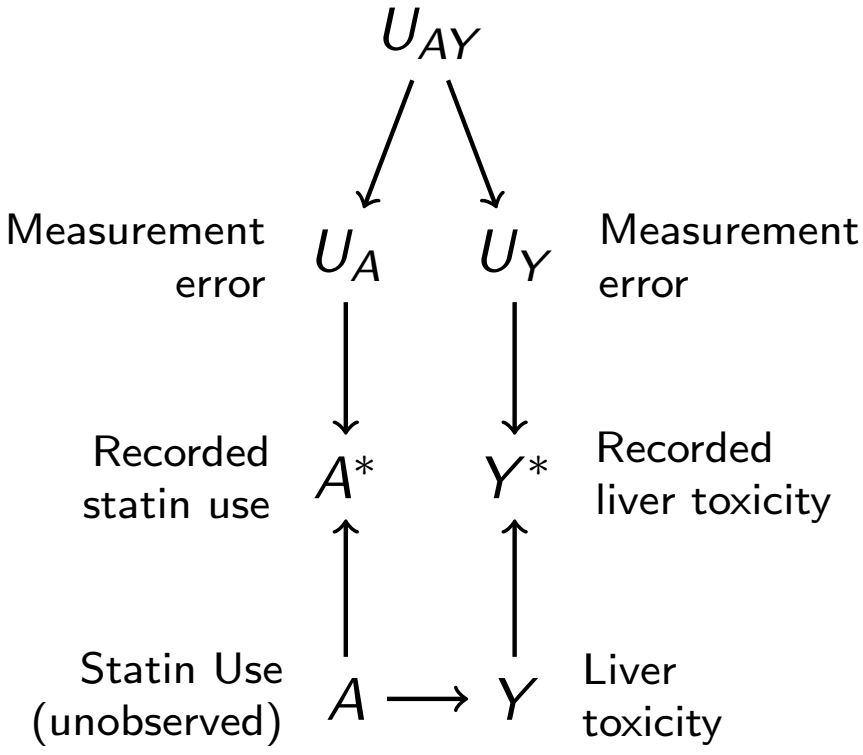

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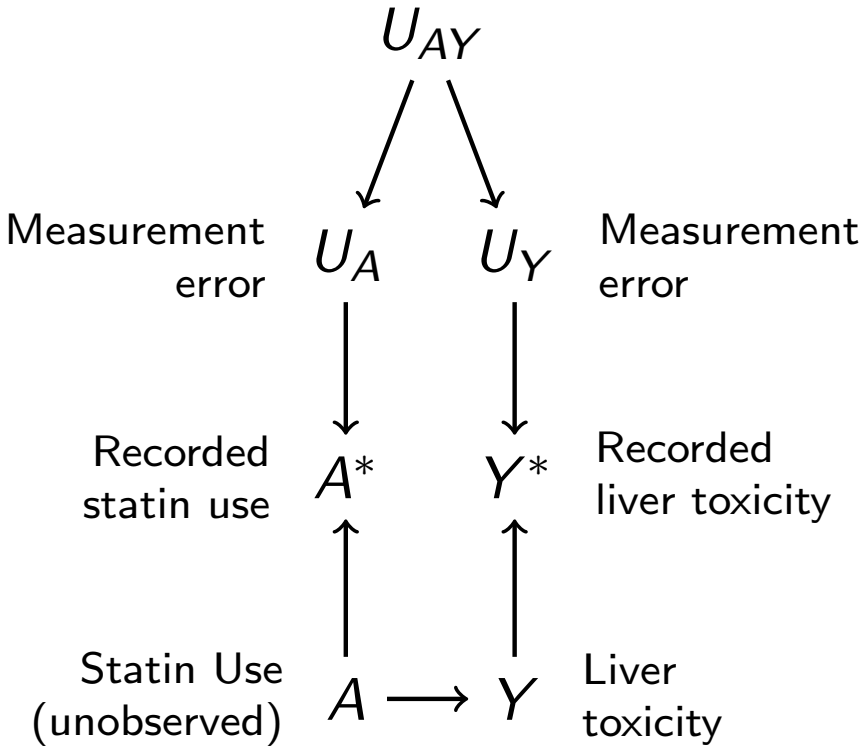

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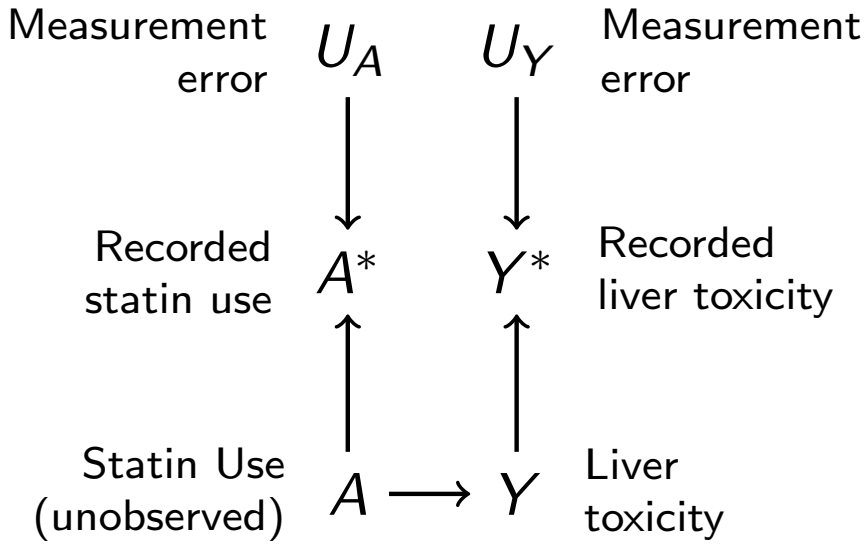

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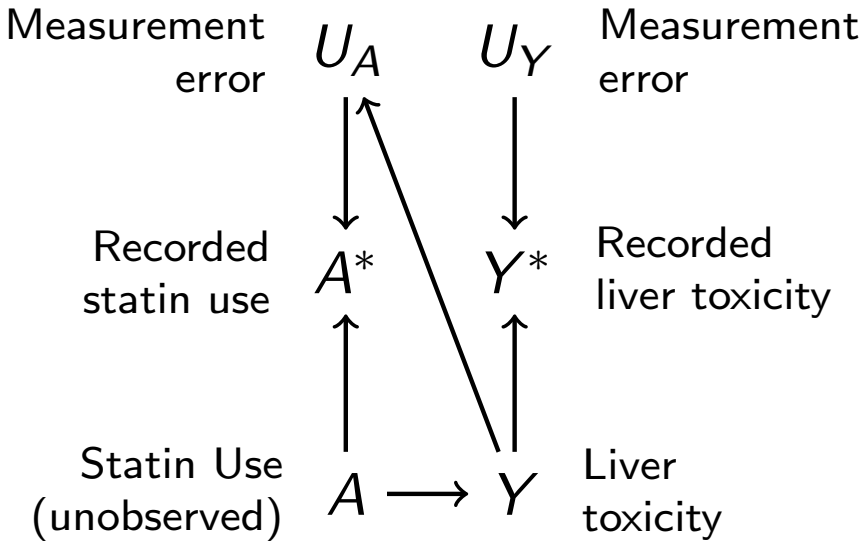

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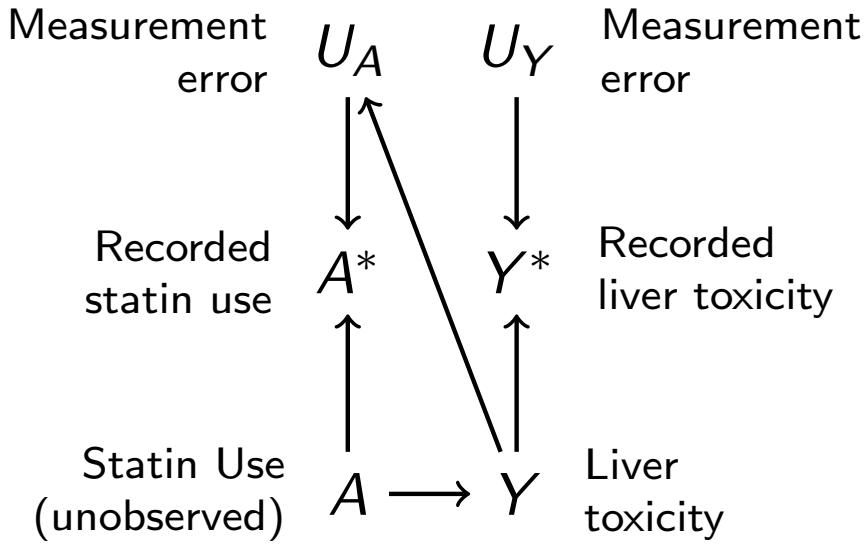

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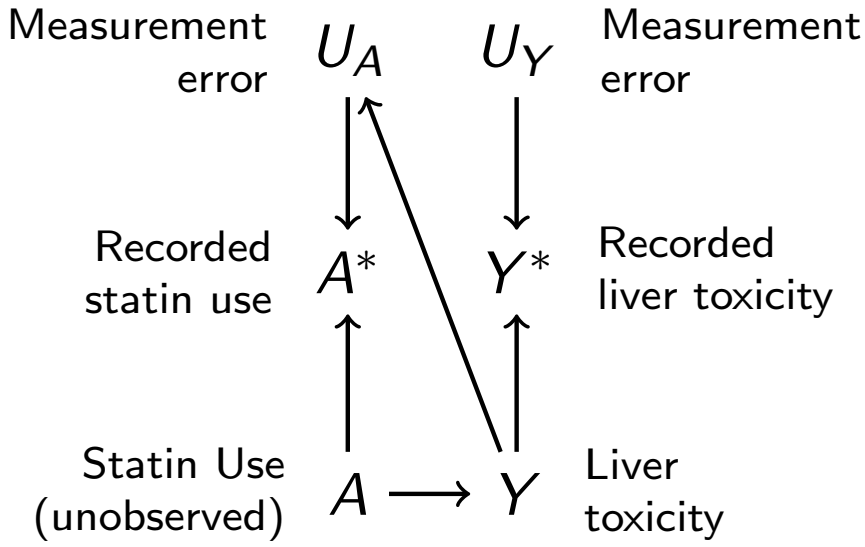

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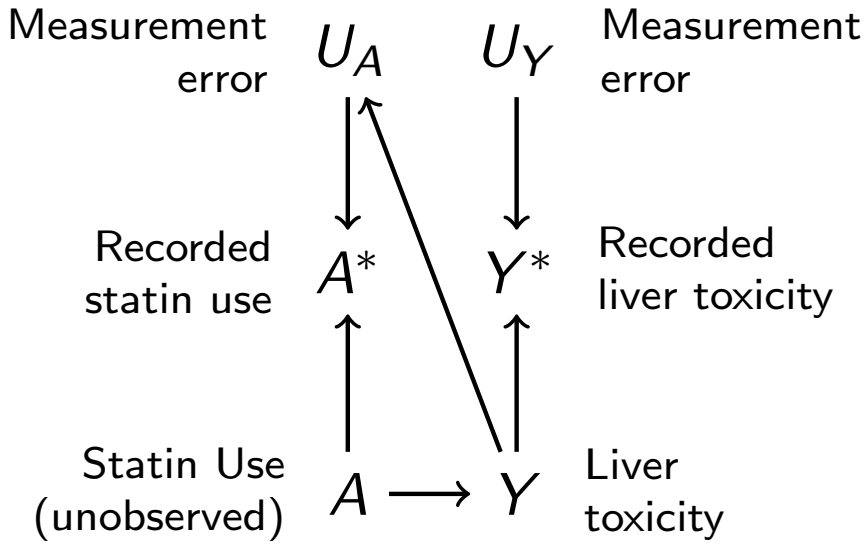

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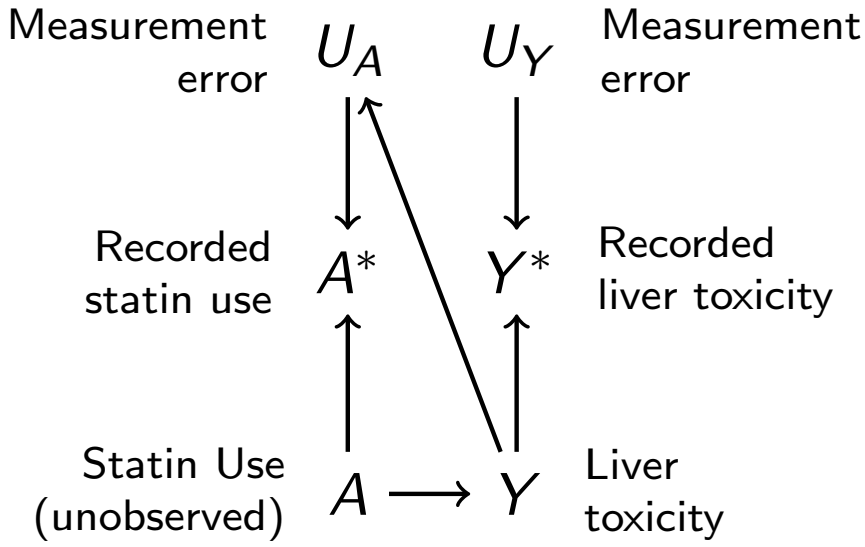

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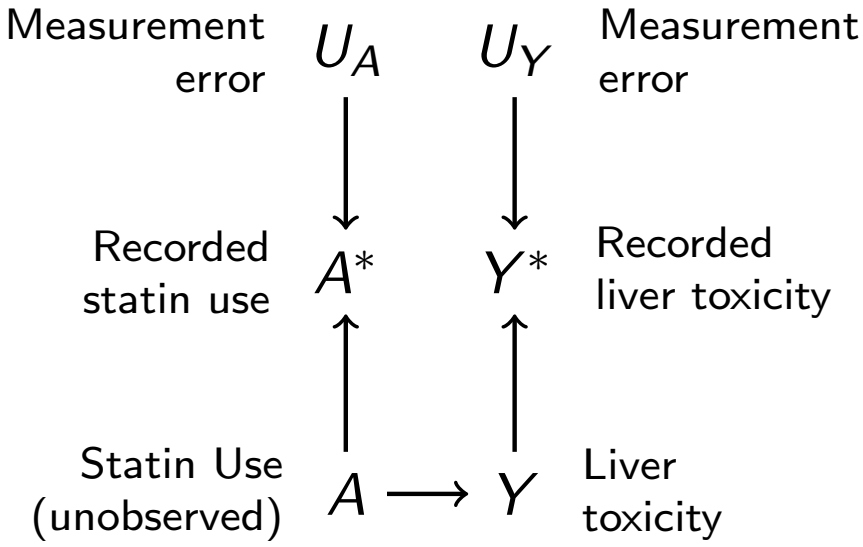

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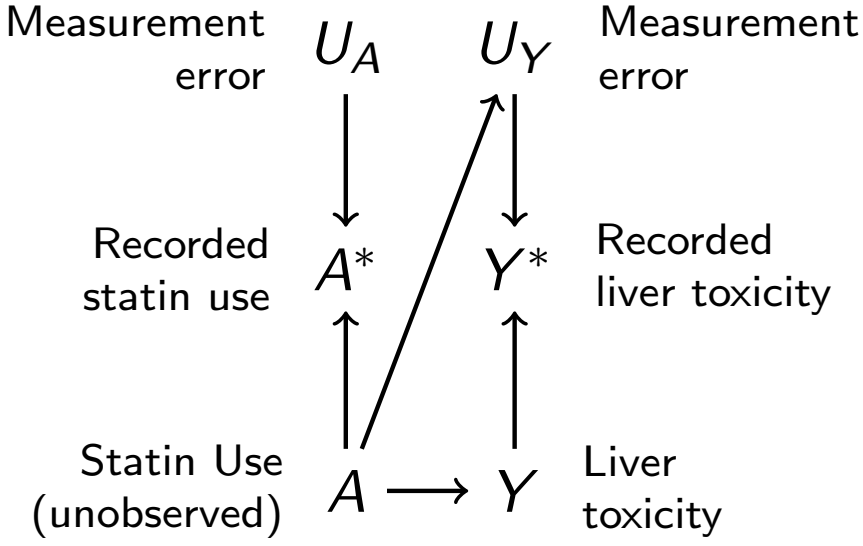
Physicians watch liver toxicity more closely among statin users



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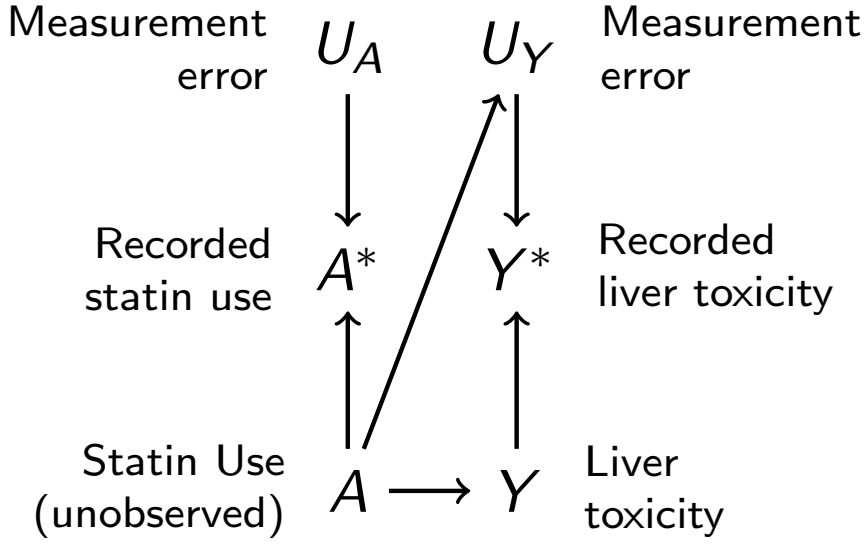

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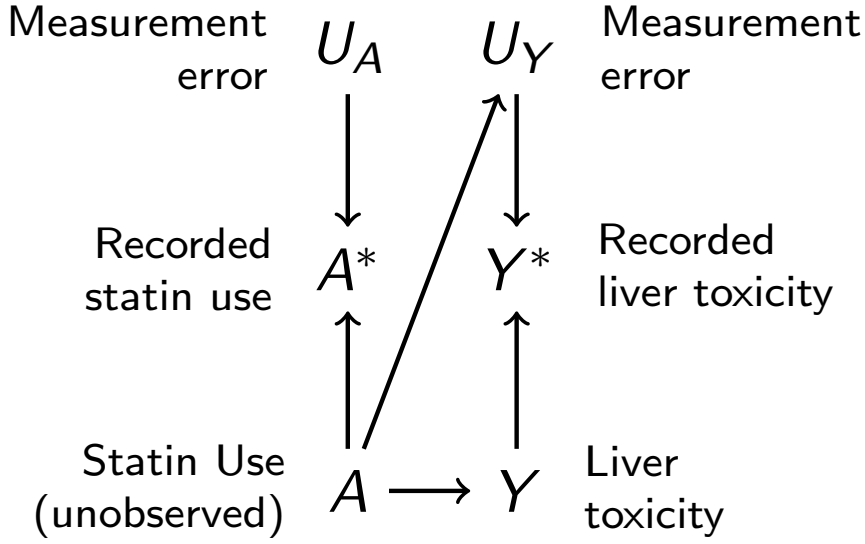

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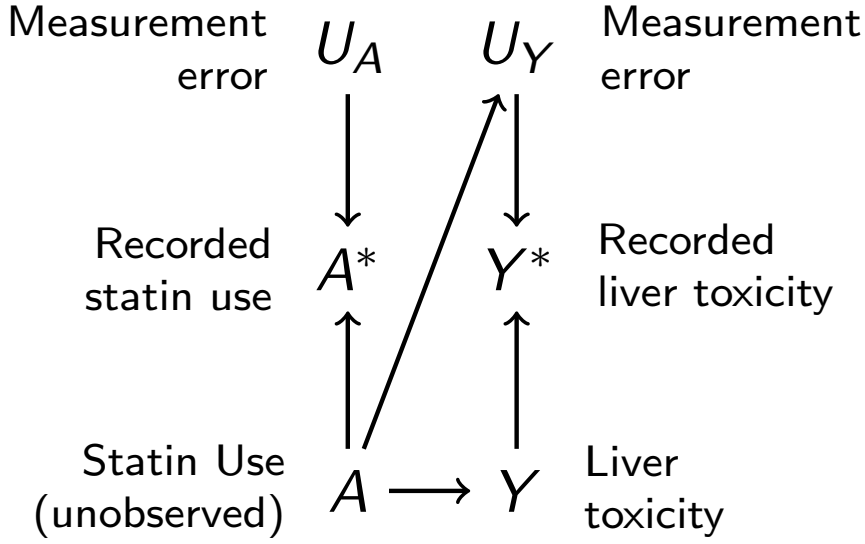

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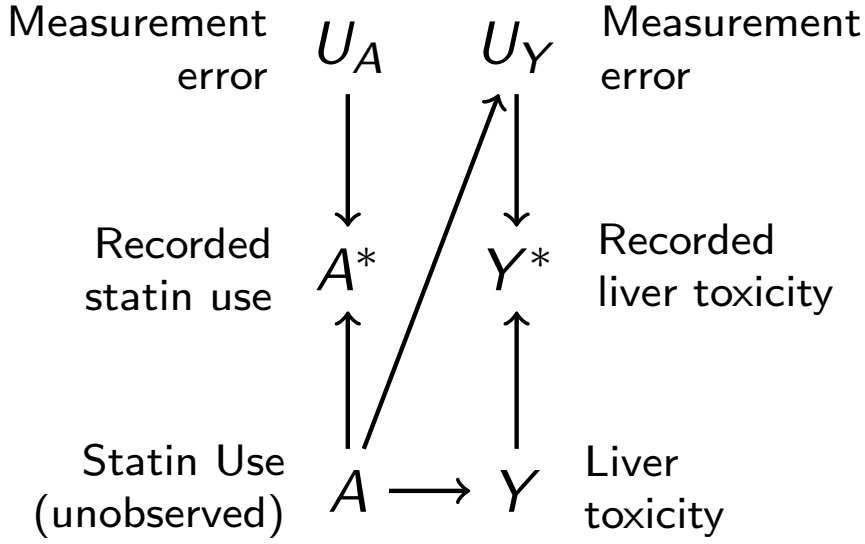

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Hernan & Cole Fig 2

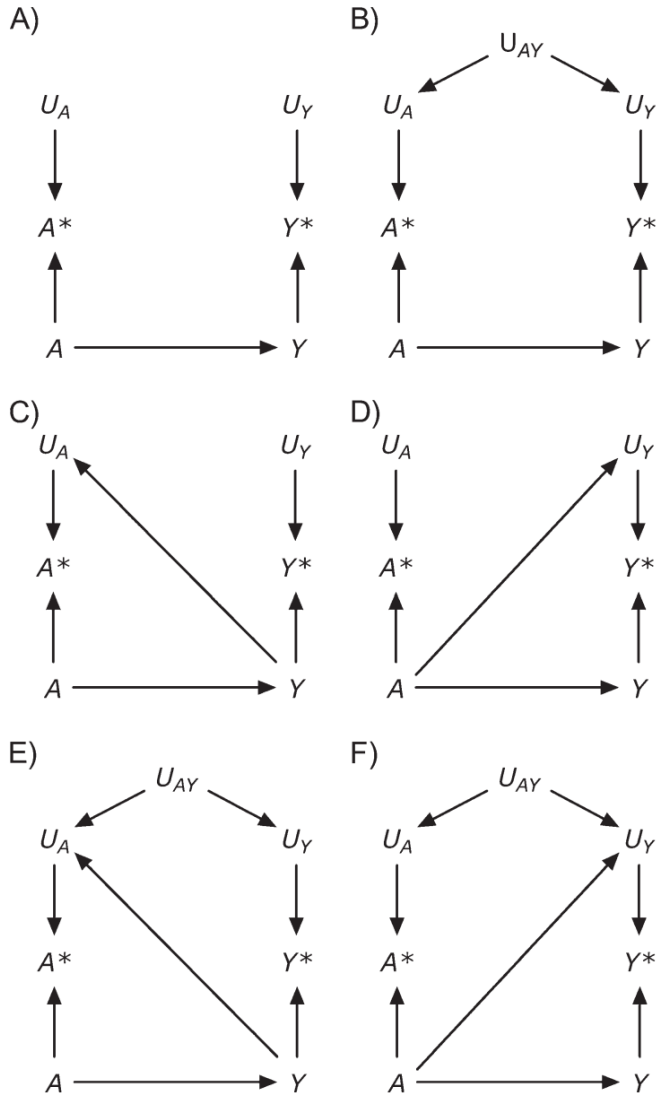

Figure 2. A structural classification of measurement error.

Hernán & Cole illustration:

Does body mass index (BMI) affect health outcomes?

Weight W and height H affect the risk of a condition A which affects a health outcome Y

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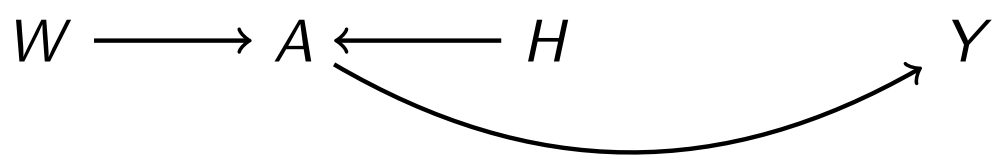

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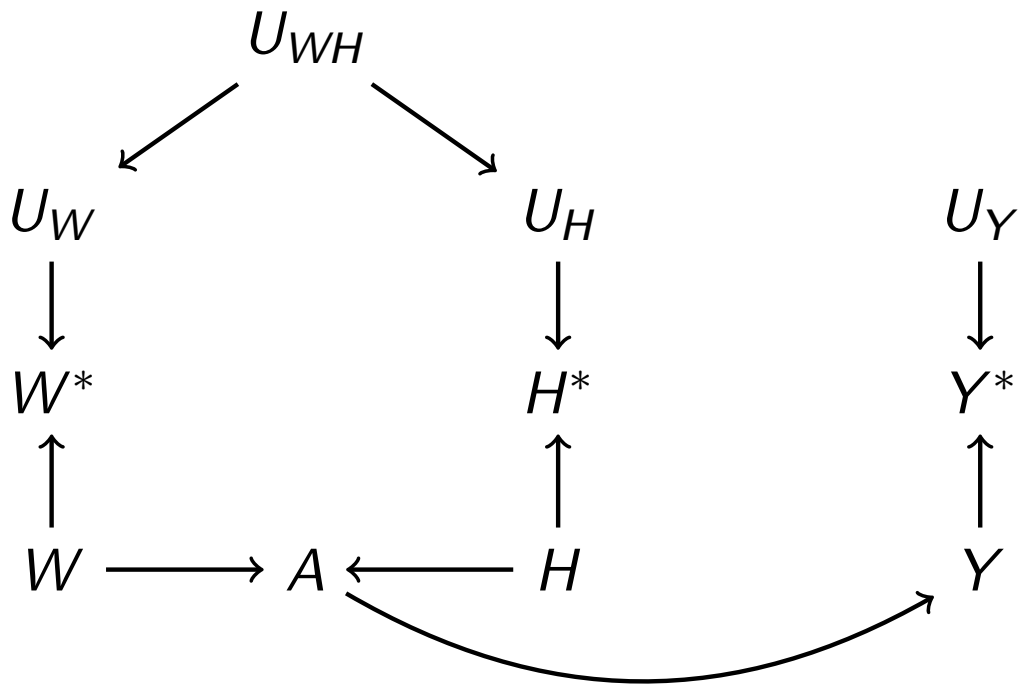

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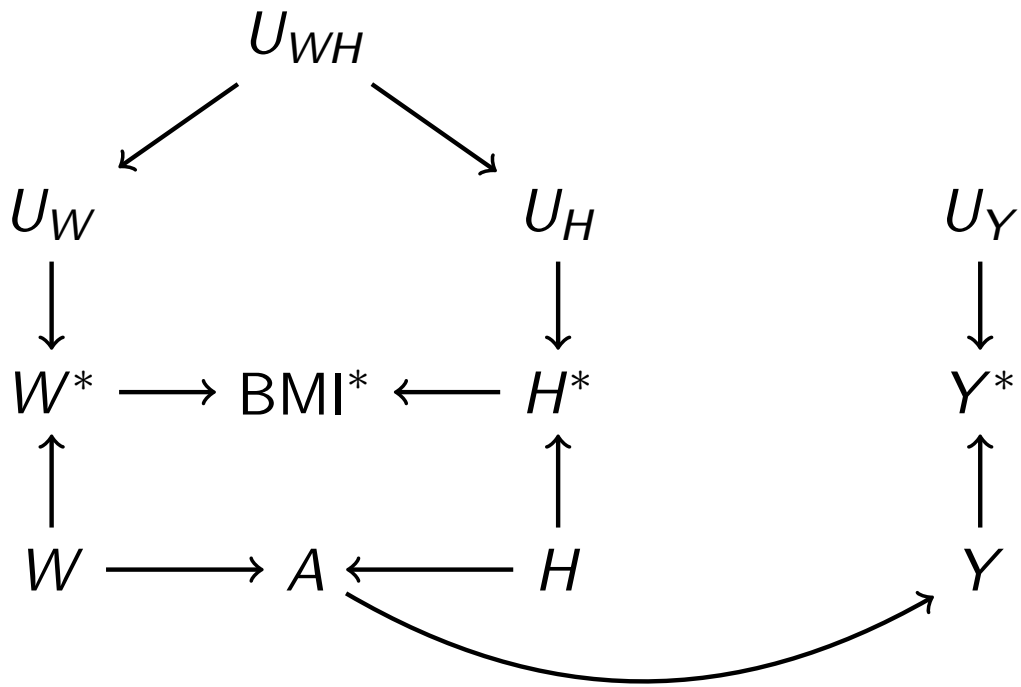

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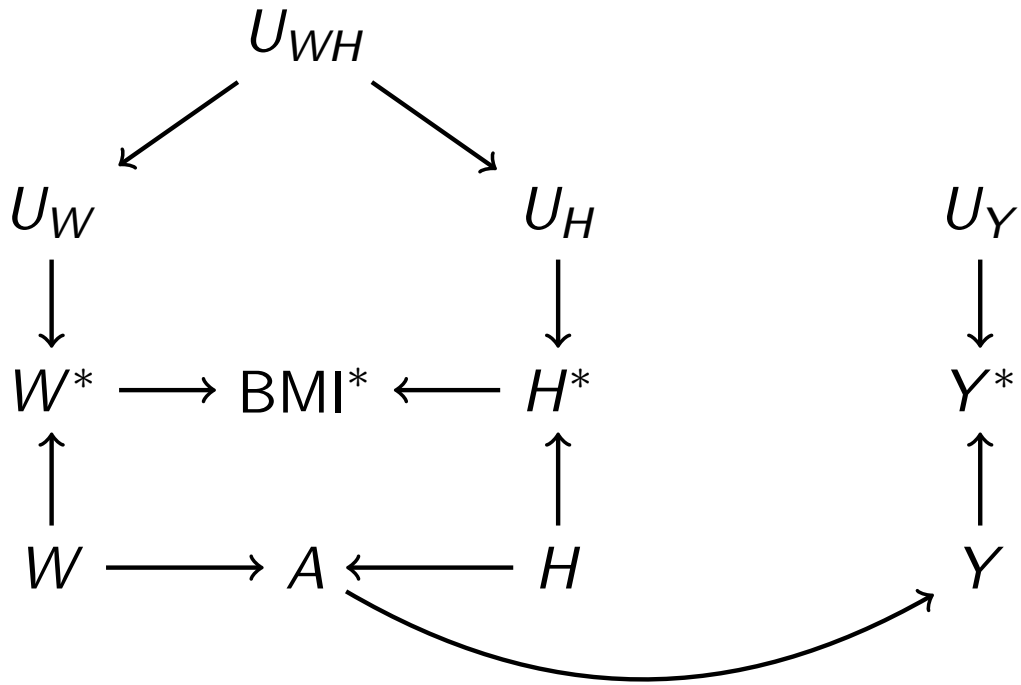

No. There is no causal path.

Examples to discuss

tinyurl.com/MeasurementExercise

Learning goals for today

At the end of class, you will be able to:

1. Present measurement error in a DAG
2. Formalize when measurement error undermines identification
3. Apply these ideas in a hypothetical research design

Let me know what you are thinking

tinyurl.com/CausalQuestions

Office hours TTh 11am-12pm and at
calendly.com/ianlundberg/office-hours
Come say hi!