Lifecourse modelling and time-varying covariates

Solomon Beer
University of Galway, Ireland
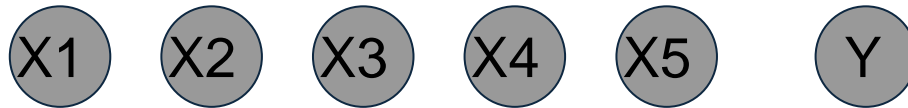*25/09/24*

Prospective cohorts

- **Repeated** exposure and covariate measures over the lifecourse

- Measurements within an individual **highly correlated** over time

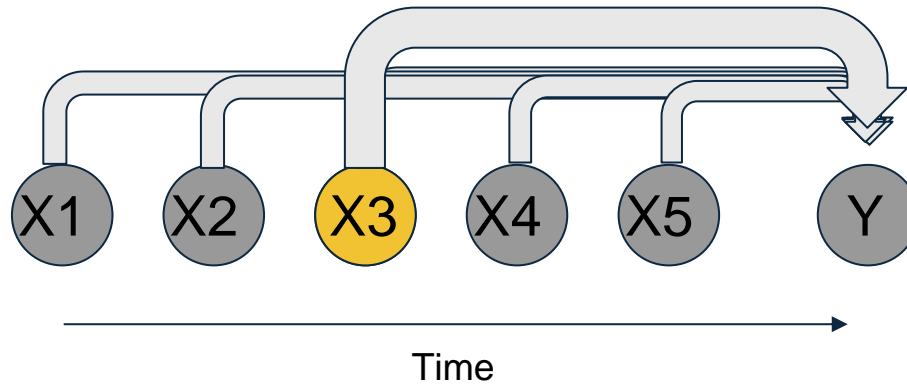- X: Exposures
- Y: Later outcome

X1 X2 X3 X4 X5 Y

Time

Lifecourse hypotheses

- Sensitive periods
- Accumulation
- Compound hypotheses

Time

Structured LifeCourse Modelling Approach

- Hypotheses defined **a priori**
- Encoded into suitable models
- Least Angle Regression Approach to the Lasso (**LARS**)
- **Post selection inference**

A structured approach to modelling the effects of binary exposure variables over the life course

Gita Mishra,[1][*][†] Dorothea Nitsch,[2][†] Stephanie Black,[1] Bianca De Stavola,[2] Diana Kuh[1] and Rebecca Hardy[1]

## Model Selection of the Effect of Binary Exposures over the Life Course

Andrew D. A. C. Smith,[a,b] Jon Heron,[a] Gita Mishra,[c] Mark S. Gilthorpe,[d] Yoav Ben-Shlomo,[a] and Kate Tilling[a,b]

A structured approach to hypotheses involving continuous exposures over the life course

Andrew DAC Smith,[1,2][*] Rebecca Hardy,[3] Jon Heron,[1] Carol J Joinson,[1] Debbie A Lawlor,[1,2] Corrie Macdonald-Wallis[1,2] and Kate Tilling[1,2]

WCE
WORLD CONGRESS OF EPIDEMIOLOGY 2024

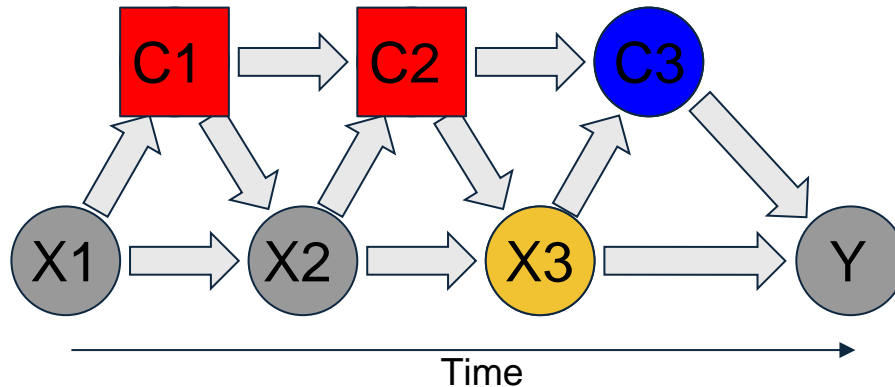# But what about time-varying covariates?

- Can switch from a **potential confounder** to a **potential mediator** depending on hypothesis
- Ignoring potential confounders leads to **bias**
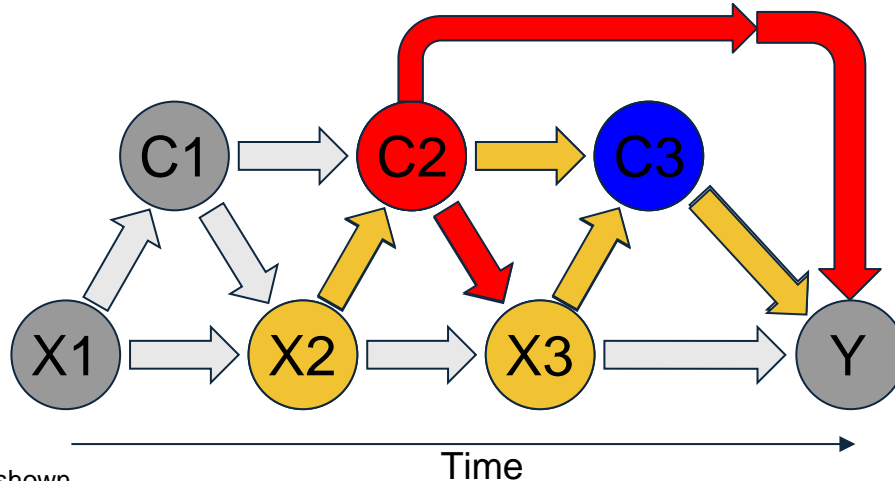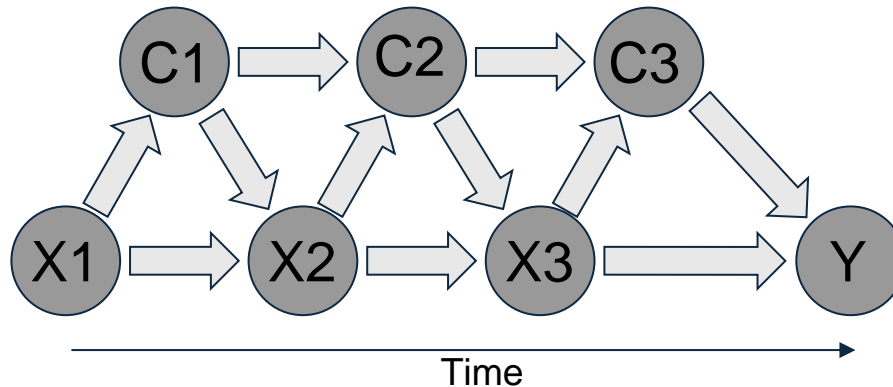

Some causal paths not shown

Time

Direct and mediated effects SLCMA

- Adjusts for time-varying covariates on a per hypothesis basis
- Sensitive period → start of sensitive pathway

Our data - DCHS

- X: **Maternal psychopathology**
  - (SRQ score)
- C: **Socioeconomic status**
  - (assets value)
- Y: **Offspring depression**
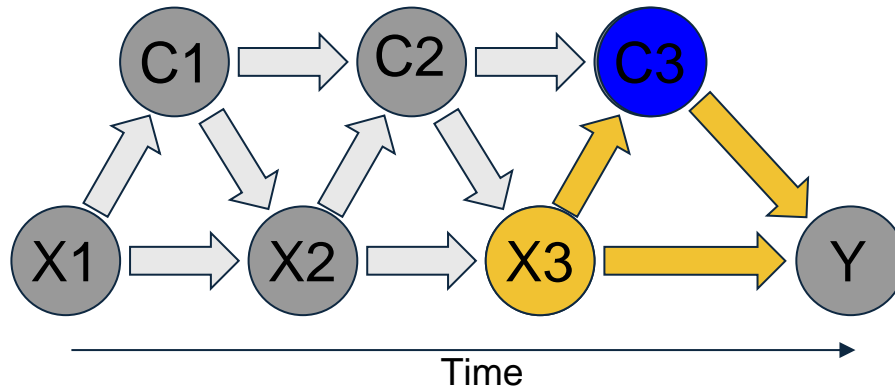 - (Offspring depression at age 8)

Socioeconomic status a plausible mediator for maternal psychopathology on later offspring depression


Time

Application

- **Sensitive period** for exposure to maternal psychopathology **at age 8** on offspring depression at age 8 even after adjusting for time-varying socioeconomic status

n = 442

Summary

- **Ignoring** time-varying covariates can **cause incorrect selections** when:
  - It is likely that **covariates may be mediators**
  - There may be **no / small direct effects**
  - There is a **compound hypothesis**

Time
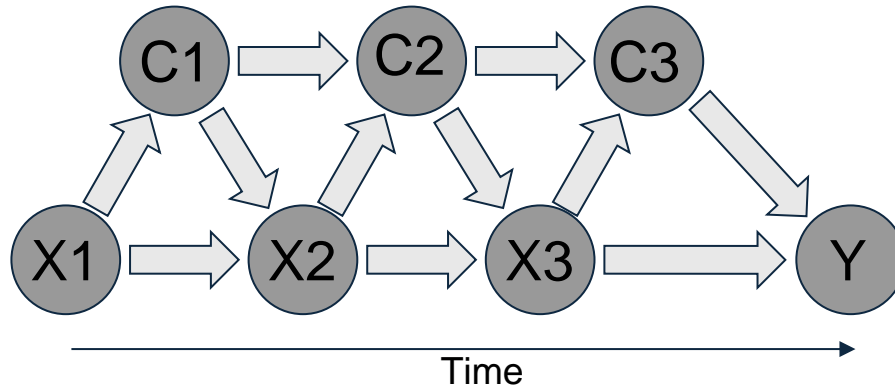
Thank you

- Andrew Simpkin, University of Galway
- Sherief Eldeeb, Massachusetts General Hospital
- Andrew Smith, University of the West of England
- Erin Dunn, Purdue University
- Marilyn Lake and all at DCHS
- CRT Genomics Data Science, funded by SFI grant number 18/CRT/6214