

The Dangers of Including Endogenous Time-Varying Covariates in Clustered Longitudinal Data Analysis

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The Project: Inspiration

“To our surprise, even without time-varying confounding (e.g., when the randomization probability is constant in an MRT), the inclusion of endogenous covariates in random effects models can cause bias in assessment of the treatment effects.” (Qian, Klasnja, and Murphy 2020)

“when using generalized estimating equations (GEE) with endogenous covariates, one should use working independence correlation structure to avoid biased estimates”(Pepe and Anderson 1994; Qian, Klasnja, and Murphy 2020)

“the issue ... is important for all longitudinal data analysis methods” (Diggle 2002)

So we should all be using GEE with working independence?

The Project

Aims:

1. Restate the issue in a psychological context

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2. Provide practical recommendations

Endogenous Time-varying Covariates: What Are They?

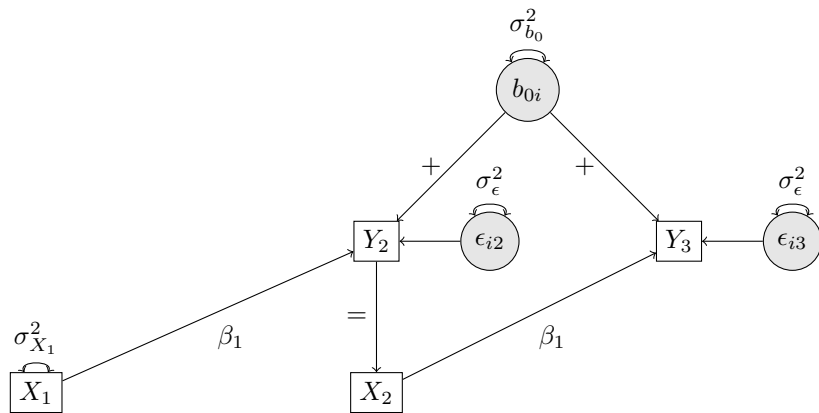


Figure 1: Path Diagram of Model Without Treatment

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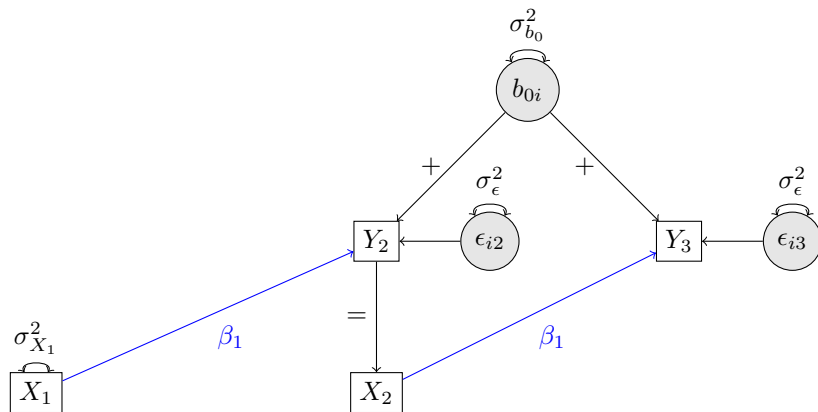
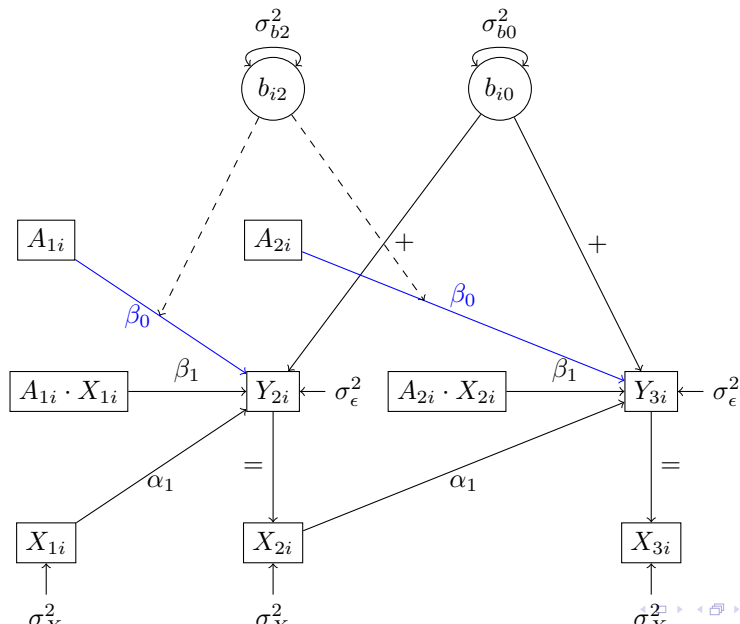
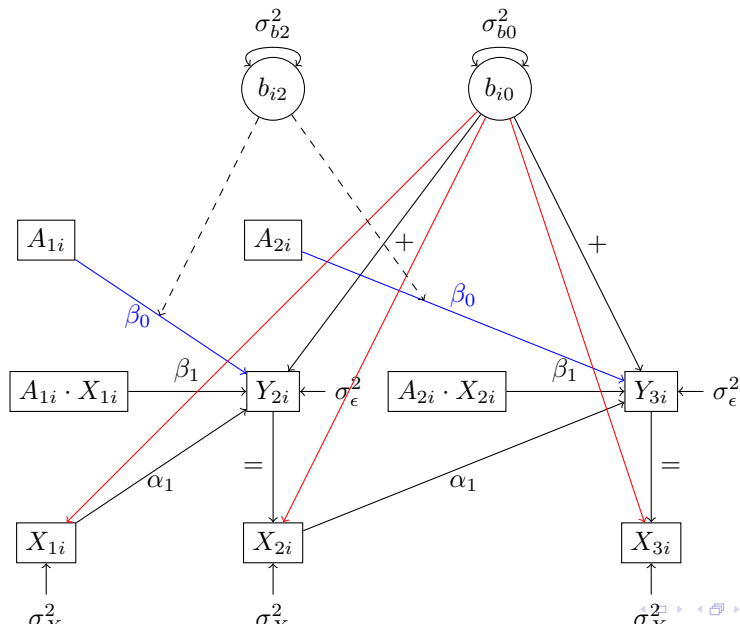


Figure 2: Path Diagram of Model Without Treatment

Generative Model 1



Generative Model 3



Variations on GM3

DAGs are the Same?

- ▶ Pearl's backdoor criterion and interaction effects?

Simulation Results

Discussion: Takeaways and Moving Forward

- ▶ Marginal relationship primary interest?

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- ▶ In practice, we don't know the DGM
 - ▶ Theory-based decisions
- ▶ Next steps
 - ▶ What makes bias increase?

References

- Diggle, Peter. 2002. *Analysis of Longitudinal Data*. OUP Oxford.
- Pepe, Margaret Sullivan, and Garnet L Anderson. 1994. "A Cautionary Note on Inference for Marginal Regression Models with Longitudinal Data and General Correlated Response Data." *Communications in Statistics - Simulation and Computation* 23 (4): 939–51. <https://doi.org/10.1080/03610919408813210>.
- Qian, Tianchen, Predrag Klasnja, and Susan A. Murphy. 2020. "Linear Mixed Models with Endogenous Covariates: Modeling Sequential Treatment Effects with Application to a Mobile Health Study." *Statistical Science : A Review Journal of the Institute of Mathematical Statistics* 35 (3): 375–90. <https://doi.org/10.1214/19-sts720>.

Appendix