When to use GEE vs. multilevel?

* If interested in only fixed effects, we can use either
  + If we’re worried about misspecification of the variance-covariance, we can always just use GEE.
  + But if we want to actually infer something about the random effects structure, we should just use multilevel.

Choosing variance-covariance structure

* When is compound symmetry wrong?
  + Compound symmetry assumes correlation within individual, but says that the correlations of any two time points within individual are equal
  + When would this be wrong?
  + In an autoregressive process where within individual, time points closer together are more similar than time points further away.
  + So far, we are always using mixed effects models to talk about time points nested within individuals. But say we have individuals nested within families. So in ij terms, i is family and j is individual. The compound symmetry assumption would say that individuals j within family i are correlated with each other, but that within-family correlation is assumed to be equal in comparing any two individuals.
  + You can consider this as a sort of exchangeability assumption in terms of the variance structure. We acknowledge that individuals within a given family are not independent, but we assume that the correlations between any two individuals are exchangeable.
  + Why would you ever use this? It’s very parsimonious.
* When is unstructured wrong?
  + Always produces best fit, but because maximum number of fitted parameters
  + If you only care about fixed effects, that’s sometimes fine
  + But if you care about the covariance structure itself, you’re likely overfitting in-sample, which can be problematic especially in smaller samples

Good answer to Part D, but in Parts B and C you could elaborate a bit more on why the compound symmetric or unstructured matrices might be conceptually wrong or why they might create bias in the fixed effects – regardless of whether there was substantive changes in the fixed effects in this example. Compound symmetry assumes correlated errors within individual but says that the correlations of any two time points are equal. When would this be wrong? In an autoregressive process where within individual, time points closer together are more similar than time points further away (e.g. income trajectories). The unstructured will always produce the best fit, but that’s because it uses the maximum number parameters. If you only care about fixed effects, that’s sometimes fine – but if you care about the covariance structure itself, you’re likely overfitting in-sample which can be problematic especially in smaller samples.