Hierarchical Linear Models II: Advanced Topics
ICPSR 2010

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Course Description
This course considers advanced topics in the applications of hierarchical linear models in social science, with special attention to recent breakthroughs and new software. Individuals who enroll should have taken the ICPSR course Hierarchical Linear Models I: Introduction or its equivalent. We will consider in detail: 1) hierarchical generalized linear models, including models for binary, binomial, count, ordinal, and multinomial outcomes; 2) spatially dependent random effects, with applications to the study of neighborhood effects on crime; 3) Multivariate models for repeated measures and dyadic data; multivariate models for level-one mediation effects 4) causal inference for multilevel observational data by means of covariance adjustment, propensity score stratification, inverse probability of treatment weighting, and fixed effects via adaptive centering; and 5) three- and four-level nested and cross-classified designs. Depending on the interests of the class, we are also prepared to discuss (with examples): multilevel missing data methods, prediction with latent variables, and the optimal design of multilevel and longitudinal research.

Required Reading

Sequence of Topics

Tuesday, July 6

Hierarchical Generalized Linear Models

- Binary outcomes (Thailand survey data; HLM, Chapter 10)
  A Bernoulli Model
  A Binomial Model
- Counts (Neighborhood predictors of homicide in Chicago; SRE, 1997)
- Models for ordinal data (Teacher Commitment data; HLM, Chap 10)
- Models for multinomial data (post-secondary education destinations; HLM Chap 10)

Reading: HLM (2nd edition) Chapter 10

Rumberger (1995)
Raudenbush and Sampson (1999a)
Raudenbush, Johnson, & Sampson (2003)

Spatially Dependent Random Effects

- The spatial distribution of neighborhood collective efficacy
- Association between collective efficacy and homicide rates

Reading: Verbitsky-Savitz and Raudenbush (2009)
Sampson, Raudenbush, & Earls (1997)

Wednesday, July 7

Multivariate linear models for change as hierarchical models

- Disaggregating within-person and between-person effects using a time-varying covariate:
  Compositional effects model (National Youth Survey data; Transition to Parenthood, KPS, 2007))
- The multivariate approach to modeling longitudinal data: The unrestricted model
- Comparison of models for level-1 residual variance: homogeneous, heterogeneous, and a log-linear function of time
- Compound symmetry and models for autoregressive (AR1) residual variance

Reading: HLM (2nd edition): Chapter 6

Sayer & Willett (1998)
Willett & Sayer (1994)
Keeton, Perry-Jenkins, & Sayer (2008)

**Extending the multivariate outcomes model to dyads (cross-sectional & longitudinal)**

- Models for distinguishable dyads (Marital distress data; cortisol data)

  Reading: Sayer & Klute (2005)
  Raudenbush, Brennan, & Barnett (1995)

  Suggested: Lyons & Sayer (2005)
  Powers, Pietromonaco, Gunlicks, & Sayer (2006)

**Extending the multivariate outcomes model to lower-level mediation effects**

- Within-person meditational processes (Work stress and relationship conflict data)

  Reading: Bauer, Preacher, & Gil (2006)

Thursday July 8

**Causal Inference for Multilevel Data: An Introduction**

I. Multilevel Propensity Score Adjustment
- Introduction and brief overview
- Rubin’s causal model
- Causal effects of educational interventions: An application using grade retention
- Multi-level randomized experiments: Naïve analysis of ECLS-K data
- Selection bias and the propensity score
- Logistic regression and hierarchical logistic regression
- Propensity score estimation
- Propensity stratification, causal analysis with propensity adjustment
- Sensitivity analysis
- Final remarks

II. Time-varying Treatments
- Inverse probability of treatment weighting (HR, 2008)
- Adaptive centering with random effects (R, 2009)

Reading: Hong & Raudenbush (2005; 2006; 2008)
Raudenbush (2009)
Friday, July 9

Three- and Four- Level Models with Nested and Cross-Classified Random Effects

- Three-level models (effects of grade retention on child growth, HY, 2007)
- Three-level cross-classified models (neighborhood and school effects on children’s educational attainment; teacher contributions to child growth, HLM, Chapter 12)
- A four-level nested model
- Four-level models with crossing and nesting (Instructional effects on child growth, HR, 2008; neighborhood and school effects on child growth)

Reading: HLM (2nd edition): Chapter 6

Suggested: Hong and Yu (2007)
            Hong and Raudenbush (2008)

Other topics will depend on the interests of the class. Likely topics include:

- Prediction with latent variables (HLM Chapter 11; RS, 1999b)
- Optimal design of multilevel and longitudinal research (RMS, 2007)
- Analysis with multilevel missing data (SR, 2007)

Readings:
Hong and Yu (2008)
Powers, Pietromonaco, Gunlicks, & Sayer (2006)
Raudenbush, Martinez, & Spybrook (2007)
Raudenbush and Sampson (1999b)
Shin and Raudenbush (2007)
References


