Hierarchical Linear Models I  
ICPSR 2011

Instructors:  Aline G. Sayer, University of Massachusetts Amherst  
Mark Manning, University of Missouri

Course Description

The hierarchical linear model provides a conceptual framework and a flexible set of analytic tools to study a variety of social, political, and developmental processes. One set of applications focuses on data in which persons are clustered within social contexts such as couples, families, classrooms, schools, or neighborhoods. Interest may center on the magnitude of social contextual effects on individual outcomes, the context specific relationships between person background and person outcomes, or interactions between features of social context and person background. A second set of applications concerns individual growth or change over time. Interest focuses on the shape of the mean growth trajectory, the variability in individual trajectories, and person-level characteristics that predict differences in growth curves. A third set of applications combines the first two types: persons changing over time who are also nested within social context. The goal is to assess the interactive effects of personal background and social context on trajectories of individual development.

The course will consider the formulation of statistical models for these three applications. Topics include an introduction to the basic two-level model for continuous outcomes (for both applications), assessment of fit, checking model assumptions, multiparameter hypothesis testing, the extension to three-level models, and an introduction to nonlinear models for binary outcomes. Depending on class interest, we will consider some of the following topics: meta-analysis, multivariate outcomes models, including the analysis of data from dyads, and measurement models within HLM. Participants will be exposed to a wide variety of examples, with emphasis on the interpretation and reporting of results. A basic understanding of statistical inference and skill in interpreting results from multiple regression are pre-requisites.

Recommended Readings

We will distribute lecture notes and annotated output that you will need during the course, as well as pdfs of the articles on the reference list. The following texts are recommended:


Sequence of Topics

Monday June 13

I. An Introduction and Brief History

* Methodological criticism of past treatment of hierarchical data
  - problems in the measurement of organizational effects
  - problems in the measurement of change
* Breakthroughs in statistical theory and computation

II. The logic of the 2-level hierarchical linear model illustrated by an application to the study of individual change over time: Chapman data

* Modeling change over time for one individual: The Level 1 model
* Modeling change over time for J individuals: The Level 2 model

II An Introduction to the HLM 6 Computer Program

* Data input and creating the MDM file
* Interactive execution
* Graphing

IV. Applications to repeated measures: NYS data

* Polynomial models
* Studying correlates of growth

Reading: Raudenbush, & Bryk: Chapters 1,2,6

Tuesday June 14

I. Time-varying covariates and group-mean centering

II. Assessing Model Fit

* Model comparison tests using deviance statistics
* Proportional reduction of variance
* Multiparameter parameter hypothesis testing

III. Assessing distributional assumptions via residual analysis

* Level-1 assumptions: Creating and using the level-1 residual file
* Level-2 assumptions: Creating and using the level-2 residual file
Wednesday June 15

I. An application of the 2-level model to organizational research

II Simplifications of the General Two-Level Model
* The oneway ANOVA with random effects
* Group means as outcomes
* The contextual effects model
* The oneway ANCOVA with random effects
* Random coefficients regression
* Cross-level model with intercepts and slopes as outcomes

Reading: Raudenbush & Bryk, Chapters 4, 5

Thursday June 16

II Introduction to the Three-Level Model: Chicago Schools Data & Sustaining Effects Study

* The level-1 model
* The level-2 model
* The Level-3 model

III Selected topics (we will choose one)

* The cross-sectional multivariate outcomes model: Barnett data
* Meta-analysis: Teacher expectancy effects
* Measurement models within HLM

Reading: Raudenbush & Bryk, Chapters 7, 8, 9

Friday June 17

I. Introduction to Non-Linear Models for Binary and Count Data

* Binary outcomes: Thailand data

Reading: Raudenbush & Bryk, Chapters 10, 11
Selected References Organized by Topic

Methodological Overview


Three-Level and Cross-Classified Models


School Effectiveness Applications


Neighborhood Effects Applications


Individual Growth Modeling Applications


Hierarchical Models for Dyads


Accelerated Longitudinal Designs

Raudenbush, S.W. and Chan, W.S. (1993). Application of a hierarchical linear model to


**Meta-Analysis**


**Program Evaluation**


**Measurement Models**


**Binary Outcomes**


**Multiple Informant/Multiple Outcomes Applications**
