Applied Multilevel Models for Longitudinal and Clustered Data

QIPSR Workshop at the University of Kentucky
5/14/2013 – 5/16/2013

Presented by:

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Materials will be available for download at:
http://psych.unl.edu/hoffman/Sheets/Longitudinal.htm

For further resources and online course materials, please visit:
http://psych.unl.edu/hoffman/HomePage.htm

COURSE OVERVIEW

Multilevel models are known by many synonyms (i.e., hierarchical linear models, general linear mixed models). The defining feature of these models is their capacity to provide quantification and prediction of random variance due to multiple sampling dimensions (across occasions, persons, or groups). Multilevel models offer many advantages for analyzing longitudinal data, such as flexible ways for modeling individual differences in change, the examination of time-invariant or time-varying predictor effects, and the use of all available complete observations. Multilevel models are also useful in analyzing clustered data (e.g., persons nested in groups), in which one wishes to examine predictors pertaining to individuals or to groups. This workshop will serve as an applied introduction to multilevel models, beginning with longitudinal data, continuing onto clustered data, and concluding with clustered longitudinal data. Although generalized multilevel models are also available, this workshop will focus on general multilevel models (i.e., for conditionally normally distributed outcomes).

The first day will be spent reviewing general linear models (e.g., regression, ANOVA) and then introducing the multilevel model for change over time. The second day will be spent two-level conditional (predictor) models for longitudinal data, including both time-invariant and time-varying predictors. The third day will be spent examining two-level conditional models for clustered data, and then three-level models for clustered longitudinal data. The primary software package utilized for instruction will be STATA, but examples using SPSS and SAS will also be provided. Participants should be familiar with the general linear model, but no prior experience with multilevel models or knowledge of advanced mathematics (e.g., matrix algebra) is assumed.

TENTATIVE SCHEDULE OF TOPICS

Day	Topic

5/14 AM — Lecture 1: Introduction to Multilevel Models

- What is multilevel modeling?
- Concepts in longitudinal data
- From between-person to within-person models
- Kinds of ANOVAs for longitudinal data

5/14 PM — Lecture 2: Describing Within-Person Change in Longitudinal Data

- Multilevel modeling notation and terminology
- Fixed and random effects of linear time
- Predicted variances and covariances from random slopes
- Dependency and effect size in random effects models
- Describing nonlinear change (polynomials, *piecewise, nonlinear*)
- Fun with likelihood estimation and model comparisons
- Data example

5/15 AM — Lecture 3: Time-Invariant Predictors in Longitudinal Models

- Missing predictors in MLM
- Effects of time-invariant predictors
- Fixed, systematically varying, and random level-1 effects
- Model building strategies and assessing significance
- Data example

5/15 PM — Lecture 4: Time-Varying Predictors in Longitudinal Models

- Time-varying predictors that fluctuate over time
- Person-Mean-Centering (PMC)
- Data example
- *Grand-Mean-Centering (GMC)*
- *Model extensions under Person-MC vs. Grand-MC*
- *Time-varying predictors that change over time*

5/16 AM — Lecture 5: Two-Level Models for Clustered Data

- Fixed vs. random effects for modeling clustered data
- ICC and design effects in clustered data
- Group-Mean-Centering vs. Grand-Mean Centering
- Data example
- *Model extensions under Group-MC and Grand-MC*

5/16 PM — Lecture 6: Three-Level Models for Clustered Longitudinal Data

- Decomposing variation across three levels in clustered longitudinal data
- Unconditional (time only) model specification
- Data example
- *Conditional (other predictors) model specification*
- *Other kinds of three-level designs*

Topics in italics may be skipped due to time constraints.