

**SPR 15TH ANNUAL MEETING
PRECONFERENCE WORKSHOP #2
May 29, 2007
8:30 AM – 5:00 PM**

Title: Analysis of Preventive Intervention Data Using Mixture Modeling In Mplus

Presenter: Bengt Muthén, UCLA

This workshop discusses methods for analyzing longitudinal data from preventive interventions. Such studies raise questions of how to analyze:

- Individual differences in growth over time
- Non-normal outcomes for rare behaviors
- Intervention effects on trajectories over time
- For whom an intervention is effective
- Selective drop-out
- Intervention effects in the presence of non-compliance
- The multilevel nature of an intervention
- The power to detect intervention effects

The workshop presents methods based on random effects and latent classes using recent advances in latent variable modeling made possible by the general modeling framework of the Mplus program (www.statmodel.com). The generality of the Mplus framework comes from the unique use of both continuous and categorical latent variables. While continuous latent variables have seen frequent use in factor analysis, structural equation modeling, and random effects growth modeling, modeling that includes categorical latent variables (latent classes) is less widespread. The workshop focuses on models that use categorical latent variables, either alone or together with continuous latent variables. The theme is the use of categorical latent variables to represent latent classes corresponding to different groups of individuals and latent trajectory classes corresponding to different types of development. An overview of conventional and new techniques is given. For each topic, issues of model specification, identification, estimation, testing, and model modification are discussed. Several examples are examined. Modeling strategies are presented. Mplus input setups are provided and Mplus output is used for interpretation of analysis results. The presentation is in lecture format with no need for computer analyses.

Course content:

Prerequisites: Intermediate understanding of latent variable structural equation modeling or multilevel modeling. Familiarity with categorical data analysis is necessary, especially logistic regression. Literature is suggested below.

- Latent class analysis
- Hidden Markov modeling, latent transition analysis
- Growth modeling with non-normal outcomes (2-part, ZIP)
- Growth mixture modeling with latent trajectory classes
- Randomized trials and treatment effects varying across latent trajectory classes
- Non-compliance and Complier-Average-Causal Effect Estimation
- Missing data analysis
- Two-level latent transition analysis
- Three-level growth mixture modeling
- Monte Carlo simulation and power estimation

References (available at www.statmodel.com under Papers):

Brown, E.C., Catalano, C.B., Fleming, C.B., Haggerty, K.P. & Abbot, R.D. (2005). Adolescent substance use outcomes in the Raising Healthy Children Project: A two-part latent growth curve analysis. *Journal of Consulting and Clinical Psychology*, 73, 699-710.

Dunn, G., Maracy, M., Dowrick, C., Ayuso-Mateos, J.L., Dalgard, O.S., Page, H., Lehtinen, V., Casey, P., Wilkinson, C., Vasquez-Barquero, J.L., & Wilkinson, G. (2003). Estimating psychological treatment effects from a randomized controlled trial with both non-compliance and loss to follow-up. *British Journal of Psychiatry*, 183, 323-331.

Jo, B. (2002). Statistical power in randomized intervention studies with noncompliance. *Psychological Methods*, 7, 178-193.

Jo, B., Asparouhov, T., Muthén, B., Ialongo, N. & Brown, H. (2007). Cluster randomized trials with treatment noncompliance. Accepted for publication in *Psychological Methods*. [hide abstract](#)

Muthén, B. (2004). Latent variable analysis: Growth mixture modeling and related techniques for longitudinal data. In D. Kaplan (ed.), *Handbook of quantitative methodology for the social sciences* (pp. 345-368). Newbury Park, CA: Sage Publications.

Muthén, B. & Muthén, L. (2000). Integrating person-centered and variable-centered analyses: Growth mixture modeling with latent trajectory classes. *Alcoholism: Clinical and Experimental Research*, 24, 882-891.

Muthén, L. & Muthén, B. (2002). How to use a Monte Carlo study to decide on sample size and determine power. *Structural Equation Modeling*, 4, 599-620.

Muthén, B., Brown, C.H., Masyn, K., Jo, B., Khoo, S.T., Yang, C.C., Wang, C.P., Kellam, S., Carlin, J., & Liao, J. (2002). General growth mixture modeling for randomized preventive interventions. *Biostatistics*, 3, 459-475.

Schaeffer, C.M., Petras, H., Ialongo, N., Poduska, J. & Kellam, S. (2003). Modeling growth in boys aggressive behavior across elementary school: Links to later criminal involvement, conduct disorder, and antisocial personality disorder. *Developmental Psychology*, 39, 1020-1035.

van Lier, P.A.C., Muthén, B., van der Sar, R.M. & Crijnen, A.A.M. (2004). Preventing disruptive behavior in elementary schoolchildren: Impact of a universal classroom-based intervention. *Journal of Consulting and Clinical Psychology*, 72, 467-478.

Prerequisite literature suggestions:

We would like to specifically recommend that participants study up on logistic regression. This is a basic building block for many of the models discussed during the two days. Below are some references. In addition, participants should have basic knowledge of structural equation modeling (SEM) and a good grasp of growth modeling, be it in a latent growth curve framework (e.g. Bollen & Curran, 2006), a multilevel framework (Raudenbush & Bryk, 2002), or a mixed model framework (Fitzmaurice, et al., 2004).

References on Categorical Data Analysis:

Agresti, A. (2002). *Categorical data analysis*. Second edition. New York: John Wiley & Sons.

Agresti, A. (1996). *An introduction to categorical data analysis*. New York: Wiley.

Hosmer, D. W. & Lemeshow, S. (2000). *Applied logistic regression*. Second edition. New York: John Wiley & Sons.

Long, S. (1997). *Regression models for categorical and limited dependent variables*. Thousand Oaks: Sage.

References on Growth Modeling:

Bollen, K.A. & Curran, P.J. (2007). *Latent curve models. A structural equation perspective*. New York: Wiley & Sons.

Fitzmaurice, G.M., Laird, N.M. & Ware, J.H. (2004). *Applied longitudinal analysis*. New York: Wiley & Sons.

Raudenbush, S.W. & Bryk, A.S. (2002). *Hierarchical linear models: Applications and data analysis methods*. Second edition. Newbury Park, CA: Sage Publications.