27:202:641
QUANTITATIVE METHODS FOR MULTILEVEL DATA
Fall 2015 Syllabus

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Class Location: Center for Law and Justice, Room 572
Lab Location: Center for Law and Justice, Room 567
Class Time: Tuesday, 10:00 to 12:40
Office Hours: By appointment

COURSE DESCRIPTION

This course provides a survey of statistical models for data having a nested or multilevel structure. This is a broad class of models that encompass cross-sectional designs in which the units are nested within some hierarchy (e.g., census tracts within cities), as well as longitudinal designs in which the units are subjected to repeated measurements over time. For applied researchers, the analysis of multilevel data presents special statistical challenges that require some resolution (e.g., serially correlated errors, unobserved heterogeneity), but also unique opportunities that are impossible with other designs (e.g., estimation of variance components or random coefficients). In the criminology and criminal justice disciplines, in particular, these designs have become something of a norm, which gives expertise with multilevel models added importance for quantitative researchers.

Weekly class meetings will comprise three substantive topics: (1) statistical theory to motivate the use of a particular type of multilevel model, (2) in-class data analysis to provide concrete applications of key concepts, and (3) in-class discussion based on research reported in peer-review journal articles. While the applications will draw heavily from examples in criminology and criminal justice, the discussions will cover broader applications from education, psychology, sociology, political science, and economics. Time permitting, a number of advanced multilevel topics will be considered, including latent variable models (e.g., item response analysis), models with more than two levels, and cross-nested models. Although an introduction to growth curve models might be provided, detailed consideration of these approaches is reserved for its own semester-long course.

Course Objectives

- Working knowledge of statistical models for the analysis of multilevel data, including their underlying assumptions, data requirements, implementation, and interpretation.
- Familiarity with the use of the Stata statistical software for a wide range of research applications with multilevel data, especially -mixed- and the -me- suite of commands.
- Ability to read, understand, and critique journal articles which employ multilevel methodology.

Course Prerequisite

It is assumed that students have completed at least two semesters of graduate-level statistics, and have an intermediate level of understanding of computer-based statistical programs (e.g., SPSS, SAS, Limdep, Stata, R). For doctoral students in the School of Criminal Justice, the prerequisites include passing grades in Introductory Statistics (27:202:542) and Intermediate Statistics (27:202:543). For doctoral students from other programs, this includes full coverage of linear regression analysis and at least some exposure to maximum likelihood estimation (e.g., logistic regression analysis).

COURSE MATERIALS

The course will rely heavily on the statistical program, Stata. Students are not required to purchase the program, although Rutgers doctoral students are entitled to a free, temporary but renewable Stata license (specifically, Stata MP2 14 for Linux, Mac, or Windows) through the university's software portal (https://software.rutgers.edu). Special prices and licenses for students are also available on the software website (http://www.stata.com). Students who do not wish to purchase the software or are not entitled to a university license will have access to it in the School of Criminal Justice computer lab (Center for Law and Justice, Room 567).

Required Textbooks

- Rabe-Hesketh, Sophia and Anders Skrondal. (2012a). *Multilevel and Longitudinal Modeling Using Stata: Volume I: Continuous Responses* (3rd edition). College Station, TX: Stata Press.
- Rabe-Hesketh, Sophia and Anders Skrondal. (2012b). *Multilevel and Longitudinal Modeling Using Stata: Volume II: Categorical Responses, Counts, and Survival* (3rd edition). College Station, TX: Stata Press.
- Raudenbush, Stephen W. and Anthony S. Bryk. (2002). *Hierarchical Linear Models: Applications and Data Analysis Methods* (2nd edition). Thousand Oaks, CA: Sage.

Students might occasionally be assigned outside reading material, such as a journal article or book chapter. The instructor will make these readings available on Dropbox, or else provide a link to them on the course Twitter account.

Course Handouts

Detailed slides and notes for many of the topics considered in this course will be made available by the instructor. These are intended to provide in-depth treatment of the statistical rationale underlying each model, in addition to concrete applications using Stata. They will be posted in a dedicated class folder on Dropbox (http://www.dropbox.com). Students are free to keep the slides and notes for their own personal use and to refer to them as needed, with the understanding that they are the intellectual property of the instructor.

COURSE GRADING

Course grading will be based on the following criteria:

Preparation and Participation	50%
Journal Articles	50%
	100%

The grading scale that will be used for the final semester grades is as follows:

A	90.0% or higher	(Outstanding)
B	80.0% to 89.9%	(Good)
C	70.0% or 79.9%	(Unsatisfactory)
F	69.9% or lower	(Failing)

Preparation and Participation (50%)

Students are expected to attend each class meeting and to have read and to be conversant with (to the extent possible) all of the required reading material. Some of this material will be of a technical nature, so the goal of the class meetings will be to help students understand what they have read (both conceptually and mathematically), and to work through empirical applications of key concepts. The weekly class meetings will also be an opportunity for students to bring their own questions or data challenges to the attention of the instructor and their classmates.

Participation will also be evaluated on the basis of students' activity on the course Twitter account (@RutgersSCJ641). The instructor will actively monitor the account, and students will be expected to create their own Twitter accounts and to "follow" the course account. This will provide a venue for commentary and discussion of course material, as well as an opportunity for students to make their classmates (and the instructor) aware of resources related to multilevel models. It might include, for example, links to user-written Stata commands, journal articles, online tutorials, statistical humor, etc.

Journal Articles (50%)

In anticipation of each class meeting, students will be required to conduct a search for a peer-reviewed journal article that has applied the model of interest to a research problem. Many research articles use a multilevel model of some form or other, so they will not be difficult to find. However, many multilevel researchers provide insufficient technical detail about their model, so students are asked to locate articles which provide basic information about the model specification (e.g., estimates of the variance components) or which provide an unusually lucid explanation and justification of the model. Articles published in high-quality journals are expected, and journal articles outside of criminology and criminal justice are welcome.

Students will be expected to link their articles to the course Twitter account (@RutgersSCJ641) and to provide short commentary. The goal will be for students to have compiled, by the end of the semester, a database of research articles covering each of the models considered in this course. These articles will be exemplars of specific multilevel modeling approaches, to which students can refer in the future for guidance concerning the presentation of their own results from multilevel models.

COURSE SCHEDULE

All readings are to be completed by the class date listed. Assignments due are listed in italics. Note that this schedule is subject to change depending on time demands. In fact, odds are very good that this schedule will not be followed to a T.

Raud = Raudenbush and Bryk (2002)
Rabe-I = Rabe-Hesketh and Skrondal (2012a)
Rabe-II = Rabe-Hesketh and Skrondal (2012b)

Class Date	Class Topic	Textbook Readings
Tue., Sept. 1	Course Introduction Multilevel Fundamentals	Raud 1, 2, 3; Rabe-I 1
Tue., Sept. 8	NO CLASS – MONDAY SCHEDULE	NA
	Standard Models	
Tue., Sept. 15	Variable Intercepts	Raud 4, 5, 9; Rabe-I 2, 3
Tue., Sept. 22	(cont.)	(cont.)
Tue., Sept. 29	Variable Coefficients	Raud 4, 5, 9; Rabe-I 4
Tue., Oct. 6	(cont.)	(cont.)
Tue., Oct. 13	Non-Linear Models	Raud 10; Rabe-II 10, 11, 12, 13
Tue., Oct. 20	(cont.)	(cont.)
	Advanced Topics	
Tue., Oct. 27	Latent Variable Models	Raud 11; Rabe-II 10, 11
Tue., Nov. 3	(cont.)	(cont.)
Tue., Nov. 10	Three-Level and Cross-Nested Models	Raud 7, 8, 12; Rabe-I 8, 9
Tue., Nov. 17	NO CLASS – A.S.C. ANNUAL MEETING	NA
Tue., Nov. 24	(cont.)	(cont.)
Tue., Dec. 1	Growth Curve Models	Raud 6; Rabe-I 5, 6, 7
Tue., Dec. 8	(cont.)	(cont.)