

SOC 570: MULTILEVEL AND LONGITUDINAL DATA ANALYSIS

Spring 2023

Tuesdays 9:00 am – 12:00 pm

Department of Sociology

Room 129, Davison Hall, Douglass Campus

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Office Hours: Thursdays 10:00 – 11:00 am or by appointment
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Course overview

This course is about applied multilevel and longitudinal modeling in social sciences. Multilevel models have many other names, including hierarchical models, random-effect models, or mixed-effect models. Longitudinal data are also referred to as panel data, repeated measures, or cross-sectional time series. The focus of this course will be regression modeling when data are clustered in some way. In cross-sectional settings, students may be nested in schools, people in neighborhoods, employees in firms, and twins in twin pairs. Longitudinal data are clustered because multiple observations over time are nested within subjects.

This course will cover topics including 1) management of multilevel and longitudinal data; 2) two-level models including random-intercept and random-coefficient models; 3) differences between random-effect and fixed-effect models; 4) models for longitudinal data, including marginal models and growth curve models; 5) models with nested and crossed random effects; 6) multilevel models for categorical/binary responses; 7) multilevel models for counts data.

A central goal of the course will be to provide you with a conceptual and practical understanding of multilevel models, so that you can apply the methods to **your own data and research interests**. You will learn through lectures, lab exercises, assignments, and a final research project in which you apply the methods to your own research. *Stata* will be the main software used in this course, but you can complete the exercises and assignments using a software that you prefer.

Textbook

Sophia Rabe-Hesketh and Anders Skrondal. (2012). *Multilevel and Longitudinal Modeling Using Stata, 3rd Edition (Volume I: Continuous Responses; Volume II: Categorical Responses, Counts, and Survival)*. College Station, TX: Stata Press.

Davide Garson. (2020). *Multilevel Modeling: Applications in Stata, IMB SPSS, SAS, R & HLM*. Thousand Oaks, CA: Sage.

Requirements

1. Assignments: Eight homework assignments will be made throughout the semester to give you practical experience working with the topic covered in the prior class. You are encouraged to work together on these exercises...but everyone must hand in his or her own completed assignment. **Each assignment should be turned in electronically on Canvas. Students will have the flexibility to complete seven out of the eight assignments** because the lowest score will be dropped from your grade. The scores of the seven assignments are worth 45% of your course grade.

2. Empirical paper discussion: Each student will give a 15 minute presentation on an assigned empirical paper to the class on March 21 or April 18. The presentation should focus on introducing the research questions of the paper, explaining the data structure, reviewing the methods used to answer the research questions, and interpreting the results. It will be helpful for us to see how multilevel/longitudinal data analysis methods and results are presented in research articles published in top social sciences journals. Students should critically comment on the strengths and weaknesses of the methods applied in the paper and the authors' presentation and interpretation of the results. Leading the discussion will account for 5% of your course grade.
3. Research paper: A central goal of the class is for students to gain the ability to apply the methods to analyze their own data and answer their research questions. You will be asked to develop a four-page research proposal by the middle of the semester, complete a research paper by the end of the semester (around 15-20 pages, excluding tables, figures, and references), and present the paper in class. Although the research paper can be brief in the theory section, you will need to clearly state the hypotheses, describe the data and methods, properly present and interpret the results, and draw meaningful conclusions. The research proposal (5%), the presentation (5%), and the final research paper (40%) together are worth 44% of your course grade.
4. Attendance policy: The material covered in this class is incremental and cumulative. That is, each week the presentation of new material will build on what we've covered previously. Therefore, regular attendance is essential, and you must keep on track with your readings and assignments (meticulous notes and clear organization will help, too). **It is imperative that you do not fall behind when learning this material.** During the semester you will likely have some competing obligations, both professional and personal. If you know that you are going to miss a class, please let me know so that we can plan ahead.

Learning Goals and Assessments

1. *Conduct original, theoretically engaged research grounded in highly skilled methodological techniques.* Students will be required to ask original research questions and answer the questions using empirical data when completing the course paper. In the course paper, students need to demonstrate their skills in estimating multilevel and longitudinal models and correctly interpreting their results.
2. *Enter the sociological profession as accomplished scholars.* During the class, students will learn and discuss ethical practices in conducting quantitative analysis and strategies for writing about quantitative analysis results. Students need to present the final paper during class and provide feedback to other presentations. The instructor will also provide feedback on students' course papers and help students develop their paper into a qualifying paper or a manuscript for publication.

Useful Websites

1. All datasets used in the textbook are available from <http://www.stata-press.com/data/mlmus3.html> You can download the dataset into a local directory on your computer.

Alternatively, individual datasets can be loaded directly into net-aware Stata by specifying the complete URL. For example,

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. use http://www.stata-press.com/data/mlmus3/pefr
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2. Solutions to exercises that are available to readers can be downloaded from <http://www.stata-press.com/books/mlmus3-answers.html>.
3. Additional readings, assignment questions, handouts, and other course-related materials will be posted on **Canvas**.

Diversity Statement

The Rutgers Sociology Department strives to create an environment that supports and affirms diversity in all manifestations, including race, ethnicity, gender, sexual orientation, religion, age, social class, disability status, region/country of origin, and political orientation. We also celebrate diversity of theoretical and methodological perspectives among our faculty and students and seek to create an atmosphere of respect and mutual dialogue. We have zero tolerance for violations of these principles and have instituted clear and respectful procedures for responding to such grievances

Academic Misconduct

Academic honesty is a subject that I take very seriously. I encourage all students to familiarize themselves with the Rutgers University policies and procedures on academic honesty, available at <http://academicintegrity.rutgers.edu/academic-integrity-at-rutgers>. All violations of academic integrity, for example, copying or plagiarizing others' work for your written assignments, will be referred to the appropriate authorities and sanctioned accordingly.

Students with Disabilities

In accordance with University policy, if you have a documented disability and require accommodations to obtain equal access in this course, please contact me at the beginning of the semester. Students with disabilities must be registered with Office of Student Disability Services and must provide verification of their eligibility for such accommodations.

Course Outline

The dates indicated are tentative and may change based upon how this class proceeds.

Week 1. January 17

Introduction to the course

Brief review of regression models and Stata programing

Readings:

Rabe-Hesketh and Skrondal, Chapter 1

Garson, Chapter 1

Week 2. January 24

Data preparation and management

Variance-components models and estimation using Stata

Readings:

Rabe-Hesketh and Skrondal, Chapter 2.1-2.10

Garson, Chapter 2 (Overview, model specification, sample size, balanced and unbalanced designs, linearity and nonlinearity) and Chapter 3

Week 3. January 31

Variance-components model continued – more examples

Hypothesis test and confidence intervals and parameter estimation

Readings:

Garson, Chapters 4 and 5

(Assignment 1 due)

Week 4. February 7

Random-intercept models with covariates and estimation using Stata

Readings:

Rabe-Hesketh and Skrondal, Chapter 3.1-3.9

Garson, Chapter 6

(Assignment 2 due)

Week 5. February 14

Random-coefficient models

Readings:

Rabe-Hesketh and Skrondal, Chapter 4

Garson, Chapter 7

(Assignment 3 due)

Week 6. February 21

Models for longitudinal and panel data

Random-intercept model and lagged-response models

Readings:

Rabe-Hesketh and Skrondal, Chapter 5

(Assignment 4 due)

Week 7. February 28

Mean structure and covariance structures
Generalized Estimating Equation (GEE)

Readings:

Rabe-Hesketh and Skrondal, Chapter 6
(Assignment 5 due)

Week 8. March 7

Growth curve models

Readings: Rabe-Hesketh and Skrondal, Chapter 7
(Research Proposal due)

Week 9. March 21

Sample empirical paper presentation

Week 10. March 28

Three-level models

Readings: Rabe-Hesketh and Skrondal, Chapter 8
Garson, Chapter 8
(Assignment 6 due)

Week 11. April 4

Crossed random effects

Readings:

Rabe-Hesketh and Skrondal, Chapter 9
Garson, Chapter 11

Week 12. April 11

Multilevel logistic regression models – random-effect and fixed-effect

Readings:

Rabe-Hesketh and Skrondal, Chapter 10
(Assignment 7 due)

Week 13. April 18

Multilevel models for ordinal OR count outcomes

Readings:

Rabe-Hesketh and Skrondal, Volume 2, Chapters 11, 12, 13
(Assignment 8 due)

Sample empirical paper presentation

Week 14. April 25

Student presentations of research paper

Paper due on Friday May 5th, 11:59pm

Sample Empirical Papers

Paper	Date	Student
1. Variance component model and two-level model De Clercq, B., Vyncke, V., Hublet, A., Elgar, F. J., Ravens-Sieberer, U., Currie, C., ... & Maes, L. (2012). Social capital and social inequality in adolescents' health in 601 Flemish communities: A multilevel analysis. <i>Social Science & Medicine</i> , 74(2), 202-210.	March 21	
2. Random coefficients and cross-level interactions Huffman, M. L., & Cohen, P. N. (2004). Racial wage inequality: Job segregation and devaluation across US labor markets. <i>American Journal of Sociology</i> , 109(4), 902-936.	March 21	
3. Lagged dependent variable model Shandra, J. M., Shandra, C. L., & London, B. (2010). Do non-governmental organizations impact health? A cross-national analysis of infant mortality. <i>International Journal of Comparative Sociology</i> , 51(1-2), 137-164.	March 21	
4. Growth curve model Chen, F., Yang, Y., & Liu, G. (2010). Social change and socioeconomic disparities in health over the life course in China: A cohort analysis. <i>American sociological review</i> , 75(1), 126-150. Cheng, S. (2014). A life course trajectory framework for understanding the intracohort pattern of wage inequality. <i>American Journal of Sociology</i> , 120(3), 633-700.	March 21	
5. Fixed-effect model Lu, Y. (2012). Household migration, social support, and psychosocial health: The perspective from migrant-sending areas. <i>Social Science & Medicine</i> , 74(2), 135-142.	March 21	
Cheng, S. (2016). The accumulation of (dis) advantage: The intersection of gender and race in the long-term wage effect of marriage. <i>American Sociological Review</i> , 81(1), 29-56.	March 21	
6. Cross-classified model Sykes, B., & Musterd, S. (2011). Examining neighbourhood and school effects simultaneously: what does the Dutch evidence show? <i>Urban Studies</i> , 48(7), 1307-1331.	April 18	
7. Multilevel logistic regression Flaherty, J., & Brown, R. B. (2010). A multilevel systemic model of community attachment: Assessing the relative importance of the community and individual levels. <i>American Journal of Sociology</i> , 116(2), 503-542.	April 18	
8. Multilevel Poisson regression Huebner, B. M. (2003). Administrative determinants of inmate violence: A multilevel analysis. <i>Journal of Criminal Justice</i> , 31(2), 107-117.		