Hierarchical Linear Models (Multilevel Level Models)  
Edpsy/Psych/Stat 587  
Fall 2015

Instructor: Carolyn Anderson  
Office: 236C Education Bldg.  
office hours: Tuesday 1:00 - 3:00pm  
e-mail: cja@illinois.edu

TA: Justin Kern  
Office: rm 418 Psychology Bldg.  
office hours: Wednesday  
e-mail: kern4@illinois.edu

Lecture: Tue/Thu 10:00-11:50 am, room 22 Education bldg.

Prerequisites: Edpsy 581 and 582 or Psych 406 and 407 are required. Edpsy/Soc 584 or Psych 594 useful but not required.

Course web-site: http://faculty.ed.uiuc.edu/cja/homepage/teaching.html. Besides course information and materials, there are links to multilevel web-sites.

Course objectives: Data in education, psychology, medicine, public health, sociology and other applied sciences are often clustered or show a multilevel or hierarchical structure. For example in educational research, researchers frequently select a sample of schools from which a sample of classes is selected from which a sample of students is selected. Measurements of attributes or characteristics of schools, classes (teachers) and students may be available. Longitudinal and repeated measures are also hierarchical or multilevel data. Most standard statistical models and tests critically rely on the assumption of independent observations. When data are clustered or show a multilevel structure, observations are typically correlated, which violates the standard independence assumption and invalidates conclusions based on standard statistical methods.

This course provides an introduction to the use of hierarchical or multilevel models that take into account dependencies between observations. Students will learn the basic ideas and theory of hierarchical linear models, as well as have many opportunities to apply the methods to real data from studies in education, psychology and social sciences. Topics that will be covered include an introduction to multilevel analyses, random intercept and slope models, 2 and 3 level models, hypothesis testing, model assessment, longitudinal (repeated measures) data, and generalized hierarchical models for dichotomous response/dependent variables.

Texts:


Additional readings are available online.

Computing: We will be using remote desktop connections to the College of Education servers that will provide access to the statistical software that we will be using. You can connect to the server using a PC or Mac computer. If you are registered in the course, you will be authorized to connect to remote.webstore.illinois.edu. Instructions for logging into remote server can be found at https://wiki.cites.uiuc.edu/wiki/ybZutAg. Approximately 5 lectures will be held using SAS
where you will be doing lab exercises. We will use SAS (version 9.4), which is also available on computers in the CITES lab in Lincoln Hall and various other places on campus. If you wish to purchase SAS, the license and media costs $37.50 from CITES. The cost is pro-rated and the license covers up to 12/31/2015. Once you have a license, you can borrow the DVDs to install it on your own computer. For current prices and options see https://webstore.illinois.edu/Shop/search.aspx?keyword=SAS.

You may use R, STATA or MATLAB but you will be responsible for learning how to use these programs to do multilevel analysis.

**Evaluation:** Students will be evaluated on the basis of homework assignments, mini-projects (computer lab work), class participation, and a final take home exam or project. 60% of grade is based on homework and 40% on final/project.

**Course Project:** Students may do a course project in lieu of a final exam. The instructor must pre-approve course projects. The range of possible projects is very broad and could include papers describing analysis of data as part of a student’s research or collaborative research, studying a topic not covered in the course (and applying it to data), or do a comparative study (what happens when you use ordinary regression versus HLM, or compare software packages). If you do a project you must have IRB approval. If you cannot complete the project by the end of the semester, I strongly encourage you to take the final (i.e., not late projects or finals).

**Illness:** If you are sick, do NOT come to lecture, the instructor’s office hours or the TAs office hours. If you need to turn in homework, you can either give it to a fellow student (preferred) or send it electronically (to both the TA and instructor).

**Fair Use/Plagiarism Policy:** Please see go to the following link for policy on academic integrity: http://education.illinois.edu/edpsy/about/academic-integrity We take this seriously.

**Emergencies:** Review http://police.illinois.edu/emergencyplanning/general/

In an emergency in this building, we’ll have three choices: RUN (get out), HIDE (find a safe place to stay inside), or FIGHT (with anything available to increase our odds for survival).

First, take a few minutes this week and learn the different ways to leave this building. If there’s ever a fire alarm or something like that, you’ll know how to get out, and you’ll be able to help others get out too.

Second, if there’s severe weather and leaving isn’t a good option, go to a low level in the middle of the building, away from windows.

If there’s a security threat, such as an active shooter, we’ll RUN out of the building if we can do it safely or we will HIDE by finding a safe place where the threat cannot see us. We will lock or barricade the door and we will be as quiet as possible, which includes placing our cell phones on silent. We will not leave our area of safety until we receive an Illini-Alert that advises us it is safe to do so. If we cannot run out of the building safely or we cannot find a place to hide, we must be prepared to fight with anything we have available in order to survive.

**Remember, RUN away or HIDE if you can, FIGHT if you have no other option.**

Finally, if you sign up for emergency text messages at emergency.illinois.edu, you’ll receive information from the police and administration during these types of situations.

If you have any questions, go to police.illinois.edu, or call 217-333-1216.
**Tentative Course Schedule**

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<thead>
<tr>
<th>Topic</th>
<th>Reading</th>
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<tbody>
<tr>
<td>Introduction: multilevel data</td>
<td>S&amp;B: ch 1, ch2</td>
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<tr>
<td>Review of multiple regression and mixed effects ANOVA &amp; multilevel data. (i.e., Statistical treatment of clustered data)</td>
<td>S&amp;B: ch 3</td>
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<tr>
<td>Random intercept model</td>
<td>S&amp;B: ch 4</td>
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<tr>
<td>Random intercept and slope</td>
<td>S&amp;B: ch 5</td>
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<tr>
<td>Estimation methods &amp; problems</td>
<td>S&amp;B: p 60-61, 89-90</td>
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<tr>
<td>Inference for fixed effects</td>
<td>S&amp;B: ch 6</td>
</tr>
<tr>
<td>Inference for random effects</td>
<td>S&amp;B: ch 6</td>
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<tr>
<td>Testing assumptions &amp; model evaluation</td>
<td>S&amp;B: ch 9</td>
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<tr>
<td>Exploratory data analysis</td>
<td>Draft Chapter 7.1 on LMM</td>
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<tr>
<td>Longitudinal data</td>
<td>S&amp;B: ch 15</td>
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<tr>
<td>Discrete dependent variables (multilevel logistic regression)</td>
<td>S&amp;B: ch 17.1, 17.2 &amp; 17.3</td>
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<tr>
<td>3-level models (in class and in context of logistic regression)</td>
<td>S&amp;B: p 67-71, 90-93</td>
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Review and overview of other interesting and important topics and that we did not have time to cover this semester.

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*S&B = Snijders & Bosker*
References


There are many more references and numerous web-sites devoted to multilevel models, HLM, etc.