Hierarchical Linear Models (Multilevel Level Models)
Edpsy/Psych/Stat 587
Fall 2017

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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.

Questions and feedback: This term we will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, Paige, and myself. Rather than emailing questions to me and/or Paige, I encourage you to post your questions on Piazza. You may also answer questions that your fellow students post. Rather than waiting for ICES at the end of the semester, I encourage you to post suggestions regarding the course. Your posts may be anonymous.

Note that you can still e-mail me or Paige directly if you have a problem or question that is specific to yourself (e.g., will be away at a conference, are ill, etc).

I have entered the e-mail addresses of all those who were registered as of August XX. You should receive a note and you just need to activate your account. Test it out!

Find our class page at: https://piazza.com/illinois/fall2017/edps587/home

If you have any problems or feedback for the developers, email team@piazza.com.

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: Approximately 5 lectures will be held using software where you will be doing lab exercises. For these “lectures”, you will need to bring a laptop.

Depending on student interest, I can teach R for multilevel modeling. Students should choose either SAS or R. There is both SAS and R code on the course web-site.

For those who wish to use SAS® (version 9.4) it is available to enrolled students on a campus server, as well as on computers in the Foreign Language Building, and various other places on campus. If you wish to purchase SAS, you can get a license from webstore.illinois.edu for $35.00 (I think) and either purchase the media or borrow it. The cost is pro-rated and the license is valid through 12/31/2016. For current prices and options see [https://webstore.illinois.edu/Shop/search.aspx?keyword=SAS](https://webstore.illinois.edu/Shop/search.aspx?keyword=SAS).

For access to SAS, we will be using remote desktop connections to campus 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 but Apple users will need to download remote desktop software from the web (unless you already have it). *If you are registered in the course*, you have been authorized to connect to remote.webstore.illinois.edu. Instructions for logging into remote server can be found at [https://wiki.cites.uiuc.edu/wiki/x/bZutAg](https://wiki.cites.uiuc.edu/wiki/x/bZutAg).

R can be downloaded for free from [https://cran.r-project.org/mirrors.html](https://cran.r-project.org/mirrors.html) and for most information see [https://www.r-project.org](https://www.r-project.org). Some students like to use Rstudio (I don’t, but that’s my personal preference). You should have a basic familiarity with R.

You may use 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, which is due Thursday December 14th at 4:30pm.

Course Project: Students may do a course project in lieu of a final exam (the final is basically a project but I choose the data and questions). 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 involving people, 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., no 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 in 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

The definition as spelled out in this document is “The definition of plagiarism is straightforward: Presenting someone else’s words, materials, manner of expression, or ideas as your own. This means that even if another person agrees to let you present his or her content as if it were yours, it is still plagiarism. Plagiarism does not require intent: it can be intentional or unintentional.”

We take this very seriously.

Emergencies: Review http://police.illinois.edu/emergency-preparedness/

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 (exits are to the North, South and two to the West). 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 Education building the east side of the basement (away from windows).

If there’s a security threat, such as an active shooter, RUN out of the building if we can do it safely or 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

<table>
<thead>
<tr>
<th>Topic</th>
<th>Reading</th>
</tr>
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<tbody>
<tr>
<td>Introduction: Multilevel data</td>
<td>S&amp;B: ch 1, ch 2</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: ch 6</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>
</tr>
<tr>
<td>Testing assumptions &amp; model evaluation</td>
<td>S&amp;B: ch 9</td>
</tr>
<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>
</tr>
<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.