Mel and Enid Zuckerman College of Public Health  
University of Arizona

SYLLABUS  
Longitudinal and Mixed Effects Models (CPH684)  
Fall 2017

Time: Monday and Wednesday (1:00pm – 2:15pm)

Location: Drachman A119  
Instructor: Jin Zhou Ph.D.  
Office Room: Drachman A242  
Phone: 520-626-1393  
Email: jzhou@email.arizona.edu

Office Hours: By appointment

Catalog Description: This course introduces basic concepts of linear algebra that are essential for understanding more advanced statistical modeling methodology. This knowledge is used to understand the General Linear Model (GLM), which includes linear regression, ANOVA, and other special applications and modern methods for the analysis of repeated measures, correlated outcomes and longitudinal data, including the unbalanced and incomplete data sets characteristic of biomedical research. Topics include an introduction to matrices for statistics, general linear models, analysis of correlated data, random effects models, and generalized linear mixed models.

Course Description: This course covers modern methods for the analysis of repeated measures, correlated outcomes, and longitudinal data, including the unbalanced and incomplete data that are characteristic of biomedical research. Topics include an introduction to the analysis of longitudinal data, the analysis of response profiles, fitting parametric curves, covariance pattern models, random effects and growth curve models, generalized linear models for longitudinal data including generalized estimating equations (GEE), and generalized linear mixed models (GLMMs). We also discuss connections with multilevel modeling.

Course Prerequisites: CPH 576A; CPH 576B

Course Learning Objectives: At the completion of the course, you will be able to:

(1) Describe the statistical methods utilized to analyze longitudinal data in a variety of settings and with a variety of types of outcome variables.

(2) Analyze a scientific problem that requires repeated measurements, identify an appropriate design, and identify the statistical methods required to analyze the data.

(3) Utilize SAS procedures GLM, MIXED, GENMOD and NLMIXED to perform longitudinal
analyses of data generated from randomized and observational studies with repeated measures designs.

(4) Apply modern methods for the analysis of longitudinal data to a range of settings encountered in biomedical and public health research.

(5) Interpret and communicate the clinical/scientific meaning of the results of your longitudinal analysis.

Program Competencies Covered:

Analytical Skills: Defines a problem
Determines appropriate uses and limitations of data
Understanding basic research designs used in public health
Makes relevant inferences from data

Communication Skills: Communicates effectively both in writing and orally (unless a handicap precludes one of those forms of communication)
Interpreting and presenting accurately and effectively demographic, statistical, and scientific information for professional and lay audiences adapting and translating public health concepts to individuals and communities
Leading and participating in groups to address specific issues, including ability to work in teams, span organizational boundaries and cross systems

Course Notes: Notes will be posted online before lecture

Required Texts/Readings:


(2) “Linear Mixed-Effects Models Using R”, Andrzej Galecki • Tomasz Burzykowski
Springer.

Course Requirements: Successful completion of all homework, examinations, and active class participation.

Grading/Student Evaluation: Homework assignments will be from the texts, and readings. The instructor will provide problems. Due dates will be given for each assignment. Late homework will not be accepted.

On both homework and examinations, partial credit will be given, so always show your work and be as neat and clear as possible. Exams and homework contribute to your final grade as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>30%</td>
</tr>
<tr>
<td>Midterm</td>
<td>40%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>30%</td>
</tr>
</tbody>
</table>

Final grades are based on the following point system:

\[ A = 90 - 100\% \]
B = 80 – 89%
C = 70 – 79%
D = 60 – 69%
E = 59% or less

**Class Attendance/Participation:** Attendance will not be traced, but you are responsible for everything that goes on in class, including any alteration to the syllabus. If I make an announcement in class, you are responsible for it.

All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion. Absences pre-approved by the UA Dean of Students (or Dean’s designee will be honored.)

**Course Schedule:** Refer to excel table in D2L.

**Required Statements:**

**Communications:** You are responsible for reading emails sent to your UA account from your professor and the announcements that are placed on the course web site. Information about readings, news events, your grades, assignments and other course related topics will be communicated to you with these electronic methods. The official policy can be found at: [http://www.registrar.arizona.edu/emailpolicy.htm](http://www.registrar.arizona.edu/emailpolicy.htm)

**Disability Accommodation:** If you anticipate issues related to the format or requirements of this course, please meet with me. I would like us to discuss ways to ensure your full participation in the course. If you determine that formal, disability-related accommodations are necessary, it is very important that you be registered with Disability Resources (621-3268; drc.arizona.edu) and notify me of your eligibility for reasonable accommodations. We can then plan how best to coordinate your accommodations. The official policy can be found at: [http://catalog.arizona.edu/2013%2D14/policies/disability.htm](http://catalog.arizona.edu/2013%2D14/policies/disability.htm)

**Academic Integrity:** All UA students are responsible for upholding the University of Arizona Code of Academic Integrity, available through the office of the Dean of Students and online: The official policy found at: [http://deanofstudents.arizona.edu/codeofacademicintegrity](http://deanofstudents.arizona.edu/codeofacademicintegrity)

**Classroom Behavior:** (Statement of expected behavior and respectful exchange of ideas)
The Dean of Students has set up expected standards for student behaviors and has defined and identified what is disruptive and threatening behavior. This information is available at: [http://deanofstudents.arizona.edu/disruptiveandthreateningstudentguidelines](http://deanofstudents.arizona.edu/disruptiveandthreateningstudentguidelines)

Students are expected to be familiar with the UA Policy on Disruptive and Threatening Student Behavior in an Instructional Setting found at: [http://policy.arizona.edu/disruptive-behavior-instructional](http://policy.arizona.edu/disruptive-behavior-instructional) and the Policy on Threatening Behavior by Students found at: [http://deanofstudents.arizona.edu/sites/deanofstudents.arizona.edu/files/Disruptive_threat_bkt__2012.pdf](http://deanofstudents.arizona.edu/sites/deanofstudents.arizona.edu/files/Disruptive_threat_bkt__2012.pdf)

**Grievance Policy:** Should a student feel he or she has been treated unfairly, there are a number of resources available. With few exceptions, students should first attempt to resolve difficulties informally by bringing those concerns directly to the person responsible for the action, or with the student's graduate advisor, Assistant Dean for Student and
Alumni Affairs, department head, or the immediate supervisor of the person responsible for the action. If the problem cannot be resolved informally, the student may file a formal grievance using the Graduate College Grievance Policy found at: http://grad.arizona.edu/academics/policies/academic-policies/grievance-policy

Grade Appeal Policy: http://catalog.arizona.edu/2013-14/policies/gradappeal.htm

Syllabus Changes: Information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate.

Plagiarism: What counts as plagiarism?
- Copying and pasting information from a web site or another source, and then revising it so that it sounds like your original idea.
- Doing an assignment/essay/take home test with a friend and then handing in separate assignments that contain the same ideas, language, phrases, etc.
- Quoting a passage without quotation marks or citations, so that it looks like your own.
- Paraphrasing a passage without citing it, so that it looks like your own.
- Hiring another person to do your work for you, or purchasing a paper through any of the on- or off-line sources.