Epidemiology III
BMTRY 748

Co-Instructors

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Department of Medicine
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## Course Outline

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Course Description and Objectives

This course will provide an in-depth quantitative view of advanced statistical analysis of epidemiological studies. Builds on techniques developed in Epidemiology I and Epidemiology II. 3 hours.

Course Readings

Reading of assigned text and papers is expected of students.

Assigned Text and Other Reference Materials (see below for additional references)

The textbook for the course is:

Rothman, Greenland, Lash  *Modern Epidemiology*, Lippincott Williams & Wilkins, 2008

The textbook is available for check-out at with June Watson, Student Services Coordinator, 135 Cannon Street. The additional readings for each week are detailed below and will be available electronically.

Organization of Course

The course consists of lectures by the co-instructors and guest lecturers. The course is taught in the spring semester on Fridays from 9 a.m. – 12 p.m. in Room 301, Cannon Street building.

Student Evaluations

Students are expected to complete written homework assignments and participate in class discussions.

Assignments

The contribution of the topics towards the final grade will generally be proportional and commensurate with the length of contact hours. Assignments will comprise 90% of your grade.

Project

The final project will contribute 10% to the course grade. The project will involve you reading a paper from recent literature on a topic of advanced epidemiologic methods covered during the course. You will select a paper from the literature on a subject matter of interest to you and consult with instructors for appropriateness. You will be responsible for preparing a 10-15 minute presentation in which you summarize the main findings. Presentations will take place during the last day of class during the scheduled final exam time.
**MODULE: CAUSALITY:**

Week 4 (previously week 1 but changed due to scheduling conflict)
Introduction to causality and causal inference

- Models of causality: sufficient causes, component causes
- Philosophy of Scientific Inference
- Causal Inference in Epidemiology

Required Readings:

Optional Reading:

Assessment: Homework. 5% of course grade

**MODULE: MODELING**

References:

Course Outline

**Week 1-3**
Longitudinal Data Analysis

- Linear Mixed Models
- Generalized Linear Mixed Models (GLMM)
  - Practical Application and Interpretation
  - SAS procedure (Proc MIXED, PROC GEE, GENMOD. Proc GLMMIX)

- Missing Data
  - Missing data mechanisms (MCAR, MAR, MNAR)
  - Analysis of missing data methods
    - Likelihood methods, Multiple Imputation
  - SAS procedures (Proc MI and MIANALYZE)

**Week 5**
Survival Analysis

- Analysis of survival data (time to dropout, time to death, time to event)
  - Parametric Survival Models
  - Semi-Parametric Survival Models
- SAS procedures (Proc PHREG, PROC LIFREG, PROC LIFTEST)

**Week 6**
Risk Prediction Models

- Fitting prediction models
- Assessing performance of prediction models (eg. accuracy, discrimination and validation)
  - SAS procedure: Proc Logistic (eg. ROC, R-square)

Assessment: Homework, 35% of course grade
**MODULE: MEASUREMENT**

Week 7  Techniques for Reducing Bias and Propensity Scores I

Required Readings (to be distributed in class):

1. Performing a 1:N Case-Control Match on Propensity Score  
   Lori S. Parsons
2. Local and Global Optimal Propensity Score Matching  
   Marcelo Coca-Perraillon
3. Matching with Propensity Scores to Reduce Bias in Observational Studies  
   Marcelo Coca-Perraillon
   Elizabeth A. Stuart.

Other resources:

Website of Software Code:  
http://www.biostat.jhsph.edu/~estuart/propensityscoresoftware.html

**Assessment: Homework, 5% of course grade**

**Week 8: Exposure Measurement Measurement Error**

Exposure measurement defined  
Methods of exposure measurement  
Measurement error (differential and non-differential)

Required Readings:  


**Week 9: Measurement I**

Assessment Methods  
Understanding the Latent Variable  
Classical Test Theory

**Week 10: Measurement II**

Reliability and Validity  
Overview to Scale Development

Required Readings

3. Additional case study articles to be distributed.

Other Resources

**Assessment: Homework, 20% of course grade**

**MODULE: SPECIAL TOPICS**

**Week 11**
Meta-analysis  
Data sources -- TBD

**Assessment: Homework, 5% of course grade**

**Week 12**
Overview of the use of biomarkers in epidemiologic studies: Laboratory Tours  
Examples to include exposure and endpoint measures: body mass measures, physical activity, serum draws, tissue preparation, diagnosis, IHC analysis, digital analysis, protein expression, immune assay, genomic & epigenomic tests.

**Week 13**
Methodologic aspects of biomarker data capture I and analysis: Exposure  
Inter-method and intra-method reliability studies  
Data analysis examples: partial correlation coefficient, coefficient of variation

**Week 14**
Methodologic aspects of biomarker II data capture and analysis: Outcome Classification of Disease: problems and pitfalls  
Data analysis: Inter and intra-rater reliability (Kappa statistics)

**Assessment: Homework, 20% of course grade**

**Week 15**
Student Presentations

**Assessment: 10% of course grade**