



University of Maryland School of Public Health

EPIB 740 Advanced Methods in Epidemiology (Tentative)

Semester: Spring, 2015
Classroom and Time: SPH 0308, 4:00 pm -6:45 pm on Mondays
Instructor: Hongjie Liu, Ph.D., M.S.
Office: SPH 2234A
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Course Description:

This course focuses on development of analytical strategies for data analysis guided by epidemiologic principles. Specific statistical modeling will be tailored for analysis of data from cross-sectional, case-control and cohort studies with emphases on effect estimates, causal inference, controlling for confounding, and assessment of interaction and mediation effects. Course topics cover applied multivariate analysis including logistic regression, log-binomial regression, Cox proportional hazards model, Poisson regression, and propensity score model.

Course Pre- and Co-requisites:

Required: EPIB 612 and EPIB652

Recommended: None

Course Learning Objectives:

Upon completing this course, the student will be able to:

- (1) Develop analytic strategies for various study designs (e.g, case-control studies, cross-sectional studies, and cohort studies), guided by the principles of epidemiology.
- (2) Understand the rationales and assumptions underlying the major statistical techniques used to analyze data from epidemiological studies.
- (3) Describe strengths, limitations, and issues pertinent to the proper application of these techniques.
- (4) Explain how interactions, confounders and dose-response relations among variables are examined.
- (5) Utilize appropriate methods of analysis to account for confounding effects and to investigate interaction and mediation effects.

- (6) Compute and interpret odds ratios, prevalence ratio, relative risks, rate ratio, hazard ratio, and their confidence intervals.
- (7) Demonstrate competency in using SAS to perform data analysis for cross-sectional, case-control, and cohort studies.

Program Competencies Addressed in this Course:

The following competencies for the PhD program in epidemiology are addressed in this course:

1. Calculate advanced epidemiology measures.
2. Critically appraise epidemiologic literature
3. Critically evaluate measures of association.
4. Describe and apply statistical approaches to address threats to validity in epidemiologic studies
5. Analyze causal associations

Required Texts and Other Readings:

Required:

No required books, but class notes and readings from various epidemiology journals will be distributed in class.

Recommended:

- (1) Woodward M. Epidemiology: Study Design and Data Analysis, 3rd edition, Champan & Hall/CRC, 2013
- (2) Rothman KJ, Greenland S, and Lash TL. Modern Epidemiology, 3rd edition, Lippincott Williams & Wilkins, Philadelphia, PA, 2008
- (3) Handouts will be distributed in class

Additional Materials Required:

- (1) Szklo M and Nieto FJ. Epidemiology: Beyond the Basics, 2nd edition, Jones and Bartlett, 2007
- (2) Afifi A, Clark VA and May S. Computer-Aided Multivariate Analysis, 4th edition, Chapman & Hall/CRC, 2004

Course Requirements:

Course sessions will entail a combination of lectures, discussions, problem sets, and in-class activities in the lab sessions. There are three parts in the 3-credit course, (1) overview of epidemiologic designs, e.g., cross-sectional, case-control, and cohort studies; (2) application of specific statistical methods in a specific study design, (3) use of statistical software (SAS) to perform data analysis. The first 2 parts will be taught by classroom lectures and the last one will be delivered in a computer lab. Class time will be used for lectures, discussions, question and answer sessions, project report, and computer lab work.

Students are expected to complete the assigned readings **prior** to the class. Students are asked to actively participate in in-class discussions and exercises.

The instructor welcomes meetings with students outside of class to discuss questions, as well as to gain more insight about the material presented in class. Students may e-mail or ask the instructor for an appointment. Please be reminded, however, that the **class will be taught during class time only**. Material will not be presented again on a one-on-one basis at other times. Therefore, attendance at every class is expected and crucial for success in the course. Excessive lateness or absence from class is disruptive to the class and your learning. **Students who miss class are responsible for obtaining notes and hand-outs from other students**. The instructor will not meet with student to retrieve copies of hand-outs from past lectures except in pre-arranged circumstances.

Homework assignment (30%)

Homework will help students to apply what they learn in class into data analysis. The homework assignments will be discussed in class. There will be 5-6 homework assignments.

This is due when assigned. Late homework will NOT be accepted without a reasonable and advance notice. Only hard copy of homework is accepted.

Class participation (10%)

Instructor will give various in-class exercises. Students are expected to actively participate during in-class exercises. During lectures and in-class exercise sessions, instructor may ask questions related to the readings to students.

Midterm exam (30%)

A mid-term and a final exam will be held during class sessions of two hours' duration. The format of the examination will consist of true/false with brief explanations and short-answer. More details on this exams will be given in class.

Final exam (30%)

There are two parts in the final exam. In the first part, students will be asked to critique a publication regarding modeling the relationship between a risk factor and an outcome, taking other variables into consideration. They will discuss potential problems in the methods that are described in the publication and provide suggestions. To work on the critique need to synthesize into their discussion epidemiologic principles and analytic techniques that you have learned in the class.

In the second part, students will be asked to analyze an epidemiologic data. The dataset used in analysis is from an observational study, which will be provided by your instructor. The following parts need to be presented in their final report: (1) key research question, (2) objective of it, (3) central hypothesis, (4) analytic strategy plan for testing the hypothesis, (4) specific statistical modeling technique used in data analysis, (5) description of approaches used to check assumptions inherent to the modeling technique, (6) list of the key variables and their roles (e.g., primary outcome or dependent variable, “exposure” or risk factor(s), major potential confounders, mediation variables or interaction), (7) interpretation of findings (point estimates and their confidence intervals). In addition, SAS codes and results need to be attached to the final report as appendix.

Tips for being successful in this course

(1) Read course materials prior to class

This course has a heavy learning load. You should plan to spend a minimum of 5 hours per week outside of class completing class readings and assignments. You are required to preview the course presentations slides that will be posted at least **two days** before the next class meeting. You are expected to carefully and critically read all material prior to class. Carefully reflecting upon the material will not only help you understand the material and make valuable contributions to the discussion, but will also help you to incorporate new ideas, perspectives, and techniques into your own research. In short, an exciting and lively class discussion depends in large part on everybody carefully and critically reading the course material.

(2) Come to see your instructor as often as possible

Your instructor will review your homework, exams, and other assignments to see what questions you missed and to explore how you might be able to improve on your study habits. If you feel you do not understand lectures or have questions about some topics, you need see your instructor as frequently as possible. Do not accumulate questions to the end of the course.

(3) Be active in learning

You are advised to make notes, rewrite notes, and share notes with your peers. If you have questions or miss some points in class, feel free to raise your hand and ask questions. You shall form a study group that meet weekly and discuss lecture topics and homework with your peers.

Course Policies:

Email – The Official University Correspondence:

Verify your email address by going to www.my.umd.edu.

All enrolled students are provided access to the University's email system and an email account. *All official University email communication will be sent to this email address* (or an alternate address if provided by the student). Email has been adopted as the primary means for sending official communications to students, so email must be checked on a regular basis. Academic advisors, faculty, and campus administrative offices use email to communicate important and time-sensitive notices.

Students are responsible for keeping their email address up to date or for redirecting or forwarding email to another address. Failure to check email, errors in forwarding email, and returned email (from "full mailbox" or "unknown user" errors for example), will not excuse a student from missing University announcement, messages, deadlines, etc. Email addresses can be quickly and easily updated at www.my.umd.edu or in-person at the Student Service Counter on the first floor of the Mitchell Building.

For technical support for University email: www.helpdesk.umd.edu or call 301-405-1400.

Absence Policy:

In accordance with University policy if you are absent for a single (1) lecture due to illness or some form of personal or family emergency, this absence will be considered "excused" and the instructor will accept a note from you attesting to the date of the illness/incident, along with an acknowledgement that the information is true. Whenever feasible, you should try to contact the instructor in advance.

Multiple or prolonged absences, and absences that prevent attendance at a major scheduled grading event (like an exam or test) will require written documentation from an appropriate health care provider/organization.

A link to pull information on the new policy covering absences from class can be found at <http://www.president.umd.edu/policies/v100g.html>

Late work and Missed Exams / Assignments:

All work is due when assigned. **Only hard copies of assignments, reports and papers are accepted except where indicated. E-mail and FAX copies will not be accepted except where indicated.** Any work not completed and handed in at the beginning of class on the due date will receive a reduction of one letter grade. Work not handed in by 5pm the following day will receive an additional letter grade reduction. Work will not be accepted beyond this point except in extreme circumstance approved by your instructor.

Course Evaluations

The University, the School of Public Health, and the Department of Epidemiology and Biostatistics are committed to the use of student course evaluations for improving the student experience, course and curriculum delivery, and faculty instruction. Your evaluations help instructors improve their courses; help deans and department chairs decide on merit pay for faculty, renewal of contracts, and support tenure and promotion decisions; and help current and future students decide on classes. You will be notified when the system (www.CourseEvalUM.umd.edu) is open.

Grading Procedures:

Your final grade will be determined by scores of class participation, mid-term exam, homework, and final exam.

Grading: Final Grade Scale

97-100	A+
94-96	A
90-93	A-
87-89	B+
84-86	B
80-83	B-
77-79	C+
74-76	C
70-73	C-
60-69	D
< 60	F

Course Outline / Course Calendar:

Course Schedule Summary			
Session	Date (Tentative)	Topic	Assignments (Tentative)
# 1	Jan., 26	Lecture 1: Epidemiologic principles in modeling relationship	
# 2	Feb., 2/9/23	Lecture 2: Analysis of case-control studies: Logistic regression	Homework 1 (due on 03/02)
# 3	Mar., 2	Lecture 3: Analysis of matched case-control studies: conditional logistic regression	Homework 2 (Due on 03/09)
# 4	Mar., 9	Lecture 4: Analysis of cross-sectional studies: log-binomial regression model	Homework 3 (Due on 03/23)
# 5	Mar., 23 /30 and April 6	Lecture 5: Analysis of cohort studies: Survival analysis	Homework 4 (due on 04/13)
# 6		Midterm test	
# 7	April 13/20/27	Lecture 6: Analysis of cohort studies: Poisson regression	Homework 5 (due on 05/04)
# 8	May 4/11/	Lecture 7: Propensity score method	Homework 6 (due on 05/18)
# 9		Final project	

Note: Numbers in brackets after learning objectives show linkage between material covered in each session and the numbered program competencies shown on page 1 of this syllabus.

Required Session Outline

Session 1	Day/Date
Introduction to course	
Course description Course schedule Teaching approach	01/26
Lecture 1: Epidemiologic principles in modeling relationship	01/26
<ol style="list-style-type: none"> 1. Generalized linear models: Overview 2. General steps in statistical modeling 3. Application of modeling in Epidemiologic studies 4. Confounding, interaction, and mediation: Overview 5. Use of causal diagrams in data analysis 6. Confounded P-value 	
Session 2	Day/Date
Lecture 2: Analysis of case-control studies: Logistic regression	02/02-02/23
<ol style="list-style-type: none"> 1. Review of odds and odds ratio 2. Review of simple logistic regression 3. Maximum likelihood estimation 4. Likelihood ratio test 5. Examples in detail 6. Assumptions in logistic regression model 7. Modeling strategy guidelines <ol style="list-style-type: none"> (1) Variable selection (2) Interaction assessment (3) Confounding assessment 	

8. A common mistake: use of bivariable analysis to screen candidates

in multiple logistic regression

9. Use “Tests of regression”, “ R^2 ” and “test of fit” with caution

10. Ordinal logistic regression: the Proportional odds model

Homework 1: Logistic regression

Session 3

Day/Date

Lecture 3: Analysis of matched case-control studies: conditional logistic regression

03/02

1. Controlling confounding in case-control studies
2. Types of matching
3. Controlling for unmatched variables
4. Two alternative maximum likelihood (ML) approaches
5. Conditional logistic regression
6. SAS syntax: proc phreg and proc mdc

Homework 2: conditional logistic regression

Session 4

Day/Date

Lecture 4: Analysis of cross-sectional studies: log-binomial regression model

03/09

- 1: Review of effect measure
- 2: Relationship of IDR, RR, ROR and PR in cross-sectional studies
3. Comparisons of three models in estimating PR in cross-section data
- 4: log-binomial regression model
- 5: Comparison of log-binomial regression with logistic regression model

Homework 3: log-binomial regression

Session 5

Day/Date

Lecture 5: Analysis of cohort studies: Survival analysis**03/23-04/06**

1. Review of measures in cohort studies
2. What is survival analysis
3. Review of study designs
4. Time, event and censoring
5. Censoring and censored data
6. Survival function
7. Hazard function
8. The Kaplan-Meier method
9. The Cox proportional hazard model
 - Assumptions
 - Time-dependent covariates
 - Assessment of confounding and interaction
10. Extended Cox model for time-dependent variables

Homework 4: Cox proportional hazard model**Session 6****Day/Date****Lecture 6: Analysis of cohort studies: Poisson regression****04/13-04/27**

1. Poisson distribution
2. Key property for Poisson distribution
3. Poisson regression model
4. Estimate Rate Ratio in a Poisson regression model
5. Assumptions in Poisson regression
6. Multiple Poisson regression model
7. Using Poisson regression model to estimate standardized event ratio (SER)
8. Overdispersion
9. Negative Binomial Model
10. Comparisons on Poisson regression model, Logistic regression model, and Cox HP model

Homework 5: Poisson regression model

Session 7	Day/Date
Lecture 7: Propensity score method	05/04-05/11
<ol style="list-style-type: none">1. Theory of Counterfactuals2. Methods used to approximate counterfactuals3. Propensity score method (PSM)<ol style="list-style-type: none">(1) General procedures in PSM(2) Properties of the propensity score(3) Use of PS in outcome models to estimate the exposure effects<ol style="list-style-type: none">a: matchingb: Stratificationc: Regression adjustment(4) Variable selection for PSM(5) Studies with rare outcome and common exposure(6) An example of PSM in detail	
Homework 6: Propensity score modeling)	

Critical university policies:

Religious Observances:

The University System of Maryland policy provides that students should not be penalized because of observances of their religious beliefs; students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. **It is the student's responsibility to inform the instructor in advance of any intended absences for religious observance.**

Special Accommodations / Disability Support Services:

If you have a documented disability and wish to discuss academic accommodations for test taking or other needs, you will need documentation from Disability Support Service (301-314-7682). If you are ill or encountering personal difficulties, please let the instructor know as soon as possible. You can also contact Learning Assistance Services (301-314-7693) and/or the Counseling Center (301-314-7651) for assistance.

Academic Integrity:

The University's code of academic integrity is designed to ensure that the principle of academic honesty is upheld. Any of the following acts, when committed by a student, constitutes academic dishonesty:

- **CHEATING**: intentionally using or attempting to use unauthorized materials, information, or study aids in an academic exercise.
- **FABRICATION**: intentional and unauthorized falsification or invention of any information or citation in an academic exercise.
- **FACILITATING ACADEMIC DISHONESTY**: intentionally or knowingly helping or attempting to help another to violate any provision of this code.
- **PLAGIARISM**: intentionally or knowingly representing the words or ideas of another as one's own in any academic exercise.

For more information see: <http://www.shc.umd.edu/code.html>.

The Honor Pledge is a statement undergraduate and graduate students should be asked to write by hand and sign on examinations, papers, or other academic assignments. The Pledge reads:

I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination.

The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit <http://www.shc.umd.edu>.

Inclement Weather / University Closings:

In the event that the University is closed for an emergency or extended period of time, the instructor will communicate to students regarding schedule adjustments, including rescheduling of examinations and assignments due to inclement weather and campus emergencies. Official closures and delays are announced on the campus website (<http://www.umd.edu>) and snow phone line (301-405-SNOW), as well as local radio and TV stations.