Biostatistics 511 – Medical Biometry I
Autumn 2019

Lecture: MWF 9:30 - 10:20
HSB T625

Discussion Sections:
W: 12:30 – 1:20, T498
W: 2:30 – 3:20, T478
Th: 8:30 – 9:20, T635
F: 8:30 – 9:20, T635
Some of the discussion sections will be held in the Health Sciences computer lab. Enter through the 3rd floor T-wing entrance to the Health Sciences Library. You should bring a USB drive to these sessions to save files and data.

Instructor: Jim Hughes, Professor of Biostatistics
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206-616-2721
jphughes@uw.edu
office hours: see chart below, or by appt.

TA's: Andrew Humbert (lead) ahumbert@uw.edu
Esther Gu esthergu@uw.edu
Parker Xie pxie73@uw.edu

Mailboxes for the TA's are in F-600. TA's will hold office hours in the Health Sciences Library. See chart below.

The chart below shows the times of class meetings and instructor/TA office hours. **TA office hours will be held in the Health Sciences Library Computer Lab**.

	Mon	Tues	Wed	Thurs	Fri
7:30					
8:30				Discuss	Discuss
9:30	Lecture	AH	Lecture		Lecture
10:30	EG (10:30 – 12:00)	AH		JH	JH
11:30					
12:30			Discuss		
1:30	PX				EG (2:00 – 3:30)
2:30			Discuss		
3:30		PX			
4:30		PX			

Course Description: The objective of this course is to provide students with an understanding of basic concepts and methods of statistical inference in the health sciences. The major topics covered are:

- Data Description and Exploratory Data Analysis
- Basic Issues in Study Design, including Sample Size Calculations
- Probability Concepts and Models
- Statistical Inference - Estimation
- Statistical Inference - Hypothesis Testing for one and two sample problems
  - Parametric approaches
  - Nonparametric approaches
- Categorical Data Analysis
- Introduction to Regression Analysis

Examples are drawn from the biomedical literature, and real data sets are analyzed by the students after a brief introduction to the use of a statistical computing package.

Learning Objectives: Upon completion of the course, students should be able to …

- Identify data types (categorical, nominal, ordinal, quantitative) and define the terms outcome variable, explanatory variable, and covariate.
- Select and interpret appropriate graphical displays and numerical summaries for both quantitative and categorical data
- Explain the difference between observational and experimental studies
- Identify and describe cohort sampling, case-control sampling and cross-sectional sampling
- Recognize and explain the concepts of confounding and effect modification
- Describe the assumptions underlying the Binomial, Poisson and Normal probability models
- Define sensitivity, specificity and predictive values in the context of a binary screening test for a disease
- Translate scientific questions into appropriate null and alternative hypotheses
- Describe the assumptions underlying z-tests, t-tests and chi-square tests and use these tests to statistically compare two samples
- Explain and interpret p-values and confidence intervals
- Describe the assumptions underlying simple linear regression and be able to fit and interpret a regression model.
- Make predictions with a simple linear regression model
- Select and apply appropriate statistical methods to analyze their own data (for scientific questions appropriate to the tools taught in the course) and develop an analysis plan
- Critique the use of statistical methods in the published biomedical literature
- Use R to read data, describe data, and perform the statistical analyses covered in the course.

Pre-requisites: Basic algebra

Textbook: Baldi, B and Moore DS (2013) The Practice of Statistics in the Life Sciences – 4th edition. Freeman (3rd edition ok). Additional materials are on reserve at the Health Sciences Library. See attached list.

Web site: Homework assignments and other course materials will be posted on the course's canvas web site. Go to http://canvas.uw.edu, login with your UW netid and select BIOST 511 from the Courses pulldown menu.

Lectures: Lectures will be captured on a tablet PC and made available on the website. Be aware, however, that computers occasionally die in the middle of a lecture. If that happens, the lecture may not be available.

Lecture Notes: Copies of the lecture notes may be purchased at the UW Bookstore. The notes are also posted on the website.

Handouts: Course handouts can be found on the website.

Discussion Board: On the canvas website you will find a link to a "Discussions". This is the course discussion board. Any student in the class may post to this board. The TA's and Prof. Hughes will monitor the list.

Software: You will need access to a software package that can do descriptive statistics, graphics, basic hypothesis testing and simple linear regression. This includes most common statistical packages. The recommended package for this course is R along with the more user-friendly front-end, RStudio. These packages are available for free at https://www.r-project.org/ and https://www.rstudio.com respectively. Examples in the class will be presented in R. Students will be introduced to this package at the beginning of the quarter.

Homework will (typically) be handed out on Wednesday and is due on the following Wednesday by 9:30 am. To avoid paper shuffling in class, homework will be handed in and returned online on the canvas website. Homework should be submitted in .doc or .pdf format. **Late homework will not be accepted.**

The homework in this class will be used to improve the learning process, and not as a part of the evaluation of your learning. Thus, homework will be marked credit/no credit based on whether or not it represents a good faith effort to answer all the questions. You do not need to give a correct answer for the questions, but you do need to provide evidence of your thought processes on each question, so that graders can tell that you made an effort. Also, because the material in this course is sequential, it is important that you complete the homework and turn it in on time, so that you are ready for the new material that follows it. If you hand the homework in on time and make a good faith effort on each question, you will receive credit for the assignment.

I encourage students to work together or in small groups on the homework problems. A good strategy is for everyone in the group to work on the problems individually and then get together to discuss the more difficult ones. However**,** the final version you hand in **should reflect your own interpretation and understanding**. That is, support and assistance with developing answers in encouraged; copying answers is not (**copied assignments will not receive credit; note that Turnitin has been enabled**). Finally, except where I explicitly request it, no computer output should be included in your answers to the homework questions.

Data Analysis Project: This is a two part project:

Part 1: Prepare a plan for the analysis of data from a study. The study description and aims will be provided by the instructor. This plan will be submitted prior to receiving the data from the study.

Part II: Analyze the data from the study according to the plan you developed in part I and prepare a one page abstract with the results.

More on this later.

Grading: Numerical grades will be based on the following:

Midterm Exam:	30%
Final Exam:	30%
Homework (see below)	20%
Data Analysis Project	20%

Homework can contribute up to 20 points towards your grade. If you hand in 85% or more of your homework on time as good faith efforts, then you will receive the maximum possible 20 pts towards your grade.

Percent of Homeworks handed in on time as good faith efforts:	Number of points (max. 20)
85% or greater	20
75%-84.9%	16
60%-74.9%	12
<60%	0

Academic Integrity (http://sph.washington.edu/students/academicintegrity/)
Students at the University of Washington (UW) are expected to maintain the highest standards of academic conduct, professional honesty, and personal integrity. The UW School of Public Health (SPH) is committed to upholding standards of academic integrity consistent with the academic and professional communities of which it is a part. Plagiarism, cheating, and other misconduct are serious violations of the University of Washington Student Conduct Code (WAC 478-120). We expect you to know and follow the university's policies on cheating and plagiarism, and the SPH Academic Integrity Policy. Any suspected cases of academic misconduct will be handled according to University of Washington regulations. For more information, see the University of Washington Community Standards and Student Conduct website.

Access and Accommodation (http://depts.washington.edu/uwdrs/faculty-resources/syllabus-statement/):
Your experience in this class is important to me. If you have already established accommodations with Disability Resources for Students (DRS), please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course. If you have not yet established services through DRS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), you are welcome to contact DRS at 206-543-8924 or uwdrs@uw.edu or disability.uw.edu. DRS offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s) and DRS. It is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law.

Learning Environment: To provide a supportive learning environment, I ask your commitment to showing respect to each other and to your instructors both inside and outside of class by avoiding behavior that might be offensive or distracting to others. Moreover, students with concerns about the instructor or teaching assistant (TA) should discuss these concerns with the course instructor and/or TA. If you are not comfortable talking with the instructor or TA, or not satisfied with the response that you receive, you may contact the Department of Biostatistics Associate Director of Academic Affairs (biostgp@uw.edu). If you are still not satisfied with the response that you receive, you may contact the Department of Biostatistics Chair (bchair@uw.edu). You may also contact the Graduate School at G-1 Communications Building, by phone at 206-543-5139 or by email at raan@uw.edu.

Religious Accommodation: Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available

at Religious Accommodations Policy (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form (https://registrar.washington.edu/students/religious-accommodations-request/).

Additional Readings:

The following material has been placed on reserve at the Health Sciences Library.

- Fisher LD and Van Belle G (1993) Biostatistics: A methodology for the Health Sciences. Wiley, New York, 991pp

Previously used as a text for this course.

- Rosner B (1995) Fundamentals of Biostatistics, 5th ed. Duxbury Press.

Previously used as a text for this course. Lots of problems.

- Moore DS (1997) Statistics: Concepts and Controversies, 4th ed. WH Freeman and Co., New York, 526 pp.

Emphasizes concepts; very few formulas; selected as "favorite statistical text" (out of 34 reviewed) by a group of undergrads at South Carolina.

- Michael M, Boyce WT, Wilcox AJ (1984) Biomedical bestiary: An epidemiologic guide to flaws and fallacies in the medical literature. Little, Brown and Co., Boston, 161pp.

A short, easy to read, virtually equation free book that discusses, with examples, the many biases and "gotcha's" that can occur in biomedical research. Strongly recommended.

- Tanur J (1972) Statistics: A guide to the Unknown

A great book of case-studies written for non-statisticians

- Tufte E (1983) The Visual Display of Quantitative Information

Classic book on the practice and pitfalls of data display.

Course Outline

Date	Lecture Topic	Suggested Reading	Discuss.
9/25	Introduction		HSCL
9/27	Descriptive Statistics – Distributions	B&M chap 1, 2	
9/30	"		
10/2	Descriptive Statistics – Relationships	B&M chap 3, 4, 5	HSCL
10/4	"		
10/7	"		
10/9	Study Design	B&M chap 7, 8	HSCL
10/11	"		
10/14	Confounding/Causality	B&M pg 112-115, 164-165	
10/16	Probability Concepts/Tools	B&M chap 9, 10	Class
10/18	Screening		
10/21	Discrete distributions	B&M chap 12	
10/23	Continuous distributions	B&M chap 11	Class
10/25	Sampling distributions		
10/28	**EXAM**		
10/30	Confidence intervals	B&M chap 13, 14	Class
11/1	Hypothesis testing: Introduction	B&M chap 14, 15	
11/4	Hypothesis testing: Introduction	B&M chap 14, 15	
11/6	Hypothesis testing: t-tests	B&M chap 17, 18	Class
11/8	Hypothesis testing: Proportions	B&M chap 19, 20	
11/11	HOLIDAY		
11/13	Hypothesis testing: Proportions	B&M chap 19, 20	Class
11/15	Sample size and power	B&M chap 15	
11/18	Nonparametric tests	B&M chap 27	
11/20	Contingency tables	B&M chap 22	HSCL
11/22	Contingency tables	B&M 20; R10.5, 10.6	
11/25	Correlation	B&M chap 3	
11/27	Simple linear regression	B&M chap 4&23	none
11/29	HOLIDAY		
12/2	Simple linear regression	B&M chap 4&23	
12/4	"		Class
12/6	Review/Catchup		

Data Analysis I Due: Fri 11/15/19 5:00pm
Data Analysis II Due: Mon 12/02/19 5:00pm
Final Exam: Wed 12/11/19 8:30 – 10:20am location: tba

B&M – Baldi and Moore
R – Rosner