Biostatistics 551
Introduction to Biostatistics for Population Health
Fall 2013

Instructor: Yingqi Zhao, Ph.D.
Office: H6/536, CSC
Phone: 263-6284
Email: yqzhao@biostat.wisc.edu

Teaching assistant: Andrew Leslie
Office: 658, WARF
Email: ajleslie@wisc.edu

Course website: https://learnuw.wisc.edu

Class meetings: 1:00-2:15 pm Tuesdays and Thursdays in K6/120 CSC

Office hours: YZ: 2:30-3:30 pm Tuesdays and Thursdays or by appointment.
AL: 10:00-11:30 am Mondays and Wednesdays or by appointment


Discussion Section: 2:30-3:20 pm Wednesdays in G5/122 CSC.
Attendance is strongly advised. Discussion section is held for the purposes of working through practice problems, answering general questions, and returning and discussing graded homework assignments. The first discussion will be held on September 4th in G5/122 CSC.

Assignments: There will be homework assignments due every other week. The importance of the homework assignments cannot be overemphasized. Much of your learning will take place while working the homework problems. Homework assignments should be well organized and reasonably neat. It is required that you show your work in order to receive credit. Homework assignments are due at the start of lecture on Tuesday. Late homework turned in before the start of the discussion section on the following Wednesday (a week and a day later) will receive (at most) half credit. Homework received after the start of discussion section will receive no credit.

Exams: There will be an in-class midterm exam and final exam. The exams will cover lecture materials, readings, and homework material. The in-class midterm will take place on Tuesday, October 29th from 1:00-3:00pm. The in-class final exam will take place on Monday, December 16th from 10:05am-12:05pm.

Grading: The course grade will be based on homework (36%), attendance and participation in the lab sessions (14%) and the two exams (25% each).
Course Objectives for Biostatistics 551

By the end of the course, students will be able to:

1. Design and interpret graphical and tabular displays of public health data
2. Perform simple probability calculations based on the rules of probability
3. Use the binomial and Poisson distributions to calculate probabilities of events
4. Use the normal distribution to calculate probabilities of events
5. Explain and evaluate the assumptions required for the use of the binomial, Poisson and normal distributions
6. Explain the implications of the Central Limit Theorem in determining the sampling distribution of the mean
7. Explain the logic of statistical hypothesis testing and confidence intervals
8. Construct and interpret one-sample hypothesis tests and confidence intervals for
   a. the mean and variance of a normal distribution
   b. the proportion of a binomial distribution
   c. the rate of a Poisson distribution
   d. the mean of an arbitrary distribution using the Central Limit Theorem
9. Perform power and sample size calculations for one-sample hypothesis tests
10. Explain and evaluate the assumptions required for one-sample hypothesis tests and confidence intervals
11. Understand the relationship between confidence intervals and hypothesis tests
12. Construct and interpret two-sample hypothesis tests and confidence intervals for
   a. differences in means with paired data
   b. differences in means with independent samples (with and without the assumption of equal variances)
13. Explain and evaluate the assumption required for the paired and independent samples t-tests
14. Construct and interpret two-sample hypothesis tests for binomial proportions
15. Construct and interpret confidence intervals for the risk difference, relative risk and odds ratio in two-sample binomial problems
16. Perform power and sample size calculations for two-sample hypothesis tests*
17. Estimate and perform inference for simple linear regression models
18. Explain and evaluate the assumptions required for simple linear regression
Syllabus for Biostatistics 551

We will cover most of the material in Chapters 1-8 and 10 of the Rosner textbook. The order of topics is given below. The section(s) in the text corresponding to each topic are listed and should be read prior to lecture.

Descriptive statistics (about 2 lectures)
- Populations and samples
- Types of data
- Graphic methods
- Measures of location
- Measures of spread
  
  Section 2.8
  Sections 2.2-2.3
  Sections 2.4-2.6

Probability and distributional models (about 8 lectures)
- Elementary probability
- Elementary properties of random variables
- Binomial distribution
- Poisson distribution
- Normal distribution
- Central limit theorem
- Normal approximation to the binomial and Poisson
  
  Sections 3.1-3.7
  Sections 4.1-4.6
  Sections 4.8-4.9
  Sections 4.10-4.13
  Sections 5.1-5.6
  Section 6.5
  Sections 5.7-5.8

One-sample inference (about 8 lectures)
- Point estimation
- The logic of hypothesis testing
- Inference for the mean of the normal distribution
- Inference for the binomial distribution
- Inference for the Poisson distribution
- Power and sample size calculations
- Confidence intervals for the mean
- Hypothesis testing and confidence intervals
- Confidence intervals for binomial and Poisson
  
  Sections 6.5, 6.7-6.9
  Sections 7.1-7.2
  Sections 7.3-7.4
  Section 7.10
  Section 7.11
  Sections 7.5-7.6
  Sections 6.5
  Section 7.7
  Sections 6.8-6.9

Two-sample inference (about 7 lectures)
- Design aspects
- Inference for paired samples
- Inference for independent samples (equal variance)
- Underlying assumptions
- Inference for independent samples (unequal variance)
- Two-sample tests for binomial proportions
- Measures of effect for binomial data
- Sample size calculations
  
  Sections 8.2-8.3
  Sections 8.4-8.5
  Sections 8.6-8.7
  Sections 10.1-10.5
  Section 13.3
  Sections 8.10-8.11*

Simple linear regression and correlation (if time allows)
- Fitting regression lines - method of least squares
- Inference and prediction for regression
- Correlation
  
  Sections 11.1-11.3
  Sections 11.4-11.5
  Section 11.7-11.8