Biostatistics 551
Introduction to Biostatistics for Population Health
Fall 2009

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

Office hours: RG: 2:30-3:30 pm Tuesdays and Thursdays or by appointment.
JL: 1:00-2:00 pm Wednesdays and Fridays

Introductory Statistics with R (2nd edition) by Dalgaard

Discussion Section: 2:30-3:30 pm Wednesdays in 2112 HSLC (Computer Lab) or K6/120 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 9th in 2112 HSLC.

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 in the TA’s mailbox on the 7th floor of the WARF building at 3:00 pm on Friday. With prior approval of the instructor, homework assignments may be turned in on the following Monday for full credit. Late homework turned in before the start of the discussion section on the following Wednesday will receive (at most) half credit. Homework received after the start of discussion section will receive no credit.

Exams: There will be one in-class midterm exam and a take-home final exam. The exams will cover lecture materials, readings, and homework material. The in-class midterm will take place on Thursday, October 22nd during the regular class time. The final exam will be handed out in class on Thursday, December 16th and due on Thursday, December 17th at 4:00 pm.

Grading: The homework will count for 50% of the final grade; the midterm and the final exam will each count 25%.
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. Specific sections in the text and the order of topics are given below.

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

Probability and distributional models (about 9 lectures)
- Elementary probability: Sections 3.1-3.7
- Elementary properties of random variables: Sections 4.1-4.6
- Binomial distribution: Sections 4.8-4.9
- Poisson distribution: Sections 4.10-4.13
- Normal distribution: Sections 5.1-5.6
- Central limit theorem: Section 6.5
- Normal approximation to the binomial and Poisson: Sections 5.7-5.8

One-sample inference (about 7 lectures)
- Point estimation: Sections 6.5, 6.7-6.9
- The logic of hypothesis testing: Sections 7.1-7.2
- Inference for the mean of the normal distribution: Sections 7.3-7.4
- Inference for the binomial distribution: Section 7.10
- Inference for the Poisson distribution: Section 7.11
- Power and sample size calculations: Sections 7.5-7.6
- Confidence intervals for the mean and variance: Sections 6.5, 6.7
- Hypothesis testing and confidence intervals: Section 7.7
- Confidence intervals for binomial and Poisson: Sections 6.8-6.9

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

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