Biostatistics 551
Introduction to Biostatistics for Population Health
Fall 2015

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

Class meetings: 2:30-3:45 pm Tuesdays and Thursdays in Natatorium 1190

Office hours: MP: Wednesday 1:15-2:15, or by appointment
WC: Monday and Friday 2-3pm, or by appointment

Text (required): Basic & Clinical Biostatistics (4th edition) by Dawson and Trapp

Lab Sections: Main lab: 2:30-3:20 pm Wednesdays in HSLC 2121
Alternative lab: 11-11:50 am Mondays in Room 1105 Pharmacy School (for Pharmacy/MPH students)

Attendance and participation in the laboratory sessions is required. In a typical lab session, students will be assigned to small groups to work through a lab exercise. If you are unable to attend a lab session, please notify the instructor in advance to make alternative arrangements.

Software: Main lab will occasionally be using SAS (available in the lab and free through UW). Alternative labs, and some lecture examples may use NCSS (provided with the book). Although software use will be limited, it is helpful to try out SAS or NCSS with the data provided with the book. Data sets are also uploaded to Learn@UW in SAS, NCSS and text formats.

Assignments: There will be six homework assignments due at the start of the lab session on the following Wednesdays: 9/23, 9/29, 10/21, 11/11, 12/2 and 12/16. 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. Only essential computer output should be turned in, and it must be accompanied by a written explanation of what the output shows.

Homework will be returned to students with comments and an indicator whether it needs to be corrected or redone. Once appropriately corrected in a timely manner, homework will receive full credit. Late homework received before the homework solutions are released will be accepted, but will receive (at most) half credit.

Exams: There will be two in-class midterm exam and final exam. The exams will cover lecture materials, readings, and homework material. The in-class midterms will take place on Thursday October 1, and Thursday November 19 during lecture time. The in-class final exam will take place on Friday, December 18th from 5:05-7:05pm.
Quizzes: There will be a brief anonymous quiz at the beginning of each lab. (Use an alias for name.) It will be graded and available for pick-up either at end of lab or at next lecture.

Grading: The course grade will be based on homework (25%), attendance and participation in the lab sessions (10%), two midterm exams (20% each) and final (25%). Quizzes are only for self assessment and overall monitoring - and not counted in grade.

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

1. Design and interpret graphical and tabular displays of public health and clinical 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. Explain and evaluate the assumptions required for the use of the binomial, Poisson and normal distributions
5. Use the normal distribution to calculate probabilities of events
6. Understand the concepts of sample, population and sampling distribution
7. Have a basic understanding of the properties of a good estimator
8. Explain the implications of the Central Limit Theorem in determining the sampling distribution of the mean
9. Explain the logic of statistical hypothesis testing and confidence intervals
10. 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
11. Perform power and sample size calculations for one-sample hypothesis tests
12. Explain and evaluate the assumptions required for one-sample hypothesis tests and confidence intervals
13. Understand the relationship between confidence intervals and hypothesis tests
14. 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)
15. Explain and evaluate the assumption required for the paired and independent samples t-tests
16. Construct and interpret two-sample hypothesis tests for binomial proportions
17. Construct and interpret confidence intervals for the risk difference, relative risk and odds ratio in two-sample binomial problems
18. Perform tests for continuous outcomes and proportions between multiple groups
19. Perform power and sample size calculations for two-sample hypothesis tests
   Estimate and perform inference for simple linear regression models and correlations
Syllabus for Biostatistics 551

The course will closely follow the book starting with Chapter 3. Please read Chapters 1 and 2 for background. A supplemental chapter will be posted for regression analysis (starting end of November.)

September 3:  Descriptive statistics for continuous measures in tables and graphs
                Chapter 3, pages 23-40

September 8:  Descriptive statistics for numbers of events, and measures of association
               Chapter 3, pages 40-44, 47-54

LAB:          Looking at descriptive tables from papers.

September 10: Finish measures of association. Introduction to probability
               Chapter 3, pages 63-68

September 15: Rules of probability
               Chapter 3, pages 63-68

LAB:          Working with measures of association

September 17: Samples and populations, statistics and parameters
               Chapter 4, pages 68-72

September 22: Binomial, Poisson distributions.
               Chapter 4, pages 72-76.

LAB:          Drawing samples

September 24: The normal distribution.
               Chapter 4, page 76-78. (plus supplemental material)

September 29: Review

LAB:          Working with probability (in HSLC 1222)

October 1:   MIDTERM 1

October 6:   Sampling distributions
               Chapter 4 pages 80-88

LAB:          Studying the behavior of estimators across samples

October 8:   Central limit theorem, good estimators.
               Chapter 4, pages 82-85, page 89, supplemental material.
October 13: Inference - confidence intervals and tests of significance.
           Chapter 4, pages 85-92

LAB: Tables from journals reporting inference

October 15: Inference on continuous measures in one group
           Chapter 5, pages 93-117

October 20: One sample inference on continuous measures continued.
           Chapter 5, pages 93-117.

LAB: More on interpreting and assessing inference in the literature.

October 22: One sample inference on proportions
           Chapter 5, pages 118-127

October 27: More on one sample inference on proportions, inference on rates
           Chapter 5, pages 118-127

LAB: More on interpreting and assessing inference in the literature

October 29: Two sample inference on means
           Chapter 6, pages 135-146

November 3: Two sample inference on means
           Chapter 6, pages 135-146

LAB: More on interpreting and assessing inference in the literature.

November 5: Two sample inference on proportions via Z and chi-square
           Chapter 6, pages 146-154

November 10: Finding the appropriate sample size
             Chapter 5, pages 127-131, pages 154-158

LAB: Sample size calculation

November 12: Inference on multiple proportions, relative risks and odds ratios
             Chapter 7, page 182-185, Chapter 8, pages 200-201

November 17: Review

LAB: Interpreting and assessing inference in the literature

November 19: Midterm 2
November 24: Stratified analyses of risks, rates and odds ratios
Chapter 3, pages 44-46. Chapter 9, pages 234-236
Supplemental material

LAB: Wednesday Lab Cancelled due to Thanksgiving

December 1: Regression analysis
Supplemental material, (Chapter 8, pages 202-214)

LAB: Relating regression analysis to methods for inference on means

December 3: Regression analysis
Supplemental material, (Chapter 10, pages 212-214)

December 8: Regression analysis
Supplemental material, (Chapter 10, pages 245-253)

LAB: Interpreting regression analyses

December 10: More on correlations, inference on correlations
Chapter 8, pages 192-200, 214-215

December 15: Review