STA 580-001/002: Biostatistics I — Fall 2007
Course Information and Syllabus Document — Dr. Charnigo

Contact information

Instructor: Dr. Richard Charnigo
Office: 203-B College of Public Health
Phone: 859.257.5678 x 82072
E-Mail: richc@ms.uky.edu, RJCharn2@aol.com
Home Page: www.ms.uky.edu/~richc
Office Hours: 2:00 to 3:00 p.m. on Mondays, except 03 September and 01 October

Teaching Assistant: Mr. Benjamin Hall
Office: 857 Patterson Tower
Phone: 859.257.9202
E-Mail: bhall2@ms.uky.edu
Office Hours: TBA at the first class meeting

Biostatistics Department Walk-In Help: Ms. Erin Abner
Office: TBA at the first class meeting
Office Hours: TBA at the first class meeting

About this course

Course Description: STA 580 introduces the basic principles of biostatistics used in the univariate analysis of data commonly encountered in biomedical studies.

Objectives:
1. You will learn the elements of hypothesis testing, including power, sample size, and tests of significance.
2. You will learn methods for analyzing data from one-way and two-way layouts, including multiple comparisons and contrasts.
3. You will learn the analysis of contingency tables, including related concepts of relative risks and odds ratios.
4. You will be introduced to the concepts of regression modeling and correlation.
5. You will be introduced to the analysis of time-dependent data subject to right censoring.

College of Public Health Terminal Objectives in Biostatistics: The last two pages of this document indicate the College of Public Health terminal objectives in biostatistics and their associated competencies. The entries in the third column indicate the minimal level of attainment for someone who has successfully completed STA 580: a "1" represents awareness, a "2" represents knowledgeability, and a "3" represents proficiency. Your personal level of attainment upon completion of STA 580 and upon completion of your degree program may be higher.

Relationship to Public Health Degree Program Goals: This course relates directly to the accomplishment of the educational program goals for the M.P.H. degree, which are described in the most current student handbook. Please reference the educational program goals throughout the semester, as they will provide a framework for this course and will contribute to your preparation for successfully completing other degree program requirements (e.g., capstone and practicum).

Textbook: Rosner, Bernard (2005). *Fundamentals of Biostatistics*, sixth edition. Belmont, CA: Thomson.

Prerequisite: MA 109 (or equivalent).

Course policies and logistics

Class Meetings: Lectures will take place on Thursdays from 3:30 to 5:20 p.m. in NURS 115 (except 22 November). Section 001 laboratories will take place on Thursdays from 6:00 to 7:50 p.m. in NURS 602J (except 30 August, 18 October, 22 November, 06 December) Section 002 laboratories will take place on Mondays from 3:30 to 5:20 p.m. in NURS 602J (except 03 September, 22 October, 26 November).

E-mail Memoranda and Course Materials: I will be sending e-mail memoranda regularly to distribute course materials, post grade information (for those who request it), and make announcements. Course materials will also be available from my home page, (www.ms.uky.edu/~richc). Please inform me if you are not receiving the memoranda.

Written Assignments: There will be six written assignments for you to prepare in laboratory and outside of class, tentatively due at 5:20 p.m. on the Thursdays of 13 September, 27 September, 11 October, 01 November, 15 November, and 06 December. You are encouraged to work in self-selected groups of two or three, in which case it suffices to hand in one copy of the assignment for the group; however, you may work individually if you prefer. Many items on the written assignments will require the use of statistical software. Do not worry if you have little or no prior experience with statistical software, as you will become familiar with SAS during laboratory. Written assignments are to be submitted in hard copy and to me in person, unless you have obtained permission to use an alternative mechanism for submission.

Examinations: There will be an in-class midterm examination from 3:30 p.m. to 5:20 p.m. on Thursday 18 October. There will be a final examination at the University's designated time from 3:30 to 5:20 p.m. on Thursday 13 December. The examinations are open-book in the sense that you may refer to any printed materials that you care to bring, including the textbook and your notes. However, you may not share printed materials or calculators during examinations, you may not use a computer or otherwise go “online” during examinations, and there is to be no collaboration on examinations.

Grading: Your grade for the course will be determined by the written assignments (30%), the midterm examination (35%), and the final examination (35%). There may be opportunities to earn bonus points. The cutoff for an "A" will be no higher than 90%, the cutoff for a "B" will be no higher than 75%, and the cutoff for a "C" will be no higher than 60%.

Late Policy: Cases involving any of the following will be handled individually: University-excused absences, University-prescribed academic accommodations, recommendations from an appropriate Dean or the Ombud. Otherwise, a written assignment may be submitted up to 24 hours late, subject to a 25% penalty; such a late submission should be left under my office door (CPH 203-B) and noted in an e-mail to me (richc@ms.uky.edu) that same day.

Makeup Policy: Cases involving any of the following will be handled individually: University-excused absences, University-prescribed academic accommodations, recommendations from an appropriate Dean or the Ombud, legitimate scheduling difficulties of which I am informed at least seven days in advance. Otherwise, a makeup examination for an unexcused absence will be available within 120 hours of the scheduled examination, at a mutually acceptable time and subject to a 25% penalty; a request for such a makeup examination should be noted in an e-mail to me (richc@ms.uky.edu) as soon as possible.

Accommodations: If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (www.uky.edu/TLC/grants/uk_ed/services/drc.html). If you have not already done so, please register with the Disability Resource Center (Room 2 Alumni Gym, 257-2754, jkarnes@uky.edu) for coordination of campus disability services available to students with disabilities.

Academic Honesty: The Department of Statistics, Department of Biostatistics, College of Arts and Sciences, College of Public Health, and the University of Kentucky place a premium on academic honesty. Please refer to the University of Kentucky Student Rights and Responsibilities document (www.uky.edu/StudentAffairs/Code/part2.html).

Unforeseen Contingencies: In the unlikely event that an unforeseen contingency requires additional course policies, you will be promptly notified in an e-mail memorandum.

Tentative schedule

Lecture **Laboratory**	Lecture topics (Relevant sections of the textbook) **Laboratory agenda (Approximate time allocation)**
R 08/23 **R 08/23 or M 08/27**	Numerical and graphical summaries of data (2.1 - 2.8) **Getting started with SAS (~70%), working on Assignment 1 and asking TA questions individually (~30%)**
R 08/30 **NO LABORATORY**	Probability; conditional probability; Bayes' theorem (3.1 – 3.7)
R 09/06 **R 09/06 or M 09/10**	Random variables; sums of random variables and the Central Limit Theorem; population and sample (4.1 – 4.9, 5.1 – 5.7, 6.2) **Getting started with SAS (~50%), working on Assignment 1 and asking TA questions individually (~50%)**
R 09/13 **R 09/13 or M 09/17**	Point and interval estimation for a mean, a variance, and a proportion (6.5, 6.7, 6.8) **Some SAS pointers (~30%), working on Assignment 2 and asking TA questions individually (~50%), TA-led group discussion of Chapter 6 methods (~20%)**
R 09/20 **R 09/20 or M 09/24**	Introduction to hypothesis testing; test concerning a mean; power and sample size (7.1 – 7.6) **Some SAS pointers (~30%), working on Assignment 2 and asking TA questions individually (~50%), TA-led group discussion of Chapter 7 methods (~20%)**
R 09/27 **R 09/27 or M 10/01**	Relating estimation to testing; test concerning a variance; test concerning a proportion (7.7, 7.9, 7.10) **Some SAS pointers (~20%), working on Assignment 3 and asking TA questions individually (~60%), TA-led group discussion of Chapter 7 methods (~20%)**
R 10/04 **R 10/04 or M 10/08**	Paired and unpaired tests concerning two means; test concerning two variances (8.1 – 8.7) **Some SAS pointers (~20%), working on Assignment 3 and asking TA questions individually (~60%), TA-led group discussion of Chapter 8 methods (~20%)**
R 10/11 **R 10/11 or M 10/15**	Outliers; power and sample size; test concerning two proportions; chi-square test for association (8.9 – 8.10, 10.1 – 10.2, 10.6) **Working on Assignment 4 and asking TA questions individually (~80%), TA-led group discussion of Chapter 10 methods (~20%)**
R 10/18 **NO LABORATORY**	*Midterm examination (covers Lectures 1 through 7)*

R 10/25 **R 10/25 or M 10/29**	Scales of measurement; sign test; signed rank test; rank sum test (9.1 – 9.4) **Working on Assignment 4 and asking TA questions individually (~80%), TA-led group discussion of Chapter 9 methods (~20%)**
R 11/01 **R 11/01 or M 11/05**	One-way layouts and the analysis of variance; multiple comparisons and linear contrasts (12.1 – 12.4) **Working on Assignment 5 and asking TA questions individually (~80%), TA-led group discussion of Chapter 12 methods (~20%)**
R 11/08 **R 11/08 or M 11/12**	Kruskal-Wallis test and Dunn procedure for one-way layouts; two-way layouts and the analysis of variance (12.7, 12.6) **Working on Assignment 5 and asking TA questions individually (~80%), TA-led group discussion of Chapter 12 methods (~20%)**
R 11/15 **R 11/15 or M 11/19**	Epidemiologic study design; relative risks and odds ratios (13.1 – 13.3) **Working on Assignment 6 and asking TA questions individually (~80%), TA-led group discussion of Chapter 13 methods (~20%)**
NO LECTURE **NO LABORATORY**	
R 11/29 **R 11/29 or M 12/03**	Simple linear regression; least squares principle; inferences about coefficients; estimation and prediction; correlation (11.1 - 11.8) **Working on Assignment 6 and asking TA questions individually (~80%), TA-led group discussion of Chapter 11 methods (~20%)**
R 12/06 **NO LABORATORY**	Survival function; censoring; Kaplan-Meier estimation; log-rank test (14.8 - 14.10)
R 12/13	*Final examination (emphasizes Lectures 8 through 14)*

Competency attainment

Terminal Objectives in Biostatistics	**Competencies**	**Level of Attainment**
1. Explain basic principles of statistical estimation and inference.	a. Conceptualize sample measurements as realizations of random variables; b. Conceptualize estimates of population parameters as realizations of random variables; c. Construct confidence intervals for population parameters; d. Formulate statistical hypothesis tests concerning population parameters; e. Quantify the power of some basic hypothesis tests; f. Determine appropriate sample sizes for some basic hypothesis tests; g. Articulate the relationship between confidence intervals and hypothesis tests.	2 2 2 2 2 2 2
2. Identify and use standard experimental and sampling designs.	Be conversant in the use of the following: a. designing and analyzing a two way lay out with interaction; b. designing and analyzing experiments with repeated measures; c. designing and analyzing simple cross over experiments; d. adjusting for the effects of confounders and/or stratifying variables; e. explaining the biostatistical components of a clinical trial including large prevention trials in public health and community intervention studies; f. monitoring the progress of a disease over time using time series analysis or disease surveillance methods; g. applying spatial statistics to a problem in public health that has a geographic component.	 1
3. Understand elementary probability concepts used in Public Health.	a. Characterize conditional probability both mathematically and intuitively; b. Express the specificity of a diagnostic test as a conditional probability; c. Express the sensitivity of a diagnostic test as a conditional probability; d. Construct and interpret the receiver operator curve of a diagnostic test; e. Apply Bayes' Theorem to calculate the predictive positive value of a diagnostic test from the specificity, sensitivity, and disease prevalence; f. Describe the binomial probability model and the contexts in which it arises; g. Describe the Poisson probability model and the contexts in which it arises; h. Employ Markov chains to describe random phenomena with a special probabilistic structure.	1 1 1
4. Apply statistical methods commonly encountered in univariate data analysis.	a. Use descriptive statistics effectively; b. Perform paired and independent t-tests to compare means; c. Calculate chi squared statistics to compare proportions as well as construct confidence intervals for odds ratios and relative risk; d. Analyze data obtained from one way ANOVA designs (including multiple comparisons and contrast); e. Fit a simple linear regression model; f. Construct Kaplan Meier curves for right censored observations and compute the log rank statistic to compare these curves between two groups.	2 2 2 2 2 2

5. Apply statistical methods commonly encountered in multivariate data analysis.	a. Identify and apply appropriate multivariate statistical models including multiple linear regression, logistic regression, Poisson regression, proportional hazards regression, and mixed models; b. Critically interpret the outcomes of the multivariate analysis; c. Conduct graphical and analytical model diagnostics, and recommend remedies based on the diagnostics; d. Integrate the outcomes of multiple studies using meta analysis.	
6. Gather, organize, and manage health survey data.	a. Design a health survey instrument; b. Assess instrument/item reliability and validity; c. Draw and analyze a simple random sample of measurements; d. Implement and analyze more complex survey designs including stratified samples, clustered samples, and multistage samples; e. Process incomplete data using imputation; f. Adopt an appropriate weighting scheme for observations in a health survey.	1
7. Effectively use statistical software to collect, manage, and analyze Public Health data.	a. Master the use of SAS analyst, a click and point statistical software; b. Acquire the skills necessary to write code for SAS programs; c. Understand the principles of data acquisition, verification, and validation; d. Become skilled at editing, combining, and linking data sets; e. Learn the fundamentals of data manipulation and analysis; f. Efficiently create tables, graphs, and reports; g. Learn the fundamentals of the SAS macro facility; h. Learn to use nQuery Advisor, a sample size calculation software program.	1
8. Critically review biostatistical issues arising in Public Health literature.	a. Demonstrate they can select appropriate statistical methods for the problem; b. Resolve controversial issues associated with competing solutions in biostatistics for the same problem (discussing strengths and weaknesses).	1 1
9. Interpret and clearly express findings.	a. Interpret univariate statistical models; b. Interpret complex multivariate statistical models; c. Express their findings clearly both verbally and in writing.	2 1
10. Integrate principles of biostatistics in the practice of Public Health.	a. Use statistical methodology to analyze public health data; b. Recognize the potential for statistics to aid in the development of guidelines and policies, the implementation and management of programs, and the evaluation of programs.	1