GRADUATE SCHOOL of ARTS and SCIENCES at COLUMBIA UNIVERSITY MEDICAL CENTER

G8012 Statistics for the Basic Sciences

Spring 2009

COURSE DESCRIPTION

(Bio)statistics is essential to ensuring that findings and practices in public health and biomedicine are supported by reliable evidence. This course covers the basic tools for the collection, analysis, and presentation of data. Central to these skills is assessing the impact of chance and variability on the interpretation of research findings and subsequent recommendations for public health practice and policy. Topics covered include: general principles of study design; estimation; hypothesis testing; several methods for comparison of discrete and continuous data including chi-square test of independence, t-test, ANOVA, correlation, and regression.

COURSE LEARNING OBJECTIVES

Students who successfully complete this course will be able to:

- Assess data sources and data quality for the purpose of selecting appropriate data for specific research questions;
- Describe basic principles and the practical importance of key concepts from probability and inference, inductive verses deductive reasoning, including random variation, systematic error, measurement error, hypothesis testing, type I and type II errors, and confidence bounds;
- Apply numerical, tabular, and graphical descriptive techniques commonly used to characterize and summarize public health data;
- Translate research objectives into clear, testable statistical hypotheses;
- Identify appropriate statistical methods to be applied in a given research setting, apply these methods, and acknowledge the limitations of those methods;
- Evaluate computer output containing statistical procedures and graphics and interpret it in a public health context; and
- Differentiate between quantitative problems that can be addressed with standard, commonly used statistical methods and those requiring input from a professional biostatistician.

INSTRUCTOR

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TEACHING ASSISTANTS

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CLASS MEETINGS
Lectures: Thursdays 9am-10:50am in HSC 303
Labs: *TBA*
Final Exam: *TBA*

TEXT AND MATERIALS

- **Pagano, Marcello and Kimberlee Gauvreau. Principles of Biostatistics. 2nd ed. Duxbury, 2000.**

- **A scientific calculator is necessary.** You don't need anything fancy; a calculator with log and exponential functions will suffice.

- *SUPPLEMENTARY TEXT (optional)*
  Gonick, Larry and Woollcott Smith. The Cartoon Guide to Statistics. HarperCollins, 1993.

- Class material will be posted on http://courseworks.columbia.edu. You will be responsible for printing all material for each class.

ASSESSMENT OF LEARNING

Final Exam	35%
Homework	35%
Quizzes	20%
Labs	10%

POLICIES
Quizzes and the final exam are closed-book and closed-notes. There are no make-up quizzes. You must inform me at least a week in advance of the final exam if you have an extenuating circumstance that will not allow you to be present for the exam. Should this be the case, you must provide documented proof and a make-up exam will be scheduled accordingly.

Homeworks are essential to mastering statistical concepts. Late homeworks are not accepted under any circumstance. You are encouraged to study in groups but you must turn in your own original homework. It is absolutely necessary to show your work neatly and completely so that you may receive full credit and proper feedback. Please make a copy your homework before you turn it in if you would like to study from it; due to the fast-paced nature of this course, your homework may not be graded before an exam.

Unit 1: Principles of Statistical Inference

Date	Topics	Pagano References
3/5	Introduction: Statistics and Research Research Design, Types of Data & Sampling Theory Descriptive Statistics: Tables, Graphs and Numerical Measures	 Ch 2.1, 22.1 Ch 2.2, 2.3, 3
3/12	Basic Probability Concepts The Binomial & Poisson Probability Distributions	Ch 6 Ch 7.2, 7.3 Appendix A.1, A.2
3/13*	**HOMEWORK 1 DUE** *STATA Lab 1*	
3/26	The Normal Probability Distribution and the Standard Normal Table Sampling Distributions & the Central Limit Theorem	Ch 7.4 Appendix A.3 Chapter 8
4/2	Student's t-distribution Intro to Unit 2 Estimation (confidence intervals) Intro to Hypothesis Testing	Ch 9.3 Ch 9.1, 9.2 Chapter 10
4/2*	**HOMEWORK 2 DUE**	

Unit 2: Inferential Procedures

Date	Topics	Pagano References
4/9	Describing Mean Differences in one, two and more than two groups Constructing confidence intervals Hypothesis Testing Power and sample size considerations Replication in Experiments	Chapters 10, 11 and 12
4/10*	**HOMEWORK 3 DUE** *STATA Lab 2*	
4/16	Inference on Proportions: Confidence intervals Hypothesis testing of one and two proportions Chi-square test of independence Odds ratios	Chapter 14 Ch 15.1 Ch 15.3
4/23*	**HOMEWORK 4 DUE**	
4/23	Correlation Simple Linear Regression Model Fitting	Ch 17.2 Ch 18.1, 18.2
4/30	Other considerations: Non-parametric methods Logistic Regression	 Ch 13.3 Ch 20.1, 20.2
5/1*	**HOMEWORK 5 DUE** *STATA Lab 3*	
5/7	**FINAL EXAM**	

* Tentative date. Subject to change.