

NUTB250 STATISTICAL METHODS FOR HEALTH PROFESSIONALS

Tufts University, Friedman School of Nutrition Science and Policy

Syllabus updated on August 31, 2017

FALL 2017

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Credit 1.0

Texts books and supplies

Required: Statistics at Square One by Michael J. Campbell, Wiley-Blackwell, 11th edition, ISBN-10:* 1405191007
ISBN-13:* 978-1405191005

Required: Statistics at Square Two by Michael J. Campbell, Wiley-Blackwell; 2nd edition, ISBN-10: 1405134909,
ISBN-13: 978-1405134903

Errata for Statistics at Square Two...

https://www.shef.ac.uk/polopoly_fs/1.43817!/file/Statistics-at-Square-Two.pdf

Optional: Statistics for Health Care Professionals: An Introduction by Dr. Ian Scott and Dr. Deborah Mazhindu, by
Ian Scott & Deborah Mazhindu

ISBN-13: 978-1446208939 ISBN-10: 1446208931 Edition: Second

Optional: Basic Biostatistics: Statistics for Public Health Practice, 2nd edition, by B. Burt Gerstman, Jones & Bartlett
Publishers; ISBN-13: 978-1284036015 ISBN-10: 1284036014

You might want to purchase the following optional book (see below). There are many online web pages you can access for free to obtain information about Stata so it is not necessary to buy this book. But, in case anyone is interesting in getting a book about Stata, I'm including a recommendation ...

Statistics with STATA: Version 12, by Lawrence C. Hamilton, Publication Date: **April 15, 2012** ISBN-10: **0840064632**, ISBN-13: **978-0840064639**

(The new updated version 14 of this text book has not been published yet so you might want to wait a while to see if it is available later this fall or spring).

Required Supplies: Inexpensive solar powered scientific calculator such as Casio Scientific Calculator (FX260SLRSC) http://www.amazon.com/Casio-FX260SLRSC-Scientific-Calculator/dp/B000Q5XTBQ/ref=sr_1_1?ie=UTF8&qid=1371753352&sr=8-1&keywords=casio+calculator+solar

There are also free scientific calculator apps for Android and Apple phones and tablets ...

Real Calc (Android) ...

<https://play.google.com/store/apps/details?id=uk.co.nickfines.RealCalc>

Rotate Apple Calculator for iPhone ...

<http://osxdaily.com/2011/12/29/iphone-scientific-calculator/>

Calc Made Easy (Apple) ...

<https://itunes.apple.com/us/app/calcmadeeasy-free-scientific/id401230894?mt=8>

CamScanner (Phone app for scanning documents with an Apple or Android phone) This app is quite useful for scanning hand calculations or other notes you wish to save as a pdf file.

<http://www.appbrain.com/app/camscanner-phone-pdf-creator/com.intsig.camscanner>

<https://itunes.apple.com/us/app/camscanner-free-pdf-document/id388627783?mt=8>

Course Description and Goals

Understanding biostatistics and social science statistical concepts and methodologies are important skills for scientists, administrators, and policy-makers. In this course students critically evaluate, compare, interpret, judge, summarize and explain statistical results published in research articles in health and nutrition journals from the region and around the world that are influencing the practice of nutrition science, policy and research. *The prerequisite to this course is a university level math/statistics course.*

Course Objectives/Outcomes

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

- explain and evaluate statistical results presented in health and nutrition journals.
- judge how biostatistics and social science statistics concepts and methodologies are interpreted and presented in published research articles.
- describe how researchers utilize experimental designs, perform descriptive statistics, perform hypothesis testing, use nonparametric tests, use t tests, utilize OLS regression modeling, construct and interpret graphical displays, use analysis of variance and multiple comparisons.

Assignments, Exams and Grade Evaluation

Each week students will view 1 or 2 online lessons, do readings and take a quiz to review the material and to assess their understanding of the material. The quizzes are "open book". That means you are allowed to review the

material and consult the books while you are taking each quiz. But, you must work alone on the quiz and not ask anyone for the answers. Performance on the weekly online quizzes will constitute 20% of the final course grade.

Mastery learning techniques will be used for examinations and course assignments. Students will take online exams after a few course lessons. For each exam you will first be given a practice exam that does not count toward your grade. You can learn from your mistakes on the practice exam and review the material for any questions that you got wrong. After taking the practice exam, you will take a real exam. If you score lower than 80% correct, you will be expected to review your mistakes and take another version of the exam. If you score higher than 80%, you can also take another version of the exam but it is optional. The higher of the two scores on the real exams is the one that counts toward your final course grade. Each exam set consists of a practice exam and two versions of the real exam. There will be 3 sets of exams. Each set of exams covers a different set of material so none of the exams is cumulative.

You must work alone on the exams and not ask anyone for the answers. The exams are NOT open book. Once you start the exam, please do not consult textbooks or the online lessons. The purpose of the exams is to test you to see how much you have learned.

There will also be 3 graded homework assignments. You will be allowed to resubmit each assignment once for regrading so you can learn from your mistakes. Feedback will be provided within 1.5 weeks of submitting homework. You must work alone on the homework assignments and not ask anyone for the answers. The homework assignments are "open book". You can use your books, notes and online materials while working on the homework assignments.

It is **important** to stay on schedule and turn in your homework assignments on time! At the discretion of the instructor, points will be subtracted from grades earned on homework assignments and exams that are not completed on time. If you would like to move through the online lessons a week or two ahead of schedule you may do so. Getting lessons done ahead of time is a great way to manage your time. It allows you to have more free time for work in other courses or work obligations when your life gets busy.

In addition to the graded homework assignments, there are several REQUIRED exercises. These exercises are required but will not be used to calculate your final grade in the course. We will give you feedback on your performance on the exercises but you will not be graded on the exercises. You must complete them in order to receive a grade for the course.

Here is a list of the required exercises ...

Lesson 2 ...

Interpreting research articles exercise

The effects of vitamin C supplementation on serum concentrations of uric acid by Han-Yao Huang, Lawrence J. Appel, Michael J. Choi, Allan C. Gelber, Jeanne Charleston, Edward P. Norkus, and Edgar R. Miller, III
ARTHRITIS & RHEUMATISM, Vol. 52, No. 6, June 2005, pp 1843–1847

Lesson 3 ...

Identifying mild and extreme outliers exercise

Lesson 10 ...

Pearson's Correlation Exercise

Lesson 12 ...

Chi-Squared Test Exercise

Lesson 11 ...

Simple linear regression exercise

Lesson 13 ...

Multiple regression exercise

Lesson 14

Statistical approaches exercise

Final grade = (average of weekly quiz grades*.2)+(average of highest exam grades * .6) + (average of highest homework grade submissions*.2)

	Open Book	Closed Book
Quizzes	x	
Homework assignments	x	
Exercises	x	
Exams		x

"Open book" means you can use your notes, online lessons but must do the work by yourself.

"Closed book" means you should not consult your notes, online lessons or books and must do the work by yourself.

Communication Policy

Students are expected to maintain regular contact with the course instructor and check email and the course web page regularly. After taking each practice test and receiving the answer key, students are **strongly encouraged** to schedule and participate in group study sessions with the other students via Skype (if possible). Conference calls can be created in Skype so you can have a virtual meeting at a convenient time. Group study is very helpful. When you have to explain a concept or procedure to another student, your understanding of the information is reinforced and deepened.

Technical Support for Online Courses and Programs @ Friedman

Online course support is provided by Friedman support staff and/or IT Support. Please do not contact faculty or TA's for technical support.

- **Telephone:** (617) 627-3376
- **Email:** canvas@tufts.edu
- **Hours:** 24 hours a day, seven days a week.

When reporting a problem, please include:

- The name and number of your online course (e.g. "NUTB 205 Online")
- Your operating system and browser
- A detailed description of the problem

This information will expedite the troubleshooting process. If you are sending a support request via email, please use your Tufts email address.

For some of your exams and homework assignments you will need a scanner, digital camera or camera phone so you can write out your answers on paper and then scan or photograph it and send us the image for grading. I'll talk more about this procedure at the residency.

Miscellaneous notes:

Optional: Students needing mathematics review before the course begins can make use of the following optional resources ...

Columbia Math primer ...

http://www.columbia.edu/itc/sipa/esp/math_review/MathPrimer.pdf

Math review test questions ...

<http://www.testprepreview.com/modules/mathematics1.htm>

http://www.testprepreview.com/gre_practice.htm

You can also view these videos ...

<http://www.youtube.com/watch?v=7hA-vTeOMAQ>

<http://www.youtube.com/watch?v=ahwIw4OCEAc&feature=related>

<http://www.youtube.com/watch?v=NCixeuWvLS0&feature=related>

<http://www.youtube.com/watch?v=EpX9ohiti6o&feature=related>

<http://www.youtube.com/watch?v=a329hvX8yDA&feature=related>

<http://www.youtube.com/watch?v=Th8TBYEuRgc&feature=related>

Required: Stata software IC version 15 (Intercooled Stata) can be ordered at discount price 198.00 USD. Purchasing Stata after you are no longer a student would be far more expensive (about 1400 USD).

Required: Microsoft Office software or free office software called "Open Office"

<http://www.openoffice.org/download/>

Academic Calendar – Fall semester 2017

Fall 2017 Classes Begin

Tuesday, September 5, 2017

MNSP Boston Fall 2017 residency begins
 Last day of classes for the semester
 Final Examination period ends

Monday, September 25, 2017
 Monday, December 11, 2017
 Thursday, December 21, 2017

NUTB250: Online Topics, Homework Assignments and Exams

Course Schedule and assignments: This schedule is subject to modification at the instructor's discretion. **Assignment dates are shown below for the weekly comprehension quizzes, 3 homework assignments and 3 sets of exams.**

DATE(S) & LOCATION	WEEK	TOPIC OR CLASS TITLE	ASSIGNMENTS & ACTIVITIES	LECTURER
Online	1	Introduction and course overview Lesson 1: Introduction and overview of statistical methods for nutrition (9/5-9/10)	Read syllabus carefully Read chapter 1 in SS1 and review study guide for chapter 1 Optional reading: Statistics for Health Care Professionals (chapters 1-3) View online lesson #1 & take online quiz (9/10)	Robert Houser
Online	2	Lesson 2: Frequency distributions, measures of central tendency and variability (9/11-9/17)	Read chapter 2 in SS1 and review study guide Optional: read chapter 6 in Statistics for Health Care Professionals View online lesson #2 & take online quiz (9/17)	Robert Houser
Online	3	Lesson 3: Graphical displays of data and exploratory data analysis (9/18-9/24)	Review chapter 1 in SS1 and review study guide Read Descriptive Statistics and Graphical Displays by Martin G. Larson http://circ.ahajournals.org/content/114/1/76.full.pdf+html Optional: Read chapter 7 in Statistics for Health Care Professionals View online lesson #3 & take online quiz (9/24)	
Residency	4	Lesson 4: Populations, samples, random assignment, and generalizability of research findings (9/25-10/1) Introduction to Stata programming (residency)	Read chapter 4 in SS1 and review study guide Optional: Read chapters 8-10 in Statistics for Health Care Professionals View online lesson #4 & take online quiz by	Robert Houser

			<p>10/1 or by 10/5 if you are busy with residency</p> <p>Homework Assignment #1 due on 9/27 via email)</p> <p>Take practice version of exam 1 during residency</p> <p>Take exam 1 version 1 (9/29)</p> <p>Take exam 1 version 2 (if necessary) TBA</p>	
Online	5	Lesson 5: Central limit theorem and confidence intervals (10/2-10/8)	<p>Review chapter 4 in SS1 and read chapter 5 in SS1</p> <p>Review study guide</p> <p>Optional: Read chapter 10 in Statistics for Health Care Professionals</p> <p>View online lesson #5 & take online quiz (10/8)</p>	Robert Houser
Online	6	Lesson 6: Confidence Intervals for the difference between means and percentages (10/9-10/15)	<p>Review chapter 5 in SS1 for lecture A and read chapter 6 for lecture B</p> <p>Review ch. 5 and 6 study guides</p> <p>View lectures A and B in the lesson #6 folder and take online quiz (10/15)</p>	Robert Houser
Online	7	Lesson 7: Nonparametric statistics Lesson 12: Chi-squared tests (10/16-10/22)	<p>Read chapter 10 in SS1 and review study guide</p> <p>Read ch. 8 in SS1 and review study guides</p> <p>Optional: Read chapter 14 in Statistics for Health Care Professionals</p> <p>View online lesson #7 & take online quiz on Saturday (10/21)</p> <p>View online lesson #12 & take online quiz (10/22)</p>	Robert Houser
Online	8	Lesson 8: Students t-test for independent and related samples (10/23-10/29)	<p>Read chapter 7 in SS1 and review study guide</p> <p>Optional: Read chapter 11 in Statistics for Health Care Professionals</p>	Robert Houser

			<p>Homework assignment #2 - due date: 10/28</p> <p>View online lesson #8 & take online quiz (10/29)</p> <p>Take Exam Two practice exam</p>	
Online	9	Lesson 9: Oneway analysis of variance and post hoc tests of statistical significance (10/30-11/5)	<p>Read ... http://udel.edu/~mcdonald/statanovaintro.html</p> <p>http://www.biostathandbook.com/onewayanova.html</p> <p>http://wise.cgu.edu/downloads/ANOVA.doc</p> <p>http://www.jerrydallal.com/LHSP/anova1.htm</p> <p>Optional: Read chapter 12 in Statistics for Health Care Professionals</p> <p>View online lesson #9 & take online quiz (11/5)</p>	Robert Houser
Online	10	Lesson 10: Introduction to correlation (11/6-11/12)	<p>Exam 2 version One – 11/6</p> <p>Read ch. 11 in SS1</p> <p>Optional: Statistics for Health Care Professionals (pages 177-183 in Chapter 16)</p> <p>Review study guide for ch. 11</p> <p>View online lesson #10 & take online quiz (11/12)</p>	Robert Houser
Online	11	Lesson 11: Introduction to simple linear regression (11/13-11/19)	<p>Review chapter 11 in SS1</p> <p>Read chapter 2 in SS2</p> <p>Optional: read pages 183-201 in chapter 16 of Statistics for Health Care Professionals</p> <p>View online lesson #11 & take online quiz (11/19)</p>	Robert Houser
Online	12	Lesson 13: Introduction to multiple regression analysis (11/20-11/26)	<p>Read www.stat.sinica.edu.tw/~stcheng/TimeSeries/part7.doc</p> <p>Optional: Read Review chapter 2 in</p>	Robert Houser

			<p>Statistics at Square Two</p> <p>Exam 2 version 2 - Assigned on 11/19 & due on 11/22</p> <p>Homework # 3 Assigned on 11/24 & due on 12/3</p> <p>View online lesson #13 & take online quiz (11/26)</p>	
Online	13	Lesson 14: Interpreting results of statistical tests (11/27-12/3)	<p>Read chapter 1 in SS1</p> <p>Read "Statistics IV: Interpreting the results of statistical tests" by Anthony McCluskey & Abdul Ghaaliq Lalkhen, <i>Contin Educ Anaesth Crit Care Pain</i>.2007; 7: 208-212 (you can log on to Tufts library and obtain the full text copy of the article for free).</p> <p>View online lesson #14 & take online quiz (12/3)</p>	Robert Houser
Online	14	Lesson 15: Selecting appropriate statistical tests and survey of methods used in nutrition and public health (12/4-12/10)	<p>Statistics at Square One, Chapter 13</p> <p>Optional: Read chapter 18 in Statistics for Health Care Professionals</p> <p>This lesson involves interacting with a VUE chart with embedded audio.</p> <p>To play this file you will need to have VUE software installed. You can obtain the software from the following web link ...</p> <p>http://vue.tufts.edu/</p> <p>The VUE file is somewhat large and so you will need to be patient while it loads. After it loads you should minimize the audio player so you can see the VUE chart.</p> <p>There is also an excellent table you can see at the following link that worth seeing (table 37.1 Selecting a statistical test)</p> <p>www.graphpad.com/www/book/choose.htm</p> <p>View online lesson #15 & take online quiz (12/10)</p> <p>Take exam 3 practice exam</p>	Robert Houser

	15	Exam Week (Dec 14, 2015 - Dec 21, 2015)	Exam 3 version One – (12/11) Exam 3 version Two - (if necessary (12/17)	
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Specific Objectives for each Lesson

Lesson 1: Introduction and Overview Statistical Methods for Nutrition

Learning objectives: Define statistics and discuss the basic steps for conducting research. Discuss the two basic types of research questions: Descriptive research questions and explanatory research questions. Understand the basic steps of formulating and testing research questions. Understand why it is necessary to operationally define the variables used in a research study. Understand how research questions are developed and how explanatory research questions are motivated by scientific theories and an understanding of proposed mechanisms of action. Understand how to avoid bias and address explanatory research questions by employing methodological and statistical controls. Understand the difference between methodological controls and statistical controls in research studies. Consider the role of research ethics in testing explanatory research questions. Understand what is meant by a "natural experiment". Understand what is meant by a "variable" and identify different types of variables and types of data. Understand what is meant by "degree of measurement precision". Consider how the selection of an appropriate measure of central tendency depends on the level of measurement. Understand how to perform statistical calculations with Google calculator.

Lesson 2: Frequency distributions, measures of central tendency and variability

Learning objectives: Understand how to interpret and produce frequency distributions and measures of central tendency and variability (dispersion) including the mode, mean, median, geometric mean, range, interquartile range (IQR), variance, standard deviation and the coefficient of variability (CV).

Lesson 3: Graphical displays of data and exploratory data analysis

Learning objectives: Understand how to interpret graphical displays of data such as stem and leaf plots, histograms, box plots, multiple line plots and scatterplots.

Lesson 4: Populations, samples, random sampling, and generalizability of research findings

Learning objectives: Understand how and why samples are obtained from populations. Understand how random assignment is useful as means of employing methodological control over extraneous factors that might influence the results of an experiment. Understand how to determine the extent to which a sample is representative of the population it is intended to reflect.

Lesson 5: Central limit theorem, standard error and confidence intervals

Learning objectives: Define "central limit theorem" and understand how to construct and interpret confidence intervals. Understand how to calculate standard error.

Lesson 6: Confidence Intervals for the difference between means and percentages

Learning objectives: Understand how to calculate the standard error of the difference between two means, understand how to calculate the standard error of the difference between two percentages, understand how to calculate confidence intervals for the difference between two means, and understand how to calculate confidence intervals for the difference between two percentages.

Lesson 7: Nonparametric statistical methods

Learning objectives: Be able to interpret commonly used nonparametric tests including Pearson's chi-squared test, Median test, Mann-Whitney U test, and Wilcoxon rank sum test.

Lesson 8: t tests for related and independent samples

Learning objectives: Understand the meaning and use of p values. Be able to interpret paired sample t-tests and independent

samples t-tests and understand their appropriate application.

Lesson 9: Oneway analysis of variance and post hoc tests of statistical significance

Learning objectives: Understand the use of oneway analysis of variance and a variety of multiple comparison procedures for comparing factor levels, including Tukey's honestly significant differences, Newman-Keuls multiple range test, and the Bonferroni adjustment.

Lesson 10: Introduction to correlation

Learning objectives: Understand how to interpret Spearman's correlation coefficient and Pearson's correlation coefficient and understand when each is appropriate.

Lesson 11: Introduction to simple linear regression analysis

Learning objectives: Know how to calculate simple linear regression analysis "by hand" with a calculator in order to develop an intuitive understanding of simple regression analysis. Understand how to produce and interpret a regression equation with one independent variable.

Lesson 12: Chi-squared tests and odds ratios

Learning objectives: Learn how to calculate and interpret one and two variable Chi-Squared tests. Understand how to evaluate a 2 by 2 contingency table. Learn how to calculate and interpret an odds ratio for a 2 by 2 table. Learn how to calculate a 95% confidence interval (CI) for the difference between two proportions. Understand how to calculate an odds ratio "by hand" from a cross tabulation of cell counts.

Lesson 13: Multiple Regression Analysis

Learning Objectives: Become familiar with multiple regression analysis and the concept of statistical modeling. Understand how to interpret a multiple regression analysis. Become familiar with standardized and unstandardized regression coefficients. Understand how to calculate and use adjusted r squared. Become familiar with the concept of model building and multiple regression assumptions.

Lesson 14 and 15: Selecting appropriate statistical tests & survey of methods used in nutrition and public health and interpreting the results of statistical tests

Learning objectives: Understand different types of variables and understand how to determine what statistics and statistical tests are appropriate for a given research question and/or hypothesis and type of data. Consider issues involved with choosing a statistical test. Consider the importance of ensuring we have an adequate sample size. Understand how the type of study design influences how we analyze the data and how we interpret statistical test results. Understand how p values relate to power and sample size. Understand the difference between statistical significance and practical significance. Understand the importance of confidence intervals in interpreting statistical test results. Understand how to minimize the risk of making a type II error. Understand how to appropriately make multiple comparisons. Understand the distinction between one and two-tailed tests.

Basic statistical concepts in nutrition research ...

<http://ncp.sagepub.com/content/28/2/182.full.pdf+html>

Stata Software for Statistical Analysis

The **Stata** statistical analysis software is required software for the *NUTB 250 & NUTB350: Statistical Methods for Health Professionals I and II* courses. Tufts students are able to purchase it at an *extremely* reduced rate and we believe it is a worthwhile investment.

The 1st Residency will have **Stata** software training and it will be required throughout NUTB 250, NUTB350 and NUTB300.

To purchase Stata:

URL: <http://www.stata.com/order/new/edu/gradplans/student-pricing/>

Then select “Stata/IC 15 perpetual (\$198)” DVD or download. This version of the software is required for our courses. The license does not expire.

You can either purchase a **DVD** copy that will be mailed to you (recommended) or **Download**. The Download option will give you an EXE file for PC’s or DMG file for Mac’s.

Please be sure to purchase Stata and install it on your notebook computer well before you travel to Boston for the Residency. If you have problems purchasing or installing, contact the Stata Software Company for support.

If you have course-specific questions before or after purchasing Stata, please contact Professor Bob Houser at robert.houser@tufts.edu.