

NUTR214 STATISTICAL METHODS FOR HEALTH CARE PROFESSIONALS

Tufts University, Friedman School of Nutrition Science and Policy

Syllabus updated on January 18, 2016

Spring 2016

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Office hours in person or online (skype voice or by skype IM) by appointment

Credit 1.0

Class meeting times: Spring Semester 2016, Thursdays, 10:00am-11:30am. Please arrive 5 minutes early if possible. Thanks!
We will meet in room 510 Sackler (small computer lab)

Texts books and supplies

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

Optional: 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 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>

CamsScanner (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/camsScanner-phone-pdf-creator/com.intsig.camsScanner>

<https://itunes.apple.com/us/app/camsScanner-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, logistic regression modeling, construct and interpret graphical displays, use analysis of variance and multiple comparisons.

Assignments, Exams and Grade Evaluation

Half of the instruction will take place during 1.5 hour weekly classroom meetings and computer lab training sessions. During the computer lab sessions, students will learn how to use Stata statistical software. The other half of instruction will take place online with weekly assigned online lessons. Each week students will view 1 or 2 online lessons and take a short "open book" quiz to assess their understanding of the material. But, you must work alone on the quiz and not ask anyone for the answers. Online quiz feedback will be generated automatically. Performance on the weekly online quizzes will constitute 20% of the final 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 15

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.

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=ahwlw4OCEAc&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>

Strongly recommended: Stata software IC version 14 (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 Calender

Spring Semester Classes Begin	Jan 21, 2016
Last day to ADD classes	Feb 04, 2016
Presidents' Day (University Holiday - No Classes	Feb 15, 2016
Substitute Monday's class schedule on Thursday	Feb 18, 2016
Last day to DROP classes without enrollment record	Feb 25, 2016
Last to make up incomplete grades from Fall 2015	Mar 03, 2016
Spring Recess Begins-Classes Suspended	Mar 19, 2016
Spring Recess Ends-Classes Resume	Mar 28, 2016
Patriot's Day (University Holiday) - No Classes	Apr 18, 2016
Last day to WITHDRAW from courses with grade of W	May 02, 2016
Last day of classes for the Spring 2016 Semester	May 02, 2016
Reading Period	May 03, 2016 - May 05, 2016
Final Exams Begin	May 06, 2016
Final Exams End	May 13, 2016

NUTR214: 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 & in class	1	Introduction to Stata programming on 1/21	Read syllabus carefully Read chapter 1 in SS1 and review study	Anaya Hall (Stata lab) & Robert

		Lesson 1: Introduction and overview of statistical methods for nutrition (1/21-1/24)	<p>guide for chapter 1</p> <p>Optional reading: Statistics for Health Care Professionals (chapters 1-3)</p> <p>View online lesson #1 & take online quiz (1/24)</p>	Houser (online)
Online & in class	2	Lesson 2: Frequency distributions, measures of central tendency and variability (1/25-1/31)	<p>Read chapter 2 in SS1 and review study guide</p> <p>Optional: read chapter 6 in Statistics for Health Care Professionals</p> <p>View online lesson #2 & take online quiz (1/31)</p>	Robert Houser
Online & in class	3	Lesson 3: Graphical displays of data and exploratory data analysis (2/1-2/7)	<p>Review chapter 1 in SS1 and review study guide</p> <p>Read Descriptive Statistics and Graphical Displays by Martin G. Larson http://circ.ahajournals.org/content/114/1/76.full.pdf+html</p> <p>Optional: Read chapter 7 in Statistics for Health Care Professionals</p> <p>View online lesson #3 & take online quiz (2/7)</p>	
Online & in class	4	Lesson 4: Populations, samples, random assignment, and generalizability of research findings (2/8-2/14)	<p>Read chapter 4 in SS1 and review study guide</p> <p>Optional: Read chapters 8-10 in Statistics for Health Care Professionals</p> <p>View online lesson #4 & take online quiz by 2/14</p> <p>Take practice version of exam 1 this week</p> <p>Homework Assignment #1 due on 2/12 via email)</p>	Robert Houser
Online only this week	5	Lesson 5: Central limit theorem and confidence intervals (2/15-2/21)	<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</p>	Robert Houser

			<p>(2/21)</p> <p>Take exam 1 version 1 (between 2/18 & 2/20)</p> <p>Take exam 1 version 2 (if necessary) TBA</p>	
Online & in class	6	Lesson 6: Confidence Intervals for the difference between means and percentages (2/22-2/28)	<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 (2/28)</p>	Robert Houser
Online & in class	7	Lesson 7: Nonparametric statistics Lesson 12: Chi-squared tests (2/29-3/6)	<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 (3/5)</p> <p>View online lesson #12 & take online quiz (3/6)</p> <p>Homework 2 assigned on 3/3 & due on 3/12</p>	Robert Houser
Online & in class	8	Lesson 8: Students t-test for independent and related samples (3/7-3/13)	<p>Read chapter 7 in SS1 and review study guide</p> <p>Optional: Read chapter 11 in Statistics for Health Care Professionals</p> <p>Homework assignment #2 - due date: 3/12</p> <p>View online lesson #8 & take online quiz (3/13)</p> <p>Take Exam Two practice exam</p>	Robert Houser
Online & in class	9	Lesson 9: Oneway analysis of variance and post hoc tests of statistical significance (3/14-3/20)	<p>Read ... http://udel.edu/~mcdonald/statanovaintro.html</p> <p>http://www.biostat handbook.com/onewayanova.html</p> <p>http://wise.cgu.edu/downloads/ANOVA.doc</p> <p>http://www.jerrydallal.com/LHSP/anova1.h</p>	Robert Houser

			<p>tm</p> <p>Optional: Read chapter 12 in Statistics for Health Care Professionals</p> <p>View online lesson #9 & take online quiz (3/20)</p> <p>Exam 2 version One – 3/17</p>	
Online only this week	10	Lesson 10: Introduction to correlation (3/21-3/27)	<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 (3/27)</p>	Robert Houser
Online & in class	11	Lesson 11: Introduction to simple linear regression (3/28-4/3)	<p>Review chapter 11 in SS1</p> <p>Read chapter 2 in SS2</p> <p>Exam 2 version Two - Assigned on 4/1 & due on 4/5</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 (4/3)</p>	Robert Houser
Online & in class	12	<p>Lesson 13: Introduction to multiple regression analysis (4/1-4/10)</p> <p>Introduction to logistic regression analysis</p>	<p>Read www.stat.sinica.edu.tw/~stcheng/TimeSeries/part7.doc</p> <p>Optional: Read Review chapter 2 in Statistics at Square Two</p> <p>Homework # 3 Assigned on 4/7 & due on 4/22</p> <p>View online lesson #13 & take online quiz (4/9)</p> <p>View online lesson on logistic regression & take online quiz (4/10)</p>	Robert Houser
Online & in class	13	Lesson 14: Interpreting results of statistical tests (4/11-4/17)	<p>Read chapter 1 in SS1</p> <p>Read "Statistics IV: Interpreting the results of statistical tests" by Anthony McCluskey</p>	Robert Houser

			<p>& 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 (4/17)</p>	
Online & in class	14	Lesson 15: Selecting appropriate statistical tests, introduction to sample size estimation and survey of methods used in nutrition and public health (4/18-14/24)	<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) www.graphpad.com/www/book/choose.htm</p> <p>View online lesson #15 & take online quiz (4/24)</p>	Robert Houser
In class	15	Review session in class on 4/28	Take exam 3 practice exam	
		Final exam	<p>Exam 3 version One – (TBA)</p> <p>Exam 3 version Two - (if necessary (TBA))</p>	

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, introduction to sample size estimation, and 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 to estimate the number of subjects needed for an experimental research study. 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

To purchase Stata:

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

Then select “Stata/IC 14 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.