PHTH 2210 Foundations of Biostatistics
Syllabus

Course Description:
Biostatistics is a field that applies statistical methodologies and reasoning to medical, biological, and public health problems. Used in many disciplines, such as psychology, epidemiology, and demography, methods developed by biostatisticians allow us to adapt and extend statistical tools to situations involving people or animals. This course for undergraduate students is intended to introduce the fundamental concepts of biostatistics. Through the collection, description, and visualization of data, students will learn to apply statistical thinking to make informed decisions related to practical problems across several health disciplines. Further, with the knowledge that each decision we make may be incorrect, we will explore methods to quantify and communicate how often we may make a mistake. Topics include descriptive statistics; sampling; estimation and hypothesis testing; sample size and power; correlation and regression methods. Examples and readings will be drawn from public health practice and the news. Use of Stata as statistical software package will be introduced.

Class Time: Fall 2017**,** Monday, Thursday 11:45am – 1:25pm
Class Location: 010 Knowles Center

Credit hours: 4 semester hours

Instructor: Prof. Justin Manjourides
Office location: 312 Robinson Hall
Office hours: To be voted on in class
Email: j.manjourides@northeastern.edu

Teaching Assistant: Mara Eyllon
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NOTE: Mara and I are here to help you learn this material. If you are struggling, I encourage you to reach out to us via our office hours, or to make an appointment. Office hours are scheduled for your benefit, and it is not a burden on us to meet with you during those times.

Corequisite: **PHTH 2211 recitation sections:**
                     Mondays: Richards Hall 241
                     Tuesdays: Forsyth 242

Prerequisites: None

Course Goal: Students participating in this course should acquire the ability read and think critically about research published in leading health journals:
- What are the goals of the study?
- How were the data collected?
- What types of biases may be present?
- Were appropriate methods used to describe, analyze, and visualize the data?
- Are the conclusions justified?

Course Outcomes: By the end of this course you will be able to:
- Interpret health data using both numeric and graphic techniques
- Quantify the uncertainty surrounding assumptions about data by creating, testing, and interpreting statistical hypotheses.
- Appropriately design studies by calculating necessary sample sizes
- Infer associations between variables through linear regression modeling
- Evaluate statistical measures reported in medical literature through research and use of course vocabulary
- Use Stata to summarize, analyze, and display data

Course Topics:

1.0 Appropriate summarizations health data:
    1.1 Types of data
    1.2 Data visualization
    1.3 Measures of center and spread
    1.4 Correlation
2.0 Basic concepts of probability:
    2.1 Prevalence, Risk Ratios, Odds Ratios
    2.2 Diagnostic testing
    2.3 Distributions of random variables
    2.4 The Central Limit Theorem
3.0 Formulations, testing, and interpretation of hypothesis tests:
    3.1 Confidence intervals
    3.2 Z-tests, t-tests, tests of proportions
    3.3 P-values,
    3.4 Type-1 errors, Type-2 errors
    3.4 Power and sample size
4.0 Linear regression
    4.1 Assumptions
    4.2 Interpretations of model parameters
    4.3 Hypothesis testing
5.0 Use of the Stata statistical software package

Recommended Textbooks:
Principles of Biostatics
Pagano and Gauvreau
2000
ISBN-13: 978-0534229023.

You can order textbooks from Northeastern University Bookstore by phone at (617) 373-3182 or (617) 373-2286, online, or purchase in person at the main campus bookstore. This book is also available at amazon.com, and there is a copy on reserve at Snell Library. Any version of the "Second Edition" of this book will suffice (the cover will be purple, not red).

Policy regarding the use of electronic devices:
Computers can be used during class for the purpose of taking notes. Tape recorders can be used but students are asked to inform the instructor. *Cell phones should, at a minimum, be on silent, but preferably turned off.*

Classroom Behavior: Classroom participation is expected. **Everyone is expected to be respectful of fellow classmates.**

Academic Honesty:
"Northeastern University is committed to the principles of intellectual honesty and integrity. All members of the Northeastern community are expected to maintain complete honesty in all academic work, presenting only that which is their own work on tests and assignments. If you have questions regarding the definitions of cheating or plagiarism, consult the Northeastern University Student Handbook and/or contact the professor prior to submitting work for evaluation."
Any student who has witnessed an act of academic dishonesty should report it to the course faculty member.

Special Accommodations: If you have specific physical, psychiatric or learning disabilities that may require accommodations for this course, please contact Northeastern's Disabilities Resource Center (DRC) at (617) 373-2675. The DRC can provide you with information and assistance to help manage any challenges that could affect your performance in the course. The University requires that you provide documentation of your disabilities to the DRC so that they may identify what accommodations are required, and arrange with the instructor to provide those on your behalf, as needed.

Title IX of the Education Amendments *of 1972 protects individuals from sex or gender-based discrimination, including discrimination based on gender-identity, in educational programs and activities that receive federal financial assistance.*

Northeastern's Title IX Policy prohibits Prohibited Offenses, which are defined as sexual harassment, sexual assault, relationship or domestic violence, and stalking. The Title IX Policy applies to the entire community, including male, female, transgender students, faculty and staff. If you or someone you know has been a survivor of a Prohibited Offense, ***confidential*** support and guidance can be found through **University Health and Counseling Services** staff (http://www.northeastern.edu/uhcs/) and the **Center for Spiritual Dialogue and Service clergy members** (http://www.northeastern.edu/spirituallife/). By law, those employees are not required to report allegations of sex or gender-based discrimination to the University. Alleged violations can be reported non-confidentially to the Title IX Coordinator within ***The Office for Gender Equity and Compliance*** at:titleix@northeastern.edu and/or through **NUPD** (Emergency 617.373.3333; Non-Emergency 617.373.2121). Reporting Prohibited Offenses to NUPD does **NOT** commit the victim/affected party to future legal action. Faculty members are considered "responsible employees" at Northeastern University, meaning they are required to report all allegations of sex or gender-based discrimination to the Title IX Coordinator.

In case of an emergency, please call 911.

Please visit **www.northeastern.edu/titleix** ***for a complete list of reporting options and resources both on- and off-campus.***

Assignments and Assessment:

50%: *Homework Assignments:* The 9 homework assignments are to be completed and turned in at the beginning of the class in which they are due. You may collaborate on your assignments, though I recommend trying the problems on your own first, which will prepare you best for the exams. If you choose to collaborate with other students, each student must turn in their own homework assignment, written in their own words. **No joint assignments will be accepted.** If your assignment is word-for-word the same as another student's, you will split the grade earned. **Late homework assignments will not be accepted.**

20%: *Midterm Exam:* The Midterm Exam will be held in class on Thursday, October 19th. The midterm will cover the topics through Diagnostic Testing. Students will be allowed to bring a calculator (NOT A PHONE) and formula sheet to the exam. The formula sheet is to be handwritten on 1 side of an 8.5 x 11 inch sheet of paper. The formula sheet must be handwritten (no photocopies, nothing computer generated). You may write as small or as large as you would like. Students will turn this formula sheet in with their midterm exam.

20%: _Final Exam:_ The Final Exam will be held according to the Northeastern University Final Exam Schedule. The final will cover the topics from Probability Distributions through the end of the course. Students will be allowed to bring a calculator (<u>NOT A PHONE</u>) and formula sheet to the exam. The formula sheet is to be handwritten on 1 side of an 8.5 x 11 inch sheet of paper. <u>The formula sheet must be handwritten (no photocopies, nothing computer generated)</u>. You may write as small or as large as you would like. Students will turn this formula sheet in with their exam.

10%: _Participation/Recitation Sections:_ Attendance and participation in weekly classes and recitation sections are expected to earn full participation credit. If a conflict arises that cannot be avoided, it is anticipated that students will provide communicate their absence to the professor and/or TA in advance. If a student needs to miss a recitation, they may communicate with the professor and/or TA to switch sections for a particular week. If a student needs to miss a class, they are still expected to turn in any assignment due during that course prior to the beginning of the class in which they are due.

Grading Scale: The grading scale will be based on the 400 points possible in the course. Points will break down as follows:

93-100% =   A
90-92%   =   A-
87-89%   =   B+
83-86%   =   B
80-82%   =   B-
77-79%   =   C+
73-76%   =   C
70-72%   =   C-
67-69%   =   D+
63-66%   =   D
60-62%   =   D-
59% and below = F

Attendance, participation and make-up work: Students are expected to attend each class on time, turn in their own assignments, and participate in the entire class. _Students are reminded to check the midterm exam date and final exam schedule before making any flight reservations home for the holidays_. Early flight reservations will **not** be a reason to miss either exam.

DATE	CLASS TOPICS	ASSIGNMENTS
Th: 7-Sep	Intro / Visualizing Data	P&G: 7-48, 52-54
M: 11-Sep	Types of Data, Center	HW 1 Assigned
Th: 14-Sep	Types of Data, Spread	
M: 18-Sep	Plotting Data	HW 1 Due / HW 2 Assigned
Th: 21-Sep	Correlation	P&G: 398-404
M: 25-Sep	Samples vs. Populations/ Sampling/ Bias	HW 2 Due / HW 3 Assigned / P&G: 514-520
Th: 28-Sep	Experimental Design	
M: 2-Oct	Confounding, Effect Modification	HW 3 Due / HW 4 Assigned P&G: 374-376,
Th: 5-Oct	Probability, Odds, Rates	P&G: 125-129, 144-149
M: 9-Oct	**NO CLASS**	**COLUMBUS DAY**
Th: 12-Oct	Diagnostic Testing	HW 4 Due, P&G: 129-144
M: 16-Oct	Probability Distributions	P&G: 162-185
Th: 19-Oct	**MIDTERM EXAM**	**MIDTERM EXAM**
M: 23-Oct	Sampling Distribution of the Mean/ CLT	HW 5 Assigned, P&G: 196-210
Th: 26-Oct	Confidence Intervals	P&G: 214-227
M: 30-Oct	Hypothesis Testing (Normal)	HW 5 Due / HW 6 Assigned P&G: 232-254
Th: 2-Nov	Hypothesis Testing (t-distributions)	
M: 6-Nov	Sample Size/ Power/ Multiple Comparisons	HW 6 Due / HW 7 Assigned P&G: 323-335
Th: 9-Nov	Article Review	
M: 13-Nov	Correlation / Regression	HW 7 Due / HW 8 Assigned P&G: 239-249
Th: 16-Nov	Simple Linear Regression	P&G: 415-428
M: 20-Nov	Multiple Regression	HW 8 Due P&G: 449-460
Th: 23-Nov	**No Class**	**THANKSGIVING**
M: 27-Nov	Multiple Regression	HW 9 Assigned
Th: 30-Nov	Logistic Regression	P&G: 432-434
M: 4-Dec	Synthesis	HW 9 Due
TBD	**FINAL EXAM**	**FINAL!!!**

DATE	LAB	LAB TOPICS
M/T: 11/12-Sep	Lab 1	Intro to Stata - Data, Centers
M/T: 18/19-Sep	Lab 2	Spread, Plotting
M/T: 25/26-Sep	Lab 3	Correlation, Sampling
M/T: 2/3-Oct	Lab 4	Confounding, Effect Modification, Design
M/T: 9/10-Oct	NO LAB	
M/T: 16/17-Oct	Lab 5	Diagnostic testing
M/T: 23/24-Oct	Lab 6	Probability Distributions, CLT
M/T: 30/31-Oct	Lab 7	Confidence intervals
M/T: 6/7-Nov	Lab 8	Hypothesis Testing
M/T: 13/14-Nov	Lab 9	Hypothesis Testing, Bootstrapping
M/T: 20/21-Nov	Lab 10	Linear Regression
M/T: 27/28-Nov	Lab 11	Multiple Regression
M/T: 4/5-Dec	Lab 12	Review