PHTH 2210 Foundations of Biostatistics

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 R as statistical software package will be introduced.

Class Time: Spring 2020, Monday, Wednesday, Thursday 1:35pm – 2:40pm
Class Location: Kariotis Hall 209

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 *at* northeastern *dot* edu

Teaching Assistant: TBD

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

Prerequisites: None

Course Goals: 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 R to summarize, analyze, and display data

Course Topics:

- 1. Data Visualization:
  - 1. Tidy data
  - 2. Grammar of graphics
  - 3. Statistical graphs with ggplot2
- 2. Data Manipulation:
  - 1. Import/exporting data
  - 2. Data wrangling with dplyr
- 3. Probability and Probability Distributions
  - 1. Sampling theory
  - 2. Diagnostic testing
  - 3. Central Limit Theorem
- 4. Statistical Inference
  - 1. Confidence intervals
  - 2. Hypothesis Testing
  - 3. P-values
  - 4. Bootstrapping
- 5. Linear regression
  - 1. Interpretations of model parameters
  - 2. Hypothesis testing
- 6. Use of the R statistical software package
  - 1. R Studio
  - 2. The Tidyverse

Classroom Behavior

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

Computers may be used during class for the purpose of taking notes and will be required during the labs. Cell phones should, at a minimum, be on silent, but preferably turned off.

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.

Assignments and Assessment

Homework Assignments (45%): The 8 homework assignments are to be completed and turned in prior to 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.

Exams (45%): Three exams will be held in class. The first two exams will be held according to the dates on the syllabus. The third exam wioll be held according to the University's Final Exam Schedule and will be announced at a later date. Students are reminded to check the exam dates and final exam schedule before making any flight reservations home for the holidays. Early flight reservations will **not** be a reason to miss any exams.

Participation (5%): Attendance and participation in classes and lab 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 in advance. 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.

R Basics quiz (5%): There will be one quiz held in class on 1/13/20. This quiz will cover the basics of the R statistical software package.

Grading Scale

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

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

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 and the Center for Spiritual Dialogue and Service clergy members. 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 http://www.northeastern.edu/titleix for a complete list of reporting options and resources both on- and off-campus.