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:
Fall 2021: Wednesday, Friday: 11:45am – 1:25pm
Recitation Sessions as signed up (PHTH 2211)
Class Location: Knowles Center 010
Recitation Sessions as signed up (PHTH 2211)

Credit hours: 4 semester hours

Instructors: Profs. Farzad Noubary & Justin Manjourides
Office location: 312 Robinson Hall (We will be mostly remote this year though)
Email: f.noubary *at* northeastern *dot* edu \ j.manjourides *at* northeastern *dot* edu
Office hours: Weekly Zoom Office Hours: Wednesdays 11:45am - 12:45pm (Link to be posted on the course Canvas page)

Teaching Assistants: Please contact the TA assigned as your Recitation Section Instructor:
Mike Williams: williams.mi *at* northeastern *dot* edu
Dairen Mathers: mather.d *at* northeastern *dot* edu
Andrew Dolman: dolman.a *at* northeastern *dot* edu
Ting-Ting Wu: wu.ting *at* northeastern *dot* edu

NOTE: We are here to help you learn this material. If you are struggling, I encourage you to reach out to either a TA or professor early. Office hours are for your benefit, and it is not a burden on us to meet with you.

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.
- 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

Pandemic Statement

These are strange and difficult times for a lot of people. You may be completely unaffected by COVID-19 or you may have suffered immeasurable losses. Your fellow classmates, teaching assistants, and professors may also be struggling from time-to-time. We are trying our best, and expect that you will try your best. We have bad days and we expect that you will have bad days too. If you are feeling any combination overwhelmed, depressed, anxious, or ill, we encourage you to reach out to the appropriate resources at Northeastern. If you are overwhelmed or anxious specifically regarding PHTH 2210, then we are the appropriate people that you should reach out to. We would like this course to be a positive experience for you. This course will be challenging at times, but we all recognize the difference between a difficult assignment and panic-inducing pressure. Please do not hesitate to contact us if this class is negatively affecting your life.

General 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. Probability distributions
    - 4. 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

Yes, this is large course, but class participation is expected. Attending class and arriving to class promptly is expected of each student (and shows respect for fellow students). Students will be called on in class, and each student can expect to be called on unexpectedly several times during the semester. 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. Non-adherence to these expectations of professional behavior will result in dismissal from class. Consistent with University policy, students must seek the course instructor's permission to record class lectures.

Discussion Board: The "optional" board topics are not graded, but are available for you to post questions on lecture materials or labs. If you have the answer to a classmates' question, feel free to respond. We will be monitoring these discussions as well and will answer any outstanding questions.

Course Format & Methodology: This course runs for a total of 15 weeks beginning September 8th, 2021 and will be delivered using a "flipped classroom" model. Each week contains one or more lessons. Lessons are organized around specific course topics, and contain readings, lectures, labs, and quizzes that you complete. Please note that all due dates and times are specified according to the Eastern Standard Time zone (EST); plan to complete and submit all assignments accordingly.

In general, the Wednesday class of each week will be for you to watch a series of videos that deliver the lecture material. Fridays will be in-person (attendance mandatory) to work through examples, answer questions, facilitate discussions, and deliver additional material as needed.

The two larger quizzes this semester will be held in class on Wednesday, Oct 20, 2021 and Wednesday, Dec 8, 2021.

Canvas This course will rely heavily on our class Canvas site. If you have questions about using Canvas, please go here first: https://digitalresilience.northeastern.edu/student-resources/

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

Weekly(ish) quizzes (15%): There will be approximately weekly quizzes that are to be completed on the start of the Friday lecture. These should be very quick quizzes (5-10 minutes) and, if you have watched the Wednesday videos, they should be very straightforward.

Labs (50%) Almost every week will have an accompanying lab serving as the "assignments" for this course. You may collaborate on your labs, though we 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 lab solutions, written in their own words.** No joint labs will be accepted. If your lab is word-for-word the same as another student's, you will split the grade earned. **Late labs will not be accepted**, as solutions will be posted promptly. Each student may drop their lowest 2 lab grades.

Quizzes (35%): This class will have two quizzes, each held during a Wednesday session. The first quiz will be held the week of **Oct 20** and will be focused on an assessment of your understanding of the topics

through the previous week. The second exam occurs during the week of **Dec 8**. The format of this quiz will be similar to the first. Though it will focus on the material *since* the first quiz, it is cumulative in the sense that you may need some of the skills learned early on (e.g. graphing and summarizing data) to complete some of the problems. **The two larger quizzes this semester will be held in class on Wednesday, Oct 20, 2021 and Wednesday, Dec 8, 2021. There will be no late quizzes.**

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.

Northeastern University abides by Section 504 of the Rehabilitation Act of 1973, which stipulates that no student shall be denied the benefits of an education "solely by reason of a handicap." Disabilities covered by law include but are not limited to, learning disabilities and hearing, sight or mobility impairments. Additional information about DRC can be found online at http://www.northeastern.edu/drc/

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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.

Syllabus Disclaimer
Any changes to the syllabus will be made at the discretion of the instructor. It is the responsibility of the student to stay informed of any such changes.