Tufts University | Graduate School of Biomedical Sciences

Course Syllabus

Biostatistics I, CTS 527/NUTR 206

Fall 2023

Course Director: Angie Mae Rodday, PhD, MS *(on maternity leave until mid-October)*
E-mail: angie.rodday@tuftsmedicine.org
Office hours: Before or during lecture session on Monday; by appointment
Contact: The best way to contact me is via email. I am typically available Mon-Fri 8:30am-5pm (ET) and will try to respond within 1-2 days.

Lecturer: Ben Sweigart, MA
Email: Benjamin.A.Sweigart@tuftsmedicine.org
Office hours: During or immediately after lecture session on Monday; by appointment
Contact: The best way to contact me is via email. I am typically available Mon-Fri 8:30am-5pm (ET) and will try to respond within 1-2 days.

Lab Instructor: Tanya Karagiannis, PhD, MS
Email: Tanya.Karagiannis@tuftsmedicine.org
Office hours (R/RStudio related): During lab session on Wednesday; by appointment
Contact: The best way to contact me is via email. I am typically available Mon-Fri 8:30am-5pm (ET) and will try to respond within 1-2 days.

Teaching Assistant: Ye Chen, MS
Email: ye.chen@tuftsmedicine.org
Office hours via Zoom (homework related): Thurs 9/21 4-5p; Thurs 10/12 4-5p; Thurs 11/2 4-5p; Thurs 11/16 4-5p; Thurs 12/7 4-5p
Contact: The best way to contact me is via email. I am typically available Mon-Fri 8:30am-5pm (ET) and will try to respond within 1-2 days.

Course Information:
Credit/s: 2.5 credits for CTS 0527; 3 credits for NUTR 0206
Grading Option: A-F
Required or Elective: Required
Prerequisites: none

Course Contact Hours, Meeting Schedule, and Location:
This course has lecture and lab components and meets from September 6 to December 18, 2023.
This course will be held primarily in person (note that some labs will be remote via Zoom). Zoom may be available for students who are geographically distant, or who require remote access due to illness or research-related events (e.g., conferences); you may also request sessions be recorded if you cannot attend a class due to illness or research-related events (e.g., conferences). Any request to attend remotely via Zoom or have a session recorded must be made to the instructor via email with at least 1 business days' notice; please cc Nina Bonnoyer on all requests (nina.bonnoyer@tuftsmedicine.org).

Lecture/Discussion:	Mondays 2:30-4:30pm (ET) (Bring laptop) Medical Education Building Rm 812. Exceptions: 9/18 in MEB851. 9/25 in MEB Rm 507
R/RStudio Lab:	Wednesdays 3-5pm (ET) (Bring laptop) MEB Rm 218. Exceptions: 10/25 in MEB Rm 216A In-person: 9/6, 9/13, 9/20, 10/4, 11/1, 12/6 Remote via Zoom: 9/27, 10/11, 10/25, 11/8, 11/15, 11/29

Refer to CTS Weekly for any additional changes in schedule or location

Brief Course Description:
This course introduces the basic principles and applications of statistics, as they are applied to problems in health and nutrition research. The emphasis is on developing an understanding of the assumptions, limitations, practical considerations and critical thinking in the use of statistical methods in health and nutrition research.

Learning Objectives:
At the conclusion of the course students should be able to:
1. Understand the process of statistical analysis used in the health professions.
2. Apply the steps of statistical inference:
    - select appropriate statistical tests for their hypothesis,
    - explore data and perform statistical tests,
    - interpret results for commonly used statistical tests.
3. Use statistical software (R/RStudio) to explore and analyze data.

Competencies for MPH Students (relevant to MPH students only):
This is a required core course in the Tufts MPH program. This course delivers foundational public health knowledge required for the MPH degree. In addition to receiving a passing grade based on the "Assignment and Grading" section of the syllabus, you must successfully complete the competency-based assessment for (the Final Project) to pass this course. If you do not get a passing grade on the competency-based assessment, please arrange to meet with the course director to discuss next steps so we can ensure you attain the competency.

Competency	**Sessions Where Competency is Taught**	**Competency-based Assessment**
Analyze quantitative data using biostatistics, informatics, computer based programming, and software, as appropriate.	All lectures and all labs	Final Project
Interpret results of data analysis for public health research, policy or practice.	All lectures and labs	Final Project

Course Texts and Materials:
- *Principles of Biostatistics*, by Pagano, Gauvreau, and Mattie (PGM). Third Edition (2022, CRC Press). Required.
    - Free electronic version available through Tufts Library.
    - Available for purchase at Amazon.
- *Introductory Statistics with R (Statistics and Computing)*, by Peter Dalgaard. Second Edition (Springer). Suggested.
    - Free electronic version available through Tufts Library.
- Lecture notes, lab material, videos, additional readings, and other material will be posted on Canvas.

Assignments and Grading:

Assignments	**Grading Weight**
Participation	10%
Discussion board (n=10)	10%
Homework (n=5)	30%
Quizzes (n=2)	30%
Final Project	20%
Total:	100%

Participation:
The following components contribute to participation in lecture and lab: attendance, asking and answering questions, and engaging in class discussions and activities. You will be asked to do a self-assessment of your participation at the end of the semester, which will be considered by the instructors when assigning your grade.

Discussion Board:
The weekly Canvas discussion board will include prompts based on lectures, readings, or other statistical topics. Students should post based on these prompts; they may also respond to other student's posts. Common themes will be discussed in the Monday's sessions. Discussion board posts are due by 5pm on Sundays. Throughout the semester, there are 13 discussion board posts, but only 10 need to be completed for full credit. Of note, some of the discussion board posts are mandatory because they are required for an in-class activity. Students are encouraged to do all posts, or at least do the readings associated with all posts.

Homework:
Homework assignments will be posted in the Assignment section of Canvas; most questions will be from the course textbook (Pagano, Gauvreau & Mattie [PGM]). Typically homework will be assigned on Wednesday and due the following Friday at 5pm (upload to Canvas). Although you may work with other students on homework assignments, your handed-in assignments must represent your own work. There will be a virtual office hour on the Thursday before homework is due from 4-5p.

Quizzes:
There will be two quizzes throughout the semester. Quizzes will be open-book and open-note format. Students must work independently, but may ask faculty clarifying questions. Calculators are allowed. Quizzes will take place in the classroom, but will be administered electronically via Canvas.

Final Project:
Students will complete a data analysis project and write-up. Additional details on the project will be provided later in the semester. Students must work independently, but may ask faculty clarifying questions. The final written project will be due at 5pm on Monday, 12/18/23

Expectations:
- Attend all classes and statistical computing labs
- Read assigned materials prior to class.
- Actively participate in class discussions and the online discussion board.
- Demonstrate an understanding of the use of statistics on assignments, quizzes, and projects.
- Demonstrate the ability to use statistical programming in analyzing data with R/RStudio.

Penalties for late or incomplete assignments:
Late assignments are generally not accepted. Reach out to the instructors as soon as possible with any unavoidable, extenuating circumstances (e.g., illness).

Remediation Policy:
Remediation is generally not offered. Reach out to the instructors if you think you are at risk of failing the course.

Course and Assignment Schedule:

Week	Topic or class title	Assignments	Reading
Week 1, 9/6	**Lecture: Introduction** -Introduce course, syllabus, expectations -Introduce biostatistics -Define variables and summary statistics	-Discussion post (mandatory) due (9/6)	PGM Ch 1 & 2
	Lab: Introduce R -Objects in R -Read in data in R		
Week 2, 9/11	**Lecture: Probability & Probability Distributions** -Explain rules of probability -Diagnostic testing -Explain probability distributions	-Discussion post due (9/10) -HW1 assigned (9/13)	PGM Ch 5-7
	Lab: -Summarize data -Calculate probabilities from distributions		
Week 3, 9/18	**Lecture: Estimation & Confidence Intervals** -Sampling distribution of the mean -Confidence intervals	-Discussion post due (9/17) -HW1 due (9/22)	PGM Ch 8 & 9
	Lab: -Confidence intervals -Data manipulation		
Week 4, 9/25	**Lecture: Hypothesis Testing** -Hypothesis testing -Study design (optional-review slides independently)	-Discussion post (mandatory) due (9/24)	PGM Ch 10 Optional reading on study design: PGM Ch 22
	Lab: (remote via Zoom) -Functions, packages, and libraries -Data manipulation		
Week 5, 10/2	**Lecture: Comparing Means** -T-test -ANOVA	-Discussion post due (10/) -HW2 assigned (10/4)	PGM Ch 11 & 12
	Lab: -T-tests		
Week 6, 10/9	No class on Monday (10/9) for Indigenous People Day	-Discussion post due (10/8) -HW2 due (10/13)	
	Lab: (remote via Zoom) -ANOVA		
Week 7, 10/16	Quiz 1 on 10/16 Lab on 10/18 cancelled		
Week 8, 10/23	**Lecture: Non-parametric tests** -Wilcoxon signed rank, Wilcoxon rank sum, Kruskal-Wallis -Missing data	-Discussion post due (10/22) -HW3 assigned (10/25)	PGM Ch 13
	Lab: (remote via Zoom) -Non-parametric tests		
Week 9, 10/30	**Lecture: Inference on Proportions, part 1** -Contingency tables and tests (Chi-square test, Fisher exact test, McNemar test)	-Discussion post due (10/29) -HW3 due (11/3)	PGM Ch 14 & 15
	Lab: -Tests for proportions		

Week 10, 11/6	**Lecture: Inference on Proportions, part 2** -Measures of association -Mantel Haenszel	-Discussion post due (11/5) -HW4 assigned (11/8)	PG Ch 16 (chapter on Canvas from old edition of textbook)
	Lab: (remote via Zoom) -MH test -OR function		
Week 11, 11/13	**Lecture: Correlation** -Correlation -Introduce final project	-Discussion post (mandatory) due (11/12) -Final project assigned (11/13) -HW4 due (11/17)	PGM Ch 16
	Lab: (remote via Zoom) -Correlation		
Week 12, 11/20	Quiz 2 on 11/20 No lab on 11/22		
Week 13, 11/27	**Lecture: Linear Regression, part 1** -Introduction to linear regression	-Discussion post (mandatory) due (11/26) -HW5 assigned (11/29)	PGM Ch 17
	Lab: (remote via Zoom) -Linear regression		
Week 14, 12/4	**Lecture: Linear Regression, part 2** -Multiple linear regression	-Discussion post due (12/3) -HW5 due (12/8)	PGM Ch 18
	Lab: -Multiple linear regression		
Week 15, 12/11	**Lecture: Linear Regression, part 3** -Model fit		
	Lab: (remote via Zoom) -Model fit		
Week 16, 12/18	**No Lecture or Lab**	-Final project due (12/18)	

This schedule is subject to modifications at the discretion of the course director.

UNIVERSITY AND GSBS POLICY

Diversity, Equity, and Inclusion for all Tufts Community Members:

It is our commitment that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is our intent to present materials and activities that are respectful of diversity: gender, sex, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Please let us know ways to improve the course for you personally or for other students or student groups.

Modified from: University of Iowa College of Education

Religious Accommodations

Both university policy and Massachusetts law provides that students unable to attend classes, participate in required course or lab activities, or take a scheduled examination because of religious observance will be provided with reasonable opportunity to make up the course work without adverse effects. The University's Religious Accommodations Policy is available at https://oeo.tufts.edu/wp-content/uploads/ReligiousAccommodationPolicy.pdf. Students requiring an accommodation should contact the course director prior to the requested dates to work out suitable accommodations.

Decolonization

The course director and lecturers acknowledge the damage done to BIPOC communities by generations of systemic racism within academia. The director also acknowledges that this is a particularly difficult time to be students, and that the political, medical, economic and personal stresses that have been amplified in the past few years disproportionately affect already marginalized students. This course enthusiastically supports the University's stated anti-racist goal (https://gsbs.tufts.edu/news/2021/03/deans-message-february-22-2021) and in pursuit of this, will abide by the following policies.

1. The director and lecturers will seek and use course resources that are inclusive of race, socio-economic standing, gender, sexuality, disability, immigration status, English language learning status, and first-generation status.
2. Microaggressions, along with any other racist remarks, actions or behaviors will not be tolerated.
3. Students experiencing challenges are encouraged to reach out to Dan Volchok (daniel.volchok@tufts.edu) or individuals whom they feel comfortable talking to and discuss solutions.

Students are encouraged to reach out to the course director with any suggestions for adjustments or further course guidelines.

Course Expectations

In addition to the course specific late work and remediation policies detailed above, students, course director and lecturers acknowledge the following:

1. The director accepts responsibility to notify students early if expectations regarding learning, attendance or participation are not being met.
2. The course director will make themselves available by multiple avenues of communication and if needed, will work with students to find mutually convenient times to meet.
3. Opportunities may be available, upon request, to retake missed or late work. If a student falls behind, the director may provide opportunities for that student to catch up. If a student is struggling to understand the material, the course director will work with the student on strategies to better understand the material.
4. Mistakes are expected and respected, and the director will make conscious efforts to prevent them from biasing their opinion of students. The director acknowledges that graduate level biological science material is difficult, and the best way to learn it is by engaging at the limits of your knowledge. If done well, this inevitably will lead to mistakes being made.

University Policies:

- ***Sexual Misconduct Policy:*** Tufts is committed to providing an education and work environment that is free from sexual misconduct. If you or someone you know has been harassed or assaulted, please contact Dan Volchok, the GSBS Sexual Misconduct Reporting Liaison, at 6-6767 or daniel.volchok@tufts.edu. He can help you find appropriate resources and discuss your options. Anonymous reporting is available through https://tuftsuniversity.ethicspointvp.com/custom/tuftsuniversity/oeo/form_data.aspthe Tufts anonymous Incident Report Form: (https://tuftsuniversity.ethicspointvp.com/custom/tuftsuniversity/oeo/form_data.asp). Students may also obtain free confidential counseling through Talk One2One at 1-800-756-3124. Campus police may be contacted at 6-6911.

- ***Americans with Disabilities Act Policy:*** Tufts University is committed to providing reasonable accommodations for qualified individuals with disabilities. If you are interested in seeking accommodations in courses or in a laboratory setting, please contact Dan Volchok, the GSBS Disability Officer, at 6-6767 or at daniel.volchok@tufts.edu.

- ***Tufts Information Stewardship Policy*** outlines the actions all members of the Tufts community are expected to follow when working with institutional data and systems (https://it.tufts.edu/ispol).

- ***Academic Conduct:*** All students are responsible for compliance with all academic standards and policies, including plagiarism and academic integrity, as outlined in the Graduate School of Biomedical Sciences Student Handbook (https://gsbs.tufts.edu/studentLife/StudentHandbook).

- ***Disclosing Conflicts of Interest***: The course director and lecturers, including guest lecturers, are expected to disclose any significant financial interests or conflicts of interest that might undermine, appear to undermine, or have the potential to undermine the objectivity of their lecture content and assigned reading materials.

Revised December 2022