

CH 99-02: INTERMEDIATE BIOSTATISTICS¹
Tufts University, Spring 2020

Instructor:

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Office Hours: Mon/Wed 4:30-5:30pm or by appointment

Class Schedule:

Mon/Wed 3:00-4:15pm; Room 206 in the Anderson Wing (Science & Engineering Complex)

Course Description:

Biostatistical analysis provides the means to identify and verify patterns in this data and to interpret the findings in a public health context. This course will offer intermediate instruction in the principles of biostatistics and the analysis of biomedical and epidemiologic data. Simple and multiple linear and logistic regression, non-parametric procedures, repeated measures analysis, survival analysis, and ethical issues in data analysis and interpretation will be covered in-depth. Stata will be used to analyze data and build models for estimation and prediction.

Course Prerequisites:

Prior statistics course (CH 31 or an equivalent) and permission of instructor. Students should have familiarity with descriptive statistics, hypothesis testing, confidence intervals, and correlation.

Course Objectives:

By the end of the course, students will be able to:

- Understand, conceptually, the application of statistical procedures for certain research questions/settings
- Choose and carry out statistical procedures as they pertain to relevant research questions
 - Create a data management and analysis plan to carry out the procedures
 - Evaluate the fulfillment of various assumptions required by chosen procedures (and suggest alternatives or solutions if assumptions are violated)
 - Interpret the results of the procedures
 - Understand the strengths and limitations of those procedures
- Distinguish between clinical and statistical significance, and safeguard against “fishing expeditions” and “p-hacking” in statistical analyses
- Evaluate quantitative evidence from both journal articles and statistical output
- Communicate (both written and verbally) the results of statistical procedures for target audiences

1. This syllabus is not a contract; the instructor reserves the right to alter course content or requirements based on new evidence, class discussions, or other pedagogical objectives.

Description of Course Activities & Requirements:

Engagement, Participation, & Attendance (10%): Class will be interactive, and participation is built into the learning philosophy of the curriculum. While in class, I expect you to respond to questions, be active in discussions, carry out any class-related assignments, and critically engage with the material and your classmates. Thus, class attendance is very important. *You are allowed one excused absence without penalty.* If you know that you need to miss class ahead of time, email me. If you need to miss more than one class, please let me know as soon as possible. You are responsible for all material discussed/presented during missed class(es). Students who miss multiple classes (unless a note from medical staff or Alpha Dean is provided), use computers for things other than class activities, or use cell phones during class time will receive lower grades.

Homework Assignments (5 assignments, 25% total): Homework will include a mixture of practice exercises and review of scientific literature. Homework is typically assigned every couple of weeks and will be due by 11:59pm on the Sunday of the week after it is assigned [for example, HW #1 is due Sunday, 2/2]. All assignments should be submitted via Canvas; you may work together with classmates on homework problems, but you must complete your own Canvas submission. *Homework assignments cannot be revised and resubmitted for a better grade.* At the end of the semester, homework grades will be averaged to provide an overall homework score.

Midterm Exam (20%): Self-explanatory; you will individually complete exams in-class without the use of your book or notes. Testable material will include lecture content, quantitative results from scientific articles, and Stata output. Exams may include multiple choice, fill-in-the-blank, and short answer questions.

Research Project (4 components, 45% total): The research project is designed to provide a holistic overview of intermediate-level statistical analysis and will simulate the process of developing a scientific manuscript. The project will involve:

1- Generating three testable hypotheses to be answered by any combination of the following procedures, and creating an analysis plan to do so (10%):

- Linear regression
- Logistic regression
- Survival analysis
- Generalized linear models
- Other analytic procedures;

2- Submitting a rough draft of the “Results” section of your project (10%);

3- Presenting your research project to your peers (10%);

4- Submitting your final research project in the form of a scientific manuscript (15%);

More detailed instructions will be provided on Canvas.

Course Grading:

Grading Components	
Participation/Attendance	10%
Homework Assignments	25%
Midterm Exam	20%
Research Project	45%
Total	100%

Grading Scale	
+; A; -	100-97.0; 96.9-93; 92.9-90
+; B; -	89.9-87.0; 86.9-83; 82.9-80
+; C; -	79.9-77.0; 76.9-73; 72.9-70
+; D; -	69.9-67.0; 66.9-63; 62.9-60
F	< 59.9

Course Materials:

Textbooks: Disclaimer—I was a student not that long ago. Biostatistics textbooks can be confusing, unnecessarily math-heavy, and expensive; thus, you have no required textbooks for this course. If you'd like to have a reference source handy, these are some useful books available at Tisch Library:

- M.M. Triola and M.F. Triola. (2006). Biostatistics for the Biological and Health Sciences, Boston, Pearson. *(You may also contact Dr. Karen Kosinski in the CH department to borrow a hard copy of this textbook.)*
- A.C. Acock. (2016). A Gentle Introduction to Stata, 6th edition. Stata Press.
- J.E. Miller. (2013). The Chicago Guide to Writing about Multivariate Analysis, 2nd edition. The University of Chicago Press, Chicago.

Any additional readings will be made available via Canvas or distributed in class prior to specific sessions. Students are required to complete ALL readings **prior to class** and should come to class ready to engage in the material for that day.

Other Materials: You are expected to have access to a calculator (any type, but not on a phone/tablet/laptop), word processing software, Stata, and the web (including email and Canvas capabilities) for successful completion of the course.

The Data Lab and Virtual Lab: Additional assistance can be found at the Data Lab at Tisch Library. The Data Lab consists of a computing lab, a collaborative space, and an instructional classroom, for use by Tufts students, researchers, and faculty members. The Data Lab is staffed with student lab assistants who provide immediate walk-in service and resources to the Tufts community for their GIS, statistical, and data visualization needs. For more information visit <https://sites.tufts.edu/datalab/>. You can find the schedule and specialty of the lab assistants on the “Service and Support” tab.

Stata is now available through the Tufts University Virtual Lab. It allows you to access software available on library computers and in computer labs without going to the library or lab. You can access the Virtual Lab at: <https://vdi.it.tufts.edu/>. ***Please keep in mind that you need to back up your work before logging off of the Virtual Lab. If you are working on something and log off without saving your work (e.g., to Google drive, Box, a flash drive, etc.), the work will be lost.*** Saving a file to the Virtual Lab desktop doesn't help; once you log out, you lose everything, even if you use your own credentials to log in.

Course Policies:

Office Hours: You may attend office hours as frequently as you like; feel free to come as a group, with a friend, or by yourself to ask questions about or discuss the course. To ensure that you have adequate time to discuss what you need, I recommend emailing ahead of time to schedule an appointment during that time block. If you have scheduling conflicts which prohibit you from meeting with me during office hours, please email me to set up an appointment for a different time.

Email: You may email me (aholme03@tufts.edu) at any time during the semester to ask questions, request an appointment, or to generally conduct correspondence. I will try to reply to emails within 48 hours (72 hours during holidays or scheduled travels). *I will not respond to questions about assignments within 12 hours of the due date.*

Grading Questions: Review your grades early and often, as I am certainly capable of making mistakes! If you have any questions about grading policies or would like to discuss a grade with me, please email me within two weeks of the grade's posting.

Assignment Submission: Assignments must be submitted as Word files via Canvas, where they will be reviewed for plagiarism via Turnitin.com. *Do not email me assignments unless you have been directed to do so; I will not accept them.* When you submit assignments to Canvas, please use the following naming scheme: *YourLastNameYourFirstName_Assignment* (e.g., HolmesAshley_HW2)

Homework Extensions: You may ask for **one** homework extension per semester; no questions asked. You must request the extension >6 hours before the homework due date. The extension will be granted for up to one week beyond the assignment's due date. After that, a late work penalty (see below) will be enforced.

Late Work: Late work will be accepted *with a grade penalty*. A 10% grade penalty will be applied for each day that an assignment is late. Assignments are considered "late" if they are submitted after 11:59pm on the day that they are due. For example, if an assignment is due at 11:59pm on Sunday and you submit it at 1:30am on Monday, you will receive a grade penalty. Penalties for late work will be reconsidered in events where students have medical documentation from Health Services or notes from Alpha Deans; short-term illness notifications do *not* constitute medical documentation. To avoid unnecessary stress, please save your work regularly, including copying it to somewhere other than your computer (e.g., flash drive, external hard drive, Box.com, etc.).

Classroom Etiquette: To foster active and engaged learning:

- If you need to leave early, let me know ahead of time and sit near the door so that you do not disturb fellow students when you leave. Similarly, if you are late to class, please enter quietly and sit near the door.
- Non-instructional use of cell phones is prohibited during class. If there is a legitimate emergency requiring cell phone contact, inform me before class.
- Please participate in discussion! While I understand that people do not participate for a variety of reasons, part of the learning process involves discussion with others. You have important things to say and your way of understanding a concept may be especially helpful to me or another student. Alternately, if you are already comfortable speaking freely in class, do not dominate conversation—this is rarely useful and can make others reluctant to participate.

Academic Integrity: At Tufts, we are committed to developing and affirming in each student a sense of personal honor and responsibility. Thus, Tufts holds its students strictly accountable for adherence to academic integrity. The consequences for violations can be severe, so it is critical that you understand the requirements of ethical behavior and academic work as described in Tufts' Academic Integrity Handbook. Faculty within the School of Arts and Sciences and the School of Engineering are required to report suspected cases of academic integrity violations to the Office of the Dean of Student Affairs Office. If cheating or plagiarism (see details below on what constitutes plagiarism) is suspected, this must be reported to the dean. More information is available at: <https://students.tufts.edu/student-affairs/student-life-policies/academic-integrity-policy>.

Plagiarism: Plagiarism is using someone else's words, ideas, or phrases in your work and representing it as your own or not properly attributing the work. If you use a source, cite it; this applies to all information either directly quoted or paraphrased. *Please be aware that copying a phrase or sentence and listing a citation at the end without using quotation marks is plagiarism.* Plagiarism is more fully discussed in the Academic Integrity Handbook, issued by the Dean of Students. For this course, you will upload your work to Canvas, where it will be assessed for plagiarism via Turnitin.com. If you plagiarize, you will get a 0 on the assignment and be reported to the dean.

Available Academic Supports: Tufts University has assistance available for students in need of academic help. The Academic Resource Center (<https://students.tufts.edu/academic-advice-and->

[support/academicresource-center](#)) provides writing support, advice on avoiding plagiarism, and other supports to ensure students' undergraduate careers are successful. If you require an accommodation as a result of a documented disability, please register with the Office of Student Accessibility Services at the beginning of the semester. If you have not already done so, call the Student Services Desk at (617)-627-2000 to arrange an appointment with the Program Director of Student Accessibility Services. More information can be found at the Tufts University Student Accessibility Services website: <https://students.tufts.edu/student-accessibility-services>. Please also contact me early in the semester so that your learning needs may appropriately be met.

Course Schedule²

Week	Date	Class Topic	Assignments ³
1	1/15	Course introduction	
2	1/20 1/22	No Class- Martin Luther King, Jr. Day Exploratory and descriptive methods	
3	1/27 1/29	Basic statistical methods: t-tests, ANOVA, & correlation Simple linear regression	HW #1 due 2/2
4	2/3 2/5	Multiple linear regression & categorical predictors Confounding in linear regression	
5	2/10 2/12	Mediation & interaction in linear regression Checking model assumptions & fit	HW #2 due 2/16
6	2/17 2/19 2/20	No Class- President's Day (Make-up class on 2/20) Predictor selection Contingency tables for binary outcomes	
7	2/24 2/26	Single predictor & multipredictor logistic models Multipredictor models + checking model assumptions & fit	HW #3 due 3/1
8	3/2 3/4	Alternative strategies for binary outcomes Nonparametric tests	
9	3/9 3/11	Midterm review session Midterm Exam	Analysis plan due 3/15
10	3/16 3/18	No Class- Spring Break No Class- Spring Break	
11	3/23 3/25	Survival data + basics of survival analysis Cox proportional hazards model	HW #4 due 3/29
12	3/30 4/1	Checking model assumptions & fit Extensions of Cox model	Rough draft due 4/5
13	4/6 4/8	Repeated measures analysis Repeated measures analysis (continued)	HW #5 due 4/12
14	4/13 4/15	Generalized linear models <i>TBD</i>	Presentation upload due 4/19
15	4/20 4/22	No Class- Patriot's Day In-Class Presentations	
16	4/27 4/29	In-Class Presentations No Class- Reading Period	
17	5/4		Written research project due

2. The course schedule may change at the instructor's discretion; the new schedule will then be posted to Canvas.

3. All assignments are due via Canvas submission by 11:59pm.