

Syllabus

CLRE 253 – BIOSTATISTICS I, 2 UNITS

Summer 2024

Course instructor

Florin Vaida, PhD, fvaida@ucsd.edu

Course Teaching Assistant

Rishi Deka, rdeka@ucsd.edu

Course Description

This course offers a rigorous, intensive introduction to Biostatistics. The first part of the course introduces the fundamentals of statistical inference: summarizing and visualizing data, probability, normal and binomial distribution, sampling, central limit theorem, confidence intervals, hypothesis testing. The second part of the course gives you the skills to understand and conduct the most commonly used analyses for continuous (scale) and binary response variables in the case of one-, two-, and three or more groups. The statistical methods will include independent samples and paired samples t-tests, tests based on ranks, Pearson's chi-square and Fisher's exact tests for binary variables, paired tests for continuous and binary variables, one-way ANOVA, correlation, and simple linear regression. Basic issues of study design will be discussed (clinical trials versus observational studies; sample size calculation; limitations of direct group comparisons in non-randomized studies). Data analyses will be conducted in R/Rstudio using datasets based on real-world biomedical studies and applications. This course is a pre-requisite for taking elective statistical courses.

Course Organization

Two 50-minute sessions per week. Case studies will be introduced and discussed for each key statistical method. We will also conduct interactive data analysis sessions using R/Rstudio. Students will work in small groups and individually.

Course Goals

Provide the knowledge, tools, and practical experience for understanding the basis of statistical inference, and for performing most commonly used basic statistical analyses for cross-sectional observational studies and randomized clinical trials.

Course Objectives

1. Develop a solid understanding of basic statistical concepts, and of the common statistical methods appropriate for biomedical data.
2. Develop the ability to read critically and understand the aspects of study design and statistical analysis from studies reported in the scientific biomedical literature.
3. Develop facility with examining and analyzing biomedical datasets using the appropriate statistical methods, in R/Rstudio.

Prerequisites and Preparation

1. Install R and Rstudio on your laptop prior to first class, from <http://www.r-project.org/index.html> and <https://www.rstudio.com/products/rstudio/>.
2. Read Chapter 1 from An Introduction to R (<https://intro2r.com>) and run Exercise 1 on your own.
3. Bring your laptop at all lectures and perform the analyses in real time, with the instructor.

Course Materials/Resources – Required and Recommended

- Detailed course notes are provided – they form the backbone of the course
- Computer software: R and Rstudio will be used in class, for homework, and for the final exam.
- Textbooks: *Basic and Clinical Biostatistics*, 5th edition. Lange Medical Books, 2020. Provided and required.
- *An Introduction to R* (<https://intro2r.com>)
- Online resources: Canvas, at canvas.ucsd.edu; extensive online resources on R are available.

Course Schedule

Lecture	Date	Topic	Reading	Assignment
L1	Jul 10 – Zoom	Study design; data summaries & visualization	BCB Ch2,3	Hw0 due
L2	Jul 17 – Zoom	Probability; normal distribution	BCB Ch4	Hw1 due
L3	Jul 24 – Zoom	Central limit theorem, confidence intervals	BCB Ch4,5	Hw2 due
L4	<i>Thu Aug 1st</i>	Hypothesis testing, single group	BCB Ch5	Hw3 due
L5	Aug 7	Inference for means of two groups	BCB Ch5,6	Hw4 due
L6	Aug 14	Inference for proportions	BCB Ch4,5	Hw5 due
L7	Aug 21	Comparing proportions, two groups	BCB Ch5,6	Hw6 due
L8	Aug 28	Comparing 3 or more groups: ANOVA	BCB Ch6,7	Hw7 due
L9	Sep 4	Correlation and simple linear regression	BCB Ch8	Hw8 due
L10	Sep 11	Review		Hw9 due
<i>Final</i>	<i>Sep 12</i>	Final Exam	BCB Ch1-8	

Course Components

- Weekly assignments, to be submitted through Canvas.
- Homework is due at 11:59pm, on the following week. Late homework is not acceptable.
- The only acceptable format is .pdf. Do not submit raw R output.
- Homework assignments will be individual or for **a group of two students** (one submission per group). Groups are assigned by instructor via Canvas and changed mid-way through the course.

Final Exam

- On-line, open-book, written exam, last week of the course. The exam will involve data analysis in R, and/or hand calculations.
- A make-up exam date will be set up for students with extenuating circumstances. The student should make special arrangements with the instructor at least two weeks in advance.
- *The best tool for preparing the final exam is practice on the prior final exams, posted on course website.*

Grading Policy

- The course grade will have two components: Homework (40%) and Final exam (60%).
- **All students receive a final grade bonus of 0-1 percentage points, based on completed evaluation by the class as a whole (0% = 0 points, 100% = 1 points, with linear interpolation in-between).**

Grade thresholds use the UCSD grading scheme:

Grade	Total Score		Grade	Total Score
A	94-100		C+	77-79.9
A-	90-93.9		C	74-76.9
B+	87-89.9		C-	70-73.9
B	84-86.9		D	61-69.9
B-	80-83.9		F	0-60.9

- Plagiarism will be dealt with according to the UCSD Policy of Integrity of Scholarship
- See your grades on Canvas canvas.ucsd.edu (if you are matriculated- in MAS Program), or on MyExtension <https://myextension.ucsd.edu/> (if you are non-matriculated/CREST, concurrent enrollment)

Course Policy and Expectations (classroom rules of conduct)

- Time Commitment: Expect to spend 4-6 hours a week outside of class.
- Attendance Policy: The general CREST attendance policy applies, no more than 3 missed sessions are allowed. You have to be present in both halves of the class.
- Academic Integrity (Plagiarism): <http://academicintegrity.ucsd.edu/>
- Late homework is not acceptable.

Communication with lecturers and teaching assistant

The best way to reach the instructor is in class, before/after lectures. The best way to reach the TA is via email.

Student Evaluation of Course and Faculty

Course and faculty evaluations provide important feedback to instructors to improve course content and teaching methodology. The evaluations are also an important factor in faculty advancement. A link to one-time course evaluations is available on the course website. All students will receive a final grade bonus of 0-1 percentage points, based on evaluation completion by the class as a whole (0% = 0 points, 100% = 1 points, with linear interpolation in-between).

Technical Requirements

The students should bring their laptop with R and Rstudio installed to every class, and conduct analyses at the same time with the instructor.

Accommodations: If you have a disability that may impact your academic performance, you may request accommodations by submitting documentation to: <https://students.ucsd.edu/well-being/disability-services/>