



**Mel and Enid Zuckerman College of Public Health
University of Arizona**

**SYLLABUS
Introduction to Biostatistics (BIOS 376, Online)
Spring 2023**

Time/Location: Online

Instructor(s) and Contact Information:

Antonio Rubio, Ph.D.

Department of Epidemiology and Biostatistics

Email: antoniorubio@arizona.edu – I will do my best to answer emails within 24 business hours of receipt (so an email received late afternoon on Friday will be answer by the end of working hours on Monday).

Office hours: Available on Discord (content questions) and by request over Zoom (for administrative issues where a private call is warranted).

Teaching Assistants:

Mark Bayer

Email: mbayer@arizona.edu

Office hours: Available on Discord

Hamza Butt

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Anthony Marrama

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Zelin Wang

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Office hours: Available on Discord

Course Description: This course introduces biostatistical methods and applications, covering descriptive statistics, probability, and inferential techniques necessary for appropriate analysis and interpretation of data relevant to health sciences. Students will use the statistical software package R and R Studio.

Course Prerequisites: MATH 112 or higher; pre-health or health education students

It is assumed that you have a grasp of algebra and basic mathematical notation and skills (e.g., using proper order of operations, solving for a variable, ability to use a simple calculator).

Course Objectives and Expected Learning Outcomes:

Course Objectives: During this course students will:

- Identify different statistical methods of visualizing and summarizing data
- Interpret and critically analyze statistical information
- Perform simple data wrangling techniques using R
- Conduct basic statistical tests using R
- Identify the limits and assumptions associated with basic statistical tests
- Recognize when and how to use different statistical tests under different conditions

Learning Outcomes (Competencies Obtained): Upon completion of this course students will be able to:

- Recognize improvements in their statistical literacy
- Explain basic statistical terminology and concepts
- Conduct basic statistical tests by hand
- Determine the proper method to be used in analyzing data sets
- Carry out basic statistical analyses using R
- Review journal articles that present basic statistical summaries and inferences

Biostatistics Competencies: Use basic biostatistical approaches and other modern methodological frameworks to design and test hypotheses.

Program Competencies Covered (BS Program level):

- Written communication: Reporting and interpreting statistical results to lay audiences
- Communicate with diverse audiences: Reporting and interpreting statistical results for statisticians as well as non-statisticians
- Use information: Statistical analysis of public health related data
- Evaluate information: Interpreting statistical results from public health domain

Course Notes and Communication:

- Course notes and other general resources will be available on D2L (d2l.arizona.edu) for review. Slides may (intentionally) be incomplete and may not work out all problems in detail. Taking notes during lecture and using the text will ensure you have a complete set of slides.
- Solutions to problems worked in class will often be posted by the end of the week.
- Students will be expected to check the D2L website on a regular basis. All course communications directed to the entire class, including announcements and emails, will be conducted via D2L.
- Please make sure you are linked to D2L to receive emails.

Classroom Technology:

- All assignments will be collected and graded using either Gradescope.com or D2L Quizzes
- Exams will be proctored via Examity. I will be using a security level for which you do not need to schedule in advance. If you prefer to take exams in person you are welcome to take exams with my in-person course (MW 9:30a – 10:45a). Please let me know at least two weeks in advance of any exam for which you'll want to take in person.
- We will be using Discord for office hours and to provide students with a forum for discussing homework problems and asking for clarifications on assignments.

Required Texts or Readings:

Textbook: Understandable Statistics (12th edition), by Brase and Brase

- Lectures, examples, and assignments will follow the framework and notation of the text.
- You might consider purchasing a hard copy or electronic version from an online retailer (e.g., amazon.com) or sharing one with a fellow classmate and splitting the cost.
- A hard copy is available on reserve at the College of Public Health, Division of Epidemiology and Biostatistics. You can check out the text for only a limited amount of time, however. Check with Kevin Comisso on the 2nd floor of Drachman Hall (southeast corner) for additional information.
- The 11th and 10th edition of the text is similar enough, however, you should realize that the page numbers for the assigned readings and sample problems might not match.

Required or Special Materials: (Tools/supplies for this course).

- *Computer:* Windows/Mac/Linux
- *Software:* R, or R Studio Cloud
 - RStudio Cloud is a user interface extension for R programming language. Both are free to download. You need them to complete the assignments from this class.
 - A detailed step-by-step installation guide will be posted on D2L.
 - I've seen mobile versions of R and R Studio although there are difficult to use without a keyboard.
 - A successful and timely installation of R or RStudio on your computer is crucial to maintaining a good grade in this course. If you are struggling in this regard, please come in for office hours.
- *Handheld calculator*
 - Your calculator should include the square root and power functions (x^y). Other useful features may include parentheses and inverse functions (x^{-1}).
 - You do not need a graphing or programmable calculator.
 - Note that cell phones, laptops, tablets, and other web-enabled devices will not be permitted during exams, so do not rely on these as your sole source for computing.

Grading Scale/Student Evaluation and Policies:

A: 90 or higher B: 80-89 C: 70-79 D: 60-69 E: 59 or less

University policy regarding grades and grading systems is available at: <http://catalog.arizona.edu/policy-type/grade-policies>

Required examinations, papers and projects:

| Component | Homework | Class Activities | Exam 1 | Exam 2 | Final Exam | Total |
|-----------|----------|------------------|--------|--------|------------|-------|
| Weight | 25% | 15% | 15% | 20% | 25% | 100% |

Description of each Assessment and Competencies Covered by the Assessment

- **Class Activities:** Most lectures will contain a class activity. Students are expected to attend all lectures.
- **Homework:** There will be 12 homework assignments throughout the semester.
- **Exams:** There will be 3 exams, including the final exam. Exams are compulsory and cannot be dropped.
- **Extra credit quizzes:** Before each midterm and twice before the final exam we will have a timed extra credit quiz to give you practice working under time pressure in a lower stress environment. These quizzes will sum to no more than 5% of the total course grade.

Course Schedule: Here is a **tentative list** of lecture topics and their associated dates.

| Weeks and Dates | Topic | Assignment |
|----------------------------------------------------------------------|------------------------------------------------------------|------------|
| Introduction to the course | | |
| Week 1 | Course introduction; R for beginners | |
| Descriptive Statistics | | |
| Week 2 | Visualizing data: Frequency tables, Bar graphs, Histograms | HW1 |
| Week 3 | Summarizing data: Measures of center | HW2 |
| Week 4 | Summarizing data: Measures of variation | HW3 |
| Week 5 | Summarizing data: Probabilities, Distributions, z-scores | HW4 |
| Week 6 | Review & Exam 1 (via Examity 2/15 - 2/16) | |
| Inferential statistics I: Estimation & Hypothesis Testing | | |
| Week 7 | Sampling distribution of mean | HW5 |
| Week 8 | Confidence Intervals and Hypothesis testing | HW6 |
| Week 9 | Hypothesis Testing (1 sample) | HW7 |
| Week 10 | Hypothesis Testing (2 samples) | HW8 |
| Week 11 | Review & Exam 2 (via Examity 3/29 – 3/30) | |
| Inferential statistics II: Correlation & Regression | | |
| Week 12 | Correlation | HW9 |
| Week 13 | Linear Regression & Inference | HW10 |
| Week 14 | Linear Regression & Inference | HW11 |
| Week 15 | Chi-square distributions and tests | HW12 |
| Week 16 | Review | |
| Week 17 | Final Exam (via Examity 5/8 – 5/9) | |

Absence and Class Attendance/Participation: (Expected attendance, participation levels)

Students are expected to review all lectures. Participation will be measured through class activities.

Grade Disputes

Disputes about grades on a particular assignment or exam will be entertained for one week from the day the assignment is returned, or 1 day before final grades are due, whichever is sooner. These will be resolved by re-grading the entire assignment or exam. Note that it is possible that this could result in a lower grade in the event that new mistakes are discovered. This should not discourage you from seeking a correction if I or the TA genuinely make a mistake in grading, as we will always do our best to be as fair as possible and will apply the same standard during a regrade that was applied originally.

The final exam will be graded and made available for review by students within 48 hours of its completion, to allow time for any requested regrades. No negotiations about individual students' letter grades will be entertained once final grades are assigned, except as permitted by the policy stated in the syllabus.

Class Policies with regards to grading and late assignments:

- No homework assignments will be dropped but the number of points needed to get 100% in a grade category will be equivalent to perfect scores on 10/12 homework assignments and 20/23 in class assignments/R Labs. Scores higher than 100% for the homework and in-class assignment categories will not spill over to other categories.
- No unexcused late work will be accepted. Even great students will occasionally miss a deadline which is why we have the policy above.
- If you are ill or experiencing some other emergency or hardship, please get in touch with the course instructor (Antonio) to discuss adjusting due dates. Please do this quickly as no assignments more than a week past due will be adjusted.
- Late attempts will not be allowed for extra credit quizzes since we need to post solutions quickly.

In-Class Exercises (Participation): This component includes:

- Completion of any self-assessments, quizzes, or surveys
- Students are encouraged to honestly assess their understanding of material and performance in the course, and to then ask for help, if necessary. To facilitate this there may be quizzes throughout the semester that will cover fundamental concepts.

Homework

- Assignments are due on Gradescope typically 1 week from the date they are assigned.
- Expect that by the time you have access to an assignment you can complete the majority of it if you have completed the reading assignment and associated class activity (if there was any).
- The best way to excel on the exams is to make sure you have mastered the homework. Also, the best way to excel on the homework assignments is to participate in class activities.
- Students are expected to review all returned work and ask for help, if necessary.
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Exams

- There are two exams that will take place, plus the final exam. Please clear your schedule for these exam days. Do not schedule plans that will interfere with your final exam.
- All exams will be given on D2L and proctored by Examity (level 1P).
- Cell phones, and other similar devices will not be permitted and should not be in sight during exams.
- You may not have your phone out during the exam period without permission. Doing so will result in an automatic test grade of zero.

- Exams cover material in class, lectures, readings (the text), homework, and any material on self-assessments or quizzes. The format of the exams mimics the format of the homework and quizzes. They are cumulative in the sense that the material builds upon itself. **There will be no R related programming questions on exams, only questions involving interpretation of the R output.**
- All exams will be closed-book with the exception of a formula sheet that we will provide and/or statistical tables, again which we will provide.
- Points earned from each exam will be converted into a percentage. These percentages will be weighted according to the grading scheme above.

Class Attendance: You are responsible for learning all content covered in class, including the in-class exercises, written notes, and any alterations to the syllabus. All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion. Absences pre-approved by the UA Dean of Students (or Dean's designee will be honored.)

Collaboration Policy: Students are encouraged to work together, both in class/office hours and otherwise, to understand problems and general approaches for solutions. However, final write-ups of solutions must be done individually. Any collaboration that takes place outside section or office hours must be identified in writing, along with the nature of the collaboration (e.g., “X and I worked together”, “Y helped me”, “I helped Z”). Copying another person's answers, work or code is not permitted, regardless of collaboration status. Clear violations of this policy will result in a grade penalty for the first offense, and an academic dishonesty report led for any offense after that. Borderline violations will result in a written warning for the first offense, and the above sequence of consequences enacted after that.

Accessibility and Accommodations: At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, you are welcome to let me know so that we can discuss options. You are also encouraged to contact Disability Resources (520-621-3268) to explore reasonable accommodation. If our class meets at a campus location: Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable. For additional information on Disability Resources and reasonable accommodations, please visit <http://drc.arizona.edu/students>

Code of Academic Integrity: Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercise must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity, available through the office of the UA Dean Students: <http://deanofstudents.arizona.edu/policies-and-codes/code-academic-integrity>

Classroom Behavior: (Statement of expected behavior and respectful exchange of ideas: Present policies to foster a positive learning environment, including use of cell phones, mobile devices, etc.). Students are expected to be familiar with the UA Policy on Disruptive Student Behavior in an Instructional Setting found at: <http://policy.arizona.edu/education-and-student-affairs/disruptive-behavior-instructional-setting>

Threatening Behavior Policy: The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to one's self, <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>

Nondiscrimination and Anti-Harassment Policy: The University of Arizona is committed to creating and maintaining an environment free of discrimination, <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

UA Smoking and Tobacco Policy: The purpose of this Policy is to establish the University of Arizona's (University) commitment to protect the health of University faculty, staff, students, and visitors on its campuses and in its vehicles, <http://policy.arizona.edu/ethics-and-conduct/smoking-and-tobacco-policy>

Syllabus Changes: Information contained in the course syllabus, other than the grade and absence policies, may be subject to change with reasonable advance notice, as deemed appropriate by the instructor.