

Mel and Enid Zuckerman College of Public Health

University of Arizona

**SYLLABUS**

**BIOS 576A: Biostatistics in Public Health**

# FALL 2018

**Time**: Tuesday and Thursday, 12:30 PM – 1:45 PM

**Location**: Drachman Hall, Rm A118

**Instructor(s) and Contact Information**:

Shikhar Kumar, Ph.D.

Department of Epidemiology and Biostatistics

Mel and Enid Zuckerman College of Public Health

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*Email*: [shikhark@email.arizona.edu](mailto:shikhark@email.arizona.edu)

**Instructor Availability:**

*Office hours*: Tuesday and Thursday, 2 PM – 3 PM, or by appointment

**Course Description:**

This course introduces biostatistical methods and applications. We will cover descriptive statistics, probability theory, and a wide variety of inferential statistical techniques that can be used to make practical conclusions about empirical data. We will use a two-fold approach to mastery of this material. On the one hand, we will look in some detail at how statistical procedures are employed, and you will conduct a number of basic procedures by hand in order to fully understand the logic of statistics. In order to complete this goal successfully, a prerequisite of at least one year of college mathematics is required. (Note that I will not check on this prerequisite formally, but you would be well advised to check with me if you have doubts about how well your background prepares you for this course). Additionally, you will learn how to use a computer package, SAS, in order to quickly perform statistical analyses in more complex situations. This combined approach will enable you to be an educated consumer and producer of statistical knowledge in the real world.

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

**Course Objectives and Expected Learning Outcomes:**

Course Objectives

During this course students will:

* Determine the proper method to be used in analyzing data sets (e.g., parametric or non-parametric methods, independent or paired samples?).
* Apply your statistical knowledge to designing research studies. This includes computing the sample sizes necessary to show statistical significance and selecting the proper study design.
* Better understand medical and scientific journal articles which frequently rely heavily on statistical procedures.
* Perform basic statistical analysis using a computer statistical software package (SAS).
* Be able to interpret computer outputs for the more commonly used statistical tests.

Learning Outcomes (Biostatistics Competencies Obtained)

Upon completion of this course students will be able to:

* Ability to identify appropriate statistical tools to address specific scientific questions
* Ability to select appropriate research designs to meet the needs of various studies, and be able to explain the limitations of implemented designs
* Ability to skillfully engage in statistical collaboration with mentors, colleagues, and clients
* Demonstrate excellent presentation skills and the ability to explain statistical concepts and findings to a general scientific audience
* Demonstrate skills in data management to handle a variety of practical problems in data format and structure
* Demonstrate advanced working skills in application of computer systems and appropriate statistical software
* Demonstrate advanced competencies in areas of professional expertise and scholarship enabling them to advance to further postgraduate study in biostatistics
* Demonstrate understanding of methods of data analysis and data monitoring

**Course Notes and communication**:

* Course notes and other general resources will be available on D2L (d2l.arizona.edu) for review.
* Solutions to problems worked in class will often by posted by the end of the week.
* I reserve the right to discontinue D2L posts (both lecture slides and problem solutions) if I feel not enough students are attending or participating in class.
* This is not an online class. Students will be expected to check the D2L website on a regular basis. All course communication, including announcements and emails, will be conducted via D2L.
* Please make sure you are linked to D2L to receive emails.

**Required Texts or Readings**:

We will be using the 7th (or 8th) edition of Fundamentals of Biostatistics, by Rosner. It is available in the Medical School Bookstore and can be also purchased online at http://www.cengagebrain.com/shop/isbn/9780538733496 (including eBook and eChapters), too. This text has a companion website. eBook and eChapters (cheaper compared to buying the whole book) are also available. The data sets used in the homework can be found on the companion website.

**Tools for this course:**

Computer: Windows/Mac/Linux

Software: SAS University Edition (Free), MS Word, PDF reader, MS Power point, Windows media player

Brain: skepticism, attention, creativity,

Handheld calculator

* Your calculator should include the square root and power functions (xy). Other useful features may include parentheses and inverse functions (x-1).
* You do not need a graphing or programmable calculator.

**Course Requirements**: (Describe as specifically as possible, what is required of the student).

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

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| --- | --- | --- |
| **Weeks and Dates** | **Topic** | **Reading (Rosner, 7th Ed)** |
| **Introduction to the course and SAS** | | |
| Week 1  (8/21 – 8/23) | Introduction to course; SAS Demo | Ch. 1 |
| **Part I** | | |
| Week 2  (8/28 – 8/30) | Descriptive Statistics | Ch. 2 (skip 2.7) |
| Week 3  (9/4 – 9/6) | Probability | Ch. 3 (skip 3.8-3.10) |
| Week 4  (9/11 – 9/13) | Distributions | Ch. 4, 5 (skip 4.1-4.7, 4.13,  5.6 5.8) |
| Week 5  (9/18 – 9/20) | Estimation | Ch. 6 (skip 6.3-6.4, 6.9) |
| Week 6  (9/25) | **Review (Take Home Exam 1 given out)** | Ch. 1-6 |
| Week 6  (9/27) | **Exam 1 due** |  |
| **Part 2** | | |
| Week 7  (10/2 – 10/4) | Hypothesis Testing (1 Sample inference) | Ch. 7: 7.1-7.4, 7.7, 7.12, 7.13 |
| Week 8  (10/9 – 10/11) | Hypothesis Testing (2 Sample inference) | Ch. 8 (skip 8.9-8.11) |
| Week 9  (10/16 – 10/18) | Non-parametric Methods | Ch. 9 |
| Week 10  (10/23 – 10/25) | Hypothesis Testing (Categorical Data) | Ch. 10 (skip 10.5-10.8) |
| Week 11  (10/30 – 11/1) | Power and Sample Size | 7.5, 7.6, 8.10, 10.5 |
| Week 12  (11/6) | **Review (Take home Exam 2 given out)** | Ch. 7-10 |
| Week 12  (11/8) | **Exam 2 due** |  |
| **Part 3** | | |
| Week 13  (11/13 – 11/15) | Simple Linear Regression | Ch. 11: 11.1-11.6 |
| Week 14  (11/20) | Multiple Linear Regression / Correlation | Ch. 11: 11.7-11.10, 11.12 |
| Week 15  (11/27 – 11/29) | Multiple Linear Regression / Multi Sample Inference (ANOVA) | Ch. 12 (skip 12.10) |
| Week 16  (12/4) | **Review (Final Exam given out)** | Ch. 1-12 |
| TBA | **Final Exam Due** |  |

**Grading Scale/Student Evaluation and Policies**

Homework assignments will be given every week and will be due in a week from the date they are posted. For each homework, the answer key will become available for you after the due day, so that you know if you are getting the right answer or not. If you don't have the right answer, you know to keep working until you figure it out. This list has been compiled recently, and although it has been checked once, it is possible that it contains the occasional error. If you are in disagreement with the answer key, but keep getting the same `wrong' answer, there is a slight possibility that the key contains an error. Check with me for confirmation if uncertain. DO NOT put off homework until the last minute! Doing the homework as soon as possible after the relevant material has been covered in lecture will make the task easier for you, and will maximally reinforce the material in your mind.

The best way to excel on the exams is to master the homework. Given the explicit scheduling of homework due dates and the logistical difficulty involved in large numbers of detailed answers, **late homework assignments will NOT be accepted unless prior arrangements have been made.** Homework must be uploaded to the “Assignments” section of D2L before the due date. Faxed and mailed submissions will not be accepted unless prior arrangements have been made (eg, due to travel to conferences, etc.). Note that most chapters have two homework assignments, one by hand and one using SAS. Bearing in mind this definition of homework assignment, the lowest two homework assignments will be dropped. It is wise to save these drops for illness or emergencies. Please be neat and orderly in your homework assignments. Homework by hand and homework in SAS need to be submitted together. Bold, highlight, or otherwise emphasize those that are obtained as computer output. Obviously, since you will have answers to most of the questions, grading will focus on how you arrived at the answers. Therefore, for homework that is not legible and well organized, only partial credit will be awarded. On both homework assignments and exams, partial credit is doled out generously; my goal is to see that you are thinking statistically. Therefore, on exams and homework always show your work (again, be as neat and clear as possible).

All three exams will be take home exams. Late Exams with NOT be accepted under any circumstances. Late submission will be given a 0. If you have a conflict with the exam dates, you should let the instructor know at the start of the semester.

Exams and homework and other components contribute to your final grade as follows:

|  |  |
| --- | --- |
| **Component** | **Weight** |
| Homework | 25% |
| Attendance | 5% |
| Class Activity (SAS based) | 10% |
| Exam 1 | 15% |
| Exam 2 | 20% |
| Final Exam | 25% |
| Total | 100% |

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| --- | --- |
| Grade | Point Range |
| A | 90% - 100% |
| B | 80% - 89% |
| C | 70% - 79% |
| D | 60% - 69% |
| E | < 60% |

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

**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 in the event that I genuinely made 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

above.

**A Note on Reading and Lectures**

The word “lecture” has its roots in the word “reading”, and comes from a historical period when books had to be hand-copied and it was more efficient for professors to read to rooms full of people than for the students to have their own copies of the text. As such is a bit of a misnomer to call class meetings “lectures” in an age when students have access to reading materials outside of class. Class meetings

should not be a mechanism for the one-way delivery of information - that's what the reading is for. Instead, students are expected to do the relevant reading before each class and have the basics, if not mastered, then at least familiar, so that class time can be spent interactively: reinforcing the reading, clarifying difficult concepts, and discussing subtleties. As an external incentive, there will be frequent quizzes on the basic concepts.

**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 filed 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.

**Required examinations, papers and projects**:

*Class Activity*: Every week will have some kind of class activity that will require students to do analyses in SAS.

*Homework*: There will be a homework assignment every week.

*Exams*: There will be 3 take home exams (including the final exam).

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

Attendance is compulsory. Participation will be measure via class activity.

**Communications**: You are responsible for reading emails sent to your UA account from your instructor and the announcements that are placed on the course web site. Information about readings, news events, your grades, assignments and other course related topics will be communicated to you with these electronic methods. The official policy can be found at: <https://www.registrar.arizona.edu/personal-information/official-student-email-policy-use-email-official-correspondence-students>

**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 Settingfound 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.

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**Do NOT plagiarize! If you have doubts, read below:**

**Plagiarism:**  What counts as plagiarism?

* Copying and pasting information from a web site or another source, and then revising it so that it sounds like your original idea.
* Doing an assignment/essay/take home test with a friend and then handing in separate assignments that contain the same ideas, language, phrases, etc.
* Quoting a passage without quotation marks or citations, so that it looks like your own.
* Paraphrasing a passage without citing it, so that it looks like your own.
* Hiring another person to do your work for you, or purchasing a paper through any of the on- or off-line sources.