# CPH/EPID 576A: Biostatistics in Public Health

Dr. Shikhar Kumar

Last Revised August 22, 2017

## 1 Course Information

### 1.1 Course Introduction

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.

### 1.2 Course Objectives

- 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.

1.3 Biostatistics Competencies

• 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

1.4 Locations and Times

Lecture Time: T/R 12:30 PM - 1:45 PM
Lecture Place: Drachman Hall, Rm A118
1.5 Textbooks

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. You may also want to download the Stata Survival Guide, which can be found on the website of this course.

1.6 Required Software

- Microsoft Word.
- Microsoft PowerPoint.
- Windows Media Player.
- pdf reader.
- SAS for homework. You can nd out how to order SAS under the SAS section on D2L.

1.7 Instructor Information

Dr. Shikhar Kumar
Department of Epidemiology and Biostatistics
Mel and Enid Zuckerman College of Public Health
Office: Drachman Hall A218
Email: shikhark@email.arizona.edu
Office Hours: Tuesdays and Thursdays, 2:00 PM - 3:00 PM, or by appointment

1.8 Teaching Assistant
2 Course Policies and Grading

2.1 Exams and Assignments

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 get 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 or the TA 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 fully credited. Homework must be uploaded to the dropbox before the due date. Faxed and mailed submissions will not be accepted unless prior arrangements have been made (e.g., 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). Exams and homework contribute to your final grade as follows:
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 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 above.

2.2 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, nal writeups 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 rst offense, and an academic dishonesty report led for any offense after that. Borderline violations will result in a written warning for the rst offense, and the above sequence of consequences enacted after that.
3 University Policies

Classroom Behavior

Students are expected to behave respectfully toward each other and to the instructor and TAs. Disrespectful behavior includes the use of cell phones or other electronic devices in the classroom during class hours.

The Arizona Board of Regents Student Code of Conduct is here: http://dos.web.arizona.edu/uapolicies/scc5308abcd.html#sccphilosophy

ABOR Policy 5-308, prohibits threats of physical harm to any member of the University community, including to oneself. See: http://policy.web.arizona.edu/~policy/threaten.shtml.

Special Needs and Accommodations

Students who need special accommodation or services should contact the Disability Resources Center
1224 East Lowell Street, Tucson, AZ 85721
(520) 621-3268 FAX (520) 621-9423
email: uadrc@email.arizona.edu
web: http://drc.arizona.edu/.

You must register and request that the Center or DRC send official notification of your accommodations needs as soon as possible. Please plan to meet with the instructor by appointment or during office hours to discuss accommodations and how the course requirements and activities may impact your ability to fully participate. The need for accommodations must be documented by the appropriate office.

Student Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to
adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: http://dos.web.arizona.edu/uapolicies/.

Confidentiality of Student Records

See http://www.registrar.arizona.edu/ferpa/default.htm

Subject to Change Statement

Information contained in this syllabus, other than the grade and absence policy, may be subject to change by the instructor, with advance notice.
## 4 Schedule

### 4.1 Lecture Topics and Readings

Here is a tentative list of lecture and lab topics and their associated dates.

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Reading</th>
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<tbody>
<tr>
<td>1 (8/22)</td>
<td>Introduction</td>
<td>Ch. 1</td>
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<tr>
<td>1 (8/24)</td>
<td>Descriptive Statistics: How to present and summarize the data</td>
<td>Ch. 2 (skip 2.7)</td>
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<tr>
<td>2 (8/29)</td>
<td>Descriptive Statistics: How to present and summarize the data</td>
<td>Ch. 2 (skip 2.7)</td>
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<tr>
<td>2 (8/31)</td>
<td>SAS Demo</td>
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<td>3 (9/5-9/7)</td>
<td>Probability</td>
<td>Ch. 3 (skip 3.8-3.10)</td>
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<td>3 (9/12-9/14)</td>
<td>Distribution</td>
<td>Ch. 4, 5 (skip 4.1-4.7, 4.13, 5.6 5.8)</td>
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<td>4 (9/19-9/21)</td>
<td>Estimation</td>
<td>Ch. 6 (skip 6.3-6.4, 6.9)</td>
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<td>5 (9/21-9/26)</td>
<td>Exam 1 (Take Home)</td>
<td>Ch. 1-6</td>
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<tr>
<td>6 (9/26-9/28)</td>
<td>Hypothesis Testing: Onesample inference</td>
<td>Ch. 7: 7.1-7.4, 7.7, 7.12, 7.13</td>
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<tr>
<td>7 (10/3-10/5)</td>
<td>Hypothesis Testing: Twosample inference</td>
<td>Ch. 8 (skip 8.9-8.11)</td>
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<td>8 (10/10-10/12)</td>
<td>Nonparametric Methods</td>
<td>Ch. 9</td>
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<tr>
<td>9 (10/17-10/19)</td>
<td>Hypothesis Testing: Categorical data</td>
<td>Ch. 10 (skip 10.5-10.8)</td>
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<tr>
<td>10 (10/24-10/26)</td>
<td>Power and Sample Size</td>
<td>7.5, 7.6, 8.10, 10.5</td>
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<tr>
<td>11 (10/26-11/31)</td>
<td>Exam 2 (Take Home)</td>
<td>Ch. 7-10</td>
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<tr>
<td>12 (10/31-11/2)</td>
<td>Simple Linear Regression</td>
<td>Ch. 11: 11.1-11.6</td>
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<td>13 (11/7-11/9)</td>
<td>Correlation Coefficient and Multiple Linear Regression</td>
<td>Ch. 11: 11.7-11.10, 11.12</td>
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<tr>
<td>14 (11/14-11/16)</td>
<td>Multi-sample Inference (ANOVA)</td>
<td>Ch. 12 (skip 12.10)</td>
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<tr>
<td>15 (11/21-12/5)</td>
<td>Final Exam Review</td>
<td>Ch. 1-12</td>
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<tr>
<td>Date</td>
<td>Event</td>
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<tr>
<td>16 12/5</td>
<td>Final Exam (Take Home)</td>
<td>Ch. 1-12</td>
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