

# PUBH 6451, SECTION 001

## Biostatistics II Spring 2019

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### COURSE & CONTACT INFORMATION

**Credits:** 4  
**Meeting Day(s):** Mon, Wed  
**Meeting Time:** 10:10-12:05pm  
**Meeting Place:** Mayo 3-125

**Instructor:** Dr. Weihua Guan  
**Email:** wguan@umn.edu  
**Office Phone:** 612-626-4765  
**Fax:**  
**Office Hours:** TBA  
**Office Location:** Mayo A443

### COURSE DESCRIPTION

PubH 6451 is the second semester of an introduction to biostatistics, statistical methods applied in the health sciences. This course covers a broad range of methods, with a focus on their practical use and interpretation in clinical trials and observational studies. The theme of the course is statistical adjustment of comparisons of study groups. In each homework, students read an assigned paper from a health-science journal, repeat the analysis in the paper and critique the methods and results. Computations will be illustrated in SAS and/or R, with discussion of basic programming elements and output for the homework. The course covers methods for working with continuous measurements (t-tests, linear regression, ANOVA), measurements in categories (risk, rates, odds, logistic and Poisson regression), and measurements of time until an event occurs (survival data, proportional hazards regression).

#### Acknowledgments

The contents of PubH 6451 have been developed with the contributions of numerous instructors. Former faculty/instructors, including Drs. Robert Leduc and William Thomas, all had roles in either the conceptual development or actual content of the current course, and are acknowledged for their contributions.

### COURSE PREREQUISITES

[[[6420, 6450] or [6414, 6415]] with grade of at least B, health sciences grad student] or instructor consent.

### COURSE GOALS & OBJECTIVES

Present methods for comparing study groups based on outcome measures that are continuous or binary, and methods for adjusting the comparison. Students will critique papers from health science journals illustrating these methods, to develop their understanding of these statistical approaches and their limitations. Students will use SAS or R to apply each method and will be able to understand and use the output produced.

### METHODS OF INSTRUCTION AND WORK EXPECTATIONS

#### Course Workload Expectations

PUBH 6451 is a 4 credit course. The University expects that for each credit, you will spend a minimum of three hours per week attending class or comparable online activity, reading, studying, completing assignments, etc. over the course of a 15-week term. Thus, this course requires approximately 180 hours of effort spread over the course of the term in order to earn an average grade.

#### Learning Community

School of Public Health courses ask students to discuss frameworks, theory, policy, and more, often in the context of past and current events and policy debates. Many of our courses also ask students to work in teams or discussion groups. We do not come to our courses with identical backgrounds and experiences and building on what we already know about collaborating, listening, and engaging is critical to successful professional, academic, and scientific engagement with topics.

In this course, students are expected to engage with each other in respectful and thoughtful ways.

- **Preceding class:** Obtain the course notes from the Moodle/Canvas page. These will be available at least 24 hours in advance of class.
- **In Class:** Attend lectures; participate in class questions/activities.
- **Readiness Quiz:** Between Wednesday and Friday, take the Readiness Quiz on the Moodle/Canvas page for that week. Review areas of the notes relating to missed questions on the quiz. Readiness Quizzes may be taken up to 3 times. A final score of 80% (usually 4/5 questions) is required to pass. Grades are recorded as Pass or Fail.

- **Complete Homework:** Homework will be due the following week, usually but not always on Wednesdays. Homework must be turned in at the start of class on the due date. You should address weaknesses highlighted by the Readiness Quiz before getting too far into the homework.

Additionally, throughout the semester we will work in small groups on a final course project to conduct an observational medical or public health study in a virtual environment known as The Islands ([https://learnandteachstatistics.wordpress.com/2015/07/27/the\\_islands/](https://learnandteachstatistics.wordpress.com/2015/07/27/the_islands/)). Your group will work with a TA assigned to you as a statistical consultant on aspects of the study process (e.g. developing a research question, methodology, analysis). This project will go on all semester and require you to consider statistical issues learned in class. The culmination of the project will be a presentation of your team's results to your peers and outside guests in the last week of class.

Materials for class will be distributed through the course Moodle/Canvas page. You will receive an email invitation to log in to the course Moodle page sent to your UMN X.500 email account. You are required to check your X.500 email account at least daily for course announcements.

In addition to asking questions in class or during office hours for instructors and TAs, discussion forums will be available on the course Moodle page. We will attempt to reply to all questions in the discussion forums within 24 hours of posting. We will not answer questions about course material sent by email, except as part of consulting on individual Island projects. However, email is a valid medium to use to ask questions concerning your grade or how your assignment was graded, and for other private matters such as absences for medical reasons, etc. Instructors and TAs can only respond to emails sent from a student's UMN X.500 email account for reasons of privacy and security.

**Computing.** The course will include examples of data analysis from SAS, version 9.4 and R. You will need SAS **OR** R output to complete your homework. The course Moodle page contains information on where to obtain the software.

You may work with a group of students on the homework, and share SAS or R output. I don't insist that every student run programs, but **every student must write their own homework paper.**

Like other work in the course, all student to student communication is covered by the Student Conduct Code (<https://z.umn.edu/studentconduct>).

## COURSE TEXT & READINGS

Course notes will be distributed on the course webpage. **Recommendation reading:**

- Moore and McCabe: *Introduction to the Practice of Statistics*, (6th ed.) (text from PubH 6450)
- Dawson and Trapp: *Basic and Clinical Biostatistics* (4th ed)
- Delwiche and Slaughter: *The Little SAS Book* (4th ed.)
- Everitt and Hothorn, *A Handbook of Statistical Analyses using R* (2<sup>nd</sup> ed.)

**COURSE OUTLINE/WEEKLY SCHEDULE** (actual schedule will be adjusted based on progress)

Date	Topic	Readings	Activities/Assignments
Jan 23	Review: <i>t</i> -tests, <i>p</i> -values, standard errors	•	•
Jan 28	One-way ANOVA	•	•
Jan 30	<i>Post hoc</i> pairwise tests and multiple comparisons	•	•
Feb 4	Displaying significant differences between means (tables, graphs); Fisher's Least Significant Difference and Analyzing data on the log scale	•	•
Feb 6	Two-factor ANOVA	•	•
Feb 11	(No class)	•	•
Feb 13	Two-factor ANOVA; adjusting comparisons using strata	•	•
Feb 18	Simple linear regression (one predictor), Intro to multiple linear regression	•	•
Feb 20	Multiple linear regression	•	•
Feb 25	ANCOVA: Adjusting comparison of groups using regression	•	•
Feb 27	Adjusting a comparison with observational data: Framingham Study	•	•
Mar 4	Issues in adjusting comparisons; comments on regression; review	•	•
Mar 6	Estimating sample size, calculating power	•	•
Mar 11	Test 1	•	•
Mar 13	Review: tables of counts, chi-square test, odds ratio, relative risk	•	•
Mar 18-22	Spring Break	•	•
Mar 25	Adjusted comparison of odds: CMH test; logistic regression	•	•
Mar 27	Logistic regression: adjusting the comparison of odds	•	•
Apr 1	Logistic regression: adjusting the comparison of odds; conditional logistic regression	•	•
Apr 3	Logistic regression examples	•	•
Apr 8	Survival analysis: Survivor function and the Kaplan-Meier estimate	•	•
Apr 10	Comparing survivor functions: log-rank and Wilcoxon tests	•	•
Apr 15	Survival analysis examples	•	•

Date	Topic	Readings	Activities/Assignments
Apr 17	Hazard function	•	•
Apr 22	Proportional hazards regression: adjusting the comparison of hazards	•	•
Apr 24	Proportional hazards regression examples	•	•
Apr 29	Poisson regression: adjusting the comparison of rates	•	•
May 1	Test 2	•	•
May 6	Wrap up; Island Presentations	•	•

## SPH AND UNIVERSITY POLICIES & RESOURCES

The School of Public Health maintains up-to-date information about resources available to students, as well as formal course policies, on our website at [www.sph.umn.edu/student-policies/](http://www.sph.umn.edu/student-policies/). Students are expected to read and understand all policy information available at this link and are encouraged to make use of the resources available.

The University of Minnesota has official policies, including but not limited to the following:

- Grade definitions
- Scholastic dishonesty
- Makeup work for legitimate absences
- Student conduct code
- Sexual harassment, sexual assault, stalking and relationship violence
- Equity, diversity, equal employment opportunity, and affirmative action
- Disability services
- Academic freedom and responsibility

Resources available for students include:

- Confidential mental health services
- Disability accommodations
- Housing and financial instability resources
- Technology help
- Academic support

## EVALUATION & GRADING

Your final grade will be determined by:

- Weekly Work (35%)
  - Readiness Quizzes (10%)
  - Homework (25%)
- Two Midterm Exams (15% Each)
- Island Project (35%)

### Grading Scale

The University uses plus and minus grading on a 4.000 cumulative grade point scale in accordance with the following, and you can expect the grade lines to be drawn as follows:

<b>% In Class</b>	<b>Grade</b>	<b>GPA</b>
93 - 100%	A	4.000
90 - 92%	A-	3.667
87 - 89%	B+	3.333
83 - 86%	B	3.000
80 - 82%	B-	2.667
77 - 79%	C+	2.333
73 - 76%	C	2.000
70 - 72%	C-	1.667
67 - 69%	D+	1.333
63 - 66%	D	1.000
< 62%	F	

- A = achievement that is outstanding relative to the level necessary to meet course requirements.
- B = achievement that is significantly above the level necessary to meet course requirements.
- C = achievement that meets the course requirements in every respect.
- D = achievement that is worthy of credit even though it fails to meet fully the course requirements.
- F = failure because work was either (1) completed but at a level of achievement that is not worthy of credit or (2) was not completed and there was no agreement between the instructor and the student that the student would be awarded an I (Incomplete).
- S = achievement that is satisfactory, which is equivalent to a C- or better
- N = achievement that is not satisfactory and signifies that the work was either 1) completed but at a level that is not worthy of credit, or 2) not completed and there was no agreement between the instructor and student that the student would receive an I (Incomplete).

Evaluation/Grading Policy	Evaluation/Grading Policy Description
<p><b>Scholastic Dishonesty, Plagiarism, Cheating, etc.</b></p>	<p>You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis (As defined in the Student Conduct Code). For additional information, please see <a href="https://z.umn.edu/dishonesty">https://z.umn.edu/dishonesty</a></p> <p>The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: <a href="https://z.umn.edu/integrity">https://z.umn.edu/integrity</a>.</p> <p>If you have additional questions, please clarify with your instructor. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.</p> <p>Indiana University offers a clear description of plagiarism and an online quiz to check your understanding (<a href="http://z.umn.edu/iuplagiarism">http://z.umn.edu/iuplagiarism</a>).</p>
<p><b>Late Assignments</b></p>	
<p><b>Attendance Requirements</b></p>	
<p><b>Extra Credit</b></p>	

## CEPH COMPETENCIES

Competency	Learning Objectives	Assessment Strategies