Course Syllabus
PubH 6451
Biostatistics II
Fall 2016 Online

Credits: 4
Class Location: Online

Instructors:
Instructor: Eric Weber
E-mail: edweber@umn.edu

Teaching Assistants:
Nathan Rubin (rubio0169@umn.edu)

Office Hours: Please use the discussion forums for the course (see section on “Course Communication”). If you are on campus or would like to meet virtually (via phone or Webex), please make an appointment with either instructor on an individual basis.

I. Course Description
PubH 6451 is the second semester of an introduction to biostatistics sequence that teaches 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 methods covered include: t-tests, linear regression, and ANOVA for continuous outcomes; relative risks, odds ratios, logistic regression, and Poisson regression for categorical outcomes; survival data, Kaplan-Meier tables and curves, and proportional hazards regression for time-to-event outcomes; and sample size estimation and power considerations. Computations will be illustrated in SAS and R, with discussion of basic programming elements and output for the homework.

This course is offered online via Moodle. Registered students will receive a welcome email with instructions about where and how to log on to the course.

II. Course Prerequisites
[([6420, 6450] or 6414] with grade of at least B, health sciences grad student] or instructor consent
III. Course Goals and Objectives

At the conclusion of the course, students will be able to compare study groups based on outcome measures that are continuous, binary, or time-to-event while adjusting for one or more variables. Students will be able to use SAS or R to apply each method and will be able to understand and use the SAS or R output produced.

Specifically, students will be able to:

- Recognize fundamentals of biostatistics in health-related fields.
- Understand the principles of hypothesis testing and the correct interpretation of hypothesis test results.
- Determine the appropriate test to use based on how the data were collected and on the outcome variable of interest.
- Use a statistical software tool (SAS or R) to analyze and graphically display data including:
  - Hypothesis Testing for Means
  - ANOVA (One- and Two-way)
  - Simple and Multiple Linear Regression
  - Logistic Regression
  - Poisson Regression
  - Survival Analysis and Proportional Hazards Analysis
  - Sample Size Estimation and Power Considerations
- Read and understand the statistical content of published research in public health.

IV. Methods of Instruction and Work Expectations

Students should be aware that the expectations and requirements in this course are no different from the expectations and requirements in a typical lecture course. This is NOT a "work at your own pace" course. Do not wait until a few days before the homework is due to begin the homework. You will need all of the time given to learn the necessary statistical programming to complete the assignment! There are specific assignment deadlines. See the schedule below for details.

The course is organized by sections or topics. For each section, there are:

- Online lectures (audio recordings; also available as slide sets with or without the lecture script).
- Software lessons (video recordings) for learning how to use a statistical software package (SAS or R).
- Homework assignments.

Typed homework assignments are to be submitted through Moodle. All assignments will involve computing; please include only relevant computer output in what you turn in. SAS or R output with circled answers will not be acceptable. Please summarize results in short answer and paragraph form using your own words. You are encouraged to work together in computing and discussing the problems. However, you are each expected to independently write up the submitted assignment using your own explanations and coding. You may work alone if you prefer. If we discover copied work between students, all students involved will receive a zero for that assignment. If it occurs more than once, you may receive an F for the entire course.

There are also two open-book and open-notes exams in this course. You must work alone on the exams.
Computing: The course will include examples of data analysis from SAS and R. You will need access to SAS or R to complete your homework.

SAS or R is available on campus:

1. Here is the IT@UMN’s spreadsheet that lists where you can find any software on campus:  
   https://it.umn.edu/software (It’s a Google Spreadsheet so it may take awhile to load.)
2. Here is the UMN Library’s link to “Where can I find SPSS or SAS?":  
   https://www.lib.umn.edu/faq/20757
3. If you have access to SAS at work, you may do your homework there. You can download all data files and example programs from the course Moodle site.
4. An annual student license for PC-SAS is available through the University of Minnesota:  
   http://it.umn.edu/sas-sas-inc
5. R can be downloaded for free at: www.r-project.org

Course Communication:

- You **MUST** use your University of Minnesota email address (X.500 address) for email. All course communication will be sent to your email account. If you have not yet initiated your U of M email account, you will need to do so at http://www.umn.edu/initiate. The instructor and TAs will not respond to emails sent from other accounts.

Communications during this online course consist of email and the discussion forums (a passive classroom). There will also be occasional course announcements posted and emailed by the instructors. Homework files are turned in only via the course web site.

- The Moodle Forums are the primary mechanism for interaction between students and the instructors and TAs, as well as among students. All of the students, the teaching assistants and the instructors can read all of the postings in the forums. Normally someone initiates a topic and others reply to the topic. The forums grow and become a resource. If you have questions about the course material or the homework assignments, post them in the appropriate forum so all students can benefit from your question. The instructors and TAs will usually respond to posted questions within a day. Students may freely respond to other students’ questions or responses.

- **Email** is available as a secondary method of contact. Email is best used for specific questions about grades or grading of assignments. We strongly prefer that questions on course material or routine administrative matters be asked in the forums so that everyone can benefit from the answer to the question and so that the instructors and TAs do not receive multiple emails asking the same question. However, if you would be more comfortable asking a question about the course material in private, then email is encouraged and is an appropriate way to do this. Generally, your question (without your name) and the answer will be added to the relevant forum as a thread afterwards.

- **In-person contact.** Anyone may make an appointment for meeting with an instructor by telephone or via Webex or similar online tools. Students located in the area may make appointments for a face-to-face in-person meeting with an instructor or TA during regular business hours. Per University policy, we cannot support face-to-face in-person meetings when the University offices are closed.

V. Course Text and Readings

There is no required textbook for this course.
Optional resource books:
(Note that some of these books may be available electronically as well as in paper versions through the University libraries. Check lib.umn.edu to see.)


Basic & Clinical Biostatistics (4th ed) by B. Dawson and R. Trapp. Lange Medical Books/McGraw-Hill. ISBN 978-0071410175. {This one is for sure available electronically through the University libraries.}


Recommended free online resources for learning SAS or R:

SAS tutorials at UCLA: http://www.ats.ucla.edu/stat/sas/

R tutorials at UCLA: http://www.ats.ucla.edu/stat/r/

Introduction to R: http://cran.r-project.org/doc/manuals/R-intro.pdf
## Course Outline/Weekly Schedule

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<th>Week</th>
<th>Date (Monday)</th>
<th>Topics</th>
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<tr>
<td></td>
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<td><strong>Section 1: Hypothesis Testing for Means</strong></td>
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| 1    | 9/5           | Lesson 1a: Hypothesis Testing for One Mean  
Lesson 1b: Hypothesis Testing for Matched Pairs Design  
Install and test SAS or R on your computer! |
| 2    | 9/12          | Lesson 1c: Hypothesis Testing for Two Independent Means  
Lesson 1d: Hypothesis Testing for Two or More Independent Means (ANOVA) |
| 3    | 9/19          | Lesson 1e: Two-Way ANOVA  
• **Assignment #1 due Saturday 9/24** |
|      |               | **Section 2: Linear Regression** |
| 4    | 9/26          | Lesson 2a: Scatter Plots and Correlation  
Lesson 2b: Linear Regression |
| 5    | 10/3          | Lesson 2c: Linear Regression Diagnostics-Plots  
Lesson 2d: Linear Regression Diagnostics-Influential and Outliers  
Lesson 2e: Calculations in the ANOVA table  
• **Assignment #2 due Saturday 10/8** |
|      |               | **Section 3: Multiple Linear Regression** |
| 6    | 10/10         | Lesson 3a: Multiple Linear Regression without Interaction  
Lesson 3b: Multiple Linear Regression with Interaction  
Lesson 3c: ANOVA vs. ANCOVA vs. Regression and Adjusted Means Comparisons  
• **Assignment #3 due Saturday 10/15** |
|      |               | **Section 4: Sample Size Estimation** |
| 7    | 10/17         | Lesson 4a: General Understanding of Sample Size and Power  
• **Assignment #4 due Saturday 10/22** |
| 8    | 10/24         | **Exam 1 Review and Exam 1**  
Exam 1 will cover Sections 1 – 3. A link to the exam will appear on the Moodle site  
**Thursday 10/27.** The link will close at 11:59pm on **Sunday 10/30.** You may begin the  
exam at any time (after the link opens until 2.5 hours before it closes) during that period.  
Once you begin, you will have a 2.5 hour time limit. |
### Section 5: Logistic Regression

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<td>10</td>
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<td>Lesson 5b: Calculating probabilities and Considering Interaction Terms</td>
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<td>Lesson 5c: ROC Curves in Logistic Regression</td>
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<td><strong>Assignment #5 due Saturday 11/12</strong></td>
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### Section 6: Survival Data

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<td>11</td>
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<td></td>
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<td>Lesson 6a: Introduction to Survival Data</td>
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<td>Lesson 6b: Kaplan Meier Estimates, Comparing Survival Curves</td>
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### Section 7: Survival Analysis

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<td>12</td>
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<td>Lesson 7a: Introduction to Survival Analysis- Cox Proportional Hazards</td>
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<td>Lesson 7b: Interaction Terms and Testing Model Assumptions</td>
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<td><strong>Assignment #6 due Saturday 11/26</strong></td>
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### Section 8: Poisson Regression

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<td>Lesson 8a: Introduction to Poisson Regression</td>
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<td>Lesson 8b: Interaction Terms and Testing Model Assumptions</td>
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<td><strong>Assignment #7 due Saturday 12/3</strong></td>
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<td>14</td>
<td>12/5</td>
<td>Exam 2 Review</td>
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<td>15</td>
<td>12/8-12/11</td>
<td>Exam 2</td>
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Exam 2 will cover Sections 4 – 8. A link to the exam will appear on the Moodle site Thursday, 12/8. The link will close at 11:59pm on Sunday 12/11. You may begin the exam at any time (after the link opens until 2.5 hours before it closes) during that period. Once you begin, you will have a 2.5 hour time limit.

### VI. Evaluation and Grading

The final grade is based on seven homework assignments (50%) and two exams (25% each). The curve for final grades will be: A = 93–100; A- = 90–92; B+ = 86–89; B = 80–85; B- = 75–79; C+ = 70–74; C = 65–69; C- = 60–64; F = below 60. For those registered S/N, S = 60-100. Depending on the distribution of the final course grades, we may lower some grade cut-offs, but we will not raise them.

Homework may be submitted up to 24 hours late, but will receive a two-point penalty for being late. Homework submitted more than 24 hours after the due date will not be accepted unless an extension was granted by the instructor in advance of the original due date. **Exams must be taken during the designated time period.**

### Course Evaluation

Beginning in fall 2008, the SPH will collect student course evaluations electronically using a software
system called CoursEval: www.sph.umn.edu/courseval. The system will send email notifications to students when they can access and complete their course evaluations. Students who complete their course evaluations promptly will be able to access their final grades just as soon as the faculty member renders the grade in SPHGrades: www.sph.umn.edu/grades. All students will have access to their final grades through OneStop two weeks after the last day of the semester regardless of whether they completed their course evaluation or not. Student feedback on course content and faculty teaching skills are an important means for improving our work. Please take the time to complete a course evaluation for each of the courses for which you are registered.

Incomplete Contracts
A grade of incomplete “I” shall be assigned at the discretion of the instructor when, due to extraordinary circumstances (e.g., documented illness or hospitalization, death in family, etc.), the student was prevented from completing the work of the course on time. The assignment of an “I” requires that a contract be initiated and completed by the student before the last official day of class, and signed by both the student and instructor. If an incomplete is deemed appropriate by the instructor, the student in consultation with the instructor, will specify the time and manner in which the student will complete course requirements.
Extension for completion of the work will not exceed one year (or earlier if designated by the student’s college). For more information and to initiate an incomplete contract, students should go to SPHGrades at: www.sph.umn.edu/grades.

University of Minnesota Uniform Grading and Transcript Policy - A link to the policy can be found at onestop.umn.edu.

VII. Other Course Information and Policies

Grade Option Change (if applicable)
For full-semester courses, students may change their grade option, if applicable, through the second week of the semester. Grade option change deadlines for other terms (i.e. summer and half-semester courses) can be found at onestop.umn.edu.

Course Withdrawal
Students should refer to the Refund and Drop/Add Deadlines for the particular term at onestop.umn.edu for information and deadlines for withdrawing from a course. As a courtesy, students should notify their instructor and, if applicable, advisor of their intent to withdraw.

Students wishing to withdraw from a course after the noted final deadline for a particular term must contact the School of Public Health Office of Admissions and Student Resources at sph-ssc@umn.edu for further information.

Student Conduct Code
The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a student at the University you are expected adhere to Board of Regents Policy: Student Conduct Code. To review the Student Conduct Code, please see:
Note that the conduct code specifically addresses disruptive classroom conduct, which means "engaging in behavior that substantially or repeatedly interrupts either the instructor's ability to teach or student learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities."

**Use of Personal Electronic Devices in the Classroom**
Using personal electronic devices in the classroom setting can hinder instruction and learning, not only for the student using the device but also for other students in the class. To this end, the University establishes the right of each faculty member to determine if and how personal electronic devices are allowed to be used in the classroom. For complete information, please reference: [http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html](http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html).

**Scholastic Dishonesty**
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. (Student Conduct Code: [http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf](http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf)) If it is determined that a student has cheated, he or she may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see: [http://policy.umn.edu/Policies/Education/Education/INSTRUCTORRESP.html](http://policy.umn.edu/Policies/Education/Education/INSTRUCTORRESP.html).

The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: [http://www1.umn.edu/oscai/integrity/student/index.html](http://www1.umn.edu/oscai/integrity/student/index.html). If you have additional questions, please clarify with your instructor for the course. 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.

**Makeup Work for Legitimate Absences**
Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include verified illness, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances do not include voting in local, state, or national elections. For complete information, please see: [http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html](http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html).

**Appropriate Student Use of Class Notes and Course Materials**
Taking notes is a means of recording information but more importantly of personally absorbing and integrating the educational experience. However, broadly disseminating class notes beyond the classroom community or accepting compensation for taking and distributing classroom notes undermines instructor interests in their intellectual work product while not substantially furthering instructor and student interests in effective learning. Such actions violate shared norms and standards of the academic community. For additional information, please see: [http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html](http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html).
Sexual Harassment
"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents Policy: http://regents.umn.edu/sites/default/files/policies/SexHarassment.pdf

Equity, Diversity, Equal Opportunity, and Affirmative Action
The University will provide equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents Policy: http://regents.umn.edu/sites/default/files/policies/Equity_Diversity EO AA.pdf.

Disability Accommodations
The University of Minnesota is committed to providing equitable access to learning opportunities for all students. Disability Services (DS) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact DS at 612-626-1333 to arrange a confidential discussion regarding equitable access and reasonable accommodations.

If you are registered with DS and have a current letter requesting reasonable accommodations, please contact your instructor as early in the semester as possible to discuss how the accommodations will be applied in the course.

For more information, please see the DS website, https://diversity.umn.edu/disability/.

Mental Health and Stress Management
As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: http://www.mentalhealth.umn.edu.

Academic Freedom and Responsibility: for courses that do not involve students in research Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.*
Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college, or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost. [Customize with names and contact information as appropriate for the course/college/campus.]

* Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".

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