The Ohio State University College of Public Health

PUBHBIO 6210
Design & Analysis of Studies in the Health Sciences
Distance Learning Section
3 credit hours – Spring 2016

Instructor: Rebecca Andridge, Ph.D.
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Office Hours: In person: Wednesdays 11:30am-12:30pm or by appointment
Online using Carmen Connect: By appointment

TA: Yiran Zhang (zhang.4830@osu.edu)

TA Office Hours: In person: Thursday, 11:10am-12:10pm, 230 Cunz Hall (computer lab)
Online using Carmen Connect: By appointment

TA Responsibilities: The TA assigned to the course will assist in moderating the discussion boards and hold office hours (in person and online by appointment). The TA may assist with scoring homework and exams; however, final grades will be assigned by the professor. **Any questions regarding grading must be directed to the professor and not the TA.**

Course Description: This course provides students with a comprehensive introduction to the principles of modern biostatistical methods and their applications in biomedical research. The course will cover material from basic data summary methods to estimation and hypothesis testing, emphasizing the understanding of methodologies from a statistical inference perspective. Application to real data from various studies in public health will be provided.

Prerequisites: Grad standing in Public Health, or enrollment in MACPR program, or permission of instructor.

Class Format: This course meets **100% at a distance**. The course is structured into 7 blocks that each last either 1 or 2 weeks, plus a short introductory block. Each regular block starts at 12:00am on a Monday and ends at 11:59pm on a Sunday (see calendar for specific dates). Each block consists of (a) recorded lectures to be watched asynchronously, (b) short online quizzes, (c) recorded sample problems, (d) practice exercises, (e) homework assignments, and (f) supplemental readings. All asynchronous activities will be accessible via Carmen. Periodically during the semester I may ask you for feedback on your learning experience, in order to improve the course.

Carmen: There is a Carmen site for this course: `http://carmen.osu.edu`
All course materials are available via Carmen.

Carmen Connect: Any online office hours or online review sessions will be held via Carmen Connect. Information about using Carmen Connect as a participant can be found at: `http://resourcecenter.odee.osu.edu/carmenconnect/attending-participant`. The link for participating will be posted on the course website.

Course Goals and Learning Objectives:

1. Learn the foundations of probability
   (a) Define key probability terms (sample space, union, intersection, etc.)
   (b) Select and use the appropriate probability rules (additive, multiplicative, Bayes') to perform probability calculations
   (c) Describe the application of probability in diagnostic testing
2. Understand the elements of probability models
   (a) Define a random variable and describe the difference between the two types: discrete and continuous
   (b) Describe characteristics of random variables with the following distributions: Bernoulli, Binomial, Poisson, Uniform (continuous), Normal
   (c) Identify the appropriate distribution for a random variable arising from specific, common circumstances
   (d) Perform probability calculations for random variables having a specific distribution
3. Understand graphical and numerical summaries of data
   (a) Distinguish between different types of quantitative data
   (b) Create and interpret frequency tables
   (c) Create and interpret graphical displays such as bar graphs, histograms, box plots
   (d) Calculate and interpret measures of central tendency: mean, median, mode
   (e) Calculate and interpret measures of spread: range, percentiles, interquartile range, standard deviation, variance, coefficient of variation
   (f) Calculate and interpret proportions, risk differences, relative risks, odds ratios
4. Understand interval estimation
   (a) Construct and interpret confidence intervals for means
   (b) Construct and interpret confidence intervals for proportions
   (c) State the Central Limit Theorem (CLT) and explain its application to confidence interval construction and statistical inference
5. Learn the fundamentals of hypothesis testing
   (a) Differentiate between the null and alternative hypotheses
   (b) Construct one- and two-sided hypotheses
   (c) Define and interpret p-values
   (d) Define type I and type II errors
   (e) Explain the duality of hypothesis testing and confidence intervals
   (f) Explain what factors impact the power of a hypothesis test
6. Learn how to conduct hypothesis tests
   (a) Perform and interpret one-sample, two-sample, and paired t-tests for means
   (b) Perform and interpret one-sample and two-sample tests for proportions based on normal theory
   (c) Perform and interpret the test of the slope in a simple linear regression analysis
7. Understand the fundamentals of simple linear regression
   (a) Construct and interpret a scatterplot to show the relationship between two continuous variables
   (b) Explain the setup, rationale, and assumptions of simple linear regression
   (c) Define the model for the mean and the model for individual outcome values
   (d) Interpret the model coefficients in simple linear regression
   (e) Make predictions with a given simple linear regression equation
   (f) Calculate and interpret Pearson correlation coefficients

Core Competencies

- *Core Competencies for MPH Students:*
  1. Apply appropriate descriptive and inferential statistical techniques to public health data and interpret results of statistical analyses in the context of public health research and evaluation.
  2. Apply epidemiologic principles to investigate the distribution of risk factors and disease in the population to improve public health.
  3. Demonstrate effective written and oral skills for communicating with different audiences in the context of professional public health activities.
- *MPH in Biostatistics Competencies*
  1. Describe preferred methodological alternatives to commonly used statistical methodswhen assumptions are not met.
  2. Develop written and oral presentations based on statistical analyses for both public health professionals and educated lay audiences
  3. Apply appropriate statistical techniques for analyzing public health-related data with specific characteristics.
  4. Describe basic concepts of probability, random variation and commonly used statistical probability distributions.
  5. Use standard statistical software for basic data management and data analysis
- *MHA Competencies*
  1. Interpret and apply statistical methods for organization decision making.

Required Text: There is **no** required textbook for this class. (Optional) readings from various sources will be posted on Carmen, including from the books listed below.

Digital/Free Reference Text: *Biostatistics and Epidemiology: A Primer for Health and Biomedical Professionals*, 4th ed., by Wassertheil-Smoller and Smoller (2015) `http://link.springer.com/book/10.1007/978-1-4939-2134-8`. You must access the book online using a university computer or be logged in through the library website if accessing from off campus (you can download a PDF for offline use).

Print Reference Texts: *Fundamentals of Biostatistics*, 7th ed., by Rosner (2011)
Introduction to the Practice of Statistics, 7th ed., by Moore, McCabe, and Craig (2012)
Principles of Biostatistics, 2nd ed., by Pagano and Gauvreau (2000)

Required Software: Stata (`http://www.stata.com/`)
For the purpose of illustration and to get the best computing support, **students are required to use Stata for all homework**. There are three options for accessing Stata:

1. Purchase Stata for your personal computer (Windows or Mac)
2. Use the PCs in the Cunz Hall computer labs (rooms 230 and 330)
3. Access Stata remotely on the CPH Biostat Server

Details on these three options are available on the course website.

Calculator: Students should have access to a scientific calculator that can perform basic arithmetic, square roots, logarithms, and exponentiation. For this online class, a program such as Microsoft Excel may suffice.

Exams: There will be two exams in this course: a midterm exam and a final exam. Each exam will have two parts: (a) a take-home component and (b) an online, timed component. The exams will have multiple-choice and short-answer questions. Many questions will require students to perform calculations and will require the use of a calculator. The take-home portions will require the use of Stata (but the online portions will not).

The **take-home component** for each exam will be available for download from Carmen for a 3 day period at the dates shown on the course calendar. Students may download the exam at any time in the window and must submit their completed take-home exams **electronically** via a Carmen dropbox by the end of the 3 day period (date shown on course calendar).

The **online, timed exam component** for each exam will be done via Carmen and will be available for a 3 day period at the dates shown on the course calendar. Students may choose any time in the window to take the exam and will have 80 minutes to complete it once started. A student cannot stop the test, logout/login and resume at a later time.

Exams **must** be taken within the scheduled windows. Students who miss taking any exam will be penalized fully in the absence of a documented excuse. **Exams must be completed without the help of other individuals, but books and notes are okay.**

Quizzes: Each recorded lecture has an associated short online mutiple-choice quiz (taken via Carmen) to help reinforce understanding of the covered concepts. Students may take up to two attempts at each quiz; if two attempts are taken then the quiz score will be the average of the two. Please note that quiz questions may be slightly different on the second attempt. A student cannot stop the quiz, logout/login and resume at a later time. **Quizzes must be completed without the help of other individuals, but books and notes are okay.**

All materials for a block will be simultaneously available for the entire block so that students can watch the lectures and take the quizzes at times that best fit their schedules. Any quiz not completed by the end of the block will be given a 0. **There are no exceptions to this rule.**

Homework: Each block (except the short intro block) has a corresponding homework assignment. These assignments are due on the end date of the block. Homework assignments will include both hand-calculation and computer (Stata) exercises. Students are permitted (indeed, encouraged) to work together on homework, but submitted assignments must be written independently.
Late homework will not be accepted. Instead, the one lowest homework score will be deleted before computing the overall homework grade.

Homework/Exam Submission: Students are required to turn homework assignments and the take-home exam components **electronically** via the provided Carmen dropboxes by the dates/times listed on the course website for each assignment. **In order to facilitate grading, assignments must be submitted as either Microsoft Word documents or as PDF files.** Using Microsoft Word to write up assignments is encouraged, but not required. It is the student's responsibility to ensure that any hand-written problems that are scanned for submission as PDFs are clearly legible.

Homework/Exam Scoring: Clear and effective communication is crucial in statistical practice. This rule is applied to both homework and exams. In any problem-solving question it is the student's responsibility to make sure that he/she justifies his/her answer and provides enough detail for the grader to understand. Points may be deducted for answers that are not well-justified, even if they are correct. **Any questions regarding grading must be directed to the professor and not the TA.**

Grading: Final class grade will be determined as follows:

Homework	20%
Quizzes	20%
Midterm – take-home component	15%
Midterm – online, timed component	15%
Final – take-home component	15%
Final – online, timed component	15%

Any questions regarding grading must be addressed **within one week** of the return of the homework or exams. No request of regrading on previous homework or exams will be accepted after the final exam except for the last homework and the final exam. As a general policy, when requested, the regrading will apply to the whole exam or the homework, not just to the specific item which the student thinks there might be a mistake. As a consequence, regrading may lead to a lower overall score. Any questions regarding grading must be **directed to the professor** and not the TA.

Grading Scale:*

94–100	A	87–89	B+	77–79	C+	60–69	D
90–93	A-	84–86	B	74–76	C	≤59	E
		80–83	B-	70–73	C-		

**The instructor reserves the right to adjust the grading scale if it appears necessary due to overall class performance. These adjustments will only raise a student's grade, not lower it.*

Grade Policy: The Division of Biostatistics has established a grade policy for progressing from PUBHBIO 6210 to PUBHBIO 6211. **A grade of B- or higher in PUBHBIO 6210 is required to enroll in PUBHBIO 6211.**

Faculty Feedback & Response Time:

The following gives you an idea of my intended availability during the course:
Grading: You can generally expect feedback within 7 days.
E-mail: I will reply to e-mails within 24 hours on school days.
Discussion board: I will check and reply to messages in the discussion boards at least every 24 hours on school days, but responses to posts will often be much quicker than 24 hours.

Technical Support:

`http://resourcecenter.odee.osu.edu/carmen`
`http://resourcecenter.odee.osu.edu/carmenconnect`
Contact 8-HELP by telephone at 614-688-4357 (TDD: 614-688-8743)
Contact 8-HELP by email at `8help@osu.edu`
Contact CPH Information Systems by telephone at 614-688-2999
Contact CPH Information Systems by email at `support@cph.osu.edu`

Disclaimer:

This syllabus should be taken as a fairly reliable guide for the course content. However, you cannot claim any rights from it and in particular I reserve the right to change due dates or the methods of assessment. Official announcements will **always** be those posted on the course website (Carmen).

Course Calendar: *Subject to change*

Dates	Block	Assignments*
1/11-1/17	**BLOCK 0: Introduction**	1 Quiz (Practice)
(1 week)	0A Biostatistics Terminology	
1/11-1/24	**BLOCK 1: Foundations of Probability**	4 Quizzes
(2 weeks,	1A Basic Probability 1	Homework 1
overlaps	1B Basic Probability 2	
w/Block 0)	1C Conditional Probability	
	1D Bayes Rule	
1/25-2/7	**BLOCK 2: Population Models**	4 Quizzes
(2 weeks)	2A Random Variables	Homework 2
	2B Discrete Models	
	2C Continuous Models	
	2D Standard Normal and Z-scores	
2/8-2/14	**BLOCK 3: Data and Samples**	3 Quizzes
(1 week)	3A Summarizing Categorical Data	Homework 3
	3B Measures of Central Tendency	
	3C Measures of Spread	
	****Note: Block 3 is only 1 week long**	
2/16-2/18	**MIDTERM – take-home component**	
2/19-2/21	**MIDTERM – online component**	
2/22-3/6	**BLOCK 4: Estimation for Means**	4 Quizzes
(2 weeks)	4A Introduction to Point Estimation	Homework 4
	4B Confidence Intervals based on z	
	4C Confidence Intervals based on t	
	4D Introduction to Hypothesis Tests	
3/7-3/27	**BLOCK 5: Inference for Means**	4 Quizzes
(3 weeks, incl.	5A One-sample Tests for Means	Homework 5
Spring Break)	5B Two-sample Tests for Means	
	5C Tests for Paired Data	
	5D Power and Sample Size	
3/28-4/10	**BLOCK 6: Proportions**	3 Quizzes
(2 weeks)	6A Inference for One Proportion	Homework 6
	Inference for Multiple Proportions	
	6C Measures of Association	
4/11-4/24	**BLOCK 7: Regression and Correlation**	3 Quizzes
(2 weeks)	7A Regression: Intro and Estimation	Homework 7
	7B Regression: Inference	
	7C Correlation	
4/28-4/30	**FINAL – take-home component**	
5/1-5/3	**FINAL – online component**	

*Due date for all assignments is **11:59pm on the end date** of the corresponding block.

Note: #1 *Block 3 is only 1 week long to accommodate the midterm week; plan accordingly.*

Note #2: *Blocks are **not** all the same "size". They range from 3 to 4 lectures, with varying lecture lengths. Please pay careful attention to the number and lengths of the posted lectures.*

Optional readings corresponding to each lecture will be posted on Carmen.

Disability Statement

Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Please contact the Office for Disability Services at 614-292-3307 (TDD: 614-292-0901) in room 150 Pomerene Hall to coordinate reasonable accommodations for students with documented disabilities. `http://www.ods.osu.edu/`.

More resources regarding accessibility can be found at
`http://ada.osu.edu/resources/Links.htm`

Student Support

A recent American College Health Survey found stress, sleep problems, anxiety, depression, interpersonal concerns, death of a significant other and alcohol use among the top seven health impediments to academic performance. Students experiencing personal problems or situational crises during the semester are encouraged to contact OSU Counseling and Consultation Services (292-5766; `http://www.ccs.ohio-state.edu`) for assistance, support and advocacy. This service is free to students and is confidential.

Academic Integrity

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University, the College of Public Health, and the Committee on Academic Misconduct (COAM) expect that all students have read and understood the University's *Code of Student Conduct* and the College's *Student Handbook*, and that all students will complete all academic and scholarly assignments with fairness and honesty. The *Code of Student Conduct* and further information on academic integrity and academic misconduct can be found at the COAM web pages (`http://oaa.osu.edu/coam.html`). Students must recognize that failure to follow the rules and guidelines established in the University's *Code of Student Conduct*, the *Student Handbook*, and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the *Code of Student Conduct* and the *Student Handbook* is never considered an "excuse" for academic misconduct, so I recommend that you review the *Code of Student Conduct* and the *Student Handbook*, specifically, the sections dealing with academic misconduct.

If I suspect a student of academic misconduct in this course, I am obligated by University Rules to report these suspicions to the Committee on Academic Misconduct. If COAM determines that you have violated the Universitys *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the University.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.