

The Ohio State University College of Public Health
PUBHBIO 6210 – Design and Analysis of Studies in the Health Sciences
Distance Learning Section – 3 credit hours –Autumn 2025

Instructor R. Scott Linder

Email: linder.5 - please send all email messages through the Canvas site)

Office Hours: Monday and Wednesday 4:30–6:00pm (Zoom link at Canvas site)

TA/Homework Grader: Christilene Tumsiah (tumsiah.1@buckeyemail.osu.edu)

Office Hour: Thursday 10:30–11:30am (Zoom link at Canvas)

Office Hours will be online. See the Canvas page for links to the Zoom meeting places. Also available by appointment, and will sometimes announce other open office hours during weekend times, as necessary. Occasionally I will need to cancel one. In that case, I will try to announce the cancellation ahead of time, and I will try to replace it.

Course Description

This course provides students with a comprehensive introduction to the principles of modern biostatistical methods and their applications to biomedical research, covering material from basic descriptive statistics and inferential statistical methods. See the course schedule for more detail. Examples using real data will be used to illustrate application to public health.

Prerequisites

Graduate standing in Public Health, enrollment in MACPR program, or instructor permission.

Class Structure

This course meets 100% at a distance. The course is segmented into 7 “blocks,” each of which lasts from approximately two weeks, plus a short introductory block (Block 0). Each regular block begins at 12:00am on its opening date and ends at 11:59pm on its closing date (see calendar for specific dates). Each block consists of (1) recorded lectures to be watched asynchronously, (2) short online quizzes, (3) a homework assignment, most of which require use of STATA, (4) recorded sample problems (optional), (5) practice exercises (optional), and (6) supplemental readings (optional). All asynchronous activities will be accessible via the Carmen Canvas page. After Block 3 there will be a 7-day midterm exam period during which students will complete both a untimed problem solving component (the “take home” component) and an online timed exam (the “online” component). After Block 7 a 9-day final exam period will follow the same format. See the course calendar at the end of this document for more detail.

Carmen Canvas

The class Carmen Canvas site is the portal through which modules may be accessed and all work will be submitted. You may find it here: <http://carmen.osu.edu> . All course materials are available at this site. **You are responsible for being aware of announcements posted to the Canvas site**, so it is recommended that you adjust your Canvas settings so that you receive by email notifications posted there. Information about using Carmen Canvas as a participant can be found at:

<https://resourcecenter.odee.osu.edu/carmencanvas>

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 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 distinguish between types discrete and continuous
- (b) For the Bernoulli, Binomial, Poisson, Uniform (continuous), and Normal distributions: (i) be able to describe characteristics, (ii) be able to identify which distribution applies to a specific common situation, and (iii.) be able to perform basic probability calculations

3. Understand graphical and numerical summaries of data

- (a) Create and interpret graphical displays such as bar graphs, histograms, box plots
- (b) Calculate and interpret measures of central tendency: mean, median, mode
- (c) Calculate and interpret measures of spread: range, percentiles, interquartile range, standard deviation, variance, coefficient of variation
- (d) 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 from 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 describing the relationship between 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 methods when 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 both data management and data analysis.
- *MHA Competencies*

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 Canvas, primarily from the two print reference texts listed below.

Digital/Free Reference Text

Biostatistics and Epidemiology: A Primer for Health and Biomedical Professionals, 4th ed., by Wassertheil-Smoller and Smoller (2015) [Referred to as *WS* in Canvas materials]

<http://link.springer.com/book/10.1007/978-1-4939-2134-8>

You must use a university computer or be logged in through the library website if accessing from off campus. However, you may download a PDF file of the text for offline use.

Print Reference Texts

Fundamentals of Biostatistics, 7th ed., by Rosner (2011) [*Rosner*]

Introduction to the Practice of Statistics, 8th ed., by More, McCabe and Craig (2015). [*MMC*] *Principles of Biostatistics*, 2nd ed., by Pagano and Gauvreau (2000) [*PG*]

Required Software

We use STATA (<http://www.stata.com>). Use of STATA is required for most homework assignments.

There are two ways access STATA:

- (a) Purchase an individual STATA for your personal computer (Windows or Mac)
- (b) Use the PCs in the Cunz Hall computer labs (rooms 230 and 330)

Note: STATA must be used for most assignments and for the “take home” portions of both exams. You may not choose to use a different software system. There is no required or expected textbook purchase for this class, so you may view purchasing an individual license for STATA as a reasonable course expense. The Department of Biostatistics in the College of Public Health views the learning of STATA as a program requirement.

Calculator

Students should have access to a scientific calculator that can perform square roots, logarithms and exponentiation. Use of a software program such as *Excel* may suffice.

Exams

There will be two exams: A midterm exam and a final exam. Each exam will take place in two parts: A take-home part and an online, timed part. Exams will contain multiple choice problems and short answer problems. Many problems will require students to perform calculations using a calculator. The take-home portion will also have problems that require the use of STATA.

The take-home portion of each exam will be available for download from the Canvas site for a 7-day (Midterm) or 9-day (Final) period using 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 Canvas by the end of this time period. The format and structure of these exam portions will resemble homework assignments, so you should expect to need to use STATA to complete many or most of the problems.

The online, timed portion of each exam will be done via Canvas and will be available for a period using dates shown on the course calendar. Students may choose any time in the window to take the exam and will have 120 minutes to complete it once started. A student cannot stop the test, or logout/login to resume at a later time.

Exams must be taken within scheduled time windows as described on the calendar below. Students that miss taking an exam will be penalized without instructor approval of a documented excuse. You are to work alone on exams and without assistance from any individual, but you may use any notes or books.

Quizzes

Each recorded lecture has an associated short online multiple-choice quiz, located on the Canvas site. These quizzes are intended to reinforce understanding of concepts. You may attempt any quiz once or twice (your choice). If you take the quiz twice, your recorded quiz score will be the average of your two attempts. Note that you'll get a slightly different version of a quiz if you take it a second time. You must work alone and without assistance from any individual, but you may use notes or books.

All materials for a block of material will be available for the entire time window during which a block is open. Hence, you may take quizzes and watch lectures during times that best fit your schedule. Any quiz not taken during the time window of its block will be scored 0.

Homework

Except for the short introductory block (Block 0), an assignment is attached to each block. **The assignment for any block must be submitted before the closing time of the corresponding block.** Assignments consist of problems that require computations, some of which are to be done by hand, and some of which are to be done using STATA. With homework assignments, I encourage students to work together... but each student should submit her/his own solution set. Late homework assignments will not be accepted, but your lowest homework score will be dropped so that it does not impact your course average.

Submission of Exams and Homework Assignments

Take-home portions of exams and homework assignments must be submitted digitally as either PDF files or Microsoft Word files to Canvas by the due date. You're encouraged to submit a clearly legible scanned PDF file of your solution set, which does not need to be typeset. All answers must be supported, and points may be deducted for unsupported answers, even if correct. Questions or concerns about grading must be directed to the instructor. **All exam and assignment submissions should consist of a single file** – not a file for each page of an assignment.

Course Grades

Your course average will be determined using the following weights:

Homework average (lowest score dropped)	20%
Quiz average	20%
Midterm Exam (take-home component)	15%
Midterm Exam (online component)	15%
Final Exam (take-home component)	15%
Final Exam (online component)	15%

If you have a dispute concerning how any assignment or exam has been graded, bring your dispute to the attention of the instructor within one week of the date it was returned. Do not make any such request of the TA/grader. No dispute will be considered after the final exam (except for a dispute regarding the last assignment or final exam). Any request for reconsideration of an assignment or exam question will result in a complete regrading of the entire assignment or exam.

Based on your course average (Average) as computed using weights described above, you're guaranteed a course grade at or higher than the course grade indicated using the scale below:

$92 \leq \text{Average} \leq 100$	A
$90 \leq \text{Average} < 92$	A–
$88 \leq \text{Average} < 90$	B+
$82 \leq \text{Average} < 88$	B
$80 \leq \text{Average} < 82$	B–
$78 \leq \text{Average} < 80$	C+
$72 \leq \text{Average} < 78$	C
$70 \leq \text{Average} < 72$	C–
$60 \leq \text{Average} < 70$	D
$0 \leq \text{Average} < 60$	E

For example, if a student's course average is 91.4%, then a grade of *at least* A– is guaranteed, but the student *might* earn an A depending on the distribution of course averages.

Note: The Division of Biostatistics requires a course grade of B– or higher in PUBHBIO 6210 in order to enroll in PUBHBIO 6211.

Faculty Feedback and Response Time

We will strive to grade assignments within 7 days, usually sooner. The instructor will strive to reply to email messages within 24 hours during school days. In fact, the instructor will strive to be responsive during weekends, also, but some allowance is requested here. Every weekday and most weekend days the instructor will check and respond to posts to the discussion board. Most weekdays this check-in will occur more than once.

Technical Support

<http://resourcecenter.odee.osu.edu/>

<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

Although this syllabus may be taken as a fairly reliable guide for the course content, the instructor reserves the right to change due dates or the methods of assessment. Official announcements will always be those posted on the course website (Canvas).

Disability Statement

Any student in need of an accommodation based on the impact of a disability should contact me privately to discuss a specific need. Please contact the Office of Disability Services at 614-292-3307 (TDD: 614-292-0901) in room 150 Pomerene Hall to coordinate any such effort. <http://www.ods.osu.edu> .

More resources concerning accessibility can be found at <https://ada.osu.edu/>

Student Support

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

An environment that fosters excellence in teaching, research and learning cannot be maintained without a community-wide adherence to academic integrity. The Ohio State University, the College Public Health, and the Committee on Academic Misconduct (COAM) expect that all students have read and understand 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. Failure to follow rules and guidelines established in the University's *Code of Student Conduct*, the *Student Handbook*, or this syllabus may constitute "Academic Misconduct." The instructor assumes that you are familiar with activities that may be construed as Academic Misconduct (see Section 3335- 23-04 of the Code of Student Conduct for more information). Any student suspected of committing Academic Misconduct will be reported to COAM.

Course Calendar (any changes will be announced through Canvas)

Dates	Block and Lectures	Assessment
T 8.26 – Su 8.31	Block 0 – Introduction 0A – Biostatistics Terminology	1 Quiz
T 8.26 – Su 9.7 Partially overlaps with Block 0	Block 1 – Probability 1A – Basic Probability 1 1B – Basic Probability 2 1C – Conditional Probability 1D – Bayes Rule	4 Quizzes Assignment 1
M 9.8 – Su 9.21	Block 2 – Population Models 2A – Random Variables 2B – Discrete Models 2C – Continuous Models 2D – Standard Normal Distribution and Z-scores	4 Quizzes Assignment 2
M 9.22 – Su 10.5	Block 3 – Data and Samples 3A – Summarizing Categorical Data 3B – Measures of Center 3C – Measures of Variation	3 Quizzes Assignment 3
M 10.6 – Su 10.12 M 10.6 – Su 10.12	Midterm Exam – Online portion Midterm Exam – Take-home portion	
M 10.13 – Su 10.26	Block 4 – Estimation for Means 4A – Introduction to Point Estimation 4B – Confidence Intervals Based on Z 4C – Confidence Intervals Based on t 4D – Introduction to Hypothesis Tests	4 Quizzes Assignment 4
M 10.27 – Su 11.9	Block 5 – Inference for Means 5A – One-sample Tests for Means 5B – Two-sample Tests for Means 5C – Tests for Paired Data 5D – Power and Sample Size	4 Quizzes Assignment 5
M 11.10 – Su 11.23	Block 6 – Inference for Proportions 6A – Inference for One Proportion 6B – Inference for Multiple Proportions 6C – Measures of Association	3 Quizzes Assignment 6
M 11.24 – Su 12.7	Block 7 – Regression and Correlation 7A – Regression: Intro and Estimation 7B – Regression: Inference 7C – Correlation	3 Quizzes Assignment 7
Sa 12.4 – Su 12.14 Sa 12.4 – Su 12.14	Final Exam – Online portion Final Exam – Take-home portion	

All assignments, quizzes and exams are due by 11:59pm on the corresponding due date. For Blocks, quizzes and assignments are always due on the last day of the time period as described in the calendar above.