BIOST 2011: Principles of Statistical Reasoning

Graduate School of Public Heath
Spring 2021

Instructor	Email	Office Hours
Jenna Carlson, PhD	JNC35@pitt.edu	Fridays 9-10 am Eastern (Zoom link in Canvas) and by appointment: calendly.com/carlson-office-hours

Teaching Assistants	Email	Office Hours
Crystal Zang	ZIZ60@pitt.edu	TBD
Greg Procario	GRP20@pitt.edu	TBD

Flex@Pitt Course Model

Participation in this course will be 100% remote. This course will be comprised of asynchronous material (you complete on your own time) and synchronous classes (during the regularly scheduled class time). All class meetings will take place through Zoom (links available in Canvas).

Course Times

Mondays, 4:30 – 5:45 pm (class) and 5:50 – 6:25 pm (recitation)
Wednesdays, 4:30 – 5:45 pm (class)

Class sessions will include instruction, discussions, and hands-on practice with example problems with feedback from the instructor and TAs. They are designed for **active participation**, not observation. Learning statistics is similar to learning a new language – it is done over time and with lots of practice! Review the didactic material prior to class time and be prepared to actively engage with the course material during class. Reviewing course notes will *not* be sufficient to learn the material for this course. Thus, your participation in this class is strongly encouraged. The designated recitation time will be used for guided practice in Stata.

Textbooks

The course materials distributed through Canvas will be sufficient. However, if you prefer to have a reference text, this course follows the notation of:

- *Biostatistics for the Biological and Health Sciences, 2nd edition* (ISBN: 978-0-13-403901-5)

I also recommend this textbook for extra guidance on understanding and interpreting statistical analyses:

- *Intuitive Biostatistics* [any edition] by Harvey Motulsky

For extra help with Stata consider reviewing:

- *Data Analysis with Stata* (ISBN: 978-1-78217-317-5)
  This text can be read online for free through the University of Pittsburgh library (library.pitt.edu)

Software

Students will perform statistical analyses required for homework assignments using Stata.

Stata (version 16 SE)

- Download Stata through the Software Download Service (software.pitt.edu)

Course Website (Canvas)

Course materials will be distributed and turned in through course website (canvas.pitt.edu), which you can access by logging in with your Pitt user ID and password. Any announcements will be distribution through Canvas, so please make sure to update your notification preferences. If you need help logging in to Canvas, call the University Help Desk at 412-

624-HELP [4357]. If you experience any issues using Canvas, you can click the Help button within Canvas, which includes 24/7 chat or telephone support. You may also find the following resources helpful in navigating Canvas:

Canvas Getting Started Guide
Canvas Student Tour Videos

Course Prerequisites, Description, and Goals

BIOST 2011 is an introductory applied biostatistics course, which introduces the concepts of statistical reasoning as applied to the study of public health problems. This course is designed for public health students that expect to primarily to be able to read and understand statistical procedures in the form of books, journal articles, reports, grants, etc. for public health students and health career professionals who will make use of statistical methods in research projects or in interpreting literature. The course will also give students the ability to perform some basic analyses. Students who intend to be professional research workers in public health areas requiring the daily application of quantitative procedures and statistics should consider taking BIOST 2041. The prerequisite is college level algebra.

The overall purpose of this course is to introduce students to basic probability and one and two sample procedures (point and interval estimation and hypothesis testing) for continuous and discrete distributions. Basic one and two sample nonparametric tests are also presented. An introduction to simple linear regression and one- and two-way ANOVA are also included. This broad goal includes use of statistical software to analyze data sets and answer research questions; recognition of situations when these procedures are and are not appropriate; and intuitive understanding of the rationale used in creating the statistical procedures presented.

Course Learning Objectives

At the conclusion of this course, a student should be able to:

- C1. Select quantitative data collection methods appropriate for a given public health context (CEPH MPH Competency #2)
- C2. Describe basic concepts of probability, random variation, and commonly used statistical probability distributions.
- C3. Describe preferred methodological alternatives to commonly used statistical procedures when assumptions are not met.
- C4. Distinguish among the different measurement scales and the implications for selection of statistical methods to be used based on these distinctions.
- C5. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate. (CEPH MPH Competency #3)
  To include:
  - C5A. Apply descriptive techniques commonly used to summarize public health data.
  - C5B. Apply common statistical methods for inference.
  - C5C. Apply basic regression methodology.
  - C5D. Apply descriptive and inferential methodologies according to the type of study design for answering a particular research question.
- C6. Interpret results of data analysis for public health research, policy or practice. (CEPH MPH Competency #4)
- C7. Explain quantitative methods and policy analysis research and evaluation methods to address health issues at multiple (individual, group, organization, community and population) levels (CEPH DrPH Competency #1)

Student Performance Evaluation

Students will be evaluated based on their performance in the following assessments. All assessments will be graded on a complete/incomplete basis.

Quizzes

There will be 15 quizzes throughout the semester. Each quiz will consist of 5 multiple choice questions emphasizing the conceptual understanding of the material from the week prior to the due date. Quizzes should be taken in Canvas by

Sunday evening each week (11:59 pm Eastern Time on the due date). Quizzes are open note, open internet, but you must work independently. You are forbidden from working with any other person (regardless of whether they are in the class or not) on quizzes. To complete a quiz, a student must earn a score of 80% or better.

Students with disability accommodations are encouraged to work with the Testing Center to schedule quizzes (http://www.studentaffairs.pitt.edu/drs/).

Homework (HW)

There will be 15 HW assignments throughout the semester. HW assignments will consist of traditional data analysis problems, in which you must select the appropriate statistical method to use and perform analysis in Stata, and discussion questions in which you must comment on the statistical concepts relating to a prompt. Guidance with HW will be offered during class and recitation. HW assignments are due by Sunday evening (11:59 pm Eastern Time on the due date). HW will be graded using a rubric that will be available in Canvas. To complete the HW you must achieve "meets expectations" or better for each criterion of the rubric.

Revising Assignments

If your first attempt on a quiz or HW submission does not earn a complete grade, you may revise it up to 2 times (3 total submissions). Any revisions must be completed within 14 days after the original quiz due date (regardless of grading time). You may confer with classmates on revisions, as long as the work you submit is entirely your own. You may also ask questions about them during TA or instructor office hours. Submitting a revision does not guarantee a complete grade; submissions will be evaluated to ensure that the student has demonstrated sufficient understanding of the material to warrant a complete grade. To revise a quiz, you will provide the correct answer for each missed question and include a detailed explanation to support the correct answer (why is that answer correct); you can submit Quiz revisions using a separate assignment link in Canvas (not the original quiz link). To revise a HW, you address the deficiencies pointed out on the rubric feedback; you can submit HW revisions by uploading a new submission to the original assignment link in Canvas.

Working Outside of the Schedule

Materials including assignments will be posted as soon as they are available, so you may be able to work ahead if you need to. Sometimes, I mistakenly forgot to "publish" something on the Canvas page to make it visible to you, so if you think you should have access to something that isn't available, please send me a message.

If something comes up (e.g. you fall ill or need to care for someone in your household), please email me ASAP. We can work out a timeframe for completing the coursework based on your specific situation. I will try my best to be accommodating, but please do not take advantage of this. Working outside the preset course schedule creates extra work for me and the TAs and limits our availability to other students. Also, please note that I do not consider planned trips (vacations, conferences, etc.) to justify accommodations in the assignment due dates.

Late work policy

Late work is NOT accepted without prior approval (before the due date) from Dr. Carlson. Extensions on assignment deadlines may be granted for unforeseen, extenuating circumstances (family emergencies, severe illness, etc.).

Grading Scale

The grade system of this course is designed to reflect each student's mastery of the learning objectives. There are a total of 15 HW assignments and 15 quizzes. Thus, students will be graded using the following terms:

Final Grade	**What you need to do to earn it**
F	Fail to meet the requirements for a D
D	Complete at least 6/15 HWs and 6/15 quizzes within 3 attempts*
D+	Complete at least 7/15 HWs and 7/15 quizzes within 3 attempts*
C-	Complete at least 8/15 HWs and 8/15 quizzes within 3 attempts*

C	Complete at least 9/15 HWs and 9/15 quizzes within 3 attempts*
C+	Complete at least 10/15 HWs and 10/15 quizzes within 3 attempts*
B-	Complete at least 11/15 HWs and 11/15 quizzes within 3 attempts*
B	Complete at least 12/15 HWs and 12/15 quizzes within 3 attempts*
B+	Complete at least 13/15 HWs and 13/15 quizzes within 3 attempts*
A-	Complete at least 14/15 HWs and 14/15 quizzes within 3 attempts*
A	Complete all 15 HWs and all 15 quizzes within 3 attempts*
A+	Complete all 15 HWs and 15 quizzes on the first attempt (no revisions needed)

* within 3 attempts means you are allowed to revise each assignment up to 2 times within 14 days after the due date

Grading concerns

Students have 24 hours after graded work is returned to request a regrade. These requests must be emailed to Dr. Carlson and include an explanation for why the regrade is necessary. Please note: a regrade means the entire assessment will be graded again which may result in a lower grade.

Academic Integrity

All students are expected to adhere to the school's standards of academic honesty. Cheating/plagiarism will not be tolerated. The Graduate School of Public Health's policy on academic integrity, which is based on the University policy, is available online in the Pitt Public Health Academic Handbook www.publichealth.pitt.edu/home/academics/academic-requirements. The policy includes obligations for faculty and students, procedures for adjudicating violations, and other critical information. Please take the time to read this policy.

Diversity

The University of Pittsburgh Graduate School of Public Health considers the diversity of its students, faculty, and staff to be a strength and critical to its educational mission. Pitt Public Health is committed to creating and fostering inclusive learning environments that value human dignity and equity. Every member of our community is expected to be respectful of the individual perspectives, experiences, behaviors, worldviews, and backgrounds of others. While intellectual disagreement may be constructive, no derogatory statements, or demeaning or discriminatory behavior will be permitted.

If you feel uncomfortable or would like to discuss a situation, please contact any of the following:

- the course director or course instructor;
- the Pitt Public Health Associate Dean for Diversity and Inclusion;
- the University's Office of Diversity and Inclusion at 412-648-7860 or https://www.diversity.pitt.edu/civil-rights-title-ix-compliance/make-report/report-form (anonymous reporting form)

Sexual Misconduct, Required Reporting, and Title IX

The University is committed to combatting sexual misconduct. As a result, you should know that University faculty and staff members are required to report any instances of sexual misconduct, including harassment and sexual violence, to the University's Title IX office so that the victim may be provided appropriate resources and support options. What this means is that as your professor, I am required to report any incidents of sexual misconduct that are directly reported to me, or of which I am somehow made aware.

There are two important exceptions to this requirement about which you should be aware: A list of the designated University employees who, as counselors and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: https://www.diversity.pitt.edu/civil-rights-title-ix-compliance/make-report/confidentiality-and-retaliation

An important exception to the reporting requirement exists for academic work. Disclosures about sexual misconduct that are shared as part of an academic project, classroom discussion, or course assignment, are not required to be disclosed to the University's Title IX office.

If you are the victim of sexual misconduct, Pitt encourages you to reach out to these resources:

- Title IX Office: 412-648-7860
- SHARE @ the University Counseling Center: 412-648-7930 (8:30 A.M. TO 5 P.M. M-F) and 412-648-7856 (AFTER BUSINESS HOURS)

If you have a safety concern, please contact the University of Pittsburgh Police, 412-624-2121.

Other reporting information is available here: https://www.diversity.pitt.edu/civil-rights-title-ixcompliance/make-report

Statement from the Department of Gender, Sexuality, and Women's Studies

[This statement was developed by Katie Pope, Associate Vice Chancellor for Civil Rights and Title IX, in conjunction with GSWS instructors.]

Disability Services

If you have a disability for which you are requesting an accommodation, please notify the instructor and Disability Resources and Services (www.studentaffairs.pitt.edu/drs/) no later than the second week of term. DRS will verify your disability and determine reasonable accommodations for this course.

COVID-19 Statement

In the midst of this pandemic, it is extremely important that you abide by public health regulations and University of Pittsburgh health standards and guidelines. While in class, at a minimum, this means you must wear a face covering and comply with physical distancing requirements; other requirements may be added by the University during the semester. These rules have been developed to protect the health and safety of all community members. Failure to comply with these requirements will result in you not being permitted to attend class in person and could result in a Student Conduct violation. For the most up-to-date information and guidance, please visit coronavirus.pitt.edu and check your Pitt email for updates before each class.

Course Schedule (Tentative)

Week	Day	Date	Type	Topic(s)	Notes
1	W	1/20/21	Lecture	Course Logistics	
2	M	1/25/21	Lecture	Basic Principles: Confounding, Bias, and Data Types	
			Recitation	Stata Bootcamp: getting data into Stata, data types in Stata	
	W	1/27/21	Lecture	Evaluating a study's results (EX: Is eating organic food better for you?)	
3	M	2/1/21	Lecture	Descriptive Statistics and Visualizations	
			Recitation	Descriptive Statistics and Visualizations in Stata	
	W	2/3/21	Lecture	Reporting Descriptive Statistics, When a variable can be both data types	Spring Term add/drop period ends 2/5
4	M	2/8/21	Lecture	Probability (Diagnostic Tests) and Normal Distributions	
			Recitation	Calculating Normal Probabilities in Stata	
	W	2/10/21	Lecture	Misc. topics on Normal Distributions or intro to CLT	
5	M	2/15/21	Lecture	CI for a proportion (including CLT)	
			Recitation	CI for a proportion in Stata	
	W	2/17/21	Lecture	What does it mean to be 95% confident?	
6	M	2/22/21	Lecture	CI for a mean (including CLT)	
			Recitation	CI for a mean in Stata	Student self-care day 2/23
	W	2/24/21	Lecture	Error bars	
7	M	3/1/21	Lecture	Intro to Hypothesis Testing and P-values	
			Recitation	One sample Z test and one-sample t test in Stata	
	W	3/3/21	Lecture	Discussion on statistical significance, type 1/2 errors	
8	M	3/8/21	Lecture	Two-sample t tests	
			Recitation	Two-sample t tests in Stata	
	W	3/10/21	Lecture	more practice with two-sample t tests	
9	M	3/15/21	Lecture	Chi-squared goodness-of-fit test and test of independence	
			Recitation	Chi-squared goodness-of-fit test and test of independence in Stata	
	W	3/17/21	Lecture	Calculating and interpretting odds ratios	
10	M	3/22/21	Lecture	Paired t test and McNemar's test	
			Recitation	Paired t test and McNemar's test in Stata	
	W	3/24/21		no class (student self-care day)	Withdrawal deadline is 3/26
11	M	3/29/21	Lecture	One-way ANOVA	
			Recitation	One-way ANOVA in Stata	
	W	3/31/21	Lecture	The issue with multiple comparisons	
12	M	4/5/21	Lecture	Linear Regression	
			Recitation	Linear Regression in Stata	
	W	4/7/21	Lecture	Modeling and interpretations of models	
13	M	4/12/21	Lecture	Logistic Regression	
			Recitation	Logistic Regression in Stata	
	W	4/14/21	Lecture	ROC curves	
14	M	4/19/21	Lecture	Nonparametric procedures	
			Recitation	Nonparametric procedures in Stata	
	W	4/21/21	Lecture	Comparing nonparametric procedures with their parametric buddies	
15	M	4/26/21	Lecture	Road map of all the procedures we learned	
			Recitation	Case study in Stata	
	W	4/28/21	Lecture	Statistical Advice	

Assignment Due Dates and Objective Mapping

Homework

Assignment	Description	Course Objectives	Due Date	Revisions Must Be Completed By
HW 1	Course Logistics	N/A	Sunday, January 24, 2021	Sunday, February 7, 2021
HW 2	Basic Principles; Stata Introduction	C1, C4	Sunday, January 31, 2021	Sunday, February 14, 2021
HW 3	Descriptive Statistics	C5A, C6, C7	Sunday, February 7, 2021	Sunday, February 21, 2021
HW 4	Probability; The Normal Distribution	C2	Sunday, February 14, 2021	Sunday, February 28, 2021
HW 5	One Categorical Variable (CI for a Proportion)	C1, C5, C6, C7	Sunday, February 21, 2021	Sunday, March 7, 2021
HW 6	One Quantitative Variable (CI for a Mean)	C1, C5, C6, C7	Sunday, February 28, 2021	Sunday, March 14, 2021
HW 7	Intro to Hypothesis Testing, Statistical Significance, and P-values	C1, C5, C6, C7	Sunday, March 7, 2021	Sunday, March 21, 2021
HW 8	Two-Sample T	C1, C5, C6, C7	Sunday, March 14, 2021	Sunday, March 28, 2021
HW 9	Chi-Squared Tests	C1, C5, C6, C7	Sunday, March 21, 2021	Sunday, April 4, 2021
HW 10*	Paired Data (Paired T and McNemars)	C1, C5, C6, C7	Sunday, March 28, 2021	Sunday, April 11, 2021
HW 11	ANOVA	C1, C5, C6, C7	Sunday, April 4, 2021	Sunday, April 18, 2021
HW 12	Linear Regression	C1, C5, C6, C7	Sunday, April 11, 2021	Sunday, April 25, 2021
HW 13	Logistic Regression	C1, C5, C6, C7	Sunday, April 18, 2021	Friday, April 30, 2021
HW 14	Nonparametric Procedures	C1, C3, C6, C7	Sunday, April 25, 2021	Friday, April 30, 2021
HW 15	Putting it all together	C1, C3, C4, C5, C6, C7	Friday, April 30, 2021	Friday, April 30, 2021

Quizzes

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Quiz 1	Course Logistics	N/A	Sunday, January 24, 2021	Sunday, February 7, 2021
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Quiz 15	Putting it all together	C1, C3, C4, C5, C6, C7	Friday, April 30, 2021	Friday, April 30, 2021