

DPHS 701

Applied Analytic Methods for Population Health Sciences I

Fall 2019

Time: 8:30-9:45 AM

Days: M/W

Academic credit: 3 hours

Course format: Lecture + discussion

Instructor's Information

Emily O'Brien, PhD
Emily.obrien@duke.edu

Brad Hammill, DrPH
brad.hammill@duke.edu

What is this course about?

This course will introduce you to study design, descriptive statistics, and analysis of statistical models with one or two predictor variables. You will learn descriptive statistics, sampling, contingency tables, one- and two-way analysis of variance, simple linear regression, and analysis of covariance. We will also explore parametric and nonparametric data analysis techniques. You will learn core concepts through team-based case studies and analysis of research datasets taken from the population health sciences literature. Most of the course content will be reinforced through programming exercises you will do in concert with PHS 503 (Introduction to Statistical Programming for Population Health Sciences). Computational exercises will primarily use the SAS Statistical Computing Platform.

What background knowledge do I need before taking this course?

We strongly recommend demonstrated familiarity with these topics through coursework, professional experience, or other means:

- At least one course in introductory statistics, or equivalent work experience

AND

- At least one college-level math course, calculus or higher (e.g., calculus, linear algebra)

What will I learn in this course?

- Apply numerical and graphical techniques to summarize data
- Understand hypothesis testing, estimation of confidence intervals, and p-values
- Choose and perform tests to analyze data from one or two samples
- Understand study design considerations related to power and sample size
- Conduct statistical analyses in modern statistical software and interpret the results

How will I know if I have met the objectives of this course?

There are two types of graded assignments in this course:

- 1. Problem sets:** Before approximately every other class, you will complete a problem set individually and submit it by 7 am the morning of class on Sakai. These will be graded based on completion (1 point for each completed assignment x 10 assignments = 10 points of your total course grade). During the first 10 minutes of class, you will divide into groups to discuss each question before we discuss the questions as a group. This activity will count toward your “in-class work” grade (10% of the total grade). You can submit the assignment with your name, date, and the problem set number as a word document or (if you work the problems by hand) a scanned PDF.
- 2. Exams (midterm and final):** The exams will be cumulative. For each exam, you will be responsible for all material related to the topics we have covered in the course to date, including lectures, discussions, readings, and in-class group work. You will be allowed to bring one 5”x7” index card with any information you want on the front and back to use during the exams.

How will my grade be calculated?

Your final grade will be determined as follows:

Midterm exam: 40%

Final exam: 40%

Homework assignments: 10%

In-class work: 10%

Total: 100%

How can I prepare for the class sessions to be successful?

Prior to each class, you will need to complete the reading assignment(s) relevant to that day’s discussion. You will also need to complete the problem set pertaining to the prior session(s’) topics, which you will submit on Sakai by 7 am the morning of class (please see course schedule below). You should bring either a calculator or laptop to class to assist you with any calculations you need to do for the group work or other class activities. You should come prepared to participate in class discussions and exercises.

What required texts, materials, and equipment will I need?

The Sakai course website will contain all information you need about the course, including the syllabus, schedule, policies, links to submit the homework assignments. We will also post any announcements relevant to the course here, so please check it often. The course website is located here:

<https://sakai.duke.edu/portal/site/45c1a375-ff10-4c32-988f-e8716a5f3077>

The required textbook for this course is: Pagano M and Gauvreau K (2000). Principles of Biostatistics. 2nd ed. Australia; Pacific Grove, CA.

<https://www.crcpress.com/Principles-of-Biostatistics-Second-Edition/Pagano-Gauvreau/p/book/9781138593145>

What optional texts or resources might be helpful?

<https://www.khanacademy.org/math/statistics-probability>

What are the course policies?

All faculty, staff, affiliates, and students of Duke University are expected to uphold and abide by the Duke Community Standard, a shared vision and expectation of personal and professional behavior.

On academic integrity:

The faculty, staff, students, and affiliates of the Department of Population Health Sciences adhere to the Duke Community Standard:

Duke University is a community dedicated to scholarship, leadership, and service and to the principles of honesty, fairness, respect, and accountability. Citizens of this community commit to reflect upon and uphold these principles in all academic and nonacademic endeavors, and to protect and promote a culture of integrity.

To uphold the Duke Community Standard:

- I will not lie, cheat, or steal in my academic endeavors;
- I will conduct myself honorably in all my endeavors; and
- I will act if the Standard is compromised.

More information on students' responsibilities regarding the Duke Community Standard [can be found here](#).

Attendance

We expect you to attend and participate in every class in person. Three absences are permitted without penalty, as long as the instructors are informed one week prior to your absence. More than three absences will result in a one-grade deduction. If you need to miss a class, please arrange with one of your classmates to get notes from the day and, if needed, follow up with one of the instructors to clarify anything about the material you do not understand.

Make-up Work

Missed problem sets or exams may be made up only in cases of extreme circumstances (e.g., death in the family or serious illness) or religious observance (please notify us in advance).

Cell Phones and Laptops

Please turn off cell phones while you are in class. Laptops may be used for note taking and completing exercises when appropriate. There is evidence that the use of laptops can distract students from classroom learning and participation, so please use your laptop thoughtfully and in a way that facilitates learning by you and your classmates.

Recognizing and Encouraging Diversity

Duke aspires to create a community built on collaboration, innovation, creativity, and belonging. Our collective success depends on the robust exchange of ideas—an exchange that is best when the rich diversity of our perspectives, backgrounds, and experiences flourishes. To achieve this exchange, it is essential that all members of the community feel secure and welcome, that the contributions of all

individuals are respected, and that all voices are heard. All members of our community have a responsibility to uphold these values.

What campus resources can help me during this course?

Full list of graduate student resources: <https://gradschool.duke.edu/student-life/student-resources>

Specific resources that may be useful:

IT support: <https://gradschool.duke.edu/student-life/student-resources#InformationTechnology>

Duke Libraries: <https://library.duke.edu/>

Tutoring: <https://stat.duke.edu/phd/current-students/tutoring>

Academic Calendar: <https://registrar.duke.edu/calendars-key-dates/future-academic-calendar>

What is the expected course schedule?

#	Day	Date	Topic	Pre-class reading	Problem set
1	Mon	8/26	Introductions & Syllabus Overview	None	
2	Wed	8/28	Descriptive statistics I	Pagano, Ch. 2, pp. 7-24	
	Mon	9/2	<i>No Class (Labor Day)</i>		
3	Wed	9/4	Descriptive statistics II	Pagano, Ch. 3, pp. 38-51	<u>Due: Problem Set #1:</u> Ch. 2, p. 30, #2, 3, 5, 7, 12, 13
4	Mon	9/9	Probability	Pagano, Ch. 6, pp. 125-131	
5	Wed	9/11	Probability Distributions	Ch. 7, 162-185	<u>Due: Problem Set #2:</u> Ch. 3, p. 59, #1, 2, 3, 6, 8 Ch. 6, p. 155, #1, 2, 8, 10
6	Mon	9/16	Sampling Distribution of the Mean	Pagano, Ch. 8, pp. 196-203	
7	Wed	9/18	Confidence Intervals	Pagano, Ch. 9, pp. 214-224	<u>Due: Problem Set #3:</u> Ch. 7, p. 191, #8, 12, 14, 18 Ch. 8, p. 211, #5, 8, 12
8	Mon	9/23	Introduction to Inference, Hypothesis Testing, and Type 1 & 2 Error	Pagano, Ch. 10, pp. 232-243	

9	Wed	9/25	Inferences on the mean	Pagano, Ch. 11, pp. 259-272	<u>Due: Problem Set #4:</u> Ch. 9, p. 227, #2, 3, 6, 8 Ch. 10, p. 254, #2, 3, 12
10	Mon	9/30	Inferences for proportions	Pagano, Ch. 14, pp. 323-335	
11	Wed	10/2	Contingency tables I	Pagano, Ch. 15, pp. 342-360	<u>Due: Problem Set #5:</u> Ch. 11, p. 278, #2, 3, 6, 8, 12 Ch. 14, p. 338, #1, 8, 10, 12
<i>10/7: No class (Fall Break)</i>					
12	Wed	10/9	Contingency tables II	Pagano, Ch. 16, pp. 374-386	
13	Mon	10/14	Review		<u>Due: Problem Set #6:</u> Ch. 15, p. 366, #2, 6, 8, 10, 14 Ch. 16, p. 393, #1, 5, 6
14	Wed	10/16	MIDTERM		
15	Mon	10/21	Power/Sample Size	Pagano, Ch. 10, pp. 243-249	
16	Wed	10/23	<i>No Class</i>		<u>Due: Problem Set #7:</u> Ch. 10, p. 254, #6, 8, 14
17	Mon	10/28	<i>Special Topics - Bayesian</i>		
18	Wed	10/30	Non-parametric Tests	Pagano, Ch. 13, pp. 302-312	
19	Mon	11/4	ANOVA I	Pagano, Ch. 12, pp. 285-294	
20	Wed	11/6	ANOVA II		
21	Mon	11/11	Correlation	Pagano, Ch. 17, pp. 398-407	<u>Due: Problem Set #8:</u> Ch. 12, p. 298, #1-4, 6, 8, 10* Ch. 13, p. 317, #1, 4, 6, 8, 12
22	Wed	11/13	<i>Special Topics – Epi methods</i>		
23	Mon	11/18	Simple linear regression	Pagano, Ch. 18, pp. 415-438	<u>Due: Problem Set #9:</u>

					Ch. 17, p. 412, #2-4, 5, 7, 8*
24	Wed	11/20	Simple linear regression		
25	Mon	11/25	Review		<u>Due: Problem Set #10:</u> Ch. 18, p. 443, #1, 2, 4, 6, 8, 10*, 12*, 13*
TBD	Thurs	12/12	FINAL EXAM		

**Instructors will provide supplemental materials (output) on Sakai*

**Please note that this syllabus is subject to change.
We will communicate any updates in class and/or over email.**