**UNIVERSITY OF MASSACHUSETTS**
**Department of Biostatistics and Epidemiology**
**BIOSTATS 540 – Introductory Biostatistics**
**Fall 2022**

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|---|---|
| **Title:** | BIOSTATS 540 – Introductory Biostatistics |
| **Course website:** | **http://people.umass.edu/~biep540w** |
| **Spire Class numbers:** | 55144 (Wed 5:00 – 7:30) and 55167(Online) |
| **Number of credits:** | 3 |
| **Instructor:** | Carol Bigelow, PhD |
| **Office:** | Department of Biostatistics & Epidemiology/402 Arnold House |
| **Umass Office Phone:** | *Dear class, In Fall 2022, I am mostly working from home. Please email!* |
| **Email:** | Email: cbigelow@schoolph.umass.edu |
| **Teaching Assistant:** | TBD |



## Course Description

This course is the first of a two semester sequence of biostatistics: BIOSTATS 540 – *Introductory Biostatistics* and BIOSTATS 640 – *Intermediate Biostatistics*. Minimal mathematical background (algebra) is required. No worries; logarithms and exponents will be reviewed as needed. The goal of BIOSTATS 540 is basic statistical literacy. We will explore the ideas of variability in nature and the tools we use for its understanding. The distinctions between systematic versus chance variability will be detailed. Concepts in simple random sampling and sampling distributions will be introduced. You will learn selected methods of data summarization, estimation, and hypothesis testing. Topics include: data summarization and visualization, chance, sampling distributions, chance and selected probability models (the Bernoulli, binomial, and normal), confidence interval estimation, statistical significance and its limitatins, and the basics of statistical hypothesis testing. I will also provide an introduction to chi square tests, simple linear regression and correlation.

## Welcome and Introductions

If you enjoy statistics, lucky you. We will be exploring data, making elegant visualizations (so much fun), and challenging our notions of what can be learned from what we call "data" (someone famous once quipped *"What's the plural of anecdote? Data!"*). We'll remind ourselves that bias is inherent to how we think and that we are often poor judges of probability. Others of you, often many, don't like statistics (and that may be putting it mildly). You're here because this is a required course and you're dreading it. We can all relate to that. In my case, I dreaded introductory biology. I had no background, the readings were overwhelming, and it was a constant struggle (and many teary nights) to frame it any useful way. If prior years are any indication, our BIOSTATS 540 Fall 2022 community will be a mix of the statistics lovers and the statistics haters, with few landing in the middle. **Welcome, *all of you*!**

A little more about us. We will be a diverse community of approximately 50 students. Some have prior statistics experience, are comfortably planted at UMass and are thriving. Others, probably the majority, are new to statistics and possibly also new to UMass. Many are also navigating additional differences (english is not first language, or find it uncomfortable to engage with others in the class or to reach out to the instructor, learning disability). We are all different in how we learn and in our barriers to learning. The key for us will be to learn together. So, please. Keep in frequent touch with me and your colleagues.

My philosophy in teaching introductory biostatistics focuses on statistical literacy with new material delivered in small bites. I believe in lots of reinforcement along the way. One more thing. I know some of you are afraid that you will have to use R in this course. Good news; you will not have to use R to be successful in this course. I have online, easy to use alternatives.

## ADA Accommodation Policy

The University of Massachusetts Amherst is committed to making reasonable, effective and appropriate accommodations to meet the needs of students with disabilities and help create a barrier-free campus. If you have a disability and require accommodations, please register with Disability Services (161 Whitmore Administration building; phone 413-545-0892) to have an accommodation letter sent to your faculty. Information on services and materials for registering are also available on their website www.umass.edu/disability."

If, because of a disability, you require special arrangements in order to meet course requirements, please contact me as soon as possible (email: cbigelow@schoolph.umass.edu) so that we can make the necessary arrangements.

**Policies on Classes and Work Missed for Extenuating Circumstances**.
Per University of Massachusetts Academic Regulations, *"Students absent due to extenuating circumstances-including jury duty, military obligations, scheduled activities for other classes, the death of a family member, or verifiable health-related incapacity-remain responsible for meeting all class requirements and contacting the faculty member in a timely fashion about making up missed work. Faculty shall offer such students reasonable assistance in making up missed classes (i.e., making arrangements for attendance at labs or discussion sections which meet at other times; providing makeup exams or labs where feasible or offer mutually agreeable alternatives to make up work)."*

If any extenuating circumstances prevent you from completing any work, please contact me as soon as possible (email: cbigelow@schoolph.umass.edu) so that we can make alternative arrangements.

## Getting Started with Remote Learning

I will be offering Zoom meetings each week. I suspect you are already very very familiar with Zoom! But on the off chance that you are new to Zoom, please be sure to familiarize yourself with the resources and technologies below before the first week of class (Wednesday – Tuesday September 7-13, 2022).

__1. Public Course Website: https://people.umass.edu/~biep540w/

__2. UMass Amherst Blackboard Learn: https://uma.umassonline.net/webapps/login/#
Resource for Learning Blackboard Learn:
*(source: Rowan University, Campbell Library)* Blackboard Tutorials for Students

__3. UMass Amherst Zoom Login: https://www.umass.edu/it/zoom
Resource for Learning Zoom:
*(source: https://support.zoom.us)* Zoom Video Tutorials
***Tip***: Be sure to watch these two tutorials, here: "Join a Meeting" and "Meeting Controls"

## Course Units, Objectives and Outcome Competencies

### Course Units

This course has 12 units:

1. Summarizing Data
2. Data Visualization
3. Basic Probability
4. Probabilities in Epidemiology
5. Populations & Samples
6. Bernoulli & Binomial Distribution
7. Normal Distribution
8. Statistical Literacy – Intro to Estimation & Hypothesis Testing
9. One Sample – Estimation & Testing
10. Two Samples – Estimation & Testing
11. Chi Square Tests
12. Simple Linear Regression & Correlation

**Objectives**

By the end of this course, you should be able to perform, interpret, and communicate the findings of selected simple statistical analyses of biological and health data, including description, confidence interval estimation and hypothesis testing.

**Outcome Competencies**

BIOSTATS 540 meets the Council on Education in Public Health (CEPH) 2016 ***quantitative*** criterion for accredited Schools (SPHs) and Programs (PHPs) instruction in introductory biostatistics:

> *"Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate."*

Course Outcome Competencies and their Relationships to ***CEPH Criterion:***

The specific outcome competencies include the following. Outcomes satisfying CEPH are indicated in bold italics.

| | Relationship to CEPH Criterion | |
|---|---|---|
| **Course Outcome Competency** | **Course Content** | **Assessment** |
| 1. Explain why we need biostatistics | | |
| 2. Distinguish among the different measurement scales and explain why these distinctions matter. | | |
| 3. ***Produce basic numerical summaries of data*** | Unit 1 – Summarizing Data | Exam 1 – Units 1 & 2 |
| 4. ***Produce basic graphical summaries of data*** | Unit 2 – Data Visualization | Exam 1 – Units 1 & 2 |
| 5. Explain basic concepts of randomness and probability | | |
| 6. ***Computer and interpret basic statistics from 2x2 tables of epidemiological data*** | Unit 6 – Bernoulli and Binomial<br>Unit 8 – Statistical Literacy<br>Unit 11 – Chi Square Tests | Exam 2 – Units 4, 5, 6 & 7 |
| 7. Describe selected probability distributions: Uniform, Bernoulli, Binomial, Normal, Student-t, F, and Chi Square | | |
| 8. ***Compute and interpret confidence intervals and hypothesis tests in selected settings: single sample, single sample of paired data, two independent samples, and simple linear regression.*** | Unit 8 – Statistical Literacy<br>Unit 9 – One Sample Inference<br>Unit 10 – Two Sample Inference<br>Unit 11 – Chi Square Tests<br>Unit 12 – Simple Linear Regression and Correlation | Exam 3 – Units 8, 9, and 10 |
| 9. Interpret selected, basic, published statistical analyses. | | |
| 10. Interpret vital statistics and public health records. | | |
| | | |

## Textbook, Software, and Internet Resources

### Textbook

*There is NO required textbook.*
However, if you are looking for a textbook reference, I recommend the book, *Introductory Statistics for the Life and Biomedical Sciences*, First Edition by Julie Vu and David Harrington. It's freely available. See below.

*Recommended*
Vu J and Harrington D
Introductory Statistics for the Life and Biomedical Sciences, First Edition.
Version date: August 8, 2021.
Download for free at:
https://openintro.org/book/biostat/

*A very reader friendly resource, very basic*
Triola MM and Triola MF
Biostatistics for the Biological and Health Sciences
Pearson Addison Wesley
2006
ISBN 0-321-19436-5

### Software

We will be using R Studio and ArtofStat. Again, you are ***not*** required to use R.

R Users: I will provide everything you need to obtain and install R and RStudio before the course begins. You do not need to do anything before the course starts.

ArtofStat Users: Similarly, there is nothing you need to do prior to the course start. If you are interested in looking around, visit www.artofstat.com. From the welcome page, click on **Online Web Apps**. Scroll and explore.

***IMPORTANT***
BIOSTATS 540 is ***not*** a course in programming in R,
nor in any other statistial software package (e.g., SAS, Stata, SPSS, Minitab, etc.)

***IMPORTANT***
Use of a statistical software package will ***not be needed for any of the exams***.

### Internet Resources

| | |
|---|---|
| *Biostatistics 540 Fall 2022 site*<br>https://people.umass.edu/~biep540w/ | *Introductory Biostatistics site resources at OpenIntro*<br>https://openintro.org/ |

## Important Dates to Remember

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|---|---|
| First Week of Class | Wednesday – Tuesday, September 7-13, 2022 |
| Last Day to Drop with no Record | Monday September 19, 2022 |
| Last Day to Drop with "DR" | Tuesday November 1, 2022 |
| Last Class | Monday December 12, 2022 |
| Final Exam Due | Monday December 19, 2022 |

## Course Schedule (Units, Homeworks, Exams)

***Units and Homeworks (13 weeks).***

| Week | Date | Unit - Lecture | Homework<br>Posting and Due Dates |
|---|---|---|---|
| 1 | Wednesday - Tuesday<br>September 7-13, 2022 | Course Introduction | *No homework this week: Use this time to access artofstat.com or R.* |
| 2 | Wednesday - Tuesday<br>September 14-20, 2022 | 1 – Summarizing Data | Posted: Wed September 14, 2022<br>Due: Friday September 23, 2022 |
| 3 | Wednesday - Tuesday<br>September 21-27, 2022 | 2 – Data Visualization | Posted: Wed September 21, 2022<br>Due: Friday September 30, 2022 |
| 4 | Wednesday - Tuesday<br>September 28- October 4, 2022 | 3 – Basic Probability | Posted: Wed September 28, 2022<br>Due: Friday October 7, 2022 |
| 5 | Wednesday - Tuesday<br>October 5-11, 2022 | 4 – Probabilities in Epidemiology | Posted: Wed October 5, 2022<br>Due: Friday October 14, 2022 |
| 6 | Wednesday - Tuesday<br>October 12-18, 2022 | 5 – Populations & Samples | Posted: Wed October 12, 2022<br>Due: Friday October 21, 2022 |
| 7 | Wednesday - Tuesday<br>October 19-25, 2022 | 6 – Bernoulli & Binomial | Posted: Wed October 19, 2022<br>Due: Friday October 28, 2022 |
| 8 | Wednesday - Tuesday<br>October 26-November 1, 2022 | 7 – Normal Distribution | Posted: Wed October 26, 2022<br>Due: Friday November 4, 2022 |
| 9 | Wednesday - Tuesday<br>November 2-8, 2022 | 8 – Estimation & Testing | Posted: Wed November 2, 2022<br>Due: Friday November 11, 2022 |
| 10 | Wednesday - Tuesday<br>November 9-15, 2022 | 9 – 1 Sample Estimation & Tests | Posted: Wed November 9, 2022<br>Due: Friday November 18, 2022 |
| 11 | Wednesday - Tuesday<br>November 16-29, 2022 | 10 – 2 Sample Estimation & Tests | Posted: Wed November 16, 2022<br>Due: Friday December 2, 2022 |
| | | | *Happy Thanksgiving* |
| 12 | Wednesday - Tuesday<br>November 30-December 6, 2022 | 11- Chi Square Tests | *There is no homework for unit 11* |
| 13 | Wednesday - Tuesday<br>December 7-12, 2022 | 12 – Simple Linear Regression & Correlation | *There is no homework for unit 12* |
| - | Final Exam Due | | **Monday December 19, 2022** |

| | | | |
|---|---|---|---|
| | | | **Exam 3 (Final) DUE Today** |
| | | | |

## Exams

***IMPORTANT***
Sorry. I do ***not*** post exams ahead of schedule

| | Posting Date | Due Date |
|---|---|---|
| **Exam 1**<br>Unit 1 - Summarizing Data<br>Unit 2 - Data Visualization | *Monday*<br>September 26, 2022 | *Mondayy*<br>October 10, 2022<br><br>(-10 points)<br>Wednesday October 12, 2022<br><br>(-20 points)<br>Monday October 17, 2022 |
| **Exam 2**<br>Unit 4 – Probabilities in Epidemiology<br>Unit 5 – Populations and Samples<br>Unit 6 – Bernoulli and Binomial Distributions<br>Unit 7 – Normal Distribution | *Monday*<br>October 31, 2022 | *Monday*<br>November 14, 2022<br><br>(-10 points)<br>Wednesday November 16, 2022<br><br>(-20 points)<br>Monday November 21, 2022 |
| **Exam 3**<br>Unit 8 – Statistical Literacy – Estimation and Hypothesis Testing<br>Unit 9 – One Sample Estimation and Hypothesis Testing<br>Unit 10 – Two Sample Estimation and Hypothesis Testing | *Monday*<br>November 28, 2022 | *Monday*<br>December 19, 2022<br><br>Last Date for Submission<br>(-10 points)<br>*Wednesday*<br>December 21, 2022 |

***IMPORTANT***

**You will *NOT* be tested on the following units:**

Unit 3. Probability Basics
Unit 11. Chi Square Tests

| Unit 12. Linear Regression |
|---|

## Course Expectations (Instructor, Teaching Assistants, and Students)

***Instructor***

- I will respond to all emails and Blackboard messages every day, *except for Saturdays*
- I will provide regularly scheduled Zoom office hours
- I will also provide Zoom meeting office hours by appointment, as appropriate.

***Teaching Assistant – Our Teaching Assistant is TBD***

- TBD will respond to Blackboard discussion thread questions every day, *except for Saturdays*
- TBD will record homework submissions within one week of their due dates.
- TBD will respond to questions in homework submissions within one week of their due dates

***Students***

- Attendance is ***not*** required
- Students will abide by the University of Massachusetts policy on academic dishonesty
- Students will abide by the policy on late submissions (see below)
- To earn full credit on the homework, students must submit **8 of the 10 homework assignments**

## Grade Determination

| | **Percent of Grade** |
|---|---|
| **Homeworks**<br>**To earn full "homework" credit (25%) you must complete 8 of the 10 assignments posted**. Where to find the assignments: The homework questions are embedded in the lecture notes for Units 1-10. | **25%,** sub-total |
| **Exams (all open book)**<br><br>**Exam 1**<br><br>**Exam 2**<br><br>**Exam 3** | **75%,** sub-total as follows:<br><br>**Best test – 40%**<br>**2nd best – 20%**<br>**3rd Best – 15%** |

## Letter Grade Determination

Your course score will be converted to a letter grade as follows:

| | |
|---|---|
| A | 95 and over |
| A- | 90 - 94 |
| B+ | 87 - 89 |
| B | 83 – 86 |
| B- | 80 - 82 |

C+ 77 – 79
C 70 – 76
F Below 70

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***IMPORTANT***

**For MPH and PHP Online Students - Policy on GPA and Course Repeat.**

***If you are an MPH or a PHP online student,***
***you must earn a grade of "B MINUS" or better in this course.***

***Note: This policy corresponds to a course score of 80 or better***

All MPH and PHP Online students must maintain a 3.0 GPA during their time as students in the program. In addition, all students must receive a final grade of "B MINUS" or better in *all* of the following courses:

BIOSTATS 540 – Introductory Biostatistics
EHS 565 – Environmental Health Practices
COM-HLTH 601 – Applications of Social and Behavioral Theory
HPP 620 – Introduction to the US Health Care System
EPI 630 – Principles of Epidemiology
HPP 624 – Research Methods

If a student fails to receive a B MINUS or better in these courses, they will have to repeat the course. If a student's overall GPA falls below the 3.0 level, the student will be subject to academic measures pursuant to Section I.4 of the Graduate Student Handbook, including academic probation and/or academic dismissal.

## Policy on Late Submissions

**Corrected 9/25/2022**

This course has a policy on late submissions that aims to be fair while at the same time accommodating those who, for whatever reason, need an extension. Please note – the policy on late submissions is different for homeworks than for exams

**Policy on Late Submissions – *Homeworks ONLY***

| | Credit Policy |
|---|---|
| **On Time** | **Full cedit** |
| **1-2 Days Late** | **Full credit – 10 points** |
| **3-7 Days Late** | **Full credit – 20 points** |
| **8+ Days Late** | **0 points (no credit)** |
| | |

**Policy on Late Submissions – Exams**

| | Credit Policy |
|---|---|
| **On Time** | **Full credit for points scored** |
| **1-2 Days Late** | **Points scored – 10 points** |

| | |
|---|---|
| **3-7 Days Late** | **Points scored – 20 points** |
| **8+ Days Late** | **0 points (no credit)** |
| | |

## Policy on Academic Dishonesty

All students are expected to adhere to guidelines of University of Massachusetts regarding academic honesty. A copy of these guidelines is available online at

www.umass.edu/dean_students/code_conduct/acad_honest.htm

The University of Massachusetts/Amherst Senate Document 89-026 defines academic dishonesty as including but not limited to:

a) Cheating – intentional deceit, trickery, or breach of confidence, used to gain some unfair or dishonest advantage in one's academic work.
b) Fabrication – intentional falsification or invention of any information or citation in any academic exercise.
c) Facilitating dishonesty – knowingly helping or attempting to help someone else commit an act of academic dishonesty.
d) Plagiarism – knowingly representing the words or ideas of another as one's own work in any academic exercise.
e) Submitting in whole or in part, without citation, prewritten term papers of another or the research of another (including but not limited to such materials sold or distributed commercially).

## Valuing, Recognizing, and Encouraging Diversity

I am committed to promoting and valuing diversity in the classroom, as I believe it enriches all of us in learning and broadening our perspectives. I also believe in inclusion, tolerance and respect for others as essential values. Thus, I will do my best to create a sense of community and will strive to promote excellence in the learning environment. I am also committed to seeking out and honoring (1) the variety of life experiences you have had, and (2) the factors that define your "diversity of presence," including: age, economic circumstances, ethnic identification, disability, gender, geographic origin, race, religion, sexual orientation, social position.

## Names and Pronouns

If you have not already indicated your first name and pronouns in SPIRE, please be sure to do so. An email to me would be fine (email: cbigelow@schoolph.umass.edu).

## Title IX Statement

The University of Massachusetts Amherst is committed to fostering a safe, productive learning environment. Title IX and our school policy prohibits discrimination on the basis of sex. Sexual misconduct — including harassment, domestic and dating violence, sexual assault, and stalking — is also prohibited at our school. UMass Amherst encourages anyone experiencing sexual misconduct to talk to someone about what happened, so they can get the support they need and our school can respond appropriately.
If you wish to speak confidentially about an incident of sexual misconduct, want more information about filing a report, or have questions about school policies and procedures, please contact our Title IX Coordinator, Débora D. Ferreira, Equal Opportunity Office (EO), 413-545- 3464, equalopportunity@admin.umass.edu.

Please be aware. UMass Amherst is legally obligated to investigate reports of sexual misconduct, and therefore it cannot guarantee the confidentiality of a report, but it will consider a request for confidentiality and respect it to

the extent possible. If you want to talk with someone who is not a mandated reporter, you can contact the Center for Women and Community, (https://www.umass.edu/cwc/, 413-545-0883, or 24-hour hotline 413-545-0800), the Center for Counseling and Psychological Help (https://www.umass.edu/counseling/, 413-545-2337), or University Health Services SANE program (https://www.umass.edu/uhs/services/sane, 413-577-5000). Please also be aware. As an instructor, I am also required by our school to report incidents of sexual misconduct and thus cannot guarantee confidentiality. I must provide our Title IX coordinator with relevant details such as the names of those involved in the incident.

## Copyright Protection