



University of Maryland School of Public Health

EPIB 315 – Biostatistics for Public Health Practice

Semester: Spring 2020
Lecture Location: School of Public Health (SPH) Room
1312
Lecture Time: Tues 11:00 am- 11:50 am,
Thurs 11:00 am- 11:50 am
Course webpage: <https://myelms.umd.edu/login>

Instructor: Rodman Turpin, PhD, MS,
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Office Hours: Tues 9:00 AM - 10:00 AM,
Thurs 9:00 AM - 10:00 AM

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Course Description:

An examination of biostatistical concepts and procedures as they relate to contemporary issues in public health. Focus on applications, hands-on-experience, and interpretations of statistical findings in public health research.

Course Prerequisites:

Minimum grade of C- in CHEM131 and CHEM132. Restriction: Must be in Public Health Science program.

Course Learning Objectives:

Upon completing this course, the student will be able to:

1. Apply basic vocabulary to summarize biomedical readings and communicate about real world biostatistics.
2. Summarize data using descriptive statistics including stem plot, frequency tables, measures of central tendency and spread.
3. Apply the properties of random variables and probability, and understand probability distributions (including Binomial and Normal Distributions).
4. Conduct statistical inference including point and interval estimations and one-sample, two sample, and multiple sample comparisons.
5. Conduct simple linear regression and interpret it.

Program Competencies Addressed in this Course:

The following competencies for the Public Health Science Program, in part or whole, are addressed in this course:

1. Identify and describe core scientific concepts underlying disease prevention, environmental protection, and health promotion.
2. Synthesize scientific knowledge to formulate solutions to public health problems.
3. Identify and define public health problems from an interdisciplinary perspective.

Texts:

Required:

- Gerstman, B. B. (2014). *Basic Biostatistics: Statistics for Public Health*, 2nd Edition. Jones & Bartlett learning, CA: San Jose. [ISBN-13: 978-1284036015]

References:

- Sullivan, L. M. (2017). *Essentials of Biostatistics in Public Health*. Jones & Bartlett learning, MA: Burlington. [ISBN-13: 978-1284108194]

Required Technology and Other Materials:

- Scientific calculator
- Pencils/pens
- A loose-leaf binder
- Blank sheets of paper
- A laptop or phone w/ Canvas app

Course Communication:

The instructor will communicate with students via e-mail regarding class cancellation, room change, or other timely announcements. **Students are responsible for keeping their email address up to date or for redirecting or forwarding email to another address. Failure to check email, errors in forwarding email, and returned email (from “full mailbox” or “unknown user” errors for example), will not excuse a student from missing University announcement, messages, deadlines, etc.** Email addresses can be quickly and easily updated at

<http://www.my.umd.edu> or in-person at the Student Service Counter on the first floor of the Mitchell Building. For technical support for University email: www.helpdesk.umd.edu or call 301-405-1400.

Student Feedback for Improving the Course:

We are interested in your feedback as we proceed through the semester! You are welcome to communicate feedback regarding the course in person or over email to the instructor and/or TA. Thank you in advance for sharing your thoughts!

Course Requirements and Expectations:

1. Attendance and Participation: Attending lectures and sections is necessary in order to do well. Exams and quizzes are based on lecture notes and exercises, discussion sessions and assigned reading. Every student is expected to attend every lecture, discussion, in-class activity, and assigned session. If you must miss a lecture or section, let the instructor or teaching assistant know **in advance (afterwards notice does not work)**. Participation is important to learning, and I encourage active participation; if you have a question, it's likely that other students do as well. Please attend office hours or schedule an appointment with the instructor or Teaching Assistant if you are having trouble with the concepts and/or assignments.
2. Course Website: Course announcements, syllabus, lecture notes, data sets, and other course materials will be distributed on the ELMS (Enterprise Learning Management System). Please check it on a regular basis. Lecture notes will be posted before class. You may wish to print these notes prior to each lecture and use them as an outline for taking notes during the class but keep in mind the professor **might keep improving the class material until the last minute before class**. You can access the website by following these directions:
 - Direct your URL to <https://myelms.umd.edu/login>.
 - Enter your Directory ID and Password.
 - Click "Courses" on the ELMS home tab.
 - Click "EPIB300-0101, 0102, 0103, 0104, 0105, 0106: Biostatistics for Public Health Practice – Fall2018".
3. Reading Assignment: Students are encouraged to complete the reading assignments before attending classes / discussion sessions.
4. Homework Questions: Please consult your TAs for homework questions. Students are also welcome to come to the instructor's office hours for homework questions.

Major Graded Assignments:

1. Homework (25%): There will be **ten** homework assignments in this class. Homework will be submitted via Canvas **before 8 pm** on the specified Monday (Course Outline / Course Calendar). **Late homework will not be accepted**. Your teaching assistant manages the grading of homeworks. Your TAs are your primary resource for homework questions. Students are also welcome to come to the instructor's office hours for homework questions. All ten homework

assignments are submitted online, and due on Mondays at 9pm. **If there are any problems accessing the online homework, contact your TA immediately.**

2. Midterm and Final (45%): One midterm examination (10%) and one final examination (30%) will be given, worth a total of 40 points. The midterm will be online (more detail will be provided in class). The final will be in class, closed book and closed note. **The final exam will be cumulative.** For the final exam, you are allowed to bring **two** pages of letter-size formula sheet. You also need to bring a **calculator [not your phone]** to facilitate the computation. **As a general rule, make-up exams and advance exams will NOT be given.** If you arrive late, you must complete the test or exam during the time allotted.
3. Lecture Exercises (20%): Each lecture will include an in-class exercise. Four of your lecture exercises (covering specific core benchmarks) are graded based on completion and showing required work. These will require accessing Canvas in class with either a laptop or phone (with the Canvas app). A laptop is preferred (for easy viewing of lecture slides during the exercise). **It is very important to bring your device that can access Canvas to every lecture.** All students must also submit their exercise work on scrap paper at the end of class, with their name.
4. Discussion Section (10%): Two graded discussion sessions exercises will be given. These will be described later in the course in your discussion sessions.
5. Extra Credit (5%): A total of 5% extra credit is available, in the form of a practice midterm and a question on your final exam. Extra credit is directly added to your total grade (it is not applied in the form of dropping a grade).

University Course Related Policies:

All University of Maryland-approved course policies are provided at the following website:

<http://www.ugst.umd.edu/courserelatedpolicies.html>

Policy descriptions, resources, and links to official policy documents are provided for:

Academic Integrity: What is cheating? What is plagiarism? What is the Honor Pledge?

Code of Student Conduct: What behavior is prohibited?

Sexual Misconduct: What to do in case of sexual harassment or sexual assault.

Discrimination: Procedures to prohibit discrimination, complaints about discrimination, harassment, and retaliation.

Accessibility: Information about disability support services (DSS) and accommodations.

Attendance, Absences, or Missed Assignments: The student must notify the instructor in a timely manner (typically first week of class). Read this prior to Schedule Adjustment date.

Student Rights Regarding Undergraduate Courses: What should I find in the course syllabus?

Am I allowed to see my exams after they are graded?

Official UMD Communication: Use of email, communication with faculty, communication about cancelled class meetings, and weather-related or other urgent notifications.

Mid-Term Grades: Provided for 100 and 200 level courses, and all student athletes.

Complaints About Course Final Grades: Questions about course grades should first be addressed to the course instructor.

Copyright and Intellectual Property: Who owns the work that I produce in class?

Final Exams: Final exams are scheduled by the University.

Course Evaluations: The School of Public Health is committed to the use of student course evaluations for improving the student experience, course and curriculum delivery, and faculty instruction.

Campus Resources: ELMS, counseling, learning workshops, tutoring, writing help, questions about graduation, adding or dropping classes, withdrawing from the semester, etc.

Course Procedures and Policies:

- **Course Etiquette:** You are expected to take notes on paper. A student version of slides will be posted online in the course website. The student version will be incomplete, with the expectation that you supplement with your class notes. For documentation on why taking notes longhand is better for your grades than on laptop, see this article at <http://www.scientificamerican.com/article/a-learning-secret-don-t-take-notes-with-a-laptop/> outlining research on this issue. Please turn off your cell phone during class time as it can be disruptive to the class and your learning. Texting during class time is not allowed unless it is an emergency.
- **Absence Policy:** In accordance with University policy if you are absent for a single (1) lecture due to illness or some form of personal or family emergency, this absence will be considered “excused” and the instructor will accept a note from you attesting to the date of the illness/incident, along with an acknowledgement that the information is true. Whenever feasible, you should contact the instructor **in advance**. Multiple or prolonged absences, and absences that prevent attendance at a scheduled grading event (like an exam, test or quiz) will require written documentation from an appropriate health care provider/organization. A link to information on this policy can be found at <http://www.president.umd.edu/policies/v100q.html>. If you miss a lecture or discussion session due to an emergency or illness, email myself (for lecture) or your TA (for discussion sessions) immediately (ideally before class starts, but never any later than when class that day ends). Late notice cannot be accepted unless there is evidence of a significant medical emergency (note that the university doesn’t allow acceptance of self-signed notes if one of the graded components is missed).
- **Late Homework and assignments:** Late homework will not be accepted without advance notice. In cases of profound documented emergency (e.g., illness, death in the family), missed homework can be dropped. If you find yourself in this position, please contact the instructor or TA **before the deadline** to discuss alternative arrangements.
- **Missed exams:** As a general rule, make-up exams and advance exams will not be given. Exceptions to this rule are evaluated on a case-by-case basis. Exams cannot be taken in advance and can only be taken late if there is a profound medical emergency (with documentation of hospitalization). If the final is missed due to profound medical emergency, the student receives an incomplete until the exam is taken. It is very strongly recommended not to travel during the date of the final (Thursday, May 14 from 8:00 to 10:00am).
- **Inclement Weather / University Closings / Emergency Procedures:** In the event that the University has a delayed opening or is closed for an emergency or extended period of time, the instructor

will communicate to students regarding schedule adjustments, including rescheduling of examinations and assignments due to inclement weather and campus emergencies.

- **Course Evaluations:** The University, the School of Public Health, and the Department of Epidemiology and Biostatistics are committed to the use of student course evaluations for improving the student experience, course and curriculum delivery, and faculty instruction. Your evaluations help instructors improve their courses; help deans and department chairs decide on merit pay for faculty, renewal of contracts, and support tenure and promotion decisions; and help current and future students decide on classes. Your participation in the evaluation of courses through CourseEvalUM is a responsibility you hold as a student member of our academic community. Your feedback is confidential and important to the improvement of teaching and learning at the University as well as to the tenure and promotion process. CourseEvalUM will be open for you to complete your evaluations starting about two weeks prior to the last day of the term before exams begin. Please go directly to the website (www.CourseEvalUM.umd.edu) to complete your evaluations. By completing all of your evaluations each semester, you will have the privilege of accessing online evaluation reports for the thousands of courses for which 70% or more students submitted their evaluations. You can access results at www.CourseEvalUM.umd.edu, the same link you use to submit your evaluations.
- If a grading error is suspected this must be brought to my attention (for lectures and exams) or your TA's attention (for discussion sessions) no later than 1 week after the homework is posted. Each grade for graded components will be posted within 1 week of the due date. All grades for graded components (other than the Final and the Final extra credit) will be posted in Canvas no later than 1 week before the final.

Grading Procedures:

Grade of this course will be determined as follows:

- Homework: 25%
- Lecture Exercises: 20%
- Discussion Section: 10%
- Midterm: 10%
- Final Exam: 35%
- Extra Credit: 5%

Grading Rubric: There Are No Deviations From this. Please Do Not Ask For Any Exceptions.

Grades	Lower Cut Off	Upper Cut Off
A+	96	100
A	92	95.99
A-	89	91.99
B+	86	88.99
B	82	85.99
B-	79	81.99
C+	76	78.99
C	72	75.99
C-	69	71.99
D+	65	68.99
D	60	64.99
F	0	59.99

Course Schedule Summary			
Session	Date	Topic	Assignments/Notes
# 1	1/28	Course Overview	-
# 2	1/30	Data Basics	HW 1 (Due 2/10 at 9 pm)
# 3	2/4	Basic Study Designs	
# 4	2/6	Activity: Stats Case Study	
# 5	2/11	Frequency Distributions	HW 2 (Due 2/17 at 9 pm)
# 6	2/13	Numeric Summary Measures	
# 7	2/18	Basics of Probability	HW 3 (Due 2/24 at 9 pm)
# 8	2/20	Diagnostic Test Probabilities	
# 9	2/25	Binomial Distribution	HW 4 (Due 3/2 at 9 pm)
# 10	2/27	Normal Distribution	
# 11	3/3	Practice Midterm (Online)	Online (at class time) ^{1*}
# 12	3/5	Midterm Review (In-class)	-
# 13	3/10	Midterm (Online)	Online (at class time) ^{1*}
# 14	3/12	Activity: Evaluating Statistics	-
-	3/17	* Spring Break *	*No meeting*
-	3/19	* Spring Break *	*No meeting*
# 15	3/24	Statistical Inference	HW 5 (Due 3/30 at 9 pm)
# 16	3/26	Hypothesis Testing and One-Sample Z test	
# 17	3/31	Statistical Power	HW 6 (Due 4/6 at 9 pm)
# 18	4/2	Confidence Intervals	
# 19	4/7	One-Sample t test	HW 7 (Due 4/13 at 9 pm)
# 20	4/9	Two Sample Z test and t test	
# 21	4/14	Paired t test	HW 8 (Due 4/20 at 9 pm)
# 22	4/16	One-Way Analysis of Variance	
# 23	4/21	Chi-Square Test	HW 9 (Due 4/27 at 9 pm)
# 24	4/23	Pearson's Correlation Coefficient	
# 25	4/28	Simple Linear Regression	HW 10 (Due 5/4 at 9 pm)
# 26	4/30	Multiple Linear Regression	
# 27	5/5	Practice Final (In-class)	-
# 28	5/7	Final Exam Review Session (In-class)	-
-	5/13	Reading Day	*No meeting*
# 29	5/14	Final Exam (In-class)	8:00 to 10:00 am
<p><i>This is a tentative schedule. Actual materials covered in each lecture might not be exactly the same.</i></p> <p>¹Online (at class time) means that you must be online during the usual class date and time (11:00 am to 11:50 am) for timed assignments.</p> <p>Unless specified as "online" or "no meeting", we will meet in class for all sessions.</p>			

Required Session Outline	
<p><i>Note: Numbers in brackets after learning objectives show linkage between material covered in each session and the numbered program competencies shown on page 1 of this syllabus.</i></p>	
Course Overview	1/28

<u>Topics: Course overview, Introduction of Biostatistics</u>	
Learning Objectives for Session 1 [<i>Competency 1</i>]	
<ul style="list-style-type: none"> - Understand the structure of scheduling for this course - Understand cutting-edge public health issues - Understand what is Biostatistics and its role in public health 	
Required and recommended readings: None	
Data Basics	1/30
<u>Topics: Data Types, Presenting Data</u>	
Learning Objectives for Session 1 [<i>Competencies 1, 2, 3</i>]	
<ul style="list-style-type: none"> - Learn types of data - Learn data structure - Learn ways to present data 	
Required and recommended readings: Chapter 1	
Basic Study Designs	2/4
<u>Topics: Types of Study Designs, Bias</u>	
Learning Objectives for Session 1 [<i>Competencies 1, 2, 3</i>]	
<ul style="list-style-type: none"> - Learn types of study designs - Learn key differences between major study designs - Learn basic forms of bias in studies - Learn types of measurement validity 	
Required and recommended readings: Chapter 2	
Activity: Stats Case Study	2/6
For this activity the class will break into groups to discuss a case study article, particularly focused on statistics. The article will be provided before class.	
Frequency Distributions	2/11
<u>Topics: Frequency Distributions</u>	
Learning Objectives for Session 2 [<i>Competencies 1, 2</i>]	
<ul style="list-style-type: none"> - Tell how often various values appear in a batch of numbers - Explore visually the shape, location, and spread of each variable's distribution - Learn stemplot and frequency tables 	
Required and recommended readings: Chapter 3	
Numeric Summary Measures	2/13
<u>Topics: Summary Statistics, Central Tendency & Spread</u>	
Learning Objectives for Sessions 3 & 4 [<i>Competencies 1, 2, 3</i>]	
<ul style="list-style-type: none"> - Understand the measures of central tendency - Compare the Mean, Median and Mode - Learn Quantiles, IQR and Boxplots - Learn variance and Standard Deviation 	
Required and recommended readings: Chapter 4	
Basics of Probability	2/18
<u>Topics: Probability Concepts</u>	
Learning Objectives for Sessions 5 & 6 [<i>Competencies 1, 2, 3</i>]	
<ul style="list-style-type: none"> - Learn basic operation on events and laws of operation - Learn basic concept of probability, conditional probability, and total probability - Differentiate independent events and disjoint events 	

Required and recommended readings: Chapter 5	
Diagnostic Test Probabilities	2/20
<u>Topics: Bayes' Theorem</u> Learning Objectives for Sessions 5 & 6 [<i>Competencies 1, 2, 3</i>] <ul style="list-style-type: none"> - Learn Bayes' Theorem - Apply Bayes' Theorem to diagnostic tests Required and recommended readings: Chapter 5	
Binomial Distribution	2/25
<u>Topics: Binomial Probability Distributions</u> Learning Objectives for Session [<i>Competencies 1, 2, 3</i>] <ul style="list-style-type: none"> - Learn Binomial Random Variable - Learn Binomial Distribution - Learn how to calculate binomial probability - Learn how to calculate cumulative probabilities for Binomial random variable - Learn expected value and variance of a Binomial Random Variable Required and recommended readings: Chapter 6	
Normal Distribution	2/27
<u>Topics: Normal Probability Distribution</u> Learning Objectives for Session [<i>Competencies 1, 2, 3</i>] <ul style="list-style-type: none"> - Learn Normal distribution and standard Normal Distribution - Learn 68-95-99.7 Rule - Learn how to read the Normal cumulative probability table - Assess departures from normality using statistical figures Required and recommended readings: Chapter 7	
Practice Midterm	3/3
Midterm Review	3/5
Midterm	3/10
Activity: Evaluating Statistics	3/12
For this activity the class will discuss statistical measures from a dataset. We will work through the process of generating and interpreting several summary measures in the context of a research question.	
Statistical Inference	3/24
<u>Topics: Introduction to Statistical Inference</u> Learning Objectives for Session [<i>Competencies 1, 2, 3</i>] <ul style="list-style-type: none"> - Learn Basic Statistical Inference - Compare population versus sample, and parameter versus statistics - Learn the sampling distribution of the sample mean - Learn central limit theorem - Learn sample weighting Required and recommended readings: Chapter 8	
Hypothesis Testing and One-Sample Z test	3/26
<u>Topics: Hypothesis Testing, One-Sample Z Test</u> Learning Objectives for Session [<i>Competencies 1, 2, 3</i>] <ul style="list-style-type: none"> - Be able to conduct hypothesis testing using the 5 step procedures - Differentiate the null and alternative hypotheses - Understand type I and type II error 	

<ul style="list-style-type: none"> - Understand and be able to calculate p-value - Make conclusion based on p-value and interpret the results - Conduct a one-sample Z test <p>Required and recommended readings: Chapter 9</p>	
Statistical Power	3/31
<p><u>Topics: Statistical Power, Sample Size</u> Learning Objectives for Session [<i>Competencies 1, 2, 3</i>]</p> <ul style="list-style-type: none"> - Learn the concept of statistical power - Learn what factors impact statistical power (e.g. sample size) - Conduct a basic power analysis for a one-sample Z test <p>Required and recommended readings: Chapter 9</p>	
Confidence Intervals	4/2
<p><u>Topics: Estimation, Confidence Intervals</u> Learning Objectives for Session [<i>Competencies 1, 2, 3</i>]</p> <ul style="list-style-type: none"> - Learn basic statistical estimation - Learn confidence intervals when population standard deviation known - Understand the relationship between hypothesis testing and confidence intervals <p>Required and recommended readings: Chapter 10</p>	
One-Sample t test	4/7
<p><u>Topics: Inference about a mean, t distribution</u> Learning Objectives for Session [<i>Competencies 1, 2, 3</i>]</p> <ul style="list-style-type: none"> - Calculate estimated standard error of the mean - Learn student's t distribution - Learn One-sample t-test - Learn how to read student's t table <p>Required and recommended readings: Chapter 11</p>	
Two Sample Z test and t test	4/9
<p><u>Topics: Comparing two population means, two sample Z test, two sample t test</u> Learning Objectives for Session [<i>Competencies 1, 2, 3</i>]</p> <ul style="list-style-type: none"> - Compare two independent samples for equal variance scenario - Understand when to use two sample Z test and two sample t test, and learn their differences - Carry out Z test and t test <p>Required and recommended readings: Chapter 12</p>	
Paired t test	4/14
<p><u>Topics: Paired data, Comparing two paired means</u> Learning Objectives for Session [<i>Competencies 1, 2, 3</i>]</p> <ul style="list-style-type: none"> - Know types of paired data (pre-test post-test, matched) - Compare two paired samples - Carry out paired t test <p>Required and recommended readings: Chapter 11</p>	
One-Way Analysis of Variance	4/16
<p><u>Topics: One-Way Analysis of Variance</u> Learning Objectives for Session [<i>Competencies 1, 2, 3</i>]</p> <ul style="list-style-type: none"> - Understand the problem of multiple comparisons - Learn one-way analysis of variance (ANOVA) and understand its key assumptions 	

- Learn F distribution and how to read table of F distribution Required and recommended readings: Chapter 13	
Chi-Square Test	4/21
<u>Topics: Chi-Square Tests</u> Learning Objectives for Session [<i>Competencies 1, 2, 3</i>] - Understand how to analyze cross-tabulated data. - Learn the chi-square distribution and how to read a chi-square table Required and recommended readings: Chapter 18	
Pearson's Correlation Coefficient	4/23
<u>Topics: Scatter Plots, Correlation</u> Learning Objectives for Session [<i>Competencies 1, 2</i>] - Understand the explanatory and response variables - Learn scatter plot - Learn how to calculate correlation coefficient - Understand the direction and strength of correlation - Learn coefficient of determination Required and recommended readings: Chapter 14	
Simple Linear Regression	4/28
<u>Topics: Simple Linear Regression</u> Learning Objectives for Session [<i>Competencies 1, 2, 3</i>] - Learn how to conduct simple linear regression - Understand least squares estimation - Learn how to interpret the intercept and slope Required and recommended readings: Chapter 14	
Multiple Linear Regression	4/30
<u>Topics: Multiple Linear Regression</u> Learning Objectives for Session [<i>Competencies 1, 2, 3</i>] - Understand the general idea of multiple linear regression - Learn categorical explanatory variables in regression models - Learn how to interpret the model - Understand how confounding and mediation are assessed in multivariate models. Required and recommended readings: Chapter 15	
Final Exam Review Session	5/5
Final Exam Review Session	5/7
Learning Day	5/13
Final Exam	5/14
<i>This is a tentative schedule. Actual materials covered in each lecture might not be exactly the same.</i>	