

PUBH 6414, SECTION 320

Biostatistical Literacy
 Summer 2019

COURSE & CONTACT INFORMATION

Credits: 3 credits

Meeting Day(s), Time, and Place: This course is entirely web-based, delivered via Moodle at <http://moodle.umn.edu>.

Contact Type	Contact Information	Role	When to Contact
Instructor	Laura Le free0312@umn.edu	Instructor for this course	<p>Please post questions on lectures, readings, group projects, and quizzes to the weekly general questions forums in the Moodle site. Instructors and Teaching Assistants (TAs) will respond on a regular basis to posted questions.</p> <p>If you have questions or concerns you do not wish to share with the entire class, feel free to email the instructors directly. Your instructors are your first line of contact. Feel free to email them about</p> <ul style="list-style-type: none"> • Questions or concerns about the class, material, assignments, deadlines, etc. • Arranging a meeting (via phone call or video chat).
Teaching Assistants	Aparajita Sur sur00001@umn.edu Yuxin Guo guo00158@umn.edu Karan Shah shah0515@umn.edu	Monitor collaborative keys and general questions forums, and grade end-of-unit quizzes	Your TAs are your second line of contact. Feel free to email them about Questions about concepts.
Technical Support	Technical support options are available on the SPH website. https://z.umn.edu/sphquickhelp	Troubleshoots technical issues related to the course site or course content.	Technical issues with the course site, media, quizzes or assignments.

Please save this contact information to your computer or print it. That way, you can still contact us in the event that you have difficulty connecting to the Internet or accessing the syllabus.

Communication in Online Courses

Communication is especially important in an online course. The course site announcement forums/discussions and email will be used to communicate with students. You are responsible for reading all course-related emails sent to your University email account and contacting us in a timely manner with any questions you may have. We strongly recommend that you check your U of M email daily. Our goal is to respond to emails within 24 hours.

COURSE DESCRIPTION

PubH 6414: Biostatistical Literacy will cover the fundamental concepts of

- study design,
- descriptive statistics,
- hypothesis testing,
- confidence intervals,
- odds ratios,
- relative risks,
- adjusted models in multiple linear,
- logistic and proportional hazards regression, and
- survival analysis.

The focus will be when to use a given method and how to interpret the results, not the actual computation or computer programming to obtain results from raw data.

This course will involve minimal calculation and offer no formal training in any statistical programming software.

COURSE PREREQUISITES

The course presupposes a basic knowledge of mathematics (including algebra). A Math Refresher website has been created by the University of Minnesota School of Public Health to help you review these concepts (<http://www.sph.umn.edu/current/resources/>). It is entirely up to you whether you utilize the review site. However, it's there to help you feel confident of the basic mathematical operations that may be referred to in the course.

COURSE GOALS & OBJECTIVES

PubH 6414: Biostatistical Literacy has the primary goal of developing student ability to read and interpret statistical results in the primary literature of their specific scientific field of interest.

METHODS OF INSTRUCTION AND WORK EXPECTATIONS

Course Workload Expectations

PubH 6414: Biostatistical Literacy is a 3-credit course. The University expects that for each credit, you will spend a minimum of three hours per week attending class, reading, studying, and completing assignments, etc. over the course of a 15-week term. Thus, this course requires approximately 135 hours of effort spread over the course of the term in order to earn an average grade.

Methods of Instruction

This course is entirely online. Therefore, time you would otherwise be in class will be incorporated into work for the course in the form of online discussions, lectures, etc.

NOTE: The online section is not self-paced. This course covers a large amount of material in a short time. The group and class activities depend on the active and timely participation of all students. Therefore, **late assignments or quizzes will not be accepted.**

The emphasis in this class will be on learning by doing. At the beginning of each unit, students will gain necessary knowledge through reading the textbook and watching or reading lectures. Then, students will work collaboratively on learning activities that explore the statistical concepts and apply them by reading and discussing research literature. Students will read and critically analyze at least one article from the medical or public health literature each unit.

Here is the breakdown of the weekly work expectations:

- **Each unit is made up of four or five days (including weekends).**
- **Preparation for unit:** Students are expected to prepare for the unit by reading several selections from the textbook and viewing several short (10-20 minute) online presentations. An online readiness quiz covering the basic terms and definitions from the readings and lecture material will be **due on Day 2 by 11:55pm** of the unit. Students are encouraged to work with other students on the readiness quizzes.

- **During unit:** The remainder of the unit will be devoted to working individually and collaboratively to explore and apply the concepts. Your learning experience is thus dependent—to some extent—on your classmates and vice versa. Because of this, it is essential that you not only participate in the activities and discussions, but that you show up prepared, having completed the preparation materials. The exploration (*Concept*) and application (*Literature*) activities are best carried out with a partner or study group in real time, either in person or via teleconference, chat, Skype, FaceTime, Google Hangouts, or similar means, but you may also work independently if you prefer. Plan to spend 2 – 3 hours working on the learning activities each unit. We will also work collaboratively as a class to create the answer keys for the *Concept* and *Literature* activities. Each student is expected to contribute at least once to each key each week. Your contributions to the collaborative keys are **due on Day 4 or 5 by 11:55pm** of the unit. The learning activity worksheets will not be collected (it is on your honor to do them).
- **End of unit:** An online end-of-unit quiz covering the learning objectives for the unit, as well as concepts from earlier weeks, will be **due on Day 4 or 5 by 11:55pm** of the unit. Students are expected to complete the end-of-unit quizzes independently.

Technology

You will use the following technology tools in this course. Please make yourself familiar with them.

- Google Docs for the activity collaborative keys. Training is available via [OIT](#).
- WebEx or Google Hangout for Island Group meetings. Information on using Google Hangout can be found [here](#), and information using WebEx can be found [here](#).

Learning Community

School of Public Health courses ask students to discuss frameworks, theory, policy, and more, often in the context of past and current events and policy debates. Many of our courses also ask students to work in teams or discussion groups. We do not come to our courses with identical backgrounds and experiences and building on what we already know about collaborating, listening, and engaging is critical to successful professional, academic, and scientific engagement with topics.

In this course, students are expected to engage with each other in respectful and thoughtful ways.

In group work, this can mean:

- Setting expectations with your groups about communication and response time during the first week of the semester (or as soon as groups are assigned) and contacting the TA or instructor if scheduling problems cannot be overcome.
- Setting clear deadlines and holding yourself and each other accountable.
- Determining the roles group members need to fulfill to successfully complete the project on time.
- Developing a rapport prior to beginning the project (what prior experience are you bringing to the project, what are your strengths as they apply to the project, what do you like to work on?)

In group discussion, this can mean:

- Respecting the identities and experiences of your classmates.
- Avoid broad statements and generalizations. Group discussions are another form of academic communication and responses to instructor questions in a group discussion are evaluated. Apply the same rigor to crafting discussion posts as you would for a paper.
- Consider your tone and language, especially when communicating in text format, as the lack of other cues can lead to misinterpretation.

Like other work in the course, all student to student communication is covered by the Student Conduct Code (<https://z.umn.edu/studentconduct>).

COURSE TEXT & READINGS

There is a required textbook for the course:

Harvey Motulsky's *Intuitive Biostatistics: A Nonmathematical Guide to Statistical Thinking* (Oxford University Press, 4th edition, 2018).

The book is available through the University of Minnesota bookstore.

The activities and literature articles used in this course are available on the course website.

This course uses journal articles, which are available via the University Libraries' E-Reserves and will be linked from the course site. It is good practice to use a citation manager to keep track of your readings. More information about citation managers is available at <https://www.lib.umn.edu/pim/citation>.

COURSE OUTLINE/WEEKLY SCHEDULE

This course has specific deadlines. All coursework must be submitted via the course site before the date and time specified on the site. **Note: assignments are due by 11:55pm CST unless indicated otherwise.**

Dates	Topic	Readings	Activities/Assignments
Unit 1 June 10–14	INTRODUCTION TO BIOSTATISTICS	<p>Textbook Readings:</p> <ul style="list-style-type: none"> Ch 1. Statistics and Probability are not Intuitive Ch 2. The Complexities of Probability Ch 3. From Sample to Population <p>Online Lectures:</p> <ul style="list-style-type: none"> Biostatistical Literacy Cycle of Research Sampling Methods Study Designs 	<ul style="list-style-type: none"> Readiness Quiz (due Tuesday, June 11) Concept and Literature Activities Contribution to Concept & Literature Activity Collaborative Keys (due Friday, June 14) End-of-Unit Quiz (due Friday, June 14)
Unit 2 June 15–18	INTRODUCTION TO SURVIVAL DATA	<p>Textbook Reading:</p> <ul style="list-style-type: none"> Ch 5. Confidence Interval of Survival Data <p>Online Lecture:</p> <ul style="list-style-type: none"> Survival Data 	<ul style="list-style-type: none"> Readiness Quiz (due Sunday, June 16) Concept and Literature Activities Contribution to Concept & Literature Activity Collaborative Keys (due Tuesday, June 18) End-of-Unit Quiz (due Tuesday, June 18)
Unit 3 June 19–23	CONFIDENCE INTERVAL FOR A PROPORTION	<p>Textbook Reading:</p> <ul style="list-style-type: none"> Ch 4. Confidence Interval of a Proportion <p>Online Lectures:</p> <ul style="list-style-type: none"> Types of Variables Confidence Interval for Proportion 	<ul style="list-style-type: none"> Readiness Quiz (due Thursday, June 20) Concept and Literature Activities Contribution to Concept & Literature Activity Collaborative Keys (due Sunday, June 23) End-of-Unit Quiz (due Sunday, June 23)
Unit 4 June 24–27	SUMMARIZING CONTINUOUS VARIABLES	<p>Textbook Readings:</p> <ul style="list-style-type: none"> Ch 7. Graphing Continuous Data Ch 9. Quantifying Scatter <p>Online Lecture:</p> <ul style="list-style-type: none"> Summarizing Continuous Data 	<ul style="list-style-type: none"> Readiness Quiz (due Tuesday, June 25) Concept and Literature Activities Contribution to Concept & Literature Activity Collaborative Keys (due Thursday, June 27) End-of-Unit Quiz (due Thursday, June 27)
Unit 5	CONFIDENCE INTERVAL FOR A MEAN	<p>Textbook Readings:</p>	<ul style="list-style-type: none"> Readiness Quiz (due Saturday, June 29)

June 28–July 2		<ul style="list-style-type: none"> • Ch 10. The Gaussian (Normal) Distribution • Ch 12. Confidence Interval of a Mean • Ch 14. Error Bars <p>Online Lecture:</p> <ul style="list-style-type: none"> • Confidence Interval For a Mean 	<ul style="list-style-type: none"> • Concept and Literature Activities • Contribution to Concept & Literature Activity Collaborative Keys (due Tuesday, July 2) • End-of-Unit Quiz (due Tuesday, July 2)
Unit 6 July 3–8	HYPOTHESIS TESTING	<p>Textbook Readings:</p> <ul style="list-style-type: none"> • Ch 15. Introducing P-values • Ch 16. Statistical Significance and Hypothesis Testing • Ch 17. Relationship Between Confidence Intervals and Statistical Significance • Ch 18. Interpreting a Result that is Statistically Significant • Ch 19. Interpreting a Result that is not Statistically Significant <p>Online Lecture:</p> <ul style="list-style-type: none"> • Hypothesis Testing 	<ul style="list-style-type: none"> • Readiness Quiz (due Friday, July 5) • Concept and Literature Activities • Contribution to Concept & Literature Activity Collaborative Keys (due Monday, July 8) • End-of-Unit Quiz (due Monday, July 8)
Unit 7 July 9–12	CHALLENGES IN STATISTICS	<p>Textbook Readings:</p> <ul style="list-style-type: none"> • Ch 20. Statistical Power • Ch 22. Multiple Comparisons Concepts • Ch 23. The Ubiquity of Multiple Comparisons • Ch 24. Normality Tests • Ch 25. Outliers • Ch 26. Choosing a Sample Size <p>Online Lectures:</p> <ul style="list-style-type: none"> • Multiple Comparisons • Normality • Outliers • Sample Size 	<ul style="list-style-type: none"> • Readiness Quiz (due Wednesday, July 10) • Concept and Literature Activities • Contribution to Concept & Literature Activity Collaborative Keys (due Friday, July 12) • End-of-Unit Quiz (due Friday, July 12)
Unit 8 July 13–17	STATISTICAL TESTS, PART 1	<p>Textbook Readings:</p> <ul style="list-style-type: none"> • Ch 27. Comparing Proportions • Ch 28. Case-Control studies <p>Online Lectures:</p> <ul style="list-style-type: none"> • Comparing Proportions: Odds • Comparing Proportions: Risks 	<ul style="list-style-type: none"> • Readiness Quiz (due Sunday, July 14) • Concept and Literature Activities • Contribution to Concept & Literature Activity Collaborative Keys (due Wednesday, July 17) • End-of-Unit Quiz (due Wednesday, July 17)
Unit 9	STATISTICAL TESTS, PART 2	Textbook Readings:	<ul style="list-style-type: none"> • Readiness Quiz (due Friday, July 19)

<p>July 18–22</p>		<ul style="list-style-type: none"> • Ch 29: Comparing Survival Curves • Ch 30. Comparing Two Means: Unpaired T-Test • Ch 31. Comparing Two Paired Groups <p>Online Lectures:</p> <ul style="list-style-type: none"> • Comparing Survival Curves • Comparing Two Means • Comparing Paired Groups 	<ul style="list-style-type: none"> • Literature Activity #1 and Literature Activity #2 • Contribution to Literature Activity #1 & Literature Activity #2 Collaborative Keys (due Monday, July 22) • End-of-Unit Quiz (due Monday, July 22)
<p>Unit 10 July 23–26</p>	<p>COMMUNICATING RISK</p>	<p>Textbook Readings:</p> <ul style="list-style-type: none"> • (Lecture) Communicating Risk: Absolute, Relative, Natural Frequencies • Ch 42. Sensitivity, specificity and ROC curves. <p>Online Lecture:</p> <ul style="list-style-type: none"> • Screening Tests 	<ul style="list-style-type: none"> • Readiness Quiz (due Wednesday, July 24) • Concept and Literature Activities • Contribution to Concept & Literature Activity Collaborative Keys (due Friday, July 26) • End-of-Unit Quiz (due Friday, July 26)
<p>Unit 11 July 27–30</p>	<p>ANOVA</p>	<p>Textbook Readings:</p> <ul style="list-style-type: none"> • Ch 39. Analysis of Variance. • Ch 40. Multiple Comparisons Tests after ANOVA <p>Online Lecture:</p> <ul style="list-style-type: none"> • Analysis of Variance (ANOVA) <p>OPTIONAL Textbook Readings:</p> <ul style="list-style-type: none"> • Ch 21. Equivalence and Non-Inferiority Testing • Ch 41. Nonparametric Methods • Ch 43. Meta-Analysis <p>OPTIONAL Online Lecture:</p> <ul style="list-style-type: none"> • Nonparametric Methods 	<ul style="list-style-type: none"> • Readiness Quiz (due Sunday, July 28) • Concept and Literature Activities • Contribution to Concept & Literature Activity Collaborative Keys (due Tuesday, July 30) • End-of-Unit Quiz (due Tuesday, July 30)
<p>Unit 12 July 31–Aug. 3</p>	<p>CORRELATION AND REGRESSION</p>	<p>Textbook Readings:</p> <ul style="list-style-type: none"> • Ch 32. Correlation • Ch 33. Simple Linear Regression <p>Online Lectures:</p> <ul style="list-style-type: none"> • Correlation • Simple Linear Regression 	<ul style="list-style-type: none"> • Readiness Quiz (due Thursday, Aug. 1) • Concept and Literature Activities • Contribution to Concept & Literature Activity Collaborative Keys (due Saturday, Aug. 3) • End-of-Unit Quiz (due Saturday, Aug. 3)
<p>Unit 13 Aug. 4–8</p>	<p>MULTIPLE LINEAR REGRESSION</p>	<p>Textbook Readings:</p> <ul style="list-style-type: none"> • Ch 34. Introducing Models • Ch 35. Comparing Models 	<ul style="list-style-type: none"> • Readiness Quiz (due Monday, Aug. 5) • Concept and Literature Activities

		<ul style="list-style-type: none"> Ch 37. Multiple Regression <p>Online Lecture:</p> <ul style="list-style-type: none"> Multiple Regression 	<ul style="list-style-type: none"> Contribution to Concept & Literature Activity Collaborative Keys (due Thursday, Aug. 8) End-of-Unit Quiz (due Thursday, Aug. 8)
<p>Unit 14 Aug. 9–13</p>	<p>LOGISTIC REGRESSION AND PROPORTIONAL HAZARDS REGRESSION</p>	<p>Textbook Reading:</p> <ul style="list-style-type: none"> Ch 38. Logistic and Proportional Hazards Regression <p>Online Lectures:</p> <ul style="list-style-type: none"> Logistic Regression Proportional Hazards Regression 	<ul style="list-style-type: none"> Readiness Quiz (due Saturday, Aug. 10) Literature Activity #1 and Literature Activity #2 Contribution to Literature Activity #1 & Literature Activity #2 Collaborative Keys (due Tuesday, Aug. 13) End-of-Unit Quiz (due Tuesday, Aug. 13)
<p>Unit 15 Aug. 14–16</p>	<p>REVIEW & END-OF-SEMESTER QUIZ</p>		<ul style="list-style-type: none"> Review Activity (optional) Contribution to Review Activity Collaborative Key (optional; due Friday, Aug. 16) End-of-Semester Quiz (due Friday, Aug. 16)

SPH AND UNIVERSITY POLICIES & RESOURCES

The School of Public Health maintains up-to-date information about resources available to students, as well as formal course policies, on our website at www.sph.umn.edu/student-policies/. Students are expected to read and understand all policy information available at this link and are encouraged to make use of the resources available.

The University of Minnesota has official policies, including but not limited to the following:

- Grade definitions
- Scholastic dishonesty
- Makeup work for legitimate absences
- Student conduct code
- Sexual harassment, sexual assault, stalking and relationship violence
- Equity, diversity, equal employment opportunity, and affirmative action
- Disability services
- Academic freedom and responsibility

Resources available for students include:

- Confidential mental health services
- Disability accommodations
- Housing and financial instability resources
- Technology help
- Academic support

EVALUATION & GRADING

Grading is determined by:

- Readiness quizzes (21%; 1.5% each)
- Active and timely participation in the collaborative answer keys (26%)
- End-of-Unit quizzes (53%; ~3.5% each)

Grading Scale

The University uses plus and minus grading on a 4.000 cumulative grade point scale in accordance with the following, and you can expect the grade lines to be drawn as follows:

% In Class	Grade	GPA
93 - 100%	A	4.000
90 – 92.99%	A-	3.667
87 – 89.99%	B+	3.333
83 – 86.99%	B	3.000
80 – 82.99%	B-	2.667
77 – 79.99%	C+	2.333
73 – 76.99%	C	2.000
70 – 72.99%	C-	1.667
67 – 69.99%	D+	1.333
63 – 66.99%	D	1.000
< 62.99%	F	

- A = achievement that is outstanding relative to the level necessary to meet course requirements.
- B = achievement that is significantly above the level necessary to meet course requirements.
- C = achievement that meets the course requirements in every respect.
- D = achievement that is worthy of credit even though it fails to meet fully the course requirements.
- F = failure because work was either (1) completed but at a level of achievement that is not worthy of credit or (2) was not completed and there was no agreement between the instructor and the student that the student would be awarded an I (Incomplete).
- S = achievement that is satisfactory, which is equivalent to a C- or better
- N = achievement that is not satisfactory and signifies that the work was either 1) completed but at a level that is not worthy of credit, or 2) not completed and there was no agreement between the instructor and student that the student would receive an I (Incomplete).

Evaluation/Grading Policy	Evaluation/Grading Policy Description
<p>Scholastic Dishonesty, Plagiarism, Cheating, etc.</p>	<p>The goal of this course is to enable students to read and interpret statistical results in the primary literature. We expect that students will complete all end-of-unit quizzes INDEPENDENTLY, without assistance from any other people. If we have any reason to suspect that a student gave assistance on an end-of-unit quiz to another student or received assistance on an end-of-unit quiz from another student or a person outside the class, all students involved will receive a score of zero on that quiz. If we believe that scholastic dishonesty has occurred, we are required by the University to report the incident to the Office of Community Standards (https://communitystandards.umn.edu/).</p> <p>You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis (As defined in the Student Conduct Code). For additional information, please see https://z.umn.edu/dishonesty</p> <p>The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: https://z.umn.edu/integrity.</p> <p>If you have additional questions, please clarify with your instructor. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.</p> <p>Indiana University offers a clear description of plagiarism and an online quiz to check your understanding (http://z.umn.edu/iuplagiarism).</p>
<p>Late Assignments</p>	<p>This course covers a large amount of material in a short time. The group and class activities depend on the active and timely participation of all students. Therefore, late assignments or quizzes will not be accepted.</p>

CEPH COMPETENCIES

Competency	Learning Objectives	Assessment Strategies* (*see Assessment Descriptions below this table)
<p>Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate.</p>	<p>Descriptive and Graphical Summaries</p> <ul style="list-style-type: none"> State which summary statistics, tables, and graphs are appropriate for each variable type (e.g., categorical variable(s): bar plot, count, proportion, 2x2 table, risk, odds, odds ratio, relative risk; continuous variable(s): histogram, boxplot, mean, median, SD, IQR, difference in means; time-to-event variable(s): Kaplan-Meier curve, 5-year survival time, median survival, hazard, hazard ratio). Normalize a continuous measurement (i.e., calculate a Z-score). Calculate any of screening test summary statistics from a table of cell counts, or the equivalent information in words (e.g. in an article) (e.g., prevalence, sensitivity, specificity, false positive, false negative, PPV, NPV). <p>Confidence Intervals</p> <ul style="list-style-type: none"> State what information you need to calculate a confidence interval and how those factors affect the width of the confidence interval. Calculate a confidence interval from a margin of error and vice versa. <p>Hypothesis Testing</p> <ul style="list-style-type: none"> Identify situations when a particular statistical test would be used (e.g., one, paired, and two-sample t-test; log-rank test; Chi-squared test; Fisher's exact test; McNemar's test; ANOVA). Be aware of the common approaches for accounting for multiple comparisons. Be aware of some of the statistical analysis options that exist if your sample is from a severely non-normal population. <p>Regression</p> <ul style="list-style-type: none"> Understand why the first step in correlation or regression analysis is to graph the data. Identify situations when a particular statistical regression method would be used (e.g., simple linear regression, multiple linear regression, logistic regression, proportional hazards regression). Use the fitted regression coefficients to obtain slope values (for simple or multiple regression), odds ratios (for logistic regression) or hazard ratios (for proportional hazards regression) for each predictor. Know what kind of a plot is used to assess how well a multiple linear regression model fits the data. 	<ul style="list-style-type: none"> Weekly Readiness quizzes Weekly End-of-Unit quizzes

Interpret results of data analysis for public health research, policy or practice.

Descriptive and Graphical Summaries

- Recognize the variable type, including categorical, continuous, and time-to-event variables.
- Distinguish between the standard deviation (SD or s) and the standard error of the mean (SE or SEM).
- Interpret summary statistics, tables, and graphs for each variable type (e.g., categorical variable(s): bar plot, count, proportion, 2x2 table, risk, odds, odds ratio, relative risk; continuous variable(s): histogram, boxplot, mean, median, SD, IQR, difference in means; time-to-event variable(s): Kaplan-Meier curve, 5-year survival time, median survival, hazard, hazard ratio).
- State the limitations of the commonly-used measures of center and spread.
- Interpret a Z-score value.
- Define screening test summary statistics (e.g., prevalence, sensitivity, specificity, false positive, false negative, PPV, NPV) and when found in a journal article or other material, correctly interpret them.
- Explain how the screening test summary statistics are related to each other.

Confidence Intervals

- Explain the purpose of a confidence interval and meaning of the confidence level.
- Make a conclusion about the significance of a result, based off of the confidence interval.

Hypothesis testing

- Know the terminology of hypothesis testing (e.g., null hypothesis, alternative hypothesis, test statistic, sampling distribution of the test statistic, p -value, false positive result, false negative result, Type I error, Type II error, power).
- Given a journal article involving a particular statistical test, state the appropriate null and alternative hypotheses (e.g., one, paired, and two-sample t-test; log-rank test; Chi-squared test; Fisher's exact test; McNemar's test; ANOVA).
- For a particular statistical test, make a conclusion based off of the p -value and a significance level (e.g., one, paired, and two-sample t-test; log-rank test; Chi-squared test; Fisher's exact test; McNemar's test; ANOVA).
- Recognize situations in which multiple comparisons may be an issue.
- Explain the consequences of failing to properly account for multiple comparisons.
- Explain the purpose of post-hoc tests following ANOVA and interpret the results.
- Explain the difference between statistical significance and clinical/practical significance.

Regression

- Weekly Readiness quizzes
- Weekly End-of-Unit quizzes

	<ul style="list-style-type: none"> • Know what it means to say that two variables are “associated”. • Interpret statistics (correlation or fitted coefficients) from regression methods and make a conclusion from its confidence interval or p-value (e.g., simple linear regression, multiple linear regression, logistic regression, proportional hazards regression). • Write down the equation for a regression model and describe what each parameter means (e.g., simple linear regression, multiple linear regression, logistic regression, proportional hazards regression). • Interpret both the residual plot and the model R^2 value. • Explain what variable selection is, how to recognize it in an article, and why it is a potential issue. 	
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Assessment Descriptions	
Weekly Readiness quizzes	<p>The readiness quizzes are based on the readings and lectures. The questions are all multiple-choice format and are written to show that the students have adequately prepared for class as outlined in the unit learning objectives. Examples of questions they may encounter include definitions, matching terminology to situations, and basic interpretation of concepts. Students are encouraged to consult the textbook and the course materials during the quizzes. They may also work collaboratively with other students in the class. Students get up to two attempts on each quiz, and are only shown their quiz score (and not question-level scores) after the attempts. The higher score on the two attempts will be final score that is counted toward their course grade.</p>
Weekly End-of-Unit quizzes	<p>The end-of-unit quizzes are intended to assess what the students have learned both from the readings and lectures and from the activities and discussions as outlined in the unit learning objectives. The questions are all short essay format. During the quizzes, students are encouraged to consult the textbook and the course materials, particularly the completed activity worksheets and any notes you may have made on lectures or other content, but they may not consult with other people. The end-of-unit quizzes must be completed independently. Students are encouraged to check all of the forums and collaborative keys for any comments or clarifications from the instructor *before* beginning the quizzes.</p>