BI311 Biostatistics Syllabus

Meeting times & location:

Section 1: 10:30 - 11:20 AM, Mon, Wed, Fri→ Henry Lab 2*

**We meet in a lab, therefore, no food or drink are permitted; close-toed shoes are also required while you are in the lab. If you choose not to comply, you will be asked to leave, and will be subject to additional discipline under Division policy*

Instructor: Michael Dohm, Associate Professor of Biology
Office: Henry Hall 6
Office Hours Monday & Friday, 12:30-2:20PM; By appointment
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Course Description

Biostatistics is a lecture, web-enhanced and hands-on course designed to provide students with the opportunity to develop analytical and statistical reasoning skills appropriate for biology. It is the first of two courses in biostatistics and epidemiology (BI 312) at Chaminade. Statistical reasoning may be defined as the ability to understand and use probability arguments and to recognize the distinction between specific and generalized conclusions. After an introduction to data sets and the three philosophical positions of statistical hypotheses (frequentist, likelihood, and Bayesian), students will learn to apply statistical reasoning to questions about biological processes. During the semester, students will be given an introduction to (1) statistical tools and approaches used in biological and biomedical research, and (2) experimental design and analysis. Students will learn about error concepts and to identify and estimate via experimental design or simulation impacts of experimental versus biological sources of error on conclusions. Students will move from descriptive statistics and issues of parameter estimation to factorial experimental design (ANOVA, contingency tables), and general linear and logit models, all with examples and problem sets from biology.

Student Learning Outcomes & linkage to Biology Program Learning Outcomes (see University Catalog for list of Biology PLO)

Students will

1. Demonstrate statistical results and data presentation through appropriate use of summary tables, graphics, and written summary sentences (PLO #1, 2, 3).
2. Identify and distinguish among data types, variables, and parameters from published research (PLO #1, 2, 3).
3. Choose, defend, and contrast among kinds of statistical tests given data sets and description of an experiment (PLO #1, 2, 3).
4. Describe the difference between description, hypothesis testing, and prediction in statistics (PLO #1, 2, 3, 7).
5. Interpret and evaluate results of statistical inference and justify statistical choices ((PLO #1, 2, 3, 7).
6. Recognize, identify, and interpret output from statistical software (PLO #2, 3, 7).

Statistical reasoning

Statistical reasoning may be defined as the ability to understand and use numbers to communicate findings and to support opinions. Statistical reasoning is important to your future, for two reasons. The biological sciences are, by their nature, an experimental science: all disciplines in biology involve the presentation and analysis of data. Consider a biomedical example: You work as an AIDS counselor in a major U.S. city. Before you is the result of a male client's HIV test. It is positive, meaning the ELISA and Western Blot tests detected HIV in the blood sample. The client, who insists that he does not fit any known risk behavior group, now sits before you, waiting to hear the results. Your training has

given you the following facts: (1) less than 0.01% of men fitting this category (heterosexual, no IV drug use) are infected with HIV in the U.S.; (2) the sensitivity of the tests is very high, 99.9% (sensitivity is defined as the percentage of individuals with a disease who are correctly classified by a test as having the disease); and the specificity of the tests is also high, 99.9% (specificity is defined as the percentage of individuals without a disease who are correctly classified by a test as not having the disease).

How do you communicate the client's test results?

Statistical reasoning is common to our daily lives. The above example illustrates the problem from the perspective of a counselor, but as citizens, we are faced with a barrage of numbers: our risk of developing a particular disease (breast cancer, 1 in 9 women; prostate cancer, 1 in 9 men, etc.); our risk from dying under general anesthesia (on average, about 0.01% or 1 death every 10,000 U.S. cases); our risk of dying in a car crash versus our risk of dying in a plane crash. Data summaries, projections and predictions, and declarations of probability and likelihood are important tools for communicating complex information. The media commonly employ these tools to present information to you: The latest results from clinical trials of an HIV drug therapy, putative links between diet and health, effects of environmental toxins on health... the list is long.

Often, the portrayal of medical and health news in the media is conflicting, and the lack of consistency can be explained in part by failure to communicate the statistical issues. One result from the media's poor presentation of science results is the impression that just about everything and anything can be shown to adversely affect health... not a very useful conclusion. More importantly, exaggerated claims are made with numbers, and it may be difficult to sort fact from interpretation from fiction when numbers are used.

Required Text(s)

1. Mike's Biostatistics book, ebook available at no cost from course web site.
2. Mike's statistics workbook, provided in class and via course web site.at no cost

Other textbooks (recommended but not required)

Helpful, short books on Biostatistics

1. Weaver, A., and S. Goldberg. 2011. Clinical biostatistics and epidemiology made ridiculously simple. MedMaster.
2. Motulsky, 2015. Essential biostatistics: A nonmathematical approach. Oxford University Press

Books on R

1. Knell, R. 2013. *Introductory R: A Beginner's Guide to Data Visualisation and Analysis Using R* [Kindle Edition]. At less than $6, this is a really good, short book to answer many of your questions about R.
2. Everitt, B. S., and T. Hothorn. 2009. *A Handbook of Statistical Analysis Using R*, 2nd edition. Chapman and Hall/CRC. This book is a reference to using R with focus on use of the command line and scripts.

Other (bio)statistics textbooks (We used these books in previous Biostatistics courses at Chaminade

1. Glover, T., and K. Mitchell. 2008. *An Introduction to Biostatistics*, 2nd edition. Waveland Press.
2. Norman, G. R, and D. L. Streiner. *Biostatistics: The Bare Essentials*. People's Medical Publishing House.
3. Whitlock, M. C., and D. Schluter. 2008. *The Analysis of Biological Data*. Roberts and Company.

Course Management System (CMS)

BI311 is a web-enhanced course: We meet at the scheduled times like any traditional course, but components of the course are available to you at all times throughout the semester. I use the CMS Moodle to help manage the course. Access to the site is via https://www.letgen.org/chaminade. Logon instructions will be provided on the first day of class. Slides presented during class time are posted on the course website for your use. Homeworks, quizzes and related materials are also made available on the site.

Assignments

Homework: There will be numerous problem sets and worksheets that will help you understand concepts that we cover in class. *The homework will not be graded*, but these weekly assignments include analyzing data relevant to lecture topics and to analysis necessary for graded reports. Homework will include, but are not limited to the following kinds of tasks: calculations and formula derivations, presenting experimental designs, methods and statistical results using tables and graphs. Homework may also include online multiple choice problems via the Moodle site. Some work will be done in class time, but most of the work will need to be completed outside of class time. You may work together on homework, but each student must turn in their own homework.

Work on your own: Your textbook also has many nice problems to work on: I will recommend many, but will not grade work from the text book. While these are not required, the more you do, the more you will benefit. You can expect a learning curve with biostatistics – it is imperative that you make the effort on your own, outside of class, to do as much applied work as you can. We will discuss some of these problems in class as part of lecture.

Quizzes: Ten (10) weekly quizzes will be assigned; these multiple choice questions are designed to test your knowledge and provide instant feed-back.

Worksheets & Reports: You will also develop two research reports based on extended data sets that we will develop during class. Reports will be in the form of a science paper and are worth 15 points each. Additional details about the report and project will be given at appropriate times in the semester.Exams

Four exams:

- Exam 1 will cover material from weeks 1 – 4
- Exam 2 will cover material from weeks 5 – 8
- Exam 3 will cover material from weeks 9 – 12
- Exam 4 will cover material from weeks 13 – 15

The exams will focus on your understanding of important concepts, your ability to evaluate experimental designs, and your ability to recognize appropriate statistics to be employed given sets of data or particular experimental designs. Exam questions will be drawn from homework and/or from suggested problems in the textbook. Because of the nature of biostatistics, all exams should be viewed as cumulative. Exam 4 will be given during Finals week.

Class Participation: You are expected to come to class prepared, to participate fully in the class. Participation includes facilitating and responding to classroom discussion and use of the forums on the course web site. The instructor will provide more information about how participation will be graded, but the outline is that participation includes any of the following activities: asking and answering questions, bringing our attention to media announcements of relevance to biostatistics, by helping in data collection needed for homework projects, by assisting others with computer and statistical software-related questions. For the online discussion, the instructor will assign each of you at least twice during the semester to serve as facilitator, i.e., to moderate forum discussions; points are also awarded based on regular responses to forum and in class questions.

Grading

Item	How many?	How often may I expect this item?	How many points is each item worth?	Total points towards your final BI311 grade
Homework	12	weekly	0	0
Quizzes	10	weekly	2.5	25
Reports & Worksheets	5	1 or 2 per month	8	40
Participation	throughout semester	grades determined by participation during weeks	Facilitator: 60% Responder: 40%	35
Exams 1 - 3	3	every 4 to 5 weeks	100	300
Exam 4	1	11AM, 10 Dec	100	100
Total				500

How your final grade is determined

Points earned	Percent (%) of total	Letter grade	Grades are interpreted as follows (from Undergraduate Catalog)
450 - 500	90-100%	A	Outstanding scholarship and an unusual degree of intellectual initiative.
400 - 449	80 - 89%	B	Superior work done in a consistent and intellectual manner.
350 - 399	70 - 79%	C	Average grade indicating a competent grasp of subject matter.
300 - 349	60 - 69%	D	Inferior work of the lowest passing grade, not satisfactory for fulfillment of prerequisite coursework.
$\leq$ 299	< 60%	F	Failed to grasp the minimum subject matter; no credit given.

Policy reminders and notices

1. This computer classroom was designed and is now maintained by Chaminade's Department of Information Technology and the Division of Natural Sciences and Mathematics so that you would have access to a state-of-the art academic computing environment. Money is simply not available to repair abused or stolen computers. Therefore, each person has the responsibility to use the computers responsibly. By using these facilities, you agree to abide by the Computer Room Policies posted in the classroom. These rules include, but are not limited to
   - No food or drink
   - You agree to adhere to the account setup procedures and use restrictions
   - No alterations of software or hardware configurations
   - No use of the computers for personal or commercial activities, (except where such activities are otherwise permitted or authorized under applicable University policies).
2. You are also expected to have read and to abide by the “Student Rules of Conduct” which are available in your copy of Chaminade University’s Student Handbook (SH).
3. Class begins and ends each time exactly on the scheduled start time. Regular attendance is expected and essential for your progress in this class. The goal of lecture and discussion will be to provide the needed context to remove barriers to your understanding of the material. We will

be using a statistics software package (R) that will be intimidating at first – going it alone is not recommended.

4. It is university policy that any student who stops attending a course without officially withdrawing may receive a failing grade (SH, p. 34). Unexcused absences equivalent to more than a week of classes will lead to a grade reduction for the course.
5. No make up quiz, exam, or presentation time will be granted for unexcused absences. For excused absences, if a student cannot attend a class in which an exam or quiz has been scheduled, the student must provide written verification of the need to miss class at least one day prior to the scheduled due date. This includes any activities sponsored by Chaminade (athletics, etc.) – it is the responsibility of the student to adhere to this policy. In the event of illness, a Doctor's note will be expected.
6. Please utilize my official office hours or make an appointment via the Moodle site if you wish to discuss biostatistics. You are encouraged to use the Ask Dr Dohm forum – if you have a question, there is an excellent chance that others in the class have similar questions.
7. Use of music devices and cell phones is prohibited during all Natural Science and Mathematics classes at Chaminade, *unless specifically permitted by your instructor* (see item 8 and 9). Use of cellphones and music devices in laboratories is a safety issue. In addition, use of cellphones and music devices in any class is discourteous and may lead to suspicion of academic misconduct. Students who cannot comply with this rule will be asked to leave class and may be subject to laboratory safety violation fines. Please refer any questions to the Dean of Natural Sciences and Mathematics.
8. You are encouraged to bring and use your laptops or tablets to Biostatistics lecture and workshops. However, on exam days, calculators will be provided for your use; you may not use your smartphones, tablets, or laptops during exams.
9. You may not record audio, images, or video in the classroom without expressed permission of the instructor.
10. The University provides a Chaminade email address for all students. Official Chaminade communications will be sent to the students' Chaminade email address and instructors will use only this email to communicate with students. It is the responsibility of the student to check their email frequently. Report email-related problems to the Helpdesk at 808-735-4855 or helpdesk@chaminade.edu.
11. You are encouraged to work together; however, all graded material must be your own. Cheating in the form of plagiarism (offering of work of another as one's own, SH, p. 33), collusion, and deception will not be tolerated and will negatively affect your grade. Because the university is an academic community with high professional standards, its teaching function is seriously disrupted and subverted by academic dishonesty. Such dishonesty includes, but is not limited to, cheating, which includes giving/receiving unauthorized assistance during an examination; obtaining information about an examination before it is given, using inappropriate/prohibited sources of information during an examination; altering answers after an examination has been submitted; and altering the records on any grade. (Refer to the CUH catalog for further information).
12. Title IX Declaration: Chaminade University of Honolulu recognizes the inherent dignity of all individuals and promotes respect for all people. Sexual misconduct, physical and/or psychological abuse will NOT be tolerated at CUH. If you have been the victim of sexual misconduct, physical and/or psychological abuse, we encourage you to report this matter promptly. As a faculty member, I am interested in promoting a safe and healthy environment, and should I learn of any sexual misconduct, physical and/or psychological abuse, I must report the matter to the Title IX Coordinator. Should you want to speak to a confidential source you may contact the following:
    - Chaminade Counseling Center| 808 735-4845.
    - Any priest serving as a sacramental confessor or any ordained religious leader serving in

the sacred confidence role.

13. Pursuant to several federal and state laws, including the Americans with Disabilities Act of 1990, as amended by the ADA Amendments Act of 2008, and Section 504 of the Rehabilitation Act of 1973, all qualified students with disabilities are protected from discrimination on basis of disability and are eligible for reasonable accommodations or modifications in the academic environment to enable them to enjoy equal access to academic programs, services, or activities. If a student would like to determine if they meet the criteria for accommodations, they should contact the Counseling Center at 808-735-4845 for further information Students with special needs who meet criteria for the Americans with Disabilities Act (ADA) provisions must provide written documentation of the need for accommodations from CUH Counseling Center (Dr. June Yasuhara, 735-4845) by the end of the third week of classes. Failure to provide written documentation will prevent your instructor from making necessary accommodations.

BI311 tentative lecture and schedule of assignments

All attempts to plan the course accurately have been made. However, the instructor reserves the right to change dates of lecture topics and due dates of some assignments.

Week	Date	Topics & etext readings	Assignments
1	Aug 22, 24, 26	**Introduction**	**Quiz00 Aug 22**
		Exam01 topics: Descriptive statistics, graphics, and experimental design: eText Ch 2, 3, 4, & 5	
2	Aug 29, 31, 2 Sep		**Quiz01 Aug 31**
			Report 1 assigned Sep 2
3	'Sep 7, 9	*Holiday Labor Day, Sep 5, no class*	**Report 1 due Sep 9**
			Quiz02 Sep 9
4	Sep 12, 14, 16		
		Review Sep 14	**Exam 1 Sep 16**
5	Sep 19, 21, 23	**Exam02 topics**: Probability, Risk analysis, Parametric & Nonparametric tests of two group comparisons; Statistical power: eText Ch 6, 7, 8, 9, 10, 11, & 14	**Quiz03 Sep 23**
6	Sep 26, 28, 30		**Quiz04 Sep 30**
			Report 2 assigned Sep 30
7	Oct 3, 5, 7		**Quiz05 Oct 5**
		Review Oct 7	**Report 2 due Oct 7th**
8	'Oct 12, 14	*Holiday: Discover's Day, Oct 10, no class*	**Exam 2 Oct 12**
		Exam03 topics: ANOVA and GLM, multiple comparisons, experimental design; Statistical assumptions: eText Ch 12, 13, 14, & 17	
9	Oct 17, 19, 21		**Quiz06 Oct 19**
			Report 3 assigned Oct 21
10	Oct 24, 26, 28		**Quiz07 Oct 26**
			Report 3 due Oct 28
11	Oct 31, Nov 2, 4	Review Nov 2	**Quiz08 Oct 31**
			Exam 3 Nov 4
12	'Nov 7, 9	**Exam04 topics**: Correlation; Regression and GLM, simple, linear, and logistic; Statistical assumptions: eText Ch 15, 16, & 17	
		Holiday: Veteran's Day, Nov 11, no class	
13	Nov 14, 16, 18		**Quiz09 Nov 14**
14	'Nov 21, 23	Holiday: Thanksgiving, Nov 24 & 25, no class	
			Quiz10 Nov 28
15	Nov 28, 30, Dec 2	Workday	**Report 4 Nov 30**
		Review Dec 2	
16	Finals week		**Exam 4 Dec 8, 11AM -- 1PM**