BI311 Syllabus

Meeting times:

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

Instructor: Associate Professor Michael Dohm
Office: Henry Hall 6; **Phone**: 739-8543
Office Hours Monday & Friday, 12-2PM; By appointment
E-mail: mdohm@chaminade.edu → Students! Use Messaging in the course website

Course Description

Biostatistics is a lecture plus hands-on course designed to provide students with the opportunity to develop analytical and statistical reasoning skills appropriate for biology. It is the first in a series 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.

> Catalog description (2015-2016 catalog): ***BI 311 Biostatistics (3)*** *Lecture course devoted to rigorous grounding in biological statistics, and in the application of statistical models to global health problems. Biostatistics is a lecture and hands-on course designed to provide students with the opportunity to develop statistical reasoning skills appropriate to analyze and implement biological experiments. Exemplars and case studies will be primarily derived from the public health field. Topics include principles of experimental design, sampling and variables, data categories and assumptions of parametric statistics, risk analysis, repeated measures, goodness of fit and contingency table analyses, and the general linear model. Prerequisites: BI 216/BI 216L, & MA 211.*

Learning Outcomes

Students will

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

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. Available as ebook and from course web site.
2. Mike's statistics workbook, provided in class and via course web site.

Other text books (recommended but not required)

Books on R

1. Knell, R. 2013. *Introductory R: A Beginner's Guide to Data Visualisation and Analysis Using R* [Kindle Edition]. Link to Amazon.com. 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. (ISBN 978-1420079333). Link to Amazon.com. This book is a reference to using R.

Other (bio)statistics textbooks

1. Glover, T., and K. Mitchell. 2008. *An Introduction to Biostatistics*, 2nd edition. Waveland Press. We

used this book previously.

2. Norman, G. R, and D. L. Streiner. *Biostatistics: The Bare Essentials.* People's Medical Publishing House. We used this book previously; any edition would be suitable.
3. Whitlock, M. C., and D. Schluter. 2008. *The Analysis of Biological Data.* Roberts and Company. We used this book previously.

Course elements

Lectures and workbook

Slides presented during class time are posted on the course website for your use. derived from my Moodle site for the course. Homeworks, quizzes and related materials are also made available on the site. Access to the site is via https://www.letgen.org/chaminade

Assignments

Homework: There will be up to twelve (12) 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.

Reports: You will also develop four 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 1-5.
- Exam 2 will cover material from weeks 6-10.
- Exam 3 will cover material from weeks 11-15

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.

Class Participation: You are expected to come to class prepared, to participate fully in class by asking questions, bringing attention to media announcements of relevance to biostatistics, by helping in data collection needed for homework projects. I also encourage all of you to assist fellow students with computer

and statistical software-related 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	4	40
Reports	4	1 or 2 per month	15	60
Exams	3	every 4 to 5 weeks	100	300
Total				400

How your final grade is determined♠

Points earned	Percent (%) of total	Interpretation of scores (from Undergraduate Catalog 2015-2016, p. 26)	Letter grade
360 - 400	90-100%	Outstanding scholarship and an unusual degree of intellectual initiative	A
320 - 359	80 - 89%	Superior work done in a consistent and intellectual manner	B
280 - 319	70 - 79%	Average grade indicating a competent grasp of subject matter	C
240 - 279	60 - 69%	Inferior work of the lowest passing grade, not satisfactory for fulfillment of prerequisite course work	D
< 239	< 60%	Failed to grasp the minimum subject matter; no credit given	F

Policy reminders and notices

1. Macbook lab use. 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. Attendance and tardiness. Students are expected to attend regularly all courses for which they are registered. Students should notify their instructors when illness or other extenuating circumstances prevents them from attending class and make arrangements to complete missed assignments. Notification may be done by sending a text message from within the course Moodle site. Other modes include emailing the instructor's Chaminade email address, calling the instructor's campus extension or by leaving a message with the instructor's division office (Natural Science and Math 1 (808) 440-4204). It is the instructor's prerogative to modify deadlines of course requirements accordingly. Any student who stops attending a course without officially withdrawing may receive a failing grade. Class begins and ends each time exactly on the scheduled start time. Unexcused absences equivalent to more

than a week of classes may lead to a grade reduction for the course. Any unexcused absence of two consecutive weeks or more may result in being withdrawn from the course by the instructor, although the instructor is not required to withdraw students in that scenario. Repeated absences put students at risk of failing grades. 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.

3. Policy on communication. 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.
4. Electronic devices. Use of music devices and cell phones is prohibited during all Natural Science and Mathematics classes at Chaminade, unless specifically permitted by your instructor. 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. BI311 Electronic devices policy: You are encouraged to bring and use your laptops and tablets to Biostatistics lecture and workshops. Calculators will be provided for your use on Exam days. Cell phone use as calculators is not permitted while taking exams.
5. Getting help in this course. Please utilize the Ask Dr Dohm forum. Most of the questions you have about biostatistics, others will have too. It is important and an expectation of the course that you participate and regular use of the forum is a great way to accomplish this. You are also encouraged to learn how to askmy official office hours or make an appointment via the Moodle site if you wish to discuss biostatistics.
6. Policy on make-up assignments. 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 a 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.
7. Academic honesty. You are encouraged to work together; however, all graded material must be your own. Cheating in the form of plagiarism, collusion, deception and will not be tolerated and will negatively affect your grade. 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.
8. ADAA Statement. 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.
9. 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.

10. The instructor may modify elements of this syllabus or schedule according to the operational needs of the class.

Tentative lecture and Exam schedule*

August	***October***
28th Monday, Introduction, Chapter 2	23th Monday, Chapter 10
30th Wednesday, Chapter 2 – 3	25st Wednesday, Chapter 10 – 11
September	27rd Friday, Chapter 10 – 11
1st Friday, Chapter 2 – 3	30th Monday, Chapter 12 – 13
4th Monday, Holiday	***November***
6th Wednesday, Chapter 2 – 3	1st Wednesday, Chapter 12 – 13
8th Friday, Chapter 3	3rd Friday, Chapter 12 – 13
11th Monday, Ch 3 – 4	6th Monday, Chapter 12 – 13
13th Wednesday, Chapter 3 – 4	8th Wednesday, Chapter 12 – 13
15th Friday, Chapter 5	10th Friday, Holiday
18th Monday, Chapter 5	13th Monday, Chapter 14
20th Wednesday, Chapter 5	15th Wednesday, Chapter 14
22nd Friday, Review	17th Friday, Review
25st Monday, **Exam01** in class	20th Monday, **Exam03** in class
27th Wednesday, Chapter 6	22nd Wednesday, Chapter 15
29th Friday, Chapter 6	24th Friday, Thanksgiving break, no class
October	27rd Monday, Chapter 15
2nd Monday, Chapter 7	29th Wednesday, Chapter 16 – 17
4th Wednesday, Chapter 7	***December***
6th Friday, Chapter 8	1st Friday, Chapter 16 – 17
9th Monday, Holiday	4th Monday, Chapter 17
11th Wednesday, Chapter 9	6th Wednesday, Chapter 17
13h Friday, Chapter 9	8th Friday, Review
16th Monday, Chapter 9	
18th Wednesday, Review	
20th Friday, **Exam02** in class	14th Thursday, 11:00AM – 1:00PM **Exam04**

* Readings from Dohm eBook. Quiz and Report schedule announced in class