



BI311 Biostatistics

Department of Biology, Division of Natural Sciences & Mathematics

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 PhD

Office: WSC 108

Office phone: 739-8543

Office Hours: Tuesday & Thursday, 10AM -- 12PM or by appointment (via Messaging best option)

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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 Biostatistics 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)

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 several 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: Eight (8) weekly quizzes will be assigned; these multiple choice questions are designed to test your knowledge and provide instant feed-back.

Four exams:

- Exam 1 will cover material up to week 4
- Exam 2 will cover material up to week 8
- Exam 3 will cover material up to week 11
- Exam 4 will cover material up to week 15

The exams focus on your understanding of important concepts, your ability to evaluate experimental designs, and your ability to recognize and apply 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.

Progression through the biostatistics course is a cumulative knowledge process.

Following Exam 1 and continuing through the fourth exam, you will be expected to draw on concepts and facts introduced in the first weeks of the course. Thus, all exams after Exam 1 are cumulative and you can expect to be asked on concepts drawn from any point prior to the exam date.

Independent Project. Upon approval from the instructor, student may replace Exam 4 with a project, designed, implemented, and analyzed by the student. Group projects are possible provided there are significant questions that can support individual reports. Students must propose and receive approval for the project no later than the end of the third week of the semester.

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

Item	How many?	How often may I expect this item?	How many points is each item worth?	Total points towards your final BI311 grade
Quizzes	8	weekly	10	80
Exams	4	every 4 to 5 weeks	80	320
Total				400

How your final grade is determined

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

Policy reminders and notices

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).

Instructor and Student Communication

Please utilize Dr Dohm's scheduled office hours or make an appointment via the letgen.org/chaminade website. You are encouraged to use the online [Ask Dr Dohm](#) forum – if you have a question, there is an excellent chance that others in the class have similar questions – use of Ask Dr Dohm forum counts as participation. Return of graded paper material will be within ten business days after you take the graded assignment.

Attendance Policy

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 – going it alone is not recommended.

The following attendance policy is from the 2018-2019 Academic Catalog (p. 57-58): Students are expected to attend regularly all courses for which they are registered. Student 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 emailing the instructor's Chaminade email address, calling the instructor's campus extension, or by leaving a message with the instructor's division office. 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. 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. Students with disabilities who have obtained accommodations from the Chaminade University of Honolulu ADA Coordinator may be considered for an exception when the accommodation does not materially alter the attainment of the learning outcomes. Federal regulations require continued attendance for continuing payment of financial aid. When illness or personal reasons necessitate continued absence, the student should communicate first with the instructor to review the options. Anyone who stops attending a course without official withdrawal may receive a failing grade or be withdrawn by the instructor at the instructor's discretion.

Late Work Policy

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.

Grades of "Incomplete"

Students and instructors may negotiate an incomplete grade when there are specific justifying circumstances. An Incomplete Contract (available from the Divisional Secretary and the Portal) must be completed. When submitting a grade the "I" will be accompanied by the alternative grade that will automatically be assigned after 90 days. These include IB, IC, ID, and IF. If only an "I" is submitted the default grade is F. The completion of the work, evaluation, and reporting of the final grade is due within 90 days after the end of the semester or term. This limit may not be extended.

Writing Policy

Instructions and expectations for written materials to be submitted by students will be provided as needed during the semester.

Cell phones, Smart Phones and Watches, Tablets, Laptops Music Devices and Cellular Phones

Students are encouraged to bring laptops or tablets to class to facilitate note-taking; the instructor may assign online activities and readings that may require the use of a laptop or tablet. However, laptops and tablets should not be misused, such as checking distracting websites. Use your best judgment and respect your classmates and instructor. Unless specifically permitted by your instructor, use of music devices, cell phones, and other personal technology is prohibited during all Natural Science and Mathematics classes, as it is discourteous and may lead to suspicion of academic misconduct. Students unable to comply will be asked to leave class. If use of such technology is permitted by the instructor, out of consideration for your classmates, please set your music devices or cell phone to silent mode during class. For in-class exams you will be asked to place all laptops, tablets, or other devices into your bag and or placed on the floor.

Accommodations

If you need individual accommodations to meet course outcomes because of a documented disability, please speak with me to discuss your needs as soon as possible so that we can ensure your full participation in class and fair assessment of your work. 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 the Counseling Center by the end of week three of the class, in order for instructors to plan accordingly. 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 (counselingcenter@chaminade.edu).

Title IX Compliance

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. If you or someone you know has been harassed or assaulted, you can find the appropriate resources by visiting Campus Ministry, the Dean of Students Office, the Counseling Center, or the Office for Compliance and Personnel Services.

Academic Conduct Policy

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. See the current Undergraduate Academic Catalog and the Student Handbook available from Student Affairs.

Course Schedule

Instructor reserves the right to adjust this schedule. Please check regularly.

Readings from [Mike's Biostatistics Book](#) -- see table of contents

All attempts to plan the course accurately have been made. If you have questions, please use

the  [Ask Dr Dohm](#) forum.

Week	Day	Date	Assignments	Mike's Biostatistics book	Chapter
1	Mon	08-26		Introduction	2
1	Wed	08-28		Probability, distributions	3
1	Fri	08-30		R-day	3
2	Mon	09-02	Labor Day	No class today	
2	Wed	09-04		Probability, distributions	3
2	Fri	09-06		Probability, distributions	3
3	Mon	09-09		Probability, distributions	4
3	Wed	09-11		Probability, distributions	4
3	Fri	09-13		R Day	4
4	Mon	09-16	Exam01		
4	Wed	09-18		Descriptive statistics; How to report statistics	4, 5
4	Fri	09-20		R Day	4, 5
5	Mon	09-23		Experimental design	6
5	Wed	09-25		Probability, Risk analysis	7
5	Fri	09-27		R Day	7
6	Mon	09-30		Probability, Risk analysis	7
6	Wed	10-02		Probability, Risk analysis	7
6	Fri	10-04		R Day	7
7	Mon	10-07	Exam02		
7	Wed	10-09		Inferential statistics	8
7	Fri	10-11		R Day	8
8	Mon	10-14	Discover's Day	No class today	
8	Wed	10-16		Inferential statistics; Categorical, Chi-square	8, 9
8	Fri	10-18		R Day	8, 9
9	Mon	10-21		2-sample tests	10
9	Wed	10-23		2-sample tests	10
9	Fri	10-25		R Day	9
10	Mon	10-28		Power	11

Week	Day	Date	Assignments	Mike's Biostatistics book	Chapter
10	Wed	10-30		ANOVA	12
10	Fri	11-01		R Day	10
11	Mon	11-04	Exam03		
11	Wed	11-06		ANOVA	12
11	Fri	11-08		ANOVA, Assumptions	12, 13
12	Mon	11-11	Veterans Day	No class today	
12	Wed	11-13		Nonparametric, ANOVA designs	14, 17
12	Fri	11-15		R Day	14, 17
13	Mon	11-18		Correlation	15
13	Wed	11-20		Correlation	15
13	Fri	11-22		R Day	15
14	Mon	11-25		Linear regression	16
14	Wed	11-27		R Day	16
14	Fri	11-29	Thanksgivings	No class today	
15	Mon	12-02		Mult regression	16
15	Wed	12-04		Logistic regression	16
15	Fri	12-06		R Day	16
16	Mon	12-09			
16	Tue	12-10			
16	Wed	12-11			
16	Thu	12-12	Exam04		

/MD