

MDSC 407

Statistics and Research Design in Health Sciences

Instructors:

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Office Hours/Policy on Answering Student Emails

By appointment with any of the Teaching Assistants and Instructor

Teaching Assistants:

- Anita Brobbey, MSc
PhD Student Biostatistics Specialization
Department of Community Health Sciences
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- Levi Frehlich
Population/Public Health Specialization
Department of Community Health Sciences
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- TBD

Time and Location:

Winter semester: January 10th (Wednesday) to April 11th (Wednesday)

Lecture: Wednesday 9:00-11:50am (Room: Clara Christie Theatre)

Lab: Friday 9am-10:50 am; 11am-12:50 pm; 1pm- 2:50pm (Room: 1501 Bioinformatics Lab)

Prerequisite/Co-Requisite:

Enrolment in the BHSc Honors program

Course Description:

This course is an introduction to statistics and research design in health sciences. As a field of study, statistics consists of a set of procedures for organizing, describing and interpreting data. Accordingly, we will focus on the theory and tools necessary to analyze data, which will be illustrated by relevant applications. The emphasis will be on statistical literacy, which is an important skill for both the analyses of health-related data and understanding and reviewing the health sciences literature.

Global Objectives

The primary objective is for students to understand formulation of a research question, the data that are collected, the statistical analyses that should be used, and the conclusions that can be drawn.

Learning Objectives

By the end of this course, students will be able to:

1. Students will understand the basic concepts and terminology used in statistics and applied to health sciences research.
2. Students will be able to understand and be able to evaluate the basic assumptions underlying common statistical tests used in health sciences research.
3. Students will be able to understand the basic concepts and assumptions underlying probability, sampling distributions, and hypothesis testing.
4. Students will be able to demonstrate the use of, and be able to interpret, results from statistical analysis involving the comparison of continuous and categorical variables between two or more groups
5. Students will be able to demonstrate the use of, and be able to interpret, results from statistical analysis involving correlations between variables and linear regression
6. Students will be able to demonstrate the ability to undertake statistical analysis using STATA.

Required Textbooks

Medical Statistics: A Textbook for the Health Sciences, 4th Edition

Michael J. Campbell; David Machin; Stephen J. Walters

Available at the Medical Bookstore or as a e-textbook

(<http://ca.wiley.com/WileyCDA/WileyTitle/productCd-HEP002315.html>)

3 copies available for short term loan (in library use only) at the Health Sciences Library

Recommended Textbooks/Readings

Biostatistics: A Foundation for Analysis in the Health Sciences, Tenth Edition

Wayne W. Daniel; Chad L. Cross

<http://ca.wiley.com/WileyCDA/WileyTitle/productCd-EHEP002458.html>

A Note regarding readings

A list of required readings for all course sections will be outlined on D2L and links and documents will be made available, where possible. Required readings have been chosen carefully to inform you and enhance the lecture material. **Students are REQUIRED to complete assigned readings BEFORE each lecture.** Instructors will proceed in class on the assumption that students have read completely the assigned readings. Students should be aware that many of the readings they will be assigned may be of an unfamiliar nature and style. Students should allot sufficient time to allow for several reads of the assigned material.

Evaluation

The University policy on grading and related matters is described in section F.2 of the 2017-2018 Calendar. In determining the overall grade in the course, the following weights will be used:

Description	Percentage of Grade	Due Date
Mid-Term Examination (Closed Book, Non-programmable calculator permitted)	30%	February 28, 2018 (in-class)
Lab Assignments	25%	At the beginning of the next labs
In-class activities and quizzes	5%	Completed during each lecture
Final Examination (Closed Book, Non-programmable calculator Permitted)	40%	To be scheduled during exam period (April 15– 26, 2018)

**A student's final grade for the course is the sum of the separate assignments. It is not necessary to pass each assignment separately in order to pass the course.

1. All lab reports must be "typewritten", at least 1.5 line spaced and written in formal English. Whenever necessary, students should use either one of the following referencing formats: Harvard or Vancouver.
2. In accordance with the Freedom of Information and Protection of Privacy Act (FOIP), students should identify themselves on written assignments (exams, term work, lab reports etc.) by placing their name on the front page and their ID number on each subsequent page.
3. The in-class mid-term and final exams will be closed-book exams. The format will include

both multiple-choice questions and written questions and any necessary materials (i.e., tables and formulas) will be provided.

4. Top Hat will be used during lecture time, 5-7 review questions will be posted for students to work together and answer. Students will need smartphone, tablet or laptop connected to the Internet or a cell-phone with SMS texting capabilities during lecture in order to participate. Details about the Top Hat access code will be provided during the first lecture.

A Note regarding Writing Assignments:

Writing skills are important to academic study in all disciplines. In keeping with the University of Calgary's emphasis on the importance of academic writing in student assignments (section E.2 of 2017-18 Calendar), writing is emphasized, and the grading thereof in determining a student's mark in this course. The Bachelor of Health Sciences values excellence in writing. Competence in writing entails skills in crafting logical, clear, coherent, non-redundant sentences, paragraphs and broader arguments, as well as skills with the mechanics of writing (grammar, spelling, punctuation). The University of Calgary offers a number of instructional services through the Students' Success Centre's Writing Support Services (<http://www.ucalgary.ca/writingsupport/>) for students seeking feedback on assignments or seeking to improve their general writing skills. Students are **strongly encouraged** to take advantage of these programs.

Grading Scheme:

A+ 97-100%	B+ 80-84%	C+ 65-69%	D+ 54-56%
A 90-96%	B 75-79%	C 60-64%	D 50-53%
A- 85-89%	B- 70-74%	C- 57-59%	F 0-49%

Missed Components of Term Work:

At the instructor's discretion, students will lose 5% per day late past the deadline for all assignments, including weekends. Without prior arrangement, assignments will NOT be accepted more than 72 hours after the posted deadline and students failing to submit any assignment within this time frame will receive a mark of zero. Students who miss TopHat review questions will receive a mark of zero unless the instructor has been previously notified. There will be NO exceptions to this policy.

It is the agreement of all Faculty and Staff involved in MDSC 407 that **extensions will NOT be granted** on any assignment or quizzes. The only exceptions to this are those in keeping with the University Calendar (illness, religious conviction, or domestic affliction) that are received in writing and with supporting documentation. Please be advised that students should notify the instructor before the assignment deadline to discuss.

Desire2Learn (D2L)

Desire 2 Learn is located on the University of Calgary server and will be used extensively for communication with students. **It is the student's responsibility to ensure that s/he gets all posted communications and documents and that s/he receives emails sent by instructors or fellow students through D2L.** Only your @ucalgary.ca email address may be linked to D2L. Please ensure that you are regularly checking your @ucalgary.ca account.

If you need help accessing or using D2L, please visit the Desire2Learn resource page for students: <http://elearn.ucalgary.ca/d2l-student/>.

Policies Governing the Course:

Attendance

Students are encouraged to attend all sections (lecturers and lab).

Conduct During Lectures

Students are expected to conduct themselves in a mature and courteous manner during ALL lectures. Students are expected to frame their comments and questions to lecturers in respectful and appropriate language, always maintaining sensitivity towards the topic.

Students are expected to take notes during each session and should not rely solely on handout material supplied by the instructors.

Electronic Devices

The Bachelor of Health Sciences program aims to create a supportive and respectful learning environment for all students. Research studies have found that student use of electronic devices (laptops, tablets, etc) in the classroom negatively affects the learning of both the user and those sitting nearby. Inappropriate use of laptops is also disruptive to your fellow classmates and disrespectful to the lecturer. The use of laptops and other electronic note-taking devices is permitted; however, their use in the classroom should be for course-related work/note-taking only. Please do **NOT surf the web, check email or do other unrelated work.** Students who use their laptops inappropriately or are otherwise disruptive during lectures will be asked to leave.

Cell phones (or similar devices) should **be turned off** (not merely silent) upon entering the classroom. Sending/receiving text messages or leaving the class to take calls is disruptive to the entire class and will not be tolerated unless absolutely necessary. The only exception to this is the use of cell phones for answering TopHat review questions, when TopHat is not actively being used cell phone use is NOT permitted. Students who disregard this rule during lectures or tutorials will be asked to leave. These items are not permitted under any circumstance during exams/quizzes, etc.

Copyright

It is the responsibility of students and professors to ensure that materials they post or distribute to others comply with the Copyright Act and the University's Fair Dealing Guidance

for Students (library.ucalgary.ca/files/library/guidance_for_students.pdf). Further information for students is available on the Copyright Office web page (<http://library.ucalgary.ca/copyright>)

A Note Regarding Instructor Intellectual Property

Generally speaking, course materials created by professor(s) (including course outlines, presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the professor(s). These materials may **NOT** be reproduced, redistributed or copied without the explicit consent of the professor. **The posting of course materials to third party websites such as note-sharing sites without permission is prohibited.** Sharing of extracts of these course materials with other students enrolled in the course **at the same time** may be allowed under fair dealing.

Academic Accommodations Based on Disability or Medical Condition

It is the student's responsibility to register with Student Accessibility Services to be eligible for formal academic accommodation in accordance with the Procedure for Accommodations for Students with Disabilities (https://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities_0.pdf). If you are a student who may require academic accommodation and have not registered with Student Accessibility Services, please contact their office at (403) 220-8237; <http://www.ucalgary.ca/access/>. Students will be provided with all necessary accommodations to ensure equal opportunity to succeed in this course. Please provide the instructor your accommodation letter from Student Accessibility Services within 14 days after the start of this course so that all needed arrangements for exams and assignments can be made.

Accommodations on Protected Grounds other than Disability

Students who require an accommodation in relation to their coursework based on a protected ground other than disability, should communicate this need, preferably in writing, to the designated BSc program contact, Mrs. Jennifer Logan (jllogan@ucalgary), or to Dr. Ebba Kurz, Associate Dean, Undergraduate Health and Science Education, Cumming School of Medicine. Students who require an accommodation unrelated to their coursework or the requirements for a graduate degree, based on a protected ground other than disability, should communicate this need, preferably in writing, to the Vice-Provost (Student Experience). For additional information on support services and accommodations for students with disabilities, visit www.ucalgary.ca/access/.

Academic Misconduct

The University of Calgary is committed to the highest standards of academic integrity and honesty. The University of Calgary has created rules to govern all its members regarding the creation of knowledge and the demonstration of knowledge having been learned. These rules are contained principally in Sections J to L of the *University of Calgary Calendar*. Students are expected to be familiar with these standards and to uphold the policies of the University in this respect. The Calendar also stipulates the penalties for violating these rules. Please know that the University and the Cumming School of Medicine take these rules seriously. **All incidences of academic dishonesty in this course, such as cheating and plagiarism, will be reported to the**

Associate Dean for investigation; infractions will be noted on the record of a student found to be guilty.

Recording of Lectures

Audio or video recording and taking photographs during lectures is prohibited except where explicit permission has been received from the instructor.

Other Important Information

Freedom of Information and Protection of Privacy Act

This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIP); students should identify themselves on written assignments (exams and term work) by their name and ID number on the front page and ID on each subsequent page. Work assigned to you by your course instructor will remain confidential unless otherwise stated before submission. The assignment cannot be returned to anyone else without your expressed permission to the instructor. Grades will be made available on an individual basis and students will not have access to other students' grades without expressed consent. Similarly, any information about yourself that you share with your course instructor will not be given to anyone else without your permission. See <http://www.ucalgary.ca/policies/files/policies/privacy-policy-2011.pdf> for more information.

Appeals

If there is a concern with the course, academic matter or a grade, first communicate with the instructor. If these concerns cannot be resolved, students can proceed with an academic appeal, as per Section I of the University Calendar. Students must follow the official reappraisal/appeal process and may contact the Student Ombuds' Office (<http://www.ucalgary.ca/ombuds>) for assistance with this and with any other academic concerns, including academic and non-academic misconduct. Students should be aware that concerns about graded term work may only be initiated **within 15 days** of first being notified of the grade.

Resources for Support of Student Learning, Success, Safety and Wellness

Student Success Centre	http://www.ucalgary.ca/ssc/
Student Wellness Centre	http://www.ucalgary.ca/wellnesscentre/
Distress Centre	http://www.distresscentre.com/
Library Resources	http://library.ucalgary.ca

Wellness and Mental Health Resources

The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the excellent mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370

MacEwan Student Centre, <https://www.ucalgary.ca/wellnesscentre/services/mental-health-services>) and the Campus Mental Health Strategy (<http://www.ucalgary.ca/mentalhealth/>).

Student Ombuds' Office

The Student Ombuds' Office supports and provides a safe, neutral space for students. For more information, please visit www.ucalgary.ca/ombuds/ or email ombuds@ucalgary.ca

Student Union (SU) Information

The SU Vice-President Academic can be reached at (403) 220-3911 or suvpaca@ucalgary.ca; the SU representatives for the Cumming School of Medicine can be reached at medrep2@su.ucalgary.ca.

Emergency Evacuation/Assembly Points

Assembly points for emergencies have been identified across campus. Assembly points are designed to establish a location for information updates from the emergency responders to the evacuees; and from the evacuated population to the emergency responders. The primary assembly point for the Health Science Centre is the Health Research Innovation Centre (HRIC) Atrium. The alternate assembly point is Parking Lot 6. For more information, see the University of Calgary's Emergency Management website: <http://www.ucalgary.ca/emergencyplan/assemblypoints>

Safewalk

Campus security will escort individuals, day or night, anywhere on campus (including McMahon Stadium, Health Sciences Centre, Student Family Housing, the Alberta Children's Hospital and the University LRT station). Call 403-220-5333 or visit <http://www.ucalgary.ca/security/safewalk> . Use any campus phone, emergency phone or the yellow phone located at most parking lot pay booths. Please ensure your personal safety by taking advantage of this service.

MDSC 407: Winter 2018 Course Schedule

The following is a list of topics for class, associated readings, and assignment due dates. Please note that unforeseen circumstances may cause changes to the schedule with respect to the timing of topics and readings. Students will be notified of all changes in a timely manner by way of email and D2L announcements. The exam dates are firm and will not be altered.

Instructors	Lecture Date	Lecture 09:00 – 10:30	Guest Lecturer / Top Hat Exercise 10:30 – 11:15	Lecture 11:15 – 11:50	Lab	Readings
Week 1 Jessalyn Holodinsky/ Dr. Fenton	Jan 10	<ol style="list-style-type: none"> 1. The role of statistics in the scientific method 2. Types of Data <ol style="list-style-type: none"> a) Categorical b) Continuous c) Count 3. Summarizing Continuous Data <ol style="list-style-type: none"> a) Median and Interquartile Range b) Percentiles c) Reference Ranges 	Guest lecturer: Dr. Tanis Fenton In Class Activity: Growth Curves Top Hat Review Questions	<ol style="list-style-type: none"> 1. The Scientific Method 2. Introduction to Research Design 3. Formulating a research question 	Introduction to STATA	Chapters 1, 3.1, 5.6
Week 2 Dr. Sajobi	Jan 17	<ol style="list-style-type: none"> 1. Populations and Samples 2. Displaying Continuous Data <ol style="list-style-type: none"> a) Displaying Continuous Data b) Stem and Leaf c) Boxplots d) Histograms e) The Normal Distribution f) Skewed Distributions 3. Summarizing Continuous Data <ol style="list-style-type: none"> a) Mean and Standard Deviation 	In class activity: <ol style="list-style-type: none"> a) Stem and Leaf b) Boxplot c) Calculating Statistics 	In class activity: <ol style="list-style-type: none"> a) Misleading statistics display in the media (Class Discussion) 	Descriptive Statistics Displays in STAT	Chapter 3

Week 3 Dr. Sajobi	Jan 24	1. Probability a) What is probability? b) Probability terminology c) Calculating the probability of an event d) Selected probability rules (Addition and Multiplication) e) Conditional, Marginal and Joint probability	2. Applications of Probability in Diagnostic studies a) Diagnostic tests b) Sensitivity, specificity c) PPVs d) NPVs e) Likelihood Ratio Tests	Group Discussion	More worked examples of probability and reading articles that use probability Assignment 1 Due	Chapters 4.1 – 4.3, 5
Week 4 Dr. Sajobi/Jessalyn Holodinsky	Jan 31	1. Probability Distributions a) Binomial Distribution b) Poisson Distribution 2. Normal Distribution a) Standardizing the Normal Distribution	Class Activity	3. Statistical Inference – Estimation 4. Sampling distributions	STATA: CI Estimation in STATA	Chapters 5.1 – 5.5
Week 5 Dr. Sajobi/Jessalyn Holodinsky	Feb 7	Standard Errors of Means a) SE of a proportion b) SE of mean Standard errors of mean differences for two independent groups	Class Exercises	Confidence Intervals a) CI for a proportion b) CI for a mean c) CI for a difference Should I use Z or t critical values	More worked examples on CI	Chapter 6
Week 6 Dr. Sajobi	Feb 14	1. Review of Statistical Inference – Estimation 2. Statistical Inference – Hypothesis Testing Comparing continuous variables a. One-sample hypothesis testing	Top Hat Review Questions	b. Two-sample hypothesis testing a) Paired T-test	Mid-term Examination Review Assignment 2 Due	Chapter 7
Week 7	Feb 21	Reading Week: No Classes or Labs				
Week 8	Feb 28	Mid-term Examination (up to Week 6)				
Week 9 Dr. Sajobi	March 7	Statistical Inference – Hypothesis Testing for Continuous variables (cont) 1. Worked Examples 2. Assessing Assumption Underlying Hypothesis Testing	Top Hat Review Questions	Review: Issues in Hypothesis Testing a. p-values rather than decisions b. One-sided vs. two-sided test c. Assumptions		Chapter 7

				(transformations, non-parametric tests) d. Relationship between hypothesis tests and CIs e. Significance: statistical vs. clinical vs. practical How not to report statistical significance		
Week 10 Dr. Sajobi	Mar 14	Hypothesis Testing for Categorical Variables 1. One-Sample hypothesis testing 2. Two-Sample hypothesis testing a) Difference in proportions	Top Hat Review Questions	Two-Sample hypothesis testing (cont) a) Chi square test b) Fishers Exact Test Worked Examples	STATA – categorical variables Estimation and hypothesis testing Assignment 3 Due	Chapter 8
Week 11 Dr. Sajobi	Mar 21	1. Review of Assumptions underlying Hypothesis Testing & Estimation 2. Differences between Parametric and Non-parametric tests 3. Hypothesis Testing using Non-parametric statistics a) One-sample b) Two-sample test c) Paired Test	Top Hat Review Questions	Worked Examples		

Week 12 Jessalyn Holodinsky/Dr. Sajobi	March 28	1. Review of Statistical Inference – Hypothesis Testing 2. One-way Analysis of Variance 3. Assessing assumption	Top Hat Review Questions	1. One-way Repeated Measures ANOVA 2. Two-way Repeated Measures ANOVA	STATA – Hypothesis Testing of continuous variables Assignment 4 Due	Chapters 8.3
Week 13 Jessalyn Holodinsky/ Dr. Sajobi	April 4	Correlation and Regression a) Interpreting correlation coefficients b) Determining the line of best fit c) Interpreting regression coefficients d) Assumptions for linear regression	Regression to the Mean	Regression Diagnostics	Correlation and regression a. Using Stata b. Interpretation c. In the literature	Chapter 9 (p 150 – 166)
Week 14 Dr. Sajobi	April 11	Course Review Assignment 5 Due	Top Hat Review Questions		NO LAB	