TXCL7565 / PHSC7565
Applied Statistics for Toxicology and Pharmaceutical Sciences

Class Meeting Time:	Fall Semester 2018; 1-2 pm on Tuesdays and Thursdays
Class Location:	University of Colorado, Skaggs School of Pharmacy and Pharmaceutical Sciences, AMC Campus Pharmacy and Pharmaceutical Sciences building, Room 2000B
Class Website:	Syllabus, files & assignments are posted on Canvas: https://ucdenver.instructure.com/login
Course Instructor:	Laura Saba, PhD Laura.Saba@ucdenver.edu
Instructor's Office:	Pharmacy and Pharmaceutical Sciences building Room V20-2124 (303) 724-9697
Instructor Office Hours:	12 - 1 pm on Mondays and Wednesdays or by appointment

Course Description: Review of estimation; formulating statistical hypotheses; confidence intervals and hypothesis testing; ANOVA; non-parametric tests; linear regression; power calculations for simple statistical test

Instructor Description: This course is about applying statistics in real life. You will learn many statistical techniques for analyzing data, as well as when and how to use them. You will learn the appropriate assumptions for these methods, how to perform the necessary calculations, and how to clearly articulate your results.

Learning Objectives: By the end of this course, students should have a basic understanding of:

- How to state a hypothesis in a statistical framework
- How to select an appropriate statistical technique for a given set of data
- How to appropriately analyze and summarize the results of a statistical analysis
- How to communicate statistical results in a variety of settings
- How to critically evaluate statistical methods and statistical conclusions

Rationale: Statistics is becoming an integral part of many fields and statistical literacy is an important skill for being a responsible and informed citizen. The goal of this course is to not only teach students how to apply statistics but also how to evaluate statistical analyses and interpretations from others.

Required Text: Philip Rowe. *Essential Statistics for the Pharmaceutical Sciences* (2nd Edition). John Wiley & Sons, Ltd, 2015.

Additional Materials:

- Access to a computer with GraphPad installed. GraphPad is a statistical software package commonly used in academia and industry. GraphPad can be installed on Windows and Apple computers. The Department of Pharmaceutical

Sciences has purchased a course license for students registered for this class that is active until December 31, 2018. If you would like a copy for your personal computer, please email me your request and I will forward the relevant information. In addition, many laboratories at SSPPS have a computer with GraphPad installed.
- Access to a computer with a word processing program, such as Microsoft Word, to complete homework assignments, exams, and projects.

Expectations and Other Details:

- This is a graduate level course. Expect to work hard. Expect to work between 2 to 4 hours per homework assignment. Expect to study for tests.
- Class attendance and participation is expected. Students are expected to enter class on time and remain in class for the duration of the class period.
- Students are expected to ask questions (during class or office hours) if they are confused. It is your responsibility to ask for help!
- Students are expected to read the relevant sections of the book. The book will go into greater detail than I am able to go into during class and will be helpful in understanding the lecture material. Material should be read BEFORE the appropriate lectures.
- Homework should be completed as the homework sets are assigned. Students will find little benefit in rushing to complete homework assignments.
- Course announcements will often be made via email and/or CANVAS. Emails will be sent to your ucdenver.edu email address in accordance with university policy. You are responsible for the information contained in any email messages I send you, regardless of whether the information is repeated in class. It is your responsibility to maintain this email address.
- Students will be able to pick up graded assignments directly from me immediately before/after class or during office hours.
- Turn off or silence cell phones during class. No texting during class.

Grades:

Homework: Homework problems will be assigned for each topic. On the designated days, students are expected to turn a physical paper copy of their completed homework into the instructor by the end of class. Except documented health, disability, or emergency reasons or prior approval, missed or late homework assignment will be scored as zero.

Late homework will be accepted up to the next class period with a 50% penalty. No late homework will be accepted after this grace period.

Quizzes: Quizzes (possibly unannounced) will be given throughout the semester to motivate students to keep up with the lectures and reading. Without prior approval or a documented health, disability, or emergency reason, missed quizzes will be scored as a zero.

Exams: There will be two exams during the semester. Both exams will be 'take home'. The first exam will be handed out on October 9th and will be due at 1pm on October 16th. The second exam will be handed out on November 27th and will be due at 1pm on December 4th. Exam dates are fixed now so plan accordingly. Without *prior* approval or a documented health, disability, or emergency reason, missed exams will be scored as a zero.

Journal Article Review/Discussion: Students will be assigned to groups. Each group will select a journal article and a specific analysis within the article to review in front of the class. Students are expected to critique the statistical methods chosen, the completeness of the methods section, the interpretation of the results, and the utility of any graphics used.

Final Project: All students are expected to complete a final project. Students will analyze a data set of interest and describe their results in a formal paper. Papers will be due during final exam week. The project grade will be determined on the basis of the accuracy of the statistical analysis and the quality of the paper. More details about this project will be given at a later time.

Final grades will be determined according to the following weighting scheme:

Quizzes	10%
Journal Article Review/Discussion	10%
Homework	20%
Final Project	20%
Exam 1	20%
Exam 2	20%

Letter grades will be determined by the following scale:

Percentage	Letter Grade	Percentage	Letter Grade
92 or higher	A	78 up to 80	C+
90 up to 92	A-	70 up to 78	C
88 up to 90	B+	68 up to 70	D+
82 up to 88	B	62 up to 68	D
80 up to 82	B-	60 up to 62	D-

Tentative Course Schedule: The following course schedule is tentative. The exam due dates are fixed but the material covered on the exams is subject to change. Homework assignment due dates will be determined by how quickly we move through the material and will be given throughout the semester. I reserve the right to modify this schedule as the semester progresses.

Date	Tentative Agenda	Reading	Assignment Due
28-Aug	Introduction/Why We Need Statistics Types of studies/inferences		
30-Aug	Data Types/Data Presentation Introduction to GraphPad	Chapters 1 & 2	
4-Sep	Descriptive Statistics/Normal Distribution - Interval data	Chapters 3 & 4	
6-Sep	Sampling from populations/Confidence Intervals	Chapters 5 & 6	
11-Sep	CANCELLED		
13-Sep	Formulating statistical hypotheses - 2-sample t-test	Chapter 7	HW1
18-Sep	P-values and power (Type 1 and Type 2 errors) - 2-sample t-test	Chapter 8, 9, 10 & 12	
20-Sep	Paired t-test	Chapter 13	HW2
25-Sep	Analysis of Variance	Chapter 14	
27-Sep	2-Way Analysis of Variance	Chapter 14	HW3
2-Oct	2-Way Analysis of Variance	Chapter 14	
4-Oct	Fixed vs Random Effects in ANOVA	Chapter 14	HW4
9-Oct	Mid-term exam review		
11-Oct	Take Home Mid-term exam – NO CLASS		
16-Oct	Correlation Analysis	Chapter 15	
18-Oct	Linear Regression	Chapter 15	
23-Oct	Multiple Regression	Chapter 15	
25-Oct	ANCOVA	Chapter 16	HW5
30-Oct	Descriptive statistics and statistical tests - nominal scale data	Chapters 17 & 18	
1-Nov	Relative risk and odds ratios	Chapter 19	
6-Nov	Multiple testing	Chapter 24	HW6
8-Nov	Picking the right test	Handout	
13-Nov	Journal article review/discussion	TBD	
15-Nov	Power Analysis	Handout	
20-Nov	CANCELLED		
22-Nov	THANKSGIVING		
27-Nov	Final Exam Review		
29-Nov	Take Home Final Exam – NO CLASS		
4-Dec	Project Preparation		
6-Dec	Project Preparation		
13-Dec	Final Project Due at 5pm		