Course Information

Course number and title: NURS 692 Applied Statistics in Healthcare
CRN: 22149
Meeting time: 9:30 – 12:20 PM, Wednesdays
Instructional Modality: Face-to-Face
Course credit hours: 3
Course web page: Brightspace
Prerequisites: Undergraduate or graduate course in statistics or biostatistics.

Information About the Instructor

Zachary Hass, PhD
Office: Johnson Hall of Nursing, Room 247B
Phone: 765-494-4020
Email: zhass@purdue.edu
Office Hours: By appointment (in person or virtual – general availability: 9:30-4:30, M-F. Email me to set up a time.)

Course Description

This course advances knowledge and skills in statistical approaches for analyzing complex healthcare data. It focuses on statistical analysis in contexts such as evidence-based practice, quality improvement, evaluation, and behavioral and population health. Topics include probability and descriptive statistics, nonparametric statistics, risk and odds ratios, sensitivity and specificity, logistic and multinomial regression, multiple linear regression, general linear models, survival and time-to-event analysis, and mixed effect modeling. The course will provide hands-on experience in statistical analysis of healthcare data.

Teaching Philosophy

I view my role in your education as an opportunity to better equip you to do quality work in your future professional life thereby increasing the positive impact I can have on the world. I view learning by doing and methods viewed through applications as powerful tools in acquiring statistical understanding. It is my goal that you come out of this course understanding why you might use a statistical method, have an intuition for what that method does, be able to use it to acquire results, and be able to interpret those results in a pragmatic fashion. I am not insulted if you don't understand the thing I've already told you nor do I think you are incompetent because you don't know the basic thing "you should have learned in undergrad", if something is unclear, please ask. As long as you are willing to work hard and be coachable I am willing to help you succeed.

Learning Resources, Technology, & Texts

Primary Text: Riffenburgh, R.H. <u>Statistics in Medicine</u>, 3rd Edition. Academic Press, 2012. (Used for methodological readings).

Selection of journal articles to be assigned via Brightspace. These will be used to illustrate methods and motivate data sets for labs and assignments.

Statistical Software – Used for completing lab work and homework assignments (can use any software, but course will be taught in SPSS and you will need to do some extra legwork to bridge the gap between SPSS capabilities and your chosen software's capabilities. MS Excel is not an acceptable statistical software).
>   SPSS v26, IBM, 2019 (or newer)
>   - Available for free download via: https://communityhub.purdue.edu/storefront/browse/statistical (subject to license availability, typically a finite number of licenses available, most convenient option).
>   - Available for remote access via: https://goremote.itap.purdue.edu/vpn/index.html (will need to download and install the citrix workspace app for best performance, should be prompted to do so at first log in. Remote access is not the most stable, particular during high volume traffic periods. If you are a wait until the last minute to do homework sort of student, this option may cause you extra grief).
>   - Available in all on campus ITaP lab computers (most reliable option).

Brightspace Page. Lectures, labs, readings, home works, and announcements will all be delivered via Brightspace. Homework will be turned in via Gradescope imbedded in Brightspace. We will also attempt to use Brightspace for general Q&A.

Word Processor such as Microsoft Word for preparing homework short reports. Free to students via the Purdue Office 365 portal.

Course Logistics

We will adjust as needed if University policy changes, otherwise the weekly plan will operate as follows:

- Readings from the text (noted in the syllabus) and papers posted on Brightspace may be read at your own pace and discretion and are provided as a resource.
- Lecture will occur on Wednesdays at 9:30 - 11:20 in Stanley Coulter Hall 183, with at least one break and intermittent engagement activities. Questions are welcome throughout.
- Around 11:20 AM Eastern Time on Wednesdays we will move into the lab portion of the class in which you will work through an SPSS data analysis example (with step by step instructions) applying the week's material to simulated data based on a research paper. I will assist with questions.
- A homework assignment based on the lab will be available Wednesday afternoons and due at 9:30 am the following Wednesday. No assignment the first week, the last assignment will be due during finals week (no final for the course) and can be skipped if you have not used your assignment drop.

Learning Outcomes

- Describe the theoretical foundations for different statistical techniques.
  - Increase knowledge of basic statistical concepts and applications.
  - Synthesize and communicate knowledge learned.
  - Generalize knowledge for the conduct of healthcare research.
- Select the most appropriate statistical approach for analyzing data from an applied health care research problem.
  - Describe different healthcare research problems, methods and applications.
  - Understand and critically assess alternative statistical approaches that address these problems.
  - Synthesize and communicate knowledge learned.
  - Generalize knowledge to the choice of statistical techniques when conducting healthcare research.
- Conduct a statistical analysis of data from an applied healthcare research study.
  - Become proficient in a statistical software program.
  - Choose from among different statistical techniques, options, and special procedures.
  - Synthesize and communicate knowledge learned.
  - Generalize knowledge to the choice of statistical techniques when conducting healthcare research.
- Interpret the results from statistical analysis of data from an applied healthcare research study, including the strengths and limitations of the statistical approach.
  - Describe the results from a statistical analysis.
  - Interpret the substantive meaning or theoretical implications of statistical results.
  - State the strengths and limitations of a technique from the standpoint of statistical criteria and substantive or theoretical implications.
  - Synthesize and communicate knowledge learned.
  - Generalize knowledge to the choice of statistical techniques when conducting healthcare research.
- Prepare a short report describing statistical results and interpretation.
  - Prepare a statement of a research problem;
  - Describe the research design and data collection strategy, and form of the data to address that problem.
  - Provide a rationale for the choice of a statistical test to address that problem.
  - Describe the results from the statistical analysis of study data.
  - Interpret the meaning and implications of the statistical results.

Instructor's Face-to-Face Office Hours

Johnson Hall 247B by appointment via email. If you prefer a virtual meeting, mention that in your email and I'll send you a Webex invite once we have an agreeable time.

Instructor's Email Availability and Policies

Please post content and course logistic questions that may benefit everyone on the *Brightspace discussion board*. If you have questions that pertain only to you, please feel free to reach out via email (zhass@purdue.edu). I will respond relatively quickly on both Brightspace and via email during normal working hours, but will be slower at nights and on weekends as I tend to my young family and engage in other leisure time pursuits.

Assignments and Points

Graded Assignments	#	Maximum Points/Exercise	Total Maximum Points
Statistical reports	14	10	140
Total			140

- Statistical Short Reports (2 pages) will be due weekly the Wednesday after they are assigned (9:30 AM via Gradescope in Brightspace). Specific instructions will provided for each assignment.
- Reports will be graded based on your ability to follow instructions, produce statistical output from data, and interpret that statistical output in a meaningful way.

Missed or Late Work

Missed assignments may only be made up when you notify me ahead of time with an explanation and plan for completion. These requests will be accepted at my discretion and may include a point penalty of 5% per day late. Asking for an extension does not guarantee it will be granted. Extensions not cleared ahead of time that are not due to University policy emergencies or circumstances will result in a grade of 0.

Grading Scale

In this class grades reflect the sum of your achievement throughout the semester. You will accumulate points as described in the assignments portion above. At the end of the semester, final grades will be calculated by adding the total points earned and translating those numbers (out of 130 as the lowest assignment score will be dropped) into the following letters. Note that the School of Nursing's policy does not permit +/- so what would've been a B+ or an A- is an A.

- A: >= 113
- B: 91 to < 113
- C: 78 to < 91
- D: 70 to < 78
- F: < 70

Attendance Policy

We meet once per week making each meeting a substantive portion of the course material. Attendance is expected, please clear planned absences ahead of time. Excessive absence (more than 3 classes > 20% of course) will result in a drop of a letter grade for each absence over 3.

Course Schedule

Week	Topic	Reading Assignment	Statistical Report
1 8/24	Planning a study: • Need for stats, study design/types, sample schemes/bias, randomization, statistical ethics Planning Analysis: • Quantification, data types, multi-variables, data management, introduction to choosing a statistical test	Riffenburgh, Chapter 1 Chap. 2.1-2.6, 2.10	
2 8/31	Probability and Relative Frequency • Basic probability concepts, estimating probability, graphing discrete and continuous outcomes Probability distributions: • Definition, spread, shape, inference, common distributions	Riffenburgh, Chapter 3-4	1
3 9/7	Descriptive Statistics • Numerical and graphical summaries for one or two variables Finding Probabilities • Understanding P-values: Normal, t, Chi-square, F, Binomial, and Poisson distribution	Riffenburgh, Chapter 5-6	2
4 9/14	Confidence Intervals • Basic structure, examples for observations and for statistics Hypothesis Testing • Basic decision theory, hypothesis statement, critical values, Type I and II error, p-value	Riffenburgh Chapter 7 Chap. 8.1-2	3
5 9/21	Testing Categorical Data • Chi-square test, Fisher's exact test, Mcnemar's test Summarizing Categorical Prediction Data • Truth table and related statistics, ROC curves	Riffenburgh Chap. 9.1-9.6, 9.8 Chap. 10	4
6 9/28	Testing Ranked Data • Signed Rank test, Rank-Sum test Means Testing using Continuous Data • Assumptions, Z/t test for single or paired samples, two sample tests, introduction to ANOVA and multiple testing	Riffenburgh Chap. 11.1-7 Chap. 12	5
7 10/5	ANOVA	Riffenburgh Chapter 13 Ch. 14.1-6	6

	• Basic experimental design, two factor ANOVA, repeated measures, ANCOVA, three or more factors, specialized designs, checking assumptions		
8 10/12	Regression and Correlation • Assumptions, Simple Regression fit and tests, types of regression and correlation • Multiple regression and variable selection	Riffenburgh Chap. 21.1-9 Chapter 22	7
9 10/19	Logistic Regression and Survival Models • Kaplan-Meier Curves, Log-Rank Test, Logistic regression, Cox regression	Riffenburgh Chapter 23	8
10 10/26	Sequential Analysis and Time Series • Sequential analysis, moving averages, autocorrelation, time series models	Riffenburgh Chapter 24	9
11 11/2	Bayesian • Introduction of concept and terminology Markov Model • Markov model and sampling schemes Bootstrapping • Basic idea and purpose	Riffenburgh Chapter 17 Chap. 20.4-9 Chap. 15.6	10
12 11/9	Sample Size • Basics of Power Analysis Select Topics from Text • Significance, multiple testing, interim analysis, agreement and reliability, Equivalence Testing	Riffenburgh Chapter 18 Ch. 15.2, 4, 5 Ch. 26.6-8 Ch. 16.1-3	11
13 11/16	Special Topics (Time permitting): Intermediate Linear Models • Mixed Models (Random effects) • Generalized Linear Models	To be determined.	12
15 11/30	Special Topics (Time permitting): Latent Variable Models • Principal Components Analysis, Factor Analysis Missing Data • Imputation, EM Algorithm, Bayesian models	To be determined	13
16 12/7	Special Topics (Time permitting): Clustering • Statistical distance, K-means Classification • Decision trees, nearest neighbor, training and test sets	To be determined	14

* Schedule and assignments subject to change. Any changes will be posted in Brightspace along with a corresponding announcement.

- Classes begin on August 22, 2022.
- No class Wednesday November 23rd (Thanksgiving Break)
- The last day of class is December 7, 2022.
- Grades are due by 5:00 pm Tuesday, December 20, 2022.

Academic Guidance in the Event of Quarantine/Isolation

In the event you are ordered into a medical quarantine or isolation, please let me know via email and we will work out an acceptable plan for how to proceed depending on where we are in the course schedule and your own circumstances.

Classroom Guidance Regarding Protect Purdue

Any student who has substantial reason to believe that another person is threatening the safety of others by not complying with Protect Purdue protocols is encouraged to report the behavior to and discuss the next steps with their instructor. Students also have the option of reporting the behavior to the Office of the Student Rights and Responsibilities. See also Purdue University Bill of Student Rights and the Violent Behavior Policy under University Resources in Brightspace.

Academic Integrity

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either emailing or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

The Purdue Honor Pledge "As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue"

Use of Copyrighted Materials

Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are protected by copyright unless the instructor has stated otherwise. Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from enrollment in the course or the University generally.

Notes taken in class are, however, generally considered to be "derivative works" of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructor. To obtain permission to sell or barter notes, the individual wishing to sell or barter the notes must be registered in the course or must be an approved visitor to the class. Course instructors may choose to grant or not grant such permission at their own discretion, and may require a review of the notes prior to their being sold or bartered. If they do grant such permission, they may revoke it at any time, if they so choose.

Nondiscrimination Statement

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. Link to Purdue's nondiscrimination policy statement.

Accessibility

Purdue University is committed to making learning experiences accessible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

Emergency Preparation

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto Brightspace and major changes will be communicated via email. You are expected to read your @purdue.edu email on a frequent basis.

Guidelines regarding ensuring access to emergency information:
- *Keep your cell phone on to receive a Purdue ALERT text message.*
- *Log into a Purdue computer connected to the network to receive any Desktop Popup Alerts.*

Mental Health/Wellness Statement

If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try WellTrack**.** Sign in and find information and tools at your fingertips, available to you at any time.

If you need support and information about options and resources, please contact or see the Office of the Dean of Students. Call 765-494-1747. Hours of operation are M-F, 8 am- 5 pm.

If you find yourself struggling to find a healthy balance between academics, social life, stress, etc. sign up for free one-on-one virtual or in-person sessions with a Purdue Wellness Coach at RecWell. Student coaches can help you navigate through barriers and challenges toward your goals throughout the semester. Sign up is completely free and can be done on BoilerConnect. If you have any questions, please contact Purdue Wellness at evans240@purdue.edu.

If you're struggling and need mental health services: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office on the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Basic Needs Security

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. There is no appointment needed and Student Support Services is available to serve students 8 a.m.-5 p.m. Monday through Friday. Considering the significant disruptions caused by the current global crisis as it related to COVID-19, students may submit requests for emergency assistance from the Critical Needs Fund

Violent Behavior Policy

Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent Behavior impedes such goals. Therefore, Violent Behavior is prohibited in or on any University Facility or while participating in any university activity.

See the University's full violent behavior policy for more detail.

Course Evaluation

During the last two weeks of the course, you will be provided with an opportunity to evaluate this course and your instructor. Purdue uses an online course evaluation system. You will receive an official email from evaluation administrators with a link to the online evaluation site. You will have up to two weeks to complete this evaluation. Your participation is an integral part of this course, and your feedback is vital to improving education at Purdue University. I strongly urge you to participate in the evaluation system.

Disclaimer

This syllabus is subject to change. Any changes will be posted in the Brightspace Online Learning System.