PSY827 – Advanced Statistics / Biostatistics

Syllabus – Fall 2022

Instructor:	Dr. Nils Myszkowski	**Time:**	T 9–12
Email:	nmyszkowski@pace.edu	**Place:**	52 Broadway 402
Office Location:	52 Broadway, Rm. 427	**Office Hours:**	M 12–4 (1–4 by appt.)
			T 12:30-1:00 & 3:50–4:20

1   Description

Statistics are essential in gathering and making sense of the best available quantitative evidence in clinical and health psychology. Built on the foundational instruction provided in PSY721 (Test & Measurements), PSY715 (Statistics & Research Design I) and PSY716 (Statistics & Research Design II), this course introduces students to a variety of advanced statistical techniques and research procedures that are especially relevant to the study of health related outcomes.

Although there is no fundamental difference in the statistics applied to psychological, biological or medical outcomes, there are specificity in the situations encountered in research in clinical/health psychology. Without loss of generality to other applications of the procedures presented, this course focuses on statistical methods that are especially prominent in this intersection of domains.

This course is the last course in the sequence of statistics course of the PhD program in Clinical Psychology (Health Care Emphasis), and therefore, it seeks to build the students' current and future autonomy in analyzing their own data. As a consequence, a greater emphasis than before is placed on:

- Models for non-normal outcomes (e.g., binary responses, count responses, etc.)

- "Real-world" data problems (e.g., violated assumptions, model uncertainty, missing data, measurement error, nested/non-independent observations)

- High-dimensional data situations (e.g., over-fitting, model selection algorithms, regularization, dimension reduction)

- Longitudinal data (e.g., time series analysis, latent growth models)

- Connecting statistics with the production of research (e.g., reproducible research reporting)

- The current evolution of statistical procedures (e.g., structural equation modeling, machine learning).

2   Objectives

The objectives of this course are:

- To understand the role of biostatistics in clinical and health psychology research

- To grasp the variety of research designs, along with their respective strengths and weaknesses

- To assess the quality of data sources in order to identify appropriate statistical techniques

- To link research designs with statistical procedures

- To use statistical software to analyze and predict biomedical and psychological outcomes

- To interpret outputs of statistical software

- To develop autonomy in designing research and analyzing data in clinical and biomedical settings

In this course, students will also have the opportunity to enhance their skills at critically evaluating research and practice, designing research, professional writing and presenting.

3   Approach

Mathematics is a critical part of statistics, but, although mathematical computations will be covered during the course, a greater emphasis is placed on understanding concepts and on *applying* them concretely: Interpreting software outputs, choosing appropriate methods in relation with research questions and reporting results. The mathematical side of statistics will only be tackled as a way to gain an accurate understanding of statistical concepts. Consequently, this course does not require students to be great mathematicians, but it does require students to be curious and engaged in understanding concepts and their applications.

4   Prerequisites

Familiarity is required in :

- Research designs in psychological science

- Psychological measurement and testing

- Common statistical procedures in psychological science, notably Linear Models (t tests, AN(C)OVA, Linear Regression, etc.), mediation and interactions/moderations.

5   Evaluation

The grading is based on the following elements:

Attendance and participation	25 %
Homework Exercise 1	15 %
Homework Exercise 2	15 %
Homework Exercise 3	15 %
Quizzes	30 %

5.1   Homework Assignments

Homework assignments consist of problems to solve using a dataset. Homework assignments are due on time, even when a student is absent. Students who cannot attend class are expected to email homework assignments the day of the class or before. Impossibility to do so has to be justified.

5.2 Quizzes

Quizzes are counted as pass-fail. To pass, students must complete all quizzes (whether the responses are correct or not). Quizzes are used for students to better understand which topics they understand better and which topics they need to review.

6 References

No textbook is specifically required for this class. Recommended readings (with various formats, textbook, journal articles, videos, etc.) associated with each class will however be provided.

7 Software

7.1 R

`R` is a popular statistical programming language. It is available for free at https://www.r-project.org/.

It is highly recommended that students operate `R` using the Integrated Development Environment (IDE) `R Studio`, which is available for free at https://rstudio.com/products/rstudio/download/ (select the Desktop Open Source version).
Popular packages for `R` will be used, including but not limited to `car`, `ggplot2`, `dplyr`, `tidyr`, `lavaan` and `lme4`.

7.2 JASP

The software `JASP` will also be used presented as an alternative for several analyses. `JASP` is free and can be downloaded at https://jasp-stats.org/. Note that, for some homework and classwork, it will be specified to the students if there is a particular software that needs to be used.

7.3 Videos

As much as possible, data management and analysis procedures will be screen-recorded by your instructor and will be available for watching online, through a link provided on Classes.

Please note however that 1) the content covered in the videos is *neither* the exhaustive content of the course *nor* the exhaustive content of the `software` part of the course, and that 2) even though reasonable efforts will be made to avoid availability issues, the availability of the videos is not totally guaranteed (in case of technical problems, for example).

8 Outline & Schedule

Note: This is a tentative schedule which may be modified during the semester. In particular, the dates for the homework assignments may be modified based on progress made in the lectures.

Week	Date	Topic	Assignment
1	Sep 13	Introduction / Tools and resources	
2	Sep 20	Statistical modeling reminders	
3	Sep 27	Linear Modeling of non-normal outcomes	
4	Oct 5	Generalized Linear Modeling (I) : Introduction	
5	Oct 11	Generalized Linear Modeling (II) : Logistic models	
6	Oct 18	Generalized Linear Modeling (III) : Poisson models	
7	Oct 25	Advanced model selection (stepwise, best subset)	Homework 1 due
8	Nov 1	Regularization (Ridge, LASSO, Elastic Net)	
9	Nov 8	Structural Equation Modeling (I) : Introduction	Homework 2 due
10	Nov 15	Structural Equation Modeling (II) : Path Analysis	
11	Nov 22	Structural Equation Modeling (III) : Latent variable models	
12	Nov 29	Multilevel modeling	Homework 3 due
13	Dec 6	Time Series Analysis / Forecasting	
14	Dec 13	Advanced measurement models	
15	Dec 20	Reproducible research	

9   Course Policies

9.1   Attendance and participation

Students are required to attend all sessions. Attendance will be recorded for each session. In case students cannot attend a session, they have to provide documented justification. Otherwise, they will lose part of the attendance and participation points.

9.2   Professional behavior

Maintaining attention is crucial in every course, but it is all the more important in statistics and research design, where missing 5 minutes can lead to struggling to understand the rest of the class. Apart from emergencies, students are expected to remain in class from the beginning to the end of the class. Time permitting, students will be allowed brief mid-class breaks.

Although this class will require the use of computers, students are expected to not use the provided devices or their own devices (smartphones, tablets, laptops) for non-course activity (browsing, messaging, consulting social media, etc.) during class time.

9.3   Classroom climate

Our Pace community benefits from the richly unique experiences and individual diversity each of us bring. Intellectual growth and development happen when we engage in free and open discourse that challenges our own assumptions and beliefs. Together we all have the responsibility to create and maintain an environment where differences are respected and valued. To that end, we will challenge all manifestations of bias and discrimination to maintain a climate of mutual respect and civility.

Whether you are learning in an online or on campus environment, the same expectations of courtesy and conduct apply. All classroom interactions should remain civil, respectful, and supportive. If you disagree with someone, aim to acknowledge your disagreement in a respectful way. Try responding with a question to open up further discussion (e.g., I'm not sure that I understand your point of view. Can you say more?). When working online, choose your words carefully. It's easy for someone to misinterpret your meaning when they can't see your expressions or hear the tone of your voice. Be careful when using sarcasm and humor. Without face-to-face communication, your comments may be misinterpreted.

9.4   Diversity

This course may cover some topics that could be sensitive to some people, making it especially important that we all treat each other with respect. Disagreement and debate are good, as long as we make sure to be respectful of each other. Comments that are discriminatory based on identities or group memberships, such as ability, age, class, ethnicity, gender, immigration status, race, religion, sex, sexual orientation, or weight, among others, are not welcome in class. If you are ever upset with any comments made in class or any other aspect of the course, please let me know, or send anonymous feedback through the survey link posted on Classes.

Psychological research should be conducted with awareness and respect for diversity. Throughout this class, students are encouraged to discuss and question claims of neutrality or generalizability in research, harms caused by some research procedures, and, in general, how research often affects and treats people differently.

Topics such as bias in measurement and sampling and their effect on statistical analysis and research will notably be discussed in class.

10 University Policies and Resources

10.1 Academic Integrity

Students in this course are required to adhere to Pace University's Academic Integrity Code. The Academic Integrity Code supports honesty and ethical conduct in the educational process. It educates students about what constitutes academic misconduct, helps to deter cheating and plagiarism, and provides a procedure for handling cases of academic misconduct. Students are expected to be familiar with the Code, which can be found under "University Policies" in the Student Handbook. Individual schools and programs may have additional standards of academic integrity. Students are responsible for familiarizing themselves with the policies of the schools, programs, and courses in which they are enrolled.

10.2 Procedure for Students Who Wish to Obtain Reasonable Accommodations for a Course

The University's commitment to equal educational opportunities for students with disabilities includes providing reasonable accommodations for the needs of students with disabilities. To request a reasonable accommodation for a qualified disability a student with a disability must self-identify and register with Student Accessibility Services for his or her campus. No one, including faculty, is authorized to evaluate the need for or grant a request for an accommodation except Student Accessibility Services. Moreover, no one, including faculty, is authorized to contact Student Accessibility Services on behalf of a student. For further information, please see Resources for Students with Disabilities page.

10.3 Technological Resources

- List of all Pace Information Technology Services

- For assistance with a technological concern (Classes, Internet, Computer, etc.), contact the Pace Helpdesk at 914-773-3648 or create a help desk ticket.

- Visit the Learning Remotely website

10.4 Appropriate Use Policy for Information Technology

Pace endorses the following statement on software and intellectual rights distributed by EDUCAUSE, the non-profit consortium of colleges and universities, committed to the use and management of information technology in higher education. The statement reads:

Respect for intellectual labor and creativity is vital to academic discourse and enterprise. This principle applies to work of all authors and publishers in all media. It encompasses respect for the right to acknowledgment, right to privacy and right to determine the form, manner and terms of publication and distribution.

Because electronic information is volatile and easily reproduced, respect for the work and personal expression of others is especially critical in computer environments. Violations of authorial integrity, including plagiarism, invasion of privacy, unauthorized access and trade secret and copyright violations, may be grounds for

sanctions against members of the academic community.

Pace's appropriate use policy applies to recordings of classroom instruction and digital artifacts created by faculty and students.

10.5   Sex-Based Misconduct Policy and Procedure

Pace University is committed to providing a safe environment for every member of its community and to ensuring that no student, faculty or staff member is excluded from participation in or denied the benefits of any University program or activity on the basis of sex. Accordingly, the University prohibits the following forms of Sex-Based Misconduct: sexual assault, sexual harassment, gender-based harassment, dating violence, domestic violence, sexual exploitation and stalking.

Instructors are a **non-confidential** resource and have an obligation to report any information about sexual assault with the Executive Director of Institutional Equity and Title IX Coordinator (Bernard Dufresne, bdufresne@pace.edu, 163 Williams Street, Room 1017, 212-346-1310). The Title IX/Affirmative Action Office is responsible for investigating violations of the sexual misconduct policy. For more information about the Pace University sexual misconduct policy, see the Sex-Based Misconduct Policy and Procedure (PDF).

Members of the University community who believe that they have been subjected to Sex-Based Misconduct are encouraged to report such incidents to the University and, where applicable, to local law enforcement. **Confidential** resources include the **University Counseling Centers**, **Offices of Sexual and Interpersonal Wellness** and **University Healthcare**. Contact information for those offices may be found in the self-care section below.

10.6   Self-Care

Your academic success in this course and throughout your college career depends heavily on your personal health and well-being. Stress is a common part of the college experience, and it often can be compounded by unexpected life changes outside the classroom. The Pace Community strongly encourages you to take care of yourself throughout the term, before the demands of midterms and finals reach their peak. Please feel free to talk with me about any difficulty you may be having that may impact your performance in this course as soon as it occurs and before it becomes unmanageable. Please know there are a number of other support services on campus that stand ready to assist you. I strongly encourage you to contact them when needed.

10.7   *Just In Case* App

The Counseling Center's Just In Case App supplies potentially life-saving mental health information to Pace University students, staff, and faculty. This smart phone App puts vital information and support options at your fingertips. Scan and open the App today, just in case you or a friend needs help. Download the Counseling Center Just In Case App or go to "Counseling Center: Just In Case" on the MyPace Mobile App.

Department	New York City
Counseling Center	212-346-1526
Dean for Students Office	212-346-1306
Health Care Unit	212-346-1600
Residential Life	212-346-1295
Student Development and Campus Activities	212-346-1590
Office of Multicultural Affairs & Diversity Programs	212-346-1563
Sexual Assault Prevention & Education	212-346-1931
Academic Advisement	
Advising Center for Exploring Majors	212-346-1798
College of Health Professions	914-773-3552
Dyson College	212-346-1518
International Student / Scholars	212-346-1368
Lubin School of Business	212-618-6550
Pforzheimer Honors College	212-346-1697
Seidenberg School	212-346-1864
Study Abroad	212-346-1368