Psychological and Quantitative Foundations (PSQF) 6270 Section 0001: Generalized Linear Models Spring 2024

Instructor and Department Information:	**Professor Lesa Hoffman (she/her—you can call me Lesa)** Educational Measurement and Statistics Program *PSQF Dept Office: South 361 Lindquist Center; DEO: Dr. Martin Kivlighan*
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Zoom Link for Class and Instructor Office Hours:	https://uiowa.zoom.us/my/lesahoffmaniowa Meeting ID: 5044356512; Mobile Access: +13126266799 *(please use your real name as your account name to be admitted)*
Course Location and Time:	166 North Lindquist Center (LC) or via zoom Tuesdays and Thursdays 2:00–3:15 PM
Instructor Office Hours:	Mondays and Wednesdays 3:00–4:30 PM in an online group format via zoom or individually by appointment
Graduate Teaching Assistants' Contact Information and Office Hours:	**Geraldo "Bladimir" Padilla** (he/him) PhD student in Educational Measurement and Statistics in PSQF Email: Geraldo-Padilla@UIowa.edu Office Hours in a hybrid group format: Tuesdays and Thursdays 9:00–11:59 AM in N476 LC or via zoom: https://uiowa.zoom.us/j/7961502515 **Nicole "Nikki" Tennessen** (she/her) PhD candidate in Higher Education and Student Affairs in EPLS and PhD student in Educational Measurement and Statistics in PSQF Email: Nicole-Tennessen@UIowa.edu Office hours in an online group format: Mondays 8:30–10:00 AM and Fridays 10:00–11:30 AM via zoom only: https://uiowa.zoom.us/j/96225611925?pwd=NEtnYmlOcHhhUEJCMUpBTUNYNTV6dz09

Schedule of Topics and Events:

This course will meet synchronously in person and on zoom. The planned schedule of topics and events given here will likely need to be adjusted throughout the course. The course website will always have the most current schedule of events and due dates: http://www.lesahoffman.com/PSQF6270/index.html

Course Objectives, Prerequisites, and Materials:

This course will illustrate the uses of generalized linear models for predicting univariate and multivariate outcomes. **The course objective is for participants to be able to complete all the necessary steps in a generalized linear model analysis**: deciding which type of model is appropriate, creating predictor variables, building models to evaluate unique effects of predictors, and interpreting and presenting empirical findings. Prior to enrolling, participants should be comfortable with general linear models (e.g., regression, ANOVA), such as is covered in PSQF 6243.

Class time will be devoted primarily to lectures, examples, and spontaneous review, the materials for which will be available for download at the course website. Readings and other resources have been suggested for each topic and may be updated later. Synchronous attendance (in person or via zoom) is encouraged but not required, and you do not need to notify the instructor of a single class absence. Video recordings of each class will be made available on YouTube so that closed captioning will be provided, and supplemental videos for specific topics (e.g., software demos) may be added as well. Auditors and visitors are always welcome to attend class. No required class sessions will be held outside the regular class time given above (i.e., no additional midterm or final exam sessions). However, because the course will have an applied focus requiring the use of statistical software, participants are encouraged to attend group-based office hours (via zoom only), in which multiple participants can receive immediate assistance simultaneously or sequentially.

Course Requirements:

Participants can earn up to **100 total points** by completing work outside of class. Up to **88 points** can be earned from submitting **homework assignments** (6 initially planned) through a custom online system or ICON as noted—these will be graded for accuracy. Homework assignments that involve **individual writing** will have the opportunity to be **revised once** to earn the maximum points. **Written assignments must be at least ¾ complete to be accepted**. Unless otherwise instructed, please use "track changes" and retain all original instructor comments so that the instructor can easily see how your revisions address the comments.

Up to **12 points** may be earned from submitting **formative assessments** (6 initially planned) through ICON; these will be graded for effort only—incorrect answers will not be penalized. Participants may earn up to **2 extra credit points** for completing homework 0; there may be other opportunities to earn extra credit at the instructor's discretion. Finally, revisions to the planned course schedule and/or content may result in fewer homework assignments and formative assessments (and thus fewer total points) at the instructor's discretion.

Policy on Accepting Late Work and Grades of Incomplete:

Participants may submit work at any point during the semester to be counted towards their grade. However, to encourage participants to keep up with the class**, late homework (HW) assignments will incur a 2-point penalty; late HW plans, HW written revisions, or formative assessments will incur a 1-point penalty** (overall, not per day)**.** Extensions will be granted as needed for extenuating circumstances (e.g., conferences, comprehensive exams, family obligations) if requested at least **two weeks in advance** of the due date. A final grade of "incomplete" will only be given in dire circumstances and entirely at the instructor's discretion. **All work must be submitted by Friday, May 10, 2023, at 5:00 PM to be included in the course grade.**

Final grades will be determined by the *percentage* earned out of the total possible points:

>96% = A+, 93–96% = A, 90–92% = A−, 87–89% = B+, 83–86% = B, 80–82% = B−, 77–79% = C+, 73–76% = C, 70–72% = C− **(PASS)**, 67–69% = D+, 63–66% = D, 60–62% = D−, <60% = F

Course Software:

Participants will need to have access to statistical software—**STATA or R+Rstudio**—that can estimate the models presented. Each of these programs is freely available to course participants in multiple ways:

- You can connect to the U Iowa Virtual Desktop (connect to the U Iowa VPN first) for free
- You can connect to the U Iowa Research Remote Desktop (connect to the U Iowa VPN first) for free
- You can install R software for free on your local machine, along with the free graphical Rstudio interface that makes R easier to use (install second after R software)
- You could also pay $48 to install a 6-month student copy of STATA on your local machine

SAS may also be used for specific examples throughout the course. The last unit of the course on path analysis will also use **M*plus*** software. Both of these are freely available on the U Iowa Virtual Desktop.

Last updated 4/28/2024

Course Textbook:

Hardin, J. W. & Hilbe, J. M. (2018). *Generalized linear models and extensions* (4th ed.). STATA Press. Available from the U of Iowa library as an e-book (for one user at a time).

Recommended Textbook for Background on General Linear Models (as needed for review):

Darlington, R. B., & Hayes, A. F. (2016). *Regression analysis and linear models: Concepts, applications, and implementation*. Guilford. Available from U Iowa library as an e-book (for multiple users at a time).

Other Course Readings (all available in ICON under "Files"):

Note—I know this is A LOT of readings, but we are covering a lot of material! I have included these sources to give you some additional tutorials and examples. I encourage you to read as many of these sources as possible, but your priority should be to participate in class and complete course work first!

Agresti, A. (2015). *Foundations of linear and generalized linear models*. Wiley & Sons.

Bürkner, P.-C., & Vuorre, M. (2019). Ordinal regression models in psychology: A tutorial. *Advances in Methods and Practices in Psychological Science, 2*(1), 77–101. https://doi.org/10.1177/2515245918823199

Certo, S. T., Busenbark, J. R., Kalm, M., & LePine, J. A. (2020). Divided we fall: How ratios undermine research in strategic management. *Organizational Research Methods, 23*(2), 211–237. https://doi.org/10.1177/1094428118773455

Enders, C. K. (2010; chapters 3–5). *Applied missing data analysis*. Guilford.

Finsaas, M. G., & Goldstein, B. L. (2021). Do simple slopes follow-up tests lead us astray? Advancements in the visualization and reporting of interactions. *Psychological Methods, 26*(1), 38–60. https://psycnet.apa.org/doi/10.1037/met0000266

Gonzales, O., Valente, M. J., Cheong, J., & MacKinnon, D. P. (2023). Mediation/indirect effects in structural equation modeling. In R. H. Hoyle (Ed.) *Handbook of structural equation modeling* (2nd ed.), pp. 409–426. Guildford.

Green, J. A. (2021). Too many zeros and/or highly skewed? A tutorial on modelling health behaviour as count data with Poisson and negative binomial regression. *Health Psychology and Behavioral Medicine, 9*(1), 436-455. https://doi.org/10.1080/21642850.2021.1920416

Hardin, J. W., & Hilbe, J. M. (2014). Estimation and testing of binomial and beta-binomial regression models with and without zero inflation. *The Stata Journal, 14*(2), 292–303. https://journals.sagepub.com/doi/pdf/10.1177/1536867X1401400204

Hoffman, L. (2015 chapters 2–3). *Longitudinal analysis: Modeling within-person fluctuation and change*. Routledge / Taylor & Francis. Also available at the University of Iowa library in electronic form.

Hsieh, F. Y. (1989). Sample size tables for logistic regression. *Statistics in Medicine, 8*(7), 795–802. https://doi.org/10.1002/sim.4780080704

Johfre, S. S., & Freese, J. (2021). Reconsidering the reference category. *Sociological Methodology, 51*(2), 235–269. https://doi.org/10.1177/0081175020982632

Knief, U., & Forstmeier, W. (2021). Violating the normality assumption may be the lesser of two evils. *Behavior Research Methods, 53*, 2576–2590. https://doi.org/10.3758/s13428-021-01587-5

Konstantopoulos, S., Li, W., Miller, S., & van der Ploeg, A. (2019). Using quantile regression to estimate intervention effects beyond the mean. *Educational and Psychological Measurement, 79*(5), 883–910. https://doi.org/10.1177/0013164419837321

Kumle L., Võ, M. L.-H., & Draschkow, D. (2021). Estimating power in (generalized) linear mixed models: An open introduction and tutorial in R. *Behavior Research Methods, 53*, 2528–2573. https://doi.org/10.3758/s13428-021-01546-0

Long, J. S. (1997 chapter 7). *Regression models for categorical and limited dependent variables*. Sage.

McCabe, C. J., Halvorson, M. A., King, K.M., Cao, X., & Kim, D. S. (2022). Interpreting interaction effects in generalized linear models of nonlinear probabilities and counts. Multivariate Behavioral Research, 57(2–3), 243-263. https://doi.org/10.1080/00273171.2020.1868966

McGinley, J. S., Curran, P. J., & Hedeker, D. (2015). A novel modeling framework for ordinal data defined by collapsed counts. *Statistics in Medicine, 34*(15), 2312–2324. https://doi.org/10.1002/sim.6495

Mize, T. (2019). Best practices for estimating, interpreting, and presenting nonlinear interaction effects. *Sociological Science, 6*(4), 81–117. http://dx.doi.org/10.15195/v6.a4

Rohrer, J. M., & Arslan, R. C. (2021). Precise answers to vague questions: Issues with interactions. *Advances in Methods and Practices in Psychological Science, 4*(2), 1–19. https://doi.org/10.1177/25152459211007368

Williams, R. (2016). Understanding and interpreting generalized ordered logit models. *The Journal of Mathematical Sociology, 40*(1), 7–20. https://doi.org/10.1080/0022250X.2015.1112384

Academic Misconduct:

As a reminder, the University of Iowa College of Education has a formal policy on academic misconduct, which all students in this course are expected to follow. While students can work with each other to understand the course content, all course activities must ultimately be completed individually. Please consult the instructor if you have questions.

Respect for Each Other:

The instructor wants ALL students to feel welcome and encouraged to participate in this course. **There is no such thing as a "stupid" question (or answer).** All course participants—enrolled students and auditing visitors—should always feel welcome to ask whatever questions will be helpful in helping them understand the course content. **Questions or comments are welcome at any point:** during class (aloud or using the zoom chat window), in office hours, over email, or in individual appointments with the instructor (available by request). Students with disabilities or who have any other special needs are encouraged to contact the instructor for a confidential discussion of their individual considerations for academic accommodation.

All participants are welcome to attend class via zoom instead of in person for any reason at any time. If it is possible that you have been exposed to COVID-19 or any other illness, please DO NOT attend class in person! Similarly, if the instructor has been exposed to illness or the weather prohibits safe travel to class, the course will move to a temporary zoom-only format to protect all course participants.

When using zoom, please provide the name you wish for us to call you inside your zoom account (i.e., so that it appears on your window while in use). Student use of cameras and microphones while on zoom is also encouraged but not required (out of respect for your privacy and/or limited bandwidth). Please note that class video recordings posted on YouTube will NOT include any video from course participants (only the class audio and screen share from the instructor will be captured). Participants who do not wish for their audio to be captured can use the zoom chat window (which also allows for private direct messages to the instructor), even while attending in person.

The University of Iowa is committed to **making the class environment (in person or online) a respectful and inclusive space** for people of all gender, sexual, racial, religious, and other identities. Toward this goal, students are invited to optionally share the names and pronouns they would like their instructors to use to address them. The University of Iowa prohibits discrimination and harassment against individuals on the basis of race, class, gender, sexual orientation, national origin, and other identity categories. For more information, contact the Office of Institutional Equity. Additional university guidelines about classroom behavior and other

student resources are provided here, student complaint procedures are provided here, and the university acknowledgement of land and sovereignty is provided here.

Respect for The Rest of Your World:

The instructor realizes that this course is not your only obligation in your work or your life. While class attendance in real time is not mandatory, it is strongly encouraged because frequent review of the material will be your best strategy for success in this course. However, if work or life events may compromise your ability to succeed, please contact the instructor for a confidential discussion so that we can work together to make a plan for your success. **Please do not wait until you are too far behind to try to catch up!**

Schedule of Events for Weeks 1–5:

Week Number	Weekday and Date		Topics	Readings and Resources for Each Topic
1	M	1/15	**NO OFFICE HOURS; NO HOMEWORK (HW) OR FORMATIVE ASSESSMENT (FA) DUE**	
	T	1/16	**MEET ON ZOOM ONLY** Lecture 0: Introduction to this Course on Generalized Linear Models	
	R	1/18	Lecture 0, continued Lecture 1 and Example 1: Review of General Linear Models	Agresti (2015) ch. 1–3 Hoffman (2015) ch. 2 Enders (2010) ch. 3 Darling & Hayes (2016) ch.10 Finsaas & Goldstein (2021) Johfre & Freese (2021)
2	M	1/22	**NO HW OR FA DUE**	
	T	1/23	**MEET ON ZOOM ONLY** Lecture 1 and Example 1, continued	
	R	1/25	Lecture 1 and Example 1, continued	
3	M	1/29	**HW0 (2 points extra credit) DUE ONLINE BY 11:59 PM**	
	T	1/30	Discussion of FA1; Lecture 1 and Example 1, continued	
	R	2/1	Lecture 1 and Example 1, continued	
4	M	2/5	**FA1 DUE VIA ICON BY 11:59 PM**	
	T	2/6	Lecture 1 and Example 1, continued	
	R	2/8	Lecture 2: Models for Categorical Outcomes Example 2a: Models for Binary Outcomes	Agresti (2015) ch. 4–5 H & H ch. 2, 9 Hsieh (1989); Mize (2019) Rohrer & Arslan (2021)
5	M	2/12	**HW1 (based on Example 1) DUE ONLINE BY 11:59 PM**	
	T	2/13	**GUEST LECTURE BY JONATHAN TEMPLIN** Lecture 2 and Example 2a, continued	
	R	2/15	Lecture 2 and Example 2a, continued	

Schedule of Events for Weeks 6–12:

Week Number	Weekday and Date	Topics	Readings and Resources for Each Topic
6	M 2/19	**FA2 DUE VIA ICON BY 11:59 PM**	
	T 2/20	Discussion of FA2; Lecture 2 and Example 2a, continued	
	R 2/22	Example 2b: Models for Ordinal and Nominal Outcomes	Agresti (2015) ch. 6 H & H ch. 15, 16 Bürkner & Vuorre (2019) Williams (2016)
7	M 2/26	**HW2 (based on Example 2a) NOW DUE ONLINE !!! WED 2/28 !!! BY 11:59 PM**	
	T 2/27	Lecture 2 and Example 2b, continued	
	R 2/29	Example 2b, continued Demonstration of Logistic Regression	
8	M 3/4	**FA3 DUE VIA ICON BY 11:59 PM**	
	T 3/5	Discussion of FA3 Demonstration of Logistic Regression, continued Demonstration of Ordinal Regression	
	R 3/7	Demonstration of Ordinal Regression, continued Lecture 3: Models for Count Outcomes	Agresti (2015) ch. 7 H & H ch. 12–14 Green (2021) McGinley et al. (2015) McCabe et al. (2022)
9	M 3/11	**NO HW OR FA DUE**	
	T 3/12	**NO CLASS OR OFFICE HOURS THIS WEEK**	
	R 3/14	**NO CLASS OR OFFICE HOURS THIS WEEK**	
10	M 3/18	**FA4 DUE VIA ICON BY 11:59 PM**	
	T 3/19	Discussion of FA4; Lecture 3, continued Example 3: Models for Count Outcomes	
	R 3/21	Lecture 3 and Example 3, continued	
11	M 3/25	**HW3 (based on Example 2b) DUE ONLINE BY 11:59 PM**	
	T 3/26	**NO CLASS TODAY**	
	R 3/28	**MEET ON ZOOM ONLY** Lecture 3 and Example 3, continued Lecture 4: Models for Other Non-Normal Outcomes Example 4a: Models for Outcomes with Ceiling or Floor Effects	Agresti (2015) ch. 8 H & H ch. 10–11 Hardin & Hilbe (2014) Certo et al. (2020) Long (1997) ch. 7
12	M 4/1	**HW5 PLAN DUE VIA ICON BY 11:59 PM**	
	T 4/2	Lecture 4 and Example 4a, continued	
	R 4/4	Lecture 4, continued Example 4b: Models for Skewed Continuous Outcomes	H & H ch. 6 Knief & Forstmeier (2021) Konstantopoulos et al. (2019)

Schedule of Events for Weeks 13–17:

Week Number	Weekday and Date		Topics	Readings and Resources for Each Topic
13	M	4/8	**HW4 (based on Example 3) DUE ONLINE BY 11:59 PM**	
	T	4/9	**HW5 PLAN REVISIONS DUE VIA ICON !!! WED APRIL 10 !!! BY 11:59 PM** Lecture 5: Multivariate Models via Univariate Software	Agresti (2015) ch. 9 H & H ch. 18–19 Kumle et al. (2021)
	R	4/11	Lecture 5, continued Example 5 Part 1: Models for Triadic Family Outcomes	
14	M	4/15	**FA5 DUE VIA ICON BY 11:59 PM**	
	T	4/16	Discussion of FA5; Lecture 5 and Example 5 Part 1, continued Bonus: Models for Repeated Measures Outcomes—see Example 4a from 2020 class version Bonus: Models for Difference Scores—see Example 5a from 2020 class version	Hoffman (2015) ch. 3
	R	4/18	Lecture 6: Multivariate Models via Path Analysis	Enders (2010) ch. 4–5 Gonzales et al. (2003)
15	M	4/22	**HW5 USING OWN DATA DUE VIA ICON BY 11:59 PM**	
	T	4/23	Lecture 6, continued Example 5 Part 2	
	R	4/25	Lecture 6 and Example 5 Part 2, continued	
16	M	4/29	**FA6 DUE VIA ICON BY 11:59 PM**	
	T	4/30	Discussion of FA6; Lecture 6, continued Example 6a: Path Models for Mediation with Normal Outcomes	
	R	5/2	**SUMBIT HW5 BY FRIDAY MAY 3 IN ORDER TO RECEIVE FEEDBACK BY MONDAY MAY 6** Lecture 6 and Example 6a, continued Example 6b: Path Models for Mediation with Binary Outcomes Example 6c: Path Models for Mediation with Nominal Outcomes	
17	M	5/6	**Office hours from !!! 1:00-2:30 PM !!!**	
	T	5/7	**NO CLASS, but office hours from 12:30-3:30 PM**	
	W	5/8	**Office hours from 3:00-4:30 PM**	
	R	5/9	**NO CLASS, but office hours from 12:30-3:30 PM**	
	F	5/10	**HW6 DUE BY 5:00 PM ONLINE: (Practice with Invariance)** **OPTIONAL REVISION TO HW5 DUE VIA ICON BY 5:00 PM** **ALL OUTSTANDING WORK MUST BE COMPLETED BY 5:00 PM**	