

PUBHBIO 7220 – Applied Generalized Linear Models in Public Health**3 credit hours – AUTUMN 2025****Tu/Th, 3:55 – 5:15 PM Eastern****Cunz 180**

Instructor: Michael Pennell

Academic Training: PhD in Biostatistics, UNC-Chapel Hill, 2006

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Instructor's Office Hours: Tuesday/Thursday 2:45 – 3:45 PM
Cunz 246

Faculty Feedback & Response Time:

The following gives you an idea of my intended availability during the course:

- **Grading:** You can generally expect feedback within 7 days.
- **E-mail:** I will reply to e-mails within one business day.

TA Name, email, and office hours: Jeongjin Lee, lee.10449@buckeyemail.osu.edu,
Tuesdays, 11 am-12 pm, Cockins 305D and Zoom

TA responsibilities: The TA will be available for specific questions about course content. The TA may assist with scoring homework and exams; however final grades will be assigned by the professor. Any questions regarding grading should be directed to the professor and not the TA.

Course description: The purpose of this class is to introduce students to generalized linear models (GLMs) for categorical and discrete data and their application in clinical and public health research. The course is organized into three modules based on type of study outcome (binary, including logistic regression; multinomial; and count). Students will be expected to implement the methods covered using statistical software and evaluate recent applications of GLMs in the biomedical literature.

Prerequisites: PUBHBIO 6211 or equivalent.

Class Format: All class sessions will be in person. A typical class meeting will be comprised of one or a combination of:

1. Lecture.
2. Case study discussion.
3. Student project presentations.

Course Objectives: Upon completion of this course students will be able to:

- Select and apply an appropriate GLM for a research study taking into consideration study design, type of outcome, and analysis goals.
- Propose and implement a model building strategy which appropriately considers study design and goals.
- Provide accurate and practical interpretations of regression coefficients under different link functions and in the presence of interactions and other covariates in the model.
- Implement diagnostic techniques to evaluate model fit and assumptions.
- Critically evaluate applications of GLMs in the biomedical literature.

Foundational MPH Competencies

- Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate.
- Interpret results of data analysis for public health research, policy or practice.

BIO MPH Specialization Competencies

- Address problems arising in public health and medicine through appropriate statements of hypotheses, study design, data collection, data management, statistical analysis, and interpretation of results.
- Recognize strengths and weaknesses of study designs and data sources commonly encountered in public health.
- Identify strengths and weaknesses of standard analytic methods.
- Use computational methods to effectively analyze complex public health and medical data

MS BIO Specialization Competencies

- Address problems arising in public health and medicine through appropriate statements of hypotheses, study design, data collection, data management, statistical analysis, and interpretation of results.
- Use computational methods to effectively analyze complex public health and medical data.

Interdisciplinary PhD in Biostatistics Learning Goals

- Work effectively and collaboratively in a team on a biological or health-related scientific question.
- Effectively communicate the results of statistical analyses to statistical and non-statistical audiences.

Core MS Competencies (all Specializations)

- Conduct a research project using appropriate research methods and ethical approaches.

A complete list of College of Public Health Competencies are located in Appendix C of the CPH Graduate Student Handbook that can be found at: <https://go.osu.edu/cphgradcompetencies>

Readings: Readings for each topic are listed in the course schedule. Many readings will come from the following two textbooks, both of which have free online versions available through the OSU libraries website:

- [Hosmer, Lemeshow, and Sturdivant. \(2013\). Applied Logistic Regression, 3rd Edition.](#)
- [Hilbe. \(2014\). Modeling Count Data.](#)

Carmen: There is a Carmen site for this course (<https://carmen.osu.edu>). All readings and assignments will be distributed via Carmen, and submission of all assignments will be done via Carmen.

You will need to use BuckeyePass (buckeyepass.osu.edu) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

- Register multiple devices in case something happens to your primary device. Visit the BuckeyePass - Adding a Device help article for step-by-step instructions (<https://admin.resources.osu.edu/buckeyepass/adding-a-device>)
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Download the Duo Mobile application (<https://admin.resources.osu.edu/buckeyepass/installing-the-duo-mobile-application>) to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357(HELP) and IT support staff will work out a solution with you.

Class Format: How this course works

- **Mode of delivery:** This course is comprised of in-person synchronous sections.
- **Credit hours and work expectations:** This is a 3-credit-hour course. According to Ohio State policy (go.osu.edu/credithours), students should expect around 3 hours per week of time spent on direct instruction in addition to 6 hours of homework/active learning activities (e.g., readings, problem sets) to receive a grade of (C) average.
- **Attendance and participation requirements:** Attendance and participation are graded on case study discussion days (see schedule for more details). Attendance and participation are expected on all other days, though not explicitly graded. Lectures will be recorded and posted on Carmen 24 hours following the class meeting. These recordings are meant to supplement in person attendance, not replace it.

Course technology

Technology skills needed for this course

- Basic computer and web-browsing skills
- Navigating Carmen (go.osu.edu/canvasstudent)
- Familiarity with the statistical software package STATA

Required equipment

- **Computer:** current Mac (MacOs) or PC (Windows 10+) with high-speed internet connection. To get the most out of each class session, a portable device capable of accessing and analyzing data (e.g., laptop or tablet) is recommended.
- **Other:** a mobile device (smartphone or tablet) to use for BuckeyePass authentication

Required software

- **STATA:** To simplify grading and improve collaboration on the group project, students are required to use STATA on all class assignments. STATA is available at a reduced rate for students on the [student purchasing page](#) of the STATA website. If you only plan on using STATA for this class, I recommend purchasing a 6-month license of STATA BE (Basic Edition) for \$48. STATA may also be accessed for free in the Public Health Informatics Lab (Cunz 230).

Recommended software

- **Microsoft 365 Copilot (formerly Office 365)**
All Ohio State students are now eligible for free Microsoft 365 Copilot (formerly Office 365). Full instructions can be found at go.osu.edu/office365help.

Technology support

For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the Ohio State IT Service Desk. Standard support hours are available at and support for urgent issues is available 24/7.

- **Self-Service and Chat support:** <http://it.osu.edu/help>
- **Phone:** 614-688-4357(HELP)
- **Email:** servicedesk@osu.edu

Assignments: Weight toward final grade is in parentheses.

Homework (20%)

There will be six homework assignments. Assignments must be submitted to the Carmen drop box by 11:59 pm the day it is due. See the course schedule for due dates. Late assignments will not be accepted. Your homework grade will be the average of your five highest scores. You are encouraged to discuss homework assignments with classmates, but you are to complete all analyses on your own and answer questions in your own words.

Case Studies (10%)

There will be four case study discussions of biomedical research articles that applied GLMs in their primary analyses. You are to read the assigned article, complete a pre-class survey,

participate in the class discussion, and submit a short post-class survey about the discussion. To receive credit for the post-class survey, you need to be present for the entire discussion. Do not attempt to submit a post-class survey if not present for the discussion. Any attempt to do so will be considered academic misconduct (see “Academic Misconduct” section).

Exams (50%)

Both the midterm (20%) and final (30%) exams will be take-home. The release dates and due dates are in the course schedule. You may use any course materials and the STATA documentation to complete the exams, but you may not discuss the exams with anyone other than the instructor. Any unauthorized collaboration will be considered academic misconduct (see “Academic Misconduct” section).

Group Project (20%)

Twenty percent of your grade will be determined by your performance on an applied data analysis project you will complete in groups assigned by the instructor. Your grade for the project will be based, in part, on an oral presentation given on 12/4 or 12/9. Instructions and guidelines for the project will be distributed within the first two weeks of the semester.

Grading: This course is letter-graded. Final class grades will be determined as follows:

- 20% Homework
- 10% Participation in Case Study Discussions
- 20% Midterm Exam
- 20% Group Project
- 30% Final Exam

Grading Scale:*

94 to 100: A	90 to < 94: A-	
87 to < 90: B+	84 to < 87: B	80 to < 84: B-
77 to < 80: C+	74 to < 77: C	70 to < 74: C-
60 to < 70: D	< 60: E	

* The instructor reserves the right to adjust the grading scale if it appears necessary due to overall class performance. These adjustments will only raise a student grade, not lower it.

Policies for this Course

- Students are expected to attend all class meetings and participate in discussions.
- Students are allowed to discuss homework assignments with each other, but each must turn in their own document, written in their own words.
- Late assignments will not be accepted. If you cannot complete the assignment on time, you are encouraged to submit partial work to avoid receiving a zero.
- If you have an exceptional circumstance that causes you to miss a case-study discussion or assignment deadline, you are to contact the instructor as soon as possible. Decisions on how to calculate your grades for these assignments will be made on a case-by-case basis.
- **Use of generative artificial intelligence (GenAI):** GenAI tools such as Copilot or ChatGPT may be used to assist with STATA coding or literature reviews (for the group

project). All other use of GenAI or writers' aids like Grammarly, or translation platforms such as Google Translate are not permitted in this course. Any unauthorized use of GenAI tools for work in this class may therefore be considered a violation of Ohio State's Academic Integrity policy and Code of Student Conduct because the work is not your own. The use of unauthorized GenAI tools will result in a referral to the Committee on Academic Misconduct. If I suspect unauthorized use of GenAI on an assignment for this course, I will ask you to communicate with us to explain your process for completing the assignment in question. If you feel you need to use GenAI for translation, please contact me first. If you have any other questions regarding this course policy, please contact me.

Copyright Statement: This syllabus and all course materials (e.g., homework assignments, solution keys, course materials) are under copyright by the instructor and cannot be posted elsewhere without written permission.

Mental Health Services: As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th Floor of the Yunkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available 24/7 by dialing 988 to reach the Suicide and Crisis Lifeline.

Religious Beliefs or Practices Accommodations: Ohio State has had a longstanding practice of making reasonable academic accommodations for students' religious beliefs and practices in accordance with applicable law. In 2023, Ohio State updated its practice to align with new state legislation. Under this new provision, students must be in early communication with their instructors regarding any known accommodation requests for religious beliefs and practices, providing notice of specific dates for which they request alternative accommodations within 14 days after the first instructional day of the course. Instructors in turn shall not question the sincerity of a student's religious or spiritual belief system in reviewing such requests and shall keep requests for accommodations confidential.

With sufficient notice, instructors will provide students with reasonable alternative accommodations with regard to examinations and other academic requirements with respect to students' sincerely held religious beliefs and practices by allowing up to three absences each semester for the student to attend or participate in religious activities. Examples of religious accommodations can include, but are not limited to, rescheduling an exam, altering the time of a student's presentation, allowing make-up assignments to substitute for missed class work, or flexibility in due dates or research responsibilities. If concerns arise about a requested accommodation, instructors are to consult their tenure initiating unit head for assistance.

A student's request for time off shall be provided if the student's sincerely held religious belief or practice severely affects the student's ability to take an exam or meet an academic requirement and

the student has notified their instructor, in writing during the first 14 days after the course begins, of the date of each absence. Although students are required to provide notice within the first 14 days after a course begins, instructors are strongly encouraged to work with the student to provide a reasonable accommodation if a request is made outside the notice period. A student may not be penalized for an absence approved under this policy.

If students have questions or disputes related to academic accommodations, they should contact their course instructor, and then their department or college office. For questions or to report discrimination or harassment based on religion, individuals should contact the [Civil Rights Compliance Office](#). (Policy: [Religious Holidays, Holy Days and Observances](#))

Office of Student Life: Disability Services: The university strives to maintain a healthy and accessible environment to support student learning in and out of the classroom. If you anticipate or experience academic barriers based on your disability (including mental health, chronic, or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion.

If you are ill and need to miss class, including if you are staying home and away from others while experiencing symptoms of a viral infection or fever, please let me know immediately. In cases where illness interacts with an underlying medical condition, please consult with Student Life Disability Services to request reasonable accommodations. You can connect with them at slds@osu.edu; 614-292-3307; or slds.osu.edu.

Grievances and Solving Problems: A student who encounters a problem related to their educational program has a variety of avenues available to seek resolution. According to University Policies, if you have a problem with this class, you should seek to resolve the grievance concerning a grade or academic practice by speaking first with the instructor or professor. Then, if necessary, you may take your case to the department chairperson. Specific procedures are outlined in [Faculty Rule 3335-8-23](#), the [CPH Graduate Student Handbook](#), and the [CPH Undergraduate Student Handbook](#). Grievances against graduate, research, and teaching assistants should be submitted first to the supervising instructor, then to the chairperson of the assistant's department.

Creating an Environment Free from Harassment, Discrimination, and Sexual Misconduct: The Ohio State University is committed to building and maintaining a community to reflect diversity and to improve opportunities for all. All Buckeyes have the right to be free from harassment, discrimination, and sexual misconduct. Ohio State does not discriminate on the basis of age, ancestry, color, disability, ethnicity, gender, gender identity or expression, genetic information, HIV/AIDS status, military status, national origin, pregnancy (childbirth, false pregnancy, termination of pregnancy, or recovery therefrom), race, religion, sex, sexual orientation, or protected veteran status, or any other bases under the law, in its activities, academic programs, admission, and employment. Members of the university community also have the right to be free from all forms of sexual misconduct: sexual harassment, sexual assault, relationship violence, stalking, and sexual exploitation.

To report harassment, discrimination, sexual misconduct, or retaliation and/or seek confidential and non-confidential resources and supportive measures, contact the Civil Rights Compliance Office:

Online reporting form at <http://civilrights.osu.edu/>,
 Call 614-247-5838 or TTY 614-688-8605,
 Or Email civilrights@osu.edu

The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects. All university employees have reporting responsibilities to the Civil Rights Compliance Office to ensure the university can take appropriate action:

- All university employees, except those exempted by legal privilege of confidentiality or expressly identified as a confidential reporter, have an obligation to report incidents of sexual assault immediately.
- The following employees have an obligation to report all other forms of sexual misconduct as soon as practicable but at most within five workdays of becoming aware of such information: 1. Any human resource professional (HRP); 2. Anyone who supervises faculty, staff, students, or volunteers; 3. Chair/director; and 4. Faculty member.

Academic Misconduct: It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee ([Faculty Rule 3335-5-48.7 \(B\)](#)). For additional information, see the [Code of Student Conduct](#).

Tentative Course Schedule

Module		Lecture	Topic	Readings*	Assignment
Introduction	8/26	1	Course Overview, Intro to GLMs	Agresti , 4.1	
Binary Outcomes	8/28	2	Bernoulli Distribution, Measures of Association		HW 1 Assigned
	9/2	3	<u>Logistic Regression:</u> a.) Fitting b.) Binary and Continuous Predictors	HLS: 1.1-1.2, 2.1-2.3, 3.1, 3.2, 3.4	
	9/4	4	c.) Polytomous Predictors d.) Confidence Intervals	HLS: 3.3, 1.4	
	9/9	5	e.) Hypothesis Testing	HLS: 1.3, 2.4	
	9/11	6	f.) Confounding g.) Effect Modification	HLS: 3.5, 3.7	HW 1 Due HW 2 Assigned
	9/16	7	h.) Model Diagnostics i.) Goodness of Fit	HLS: 5.2-5.4	
	9/18	8	j.) Model Building Strategies	HLS: 4.1-4.4	
	9/23	9	k.) Case Study	TBD	

	9/25	10	Relative risk regression	Zou, 2004	HW 2 Due HW 3 Assigned
	9/30	11	<u>Case-Control Studies:</u> a.) No Matching b.) 1:1 Matching c.) M:1 Matching	HLS: 6.3, 7.1-7.4	Project Proposal Due
	10/2	12	d.) Case Study	TBD	
Multinomial Outcomes	10/7	13	<u>Multinomial distribution</u> <u>Unordered Response</u> <u>Categories</u> a.) Generalized Logit Model	HLS: 8.1	
	10/9	14	b.) Hypothesis testing c.) Assumption checking	HLS: 8.1	HW 3 Due, Midterm available at 6:00 am on 10/10, Due 10/13 at 11:59 pm
	10/14	15	d.) Goodness-of-fit e.) Variable selection	HLS: 8.1	HW4 Assigned
	10/16	Fall Break, No Class			
	10/21	16	<u>Ordinal Outcome Categories</u> a.) Tests of Association b.) Measures of Association	Agresti, 3.4	
	10/23	17	c.) Proportional odds model	HLS: 8.2	Project Progress Report 1 Due
	10/28	18	d.) Model diagnostics e.) Testing proportional odds f.) Partial proportional odds model	HLS: 8.2	HW 4 Due HW 5 Assigned
	10/30	19	Case Study in Multinomial Modeling	TBD	
Count Outcomes	11/4	20	Linear Regression on Transformed Outcome <u>Poisson Regression</u> a.) Poisson Distribution b.) Interpretation	H: 2.1-2.5	
	11/6	21	c.) Offsets d.) Model diagnostics	H: 2.6, 3.1-3.3, 4.1-4.2	
	11/11	Veteran's Day, No Class			
	11/13	21	<u>Negative Binomial Regression</u> a.) Negative Binomial Distribution b.) Interpretation c.) Model Assessment	H: 5.1-5.4	
	11/18	23	<u>Count Data with Excess Zeros</u> a.) Hurdle Model	H: 7.2	HW 5 Due HW 6 Assigned
	11/20	24	b.) Mixture Models	H: 7.3	Project Progress Report 2 Due

	11/25	25	Model Building Strategies for Count Data	H: 3.4.3	
	11/27	Thanksgiving Break, No Class			
	12/2	26	Case Study on Count Outcomes	TBD	Slides Due 12/3
	12/4	27	Student Presentations		
	12/9	28	Student Presentations		HW 6 Due Final Exam Available at 6:00 am on 12/10, Due 12/17 at 11:59 pm

*HLS: [Hosmer, Lemeshow Sturdivant](#), H: [Hilbe](#)

Alignment of Course Assessments with Degree Program Competencies

		Homework	Midterm	Final	Project
Foundational MPH Competencies					
Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate (3)		X	X	X	X
Interpret results of data analysis for public health research, policy or practice (4)		X	X	X	X
MPH BIO Specialization Competencies					
Address problems arising in public health and medicine through appropriate statements of hypotheses, study design, data collection, data management, statistical analysis, and interpretation of results (1)		X	X	X	X
Recognize strengths and weaknesses of study designs and data sources commonly encountered in public health (2)		X	X	X	X
Identify strengths and weaknesses of standard analytic methods (3)		X	X	X	X
Use computational methods to effectively analyze complex public health and medical data (5)		X	X	X	X
MS BIO Specialization Competencies					
Address problems arising in public health and medicine through appropriate statements of hypotheses, study design, data collection, data management, statistical analysis, and interpretation of results (7)		X	X	X	X
Use computational methods to effectively analyze complex public health and medical data (10)		X	X	X	X
Interdisciplinary PhD in Biostatistics Learning Goals					
Can work effectively and collaboratively in a team on a biological or health-related scientific question					X
Can effectively communicate the results of statistical analyses to statistical and non-statistical audiences		X	X	X	X
Core MS Competencies (all Specializations)					
Conduct a research project using appropriate research methods and ethical approaches.					X