

UNIVERSITY OF KENTUCKY
COLLEGE OF PUBLIC HEALTH
COURSE SYLLABUS

CPH 565-001

**Special Topics in Public Health:
Introductory Concepts and Computations for Bayesian Biostatistics**

Term: Spring 2025

Credit hours: 3

Course delivery mode: In person (Occasionally, a session may be changed to synchronous Zoom or replaced by a recording to be viewed asynchronously; if so, you will be notified in advance. In particular, the session on Tuesday 18 February will be conducted by synchronous Zoom.)

Meeting days/time/location: We will meet on Tuesdays and Thursdays from 2:00 to 3:15 p.m. in Nursing room 213. The first meeting will be on Tuesday 14 January, and the last meeting will be on Tuesday 29 April. There will be no meetings on Tuesday 18 March (Spring Break), Thursday 20 March (Spring Break), and Thursday 01 May (Reading Day).

Instructor Information

Name: Dr. Richard Charnigo, Professor of Biostatistics and of Statistics

Email: richard.chnigo@uky.edu (This is the preferred way to contact me. For e-mails requesting a response, I generally reply within 24 hours, except possibly on weekends or holidays.)

Office building and room number: Multidisciplinary Science Building room 325

Office phone: 859.218.2072 (If you cannot reach me by phone, please try e-mail.)

Office hours: I will be available in Multidisciplinary Science Building room 325 from 3:30 to 6:00 p.m. on most Thursdays after in person class meetings; two exceptions will be 16 January and 17 April. I will also be available upon reasonable (e-mail) request for Zoom meetings with individual students, or groups of students, at mutually agreeable times.

Course Description

This course provides focused coverage within domains of public health, including, but not limited to: Biostatistics; Epidemiology; Gerontology; Health, Behavior & Society; Health Management & Policy; and Preventive Medicine and Environmental Health. A central goal of these special topics courses is to provide a public health context to material in a way that promotes applicability to undergraduate and graduate students university-wide.

Course Overview

Most statistical methods that people learn are contained within a classical or “frequentist” framework. While such methods are definitely useful, modern technology greatly expedites data analysis within a Bayesian framework. After completing this course, you can decide whether (or under what circumstances) you find the Bayesian framework more appealing. In the meantime, though, your understanding of statistical concepts and computational tools will grow.

Course Prerequisites

There are no formal prerequisites, but students enrolling in this course are expected to have some background in statistical methods through prior coursework.

Student Learning Outcomes

Upon completion of this course, you will be able to:

- (1) describe a Bayesian framework, both informally (as allocating credibility) and formally (in terms of prior, posterior, and likelihood);
- (2) describe probability in terms of relative frequencies, subjective views, and the mathematical constructs of mass and density functions;
- (3) describe the Metropolis and Gibbs algorithms;
- (4) analyze one-group binary and metric data by analytically obtaining posterior distributions for Bernoulli and normal likelihoods with conjugate prior distributions; and,
- (5) analyze two-group binary and metric data by Markov Chain Monte Carlo computations using R and JAGS.

In terms of Bloom's taxonomy, the first three outcomes entail at least "Understanding", while the last two outcomes entail at least "Analysis".

Textbooks and Required Materials

Our textbook will be the second edition of *Doing Bayesian Data Analysis* (2015) by John Kruschke (published by Academic Press, ISBN 978-0-12-405888-0). This textbook is freely and legally available to you online. Go to {libraries.uky.edu}, click the InfoKat link, and search for the author's last name. One of the entries will be for online access to our textbook. You may need to supply your UKY credentials (username and password). Again, you want the second edition.

Skill and Technology Requirements

Course materials will be posted on Canvas {<https://www.uky.edu/canvas>}. These will include lecture notes/slides as well as instructions for your portfolios. I may send e-mails or make posts to Canvas at late hours. However, you are not expected to monitor e-mails or Canvas posts at late hours (nor on weekends or holidays). You will also use R and JAGS, freely available applications for statistical computing generally and for Gibbs sampling particularly. No prior knowledge of these applications is expected. Questions regarding any of the above may be posed to me.

Course Details

Class Attendance

On some (but perhaps not all) days that we meet in person, I will record attendance. The number of recorded absences which have not been excused will be converted to a letter grade for attendance as shown below. Two instances of unexcused extreme tardiness (> 15 minutes) will count as one unexcused absence. (Note: Attendance will not be recorded on a day that we meet by synchronous Zoom; if you are unable to join on such a day, please ask a classmate for his/her notes and then review those asynchronously.)

Number of recorded unexcused absences	Letter grade	Number of recorded unexcused absences	Letter grade
0	A+	5	B-
1	A	6	C+
2	A-	7	C
3	B+	8	C-
4	B	9 or more	E

Portfolio

Throughout the semester, you will accumulate an electronic portfolio of work for this course. The portfolio will include your solutions to various assigned problems along with your responses to various writing prompts, which may call on you to speak regarding published literature, blog entries, news items, and/or your own research. Although both undergraduate and graduate students in this course will prepare portfolios, more will be asked of graduate students (to comply with University policy for 400G and 500 level courses).

Your portfolio will be submitted for instructor review (via e-mailed PDF to the instructor, with subject line "CPH 565 Portfolio") three times during the semester: by 11:59 p.m. on Tuesday 18 February, by 11:59 p.m. on Tuesday 25 March, and by 11:59 p.m. on Tuesday 22 April. Each time, a 48-hour grace period will apply, during which you may submit the portfolio without late penalty.

Some limited collaboration with classmates is permissible. You may discuss how to solve problems or your ideas regarding writing prompts, but each person must write up his/her own solutions or responses. You may help a classmate to debug R or JAGS code, but you can't rewrite it for him/her (and vice versa). You may proofread or critique a classmate's draft solution or response, but you can't rewrite it for him/her (and vice versa). In essence, you may collaborate to the extent that all items in your portfolio remain yours (rather than becoming yours plus someone else's). That said, such collaboration must be formally acknowledged within the portfolio itself. If you need further guidance about matters in this paragraph, please ask me.

You may consult pre-existing print or Internet sources as you work on your portfolio, but you must not plagiarize. You may not ask questions in online forums, without my prior permission. You may not seek assistance from artificial intelligence, such as ChatGPT, without my prior permission. Prior permission to employ artificial intelligence is hereby granted for uses involving only spelling and grammar checking; such uses must be documented, including your exact inputs to artificial intelligence.

Each of the three portfolio assessments will result in a letter grade from A+ to E.

Midterm Examination

There will be a midterm examination in class, from 2:00 to 3:15 p.m., on Tuesday 04 March. This activity is individual, closed-book, and closed-technology. You will not be asked to write or interpret R code on the midterm examination, although you may be asked to interpret numerical or graphical results that the instructor has obtained by running R code. You may bring and consult two 8.5" x 11" pages with notes handwritten on both sides. These pages may not be shared with other students while the examination is in progress. The midterm examination will result in a letter grade from A+ to E.

Final Examination

There will be a final examination during the Registrar's officially scheduled time from 1:00 to 3:00 p.m. on Tuesday 06 May. This activity is individual, closed-book, and closed-technology. You will not be asked to write or interpret R or JAGS code on the midterm examination, although you may be asked to interpret numerical or graphical results that the instructor has obtained by running R or JAGS code. You may bring and consult four 8.5" x 11" pages with notes handwritten on both sides. These pages may not be shared with other students while the examination is in progress. The final examination will result in a letter grade from A+ to E.

Semester Grades

As indicated above, you will receive letter grades for class attendance, for each of the three portfolio assessments, for the midterm examination, and for the final examination. Also, the better of your letter grades for the third portfolio assessment and the final examination will be duplicated. This will yield seven letter grades, from which a corresponding grade point average (GPA) will be calculated, using

A = 4, B = 3, C = 2, E = 0 and handling + or - by adding or subtracting 1/3. The letter grade to which your GPA is closest will be your official course grade. I expect that most, if not all, semester grades will be A or B.

For example, suppose that a student has A for attendance, B, A-, and A for the three portfolio assessments, B for the midterm examination, and B for the final examination. The A for the third portfolio assessment is duplicated, so that the seven letter grades (sorted) are A, A, A, A-, B, B, and B. The corresponding GPA is $(4 + 4 + 4 + 4 - 1/3 + 3 + 3 + 3) / 7 = 3.52$, and the official course grade is A because 3.52 is closer to 4 than it is to 3.

Midterm Grades

A midterm grade will be reported to the Registrar, based on a preliminary GPA calculated from the first portfolio assessment and the midterm examination. In the example above, the student has a preliminary GPA of $(3 + 3)/2 = 3.00$ and receives a midterm grade of B.

Assignment Policies

Assignment Submissions

As mentioned above, your portfolio submissions are to be e-mailed to the instructor as PDF files. Please use subject line "CPH 565 Portfolio".

Late Assignments

Portfolio submissions arriving after conclusion of the 48-hour grace period but within one week will be penalized by one letter grade, and submissions after one week will not receive credit, except for cases involving: excused absences (including religious observances), extensions requested and granted before conclusion of the 48-hour grace period, University-prescribed academic accommodations, and/or recommendations for special consideration from an appropriate administrator or the Ombud.

Attendance Policy and Acceptable Documentation for Excused Absences

Unexcused absences (and unexcused extreme tardiness) will factor into your attendance grade, as described above. That said, there are several reasons for which an absence may be excused (including religious observances). Also, nobody wants to contract COVID or influenza. Therefore, if you are acutely ill, please consider yourself excused. Please feel free to wear a face mask on any day, if you have elevated concern about contracting or transmitting COVID or influenza.

Please do let me know whenever you will miss a class session. If you think that your reason for missing rises to the level of an excused absence, please tell me the reason. In this context, you do not need to disclose exact details of a medical condition or other potentially sensitive information. I just need to be convinced that the reason does rise to the level of an excused absence. In some cases, especially if you are repeatedly requesting excused absences, I may request verification (e.g., a note from a medical provider). A student who misses the midterm examination or the final examination due to an excused absence (or for whom a University-prescribed academic accommodation warrants an alternative time and place for the examination) can arrange with me to take a make-up examination at a mutually acceptable time. Students whose excused absences exceed 20% of the class sessions may be advised to withdraw from the course.

A student who misses the midterm examination due to an unexcused absence, or who has unexcused extreme tardiness (> 15 minutes) and makes a written request (within 48 hours) for an alternative examination, will have an opportunity to complete a make-up examination at a mutually acceptable time, subject to a penalty of one letter grade on the examination. (In such cases, extra time will not be granted on a scheduled make-up examination due to extreme tardiness that day, and an unexcused absence from a scheduled make-up examination will result in an "E" on the examination.)

A student who misses the final examination due to an unexcused absence, or who has unexcused extreme tardiness (> 24 minutes) and makes a written request (within 48 hours) for an alternative examination, will have an opportunity to complete a make-up examination at a mutually acceptable time, subject to a penalty of one letter grade on the examination. (In such cases, the semester grade may initially and temporarily be an “incomplete”; extra time will not be granted on a scheduled make-up examination due to extreme tardiness that day, and an unexcused absence from a scheduled make-up examination will result in an “E” on the examination.)

Tentative Course Schedule

Below is a tentative plan. As noted above, portfolios will be submitted for instructor review by 11:59 p.m. on Tuesday 18 February, by 11:59 p.m. on Tuesday 25 March, and by 11:59 p.m. on Tuesday 22 April. Each time, a 48-hour grace period will apply, during which there will be no late penalty. For the University’s academic calendars, see {<https://registrar.uky.edu/academic-calendars/years/university/2024-2025>}.

Tuesday 14 January	Introduction and Limitations of Classical Inference (Chapter 1)
Thursday 16 January	Reallocating Credibility (Chapter 2)
Tuesday 21 January	Parametric Models (Chapter 2)
Thursday 23 January	R Commands and Variable Types (Chapter 3)
Tuesday 28 January	R Programming (Chapter 3)
Thursday 30 January	Graphical Displays in R (Chapter 3)
Tuesday 04 February	Relative Frequencies and Subjective Probability (Chapter 4)
Thursday 06 February	Discrete Probability Distributions (Chapter 4)
Tuesday 11 February	Continuous Probability Distributions (Chapter 4)
Thursday 13 February	Conditional Probabilities and Independence (Chapter 4)
Tuesday 18 February	Bayes’ Rule (Chapter 5)
Thursday 20 February	Prior Distribution, Posterior Distribution, and Likelihood (Chapter 5)
Tuesday 25 February	Bernoulli Likelihood (Chapter 6)
Thursday 27 February	Beta Prior and Posterior Distributions (Chapter 6)
Tuesday 04 March	Midterm Examination
Thursday 06 March	Metropolis Algorithm and Random Walks (Chapter 7)
Tuesday 11 March	Metropolis Algorithm with Bernoulli Likelihood and Beta Prior (Chapter 7)
Thursday 13 March	Two-Parameter Problems (Chapter 7)
Tuesday 18 March	No class – Spring Break
Thursday 20 March	No class – Spring Break
Tuesday 25 March	Gibbs Sampling and Markov Chain Monte Carlo (Chapter 7)
Thursday 27 March	Performance of Markov Chain Monte Carlo (Chapter 7)
Tuesday 01 April	Illustrating JAGS (Chapter 8)
Thursday 03 April	Some capabilities of JAGS (Chapter 8)
Tuesday 08 April	Normal Likelihood, Normal Prior, and Normal Posterior (Chapter 16)
Thursday 10 April	Outliers and T Distributions (Chapter 16)
Tuesday 15 April	Comparing Two Groups (Chapter 16)
Thursday 17 April	Hierarchical Modeling and Hyperparameters (Chapter 9)
Tuesday 22 April	Multiple Subjects (Chapter 9)
Thursday 24 April	Shrinkage (Chapter 9)
Tuesday 29 April	Stratification (Chapter 9)
Thursday 01 May	No class – reading day

Instructor Expectations

1. I expect you to read the relevant portions of the textbook, and to review my lecture notes/slides, in a timely manner that corresponds to our progress through the course material.
2. Please check the e-mail address under which you registered for the course regularly. As a courtesy, I will add alternate e-mail addresses to my mailing list upon request. You are responsible for all material and announcements conveyed by e-mail.
3. You are encouraged to ask questions by e-mail and/or visit me during office hours. You may also request appointments with me on Zoom. Prior permission from me (and from any other attendees, if applicable) is required to record a Zoom meeting.
4. If you wish to appeal my grading, you may present an appeal. This must be done within one week of the time I inform you of my grading. I will try to grade your work within one week, though occasionally I may be delayed. Since you are not scheduled to meet with me after your final examination, you may retrieve your graded final examination in May 2025.

Academic Policy Statements

It is the student's responsibility to be informed concerning all regulations and procedures required by the program of study, College or the University. Students should become familiar with the Undergraduate Catalog or the Graduate Catalog as appropriate; see {<https://catalogs.uky.edu>}. Academic disputes will be evaluated against these policies. This serves as formal notification of academic policies.

Students and faculty can locate University policies at {<https://provost.uky.edu/proposals/guidance-course-proposals/standard-academic-policy-statements>}.

Academic Offenses (Cheating, Plagiarism, and Falsification or Misuse of Academic Records)

Information regarding academic offenses can be found at {<https://provost.uky.edu/proposals/guidance-course-proposals/academic-offenses>}.

The following material is reprinted from {<https://ombud.uky.edu/students/what-plagiarism>}.

Plagiarism

All academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research or self-expression. In cases where students feel unsure about a question of plagiarism involving their work, they are obliged to consult their instructors on the matter before submission. When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording or content from another source without appropriate acknowledgment of the fact, the students are guilty of plagiarism.

Plagiarism includes reproducing someone else's work (including, but not limited to a published article, a book, a website, computer code or a paper from a friend) without clear attribution. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work which a student submits as their own, whoever that other person may be, except under specific circumstances (e.g. Writing Center review, peer review) allowed by the Instructor of Record or that person's designee. Plagiarism may also include double submission, self-plagiarism or unauthorized resubmission of one's own work, as defined by the instructor.

Students may discuss assignments among themselves or with an instructor or tutor, except where prohibited by the Instructor of Record (e.g. individual take-home exams). However, the actual work must be done by the student, and the student alone, unless collaboration is allowed by the Instructor of Record (e.g. group projects). When a student's assignment involves research in outside sources or information, the student must carefully acknowledge exactly what, where and how they have employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content and phraseology intact is plagiaristic. However, nothing in this AR shall apply to those ideas which are so generally and freely circulated as to be a part of the public domain.

Common Knowledge

Common knowledge does not require citations. If a student is in doubt about whether a source needs to be cited, ask the course instructor before submitting the assignment or a draft of the assignment. Drafts of assignments may be charged with plagiarism.

The following material is reprinted from {<https://ombud.uky.edu/students/what-cheating>}.

Cheating

Cheating is defined by its general usage. It includes, but is not limited to, the wrongfully giving, taking or presenting any information or material by a student with the intent of aiding himself or another on any academic work which is considered in any way in the determination of the final grade.

The fact that a student could not have benefited from an action is not by itself proof that the action does not constitute cheating. Any question of definition shall be referred to the University Appeals Board.

Instructor's Comments on Plagiarism

I will mention the following points regarding your portfolios:

1. If using text verbatim from any source, even the textbook or my lecture notes/slides, then please use quotation marks and cite the source. However, some reasonable judgment can be exercised here. A three-word string like "beta prior distribution", which does not reflect intellectual insight or verbal creativity, would not warrant quotation marks nor a citation. If in doubt, please ask me.

2. If using an idea from any source, even the textbook or my lecture notes/slides, then please cite the source. The exception is if the idea could reasonably be considered common knowledge; in this case, citation is not required but may be included if you want to maintain a record of where you found information. (You may think of common knowledge as something that is easily discovered by Internet search and corroborated by multiple sources.) If in doubt, please ask me.

Student Resources

The University offers a variety of resources to students; please see the resources and links below.

Mental Health Resources {<https://studentsuccess.uky.edu/get-help>}

Academic Support {<https://studentsuccess.uky.edu/academicresources>}

Disability Resource Center {<https://studentsuccess.uky.edu/disability-resource-center>}

Academic Ombud {<https://ombud.uky.edu/students>}

Class Recording Information

Regarding materials which I post on Canvas:

1. These materials are for your educational use in this class. They cannot be shared with or sold to others without my prior permission.

2. You may use these materials for reasonable educational and professional purposes extending beyond this class, such as studying for a comprehensive or qualifying examination in a degree program, preparing for a professional or certification examination, or to assist you in fulfilling your responsibilities at a job or an internship.

3. Recordings posted to Canvas will likely be deleted within 6 months of their posting. If you want to have them for a longer time, please download them.

Otherwise:

4. Video and audio recordings by students are not permitted during the class unless the student has received prior permission from the instructor. Any sharing, distribution, or uploading of these recordings outside of the parameters of the class is prohibited. Students with specific recording accommodations approved by the Disability Resource Center should present their official documentation to the instructor.

Other Course-Related Information

If an unforeseen contingency arises that requires a new policy, or if some clarification is warranted, then I will make an appropriate announcement.

Classroom Emergency Preparedness and Response Information

The last two pages of this document contain information about emergencies, as requested by the University administration.

Nothing is more important than the safety and well-being of our campus community. While the University of Kentucky Police Department continues to enhance campus safety measures, it's important to remember that everyone has a responsibility in keeping our community safe. To find more information visit [Emergency Response Guide | University of Kentucky Police Department \(uky.edu\)](#)

Emergency Reporting & Action

Reporting

If there is an emergency, **DIAL 911**. To report suspicious activity or non-emergency situations, call the UK Police Department at 859-257-8573 or #UKPD from any mobile phone.

If an emergency occurs in a classroom or residence hall with a red emergency button, press to quickly notify UKPD. Emergency responders will immediately be dispatched to your location.

Action

During an emergency, you are responsible for your own safety.

If an emergency occurs during class, your instructor will provide further direction based on university and department emergency plans.

Warning Systems

UK Alert

The university provides emergency notifications through UK Alert, which sends messages via email, text message, phone calls, building alarm systems, digital signage, social media and outdoor sirens. If you receive a UK Alert message during class, notify your instructor and classmates immediately.

For more information, visit <https://police.uky.edu/get-notified/uk-alert>.

LiveSafe

The university provides additional emergency preparedness information and safety tools through LiveSafe, a free mobile app for iOS and Android. You can report suspicious activity, message with UK Police and virtually escort your friends through the SafeWalk tool.

For more information, visit <https://police.uky.edu/safety/livesafe>.

Blue Emergency Towers

Blue Emergency Notification Towers are strategically placed at over 50 locations across campus to provide outdoor alert tones and broadcast emergency messages with loud speakers. Each tower also features an emergency push button speaker phone that reaches UKPD and a camera mounted above the tower.

For more information, visit <https://police.uky.edu/safety/blue-emergency-towers>.

Medical Emergency

If there is a medical emergency, dial 911 and do not act outside the scope of your medical training. After dialing 911, inform your instructor of the situation.

Evacuation

It is required to evacuate for a fire alarm or when university officials order us to do so. Evacuation routes are marked with illuminated exit signs throughout the building. Avoid using elevators during any evacuation.

Emergency Sheltering

Storm Sheltering

Report to the recommended shelter locations. Recommended shelter locations are marked throughout the building.

If shelter locations are unavailable, protect yourself from lightning and flying debris by moving to an interior room or hallway on the building's lowest level. Avoid outside doors and windows and get under a sturdy table and use your arms to protect your head and neck.

Shelter-in-Place

If a shelter-in-place order is issued, you will learn about this through UK Alert, the university's emergency notification system.

If you are inside, stay where you are unless the building you are in is affected. If the building is affected, and the fire alarm has been activated or directed by law enforcement, you should evacuate. If you are outdoors, proceed into the closest UK building or follow instructions from emergency personnel or alerts.

It is ideal to shelter-in-place in an interior room with the fewest or no windows and no doors to the outside if possible. Shut all windows and close exterior doors.

If a hazardous chemical release occurs outside the building, follow these same procedures.

Active Aggressor

In a situation where an aggressor is trying to attack you or others, follow three steps:

1. Run - Attempt to get away from the attacker.

2. Hide - If you cannot run, barricade yourself in a safe place. Turn your phone to silent and dim your brightness. If possible, use the LiveSafe App to message UK Police and alert them to your location. If you don't have the app, dial 911. If you cannot speak, leave the line open and allow the dispatcher to listen.

3. Fight - If you cannot run or hide, do whatever you need to do to stop the attacker.

UK Police will communicate additional information through the UK Alert system during an active aggressor situation. Every UKY email automatically receives UK Alerts. You can also sign up in myUK to receive alerts via text and phone call.