

# PH620: Advanced Biostatistics

## Spring 2021

**Instructor:** Colin Farrell, PhD., MPH

**Office:** *OFFICE IS CLOSED FOR THE SEMESTER*

**Zoom Hours:** Tues/Thurs, 11:00-1:00; Wednesday, 2:00-4:00; By Appointment (Blackboard Collaborate, phone)

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*Email is the best way to contact me, as I will almost always have immediate access. Calling my Google Number (G) is best after you have scheduled a time to speak with me, so I know to anticipate the call. I will not be taking face-to-face appointments/meetings at any time during the semester.*

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## Required Text/Materials

- **'Multiple Regression and Beyond, 2<sup>nd</sup> Ed' by Timothy Keith (ISBN: 9781138811959)**
- **'Applied Logistic Regression Analysis' by Scott Menard**
- **'Multilevel Modeling' by Douglas Luke**
- **SAS**
- **Microsoft Word**

## Course Description

Application of quantitative analysis approaches to evaluation of epidemiological based data using descriptive and inferential statistical methods. Discussion and application to a healthcare dataset.

## Course Goals or Overview

The purpose of this course is to gain a deeper understanding of Logistic and Linear Regression, as well as introduce Multilevel Modeling and Structural Equation Modeling – two advanced statistical methods that will likely be appropriate for advanced Public Health research. This course will focus more on the theoretical understanding of the aforementioned methods, opposed to the mathematical calculation, seeing as all analyses will be done using SPSS and SAS.

## Course Objectives

1. Demonstrate the ability to select and correctly apply complex methods of analysis. \*
2. Demonstrate the ability to analyze quantitative data using SPSS and SAS.
3. Interpret results of data analysis for public health research and/or practice.
4. Demonstrate the ability to develop, analyze, and communicate the findings for complex health issues.
5. Articulate the strengths and limitations of various methods of analyses. \*

*\* denotes foundational knowledge objective*

## Course Assessments

**Weekly SAS Exercise:** Every week of the course, we will be covering *some* aspect of performing analysis within SAS. SAS is a very powerful, but not incredibly user-friendly, program, and being able to perform analyses using the program requires actually working with the program. To ensure that you are engaging with the program on a weekly basis, and learning about the kinks and pitfalls of the program, you will have a weekly SAS exercise, which must be completed before the next class period.

**Assignments:** Throughout the semester, you will have multiple homework assignments. The homework assignments will evaluate your ability to not only interpret the results, but also to develop theoretically and fundamentally sound research questions, while identifying datasets that will appropriately evaluate your question. You will also be assessed on your understanding of the elements of statistical theory that are discussed in the course.

**Short Essays:** In addition to the assignments, you will be required to complete two 'short' essays throughout the semester. The purpose of these essays is to communicate that you have a firm understanding of the content we will be covering. The essay questions will be assigned and you will be expected to focus your essay on the assigned topic. These essays will be approximately 3-7 pages each, double-spaced, 12 Font, Times New Roman, standard margins, and in APA format. You will be expected to utilize additional sources beyond the course texts to complete these essays.

**Methodology Application:** At three points during the semester, you will be provided with three separate articles that are examples of the application of the statistical method we just finished discussing. You will need to provide a brief review of the article, and identify and articulate the strengths and limitations of each analysis. Finally, you will be required to rank the articles from best to worst.

**Research Paper & Presentation:** The premise of the paper is simple: Identify an area of interest, and develop a research question within this area. Given that research question, identify a viable dataset in order to implement said study. I would like you to write a paper, roughly 4,000 words (~ 15 pages, double-spaced), which includes an explanation of your research interest, a concise yet thorough literature review regarding existing findings associated with your research idea, an overview of the analysis that was used in the paper, the results of the paper, and the conclusions that can be drawn from the results. You are expected to utilize one of the four methods we will be discussing in class.

***Papers are due by May 1, 2021, 11:59 PM.*** As part of the final grade of your paper, you will be required to provide a recorded presentation of your findings to the class during the final week (Due April 28). Additional information will be provided throughout the semester.

## Grading

A: 100%-90%  
B: 89.99%-80%  
C: 79.99%-70%  
D: 69.99%-60%  
F: <60%

Your final grade will be calculated using the following weights:

Weekly SAS Exercises: 10%  
Assignments: 25%  
Short Essays: 20%  
Methodology Application: 15%  
Research Paper: 30%

## Academic Dishonesty

Students who commit any act of academic dishonesty may receive from the instructor a failing grade in that portion of the course work in which the act is detected or a failing grade in a course without possibility of withdrawal. The faculty member may also present the case to the Office of Judicial Affairs for disciplinary sanctions. A student who believes a faculty member has dealt unfairly with him/her in a course involving academic dishonesty may seek relief through the Student Complaint Procedure.

## Title IX Sexual Misconduct/Assault

Western Kentucky University (WKU) is committed to supporting faculty, staff and students by upholding WKU's Title IX Sexual Misconduct/Assault Policy (#0.2070) at

<https://www.wku.edu/eo/titleixbrochure2020.pdf>, and

Discrimination and Harassment Policy (#0.2040) at

[https://www.wku.edu/senate/archives/archives\\_2016/e-5-b-0-2040-discrimination-harassment-policy.pdf](https://www.wku.edu/senate/archives/archives_2016/e-5-b-0-2040-discrimination-harassment-policy.pdf).

Under these policies, discrimination, harassment and/or sexual misconduct based on sex/gender are prohibited. If you experience an incident of sex/gender-based discrimination, harassment and/or sexual misconduct, you are encouraged to report it to the Title IX Coordinator, Andrea Anderson, 270-745-5398 or Title IX Investigators, Michael Crowe, 270-745-5429 or Joshua Hayes, 270-745-5121.

Please note that while you may report an incident of sex/gender based discrimination, harassment and/or sexual misconduct to a faculty member, WKU faculty are "Responsible Employees" of the University and **MUST** report what you share to WKU's Title IX Coordinator or Title IX Investigator. If you would like to speak with someone who may be able to afford you confidentiality, you may contact WKU's Counseling and Testing Center at 270-745-3159.

## Disability Accommodations

In compliance with University policy, students with disabilities who require academic and/or auxiliary accommodations for this course must contact the Student Accessibility Resource Center located in Downing Student Union, 1074. SARC can be reached by phone number at 270-745-5004 [270-745-3030 TTY] or via email at [sarc.connect@wku.edu](mailto:sarc.connect@wku.edu). Please do not request accommodations directly from the professor or instructor without a faculty notification letter (FNL) from The Student Accessibility Resource Center.

***I enforce a strict no-discrimination policy within my classroom and within my office. This means that there will be no discriminating or disparaging of individuals based on any characteristic – race, gender, gender identity, religion, disability, age, or sexuality. Anyone who does discriminate will be subject to the policies defined in the code of conduct within the Western Kentucky University handbook.***

## Food Insecurity

Food insecurity is a condition where an individual does not have adequate resources to feed themselves and/or their family, either nutritiously or not at all (USDA, 2013). Food insecurity is a common issue at colleges and universities across the United States, and may impact academic success (Hunger on Campus, 2016). If food insecurity is an issue for you, or someone you know, help is readily available. Please contact the WKU Office of Sustainability at (270) 745-2508, send an email to [sustainability@wku.edu](mailto:sustainability@wku.edu).

## MPH Competencies

This course contributes to the development of the following competencies:

Evidence-based Approaches to Public Health	Obj.	Assessments
1. Apply epidemiological methods to the breadth of settings and situations in public health practice	1	Homework Assignments, Research Paper
2. Select quantitative and qualitative data collection methods appropriate for a given public health context		
3. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate	2, 3, 4	Homework Assignments, Research Paper
4. Interpret results of data analysis for public health research, policy or practice	3, 4	Homework Assignments, Research Paper
Public Health & Health Care Systems		
5. Compare the organization, structure and function of health care, public health and regulatory systems across national and international settings		
6. Discuss the means by which structural bias, social inequities and racism undermine health and create challenges to achieving health equity at organizational, community and societal levels		
Planning & Management to Promote Health		
7. Assess population needs, assets and capacities that affect communities' health		
8. Apply awareness of cultural values and practices to the design or implementation of public health policies or programs		
9. Design a population-based policy, program, project or intervention		
10. Explain basic principles and tools of budget and resource management		
11. Select methods to evaluate public health programs		
Policy in Public Health		
12. Discuss multiple dimensions of the policy-making process, including the roles of ethics and evidence		
13. Propose strategies to identify stakeholders and build coalitions and partnerships for influencing public health outcomes		
14. Advocate for political, social or economic policies and programs that will improve health in diverse populations		
15. Evaluate policies for their impact on public health and health equity		
Leadership		
16. Apply principles of leadership, governance and management, which include creating a vision, empowering others, fostering collaboration and guiding decision making		
17. Apply negotiation and mediation skills to address organizational or community challenges		
Communication		
18. Select communication strategies for different audiences and sectors		
19. Communicate audience-appropriate public health content, both in writing and through oral presentation	3, 4	Class presentations, Research Paper presentation, Homework Assignments

20. Describe the importance of cultural competence in communicating public health content		
Interprofessional Practice		
21. Perform effectively on interprofessional teams		
Systems Thinking (waiting on technical assistance paper from CEPH)		
22. Apply systems thinking tools to a public health issue		
WKU MPH Program Competencies		
1. Apply health behavior theories and models to address public health problems.		
2. Describe the role of budgeting; methods of seeking extramural funding; and methods of financial analysis in making decisions about policies, programs and services.		
3. Describe the roles of history, power, privilege and structural inequality in producing health disparities.		
4. Integrate social determinants into public health science, practice, and research.	3, 4	Homework Assignments, Research Paper
5. Identify the direct and indirect population health effects of environmental hazards (biological, chemical and physical) on humans, animals and the ecology.		

## Foundational Knowledge

The following foundational knowledge requirements are addressed in this course:

Profession & Science of Public Health	Obj	Assessments
1. Explain public health history, philosophy and values		
2. Identify the core functions of public health and the 10 Essential Services.		
3. Explain the role of quantitative and qualitative methods and sciences in describing and assessing a population's health	1, 5	Short Essays, Homework Assignments, Class Presentations
4. List major causes and trends of morbidity and mortality in the US or other community relevant to the school or program		
5. Discuss the science of primary, secondary and tertiary prevention in population health, including health promotion, screening, etc.		
6. Explain the critical importance of evidence in advancing public health knowledge		
Factors Related to Human Health		
7. Explain effects of environmental factors on a population's health		
8. Explain biological and genetic factors that affect a population's health		
9. Explain behavioral and psychological factors that affect a population's health		
10. Explain the social, political and economic determinants of health and how they contribute to population health and health inequities		
11. Explain how globalization affects global burdens of disease		
12. Explain an ecological perspective on the connections among human health, animal health and ecosystem health (eg, One Health)		

## Course Topics and Schedule

Class Schedule		Reading for the week
Week 1	Introduction	Bivariate & Partial Correlation (BB)
Week 2	Recap and more bivariate	Keith (Ch 1)
Week 3	Causal Order & Introduction to SAS	Davis (BB)
Week 4	Linear Regression	Keith (Ch 2-5); Schroeder, Sjoquist, & Stephan
Week 5	Linear Regression (continued)	Keith (Ch 6-9)
Week 6	Application of Linear Regression	To be announced
Week 7	Logistic Regression	Menard, pg. 1-66
Week 8	Logistic Regression (continued)	Menard, pg. 66-102; King & Zeng (BB)
Week 9	Application of Logistic Regression	To be announced
Week 10	Multilevel Modeling	Luke, pg. 1-53
Week 11	Multilevel Modeling (continued)	Luke, pg. 53-72; Diez-Roux (BB)
Week 12	Structural Equation Modeling (SEM)	Keith (Ch 11-14), Path Analysis (BB)
Week 13	SEM (continued)	Keith (Ch 15-20)
Week 14	Application of SEM	To be announced
Week 15	<b><i>Final Paper and Presentations are due</i></b>	

### Important Dates:

January 19, 2021 Class Begins

January 26, 2021 Last day to withdraw from class without a grade

**March 25, 2021** *Last day to withdraw from course (No refund after February 8)*

April 30, 2021 Class Ends