**CPH 931-001: Professional Seminar in Biostatistics** **Fall 2008**
**Course Information and Syllabus Document** **Dr. Charnigo**

## *Contact information*

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## *About this course*

Course Description: CPH 931 links academic work in biostatistics to applications in public health practice, providing the student with additional methodological tools as he/she prepares for a leadership role in public health.

Course-Specific Objectives:

1. You will learn how to analyze data with a continuous outcome when the assumptions for ordinary linear regression are not satisfied.
2. You will learn how to analyze data with an outcome that is neither continuous nor binary.
3. You will learn how to analyze data with a time-to-event outcome using methods besides ordinary proportional hazards regression.
4. You will learn to apply principles of evidence-based medicine and public health.

Textbook: There is no required textbook for this course. Material will be drawn from several sources, including but not necessarily limited to those listed below.

- Chatterjee S, Hadi A, and Price B. *Regression Analysis by Example, 3rd Edition*. New York, NY: John Wiley & Sons, 2000.
- Ryan T. *Modern Regression Analysis*. New York, NY: John Wiley & Sons, 1997.
- Johnson R and Wichern D. *Applied Multivariate Statistical Analysis, 5th Edition.* Upper Saddle, NJ: Prentice Hall, 2002.
- Verbeke G and Molenberghs G. *Linear Mixed Models for Longitudinal Data*. New York, NY: Springer-Verlag, 2000.
- Little R and Rubin D. *Statistical Analysis with Missing Data, 2nd Edition*. Hoboken, NJ: John Wiley & Sons, 2002.
- Kleinbaum D and Klein M. *Logistic Regression, 2nd Edition*. New York, NY: Springer-Verlag, 2002.
- McCullagh P and Nelder J. *Generalized Linear Models, 2nd Edition.* Boca Raton, FL: CRC Press, 1989.
- Klein J and Moeschberger M. *Survival Analysis, 2nd Edition.* New York, NY: Springer-Verlag, 2003.
- Guyatt G and Rennie D, Eds. *Users' Guides to the Medical Literature: A Manual for Evidence-Based Clinical Practice.* Chicago, IL: American Medical Association, 2002.
- Stroup D and Teutsch S, Eds. *Statistics in Public Health: Quantitative Approaches to Public Health Problems*. New York, NY: Oxford University Press, 1998.
- Korn E and Graubard B. *Analysis of Health Surveys*. New York, NY: John Wiley & Sons, 1999.

Prerequisite: CPH 930 and enrollment in the Dr.P.H. program; basic knowledge of SAS from CPH 930 is assumed.

## *Course policies and logistics*

Class Meetings and Computers: We will meet on Tuesdays from 12 Noon to 2:30 p.m. in 207 College of Public Health, except for Tuesday 04 November (Election Day). Desktop computers equipped with SAS are available in 207 College of Public Health. You are welcome to use these computers, but you are advised to save your work on memory sticks since you may not have access to the same computer each week. If you prefer to use your own laptop computer, you will need to have a recent version of SAS installed. Inquiries about acquiring a personal SAS license may be directed to Aric Schadler of the SSTARS Center at schadler@ms.uky.edu.

E-mail Memoranda and Course Materials: I will be sending e-mail memoranda regularly to distribute course materials, post grade information (for those who request it), and make announcements. Course materials will also be available from my home page, www.richardcharnigo.net. Please inform me if you are not receiving the memoranda.

Written Assignments: There will be five written assignments for you to prepare outside of class. These assignments will be due at 2:30 p.m. on Tuesday 23 September, Tuesday 07 October, *Wednesday* 05 November, Tuesday 18 November, and Tuesday 02 December. You are permitted to work in self-selected groups of two or three, in which case you may hand in one copy of the assignment for the group. Written assignments are ordinarily to be submitted in hard copy. However, electronic submission (in Microsoft Word 2003 or PDF) may be allowed under exceptional circumstances *if* you obtain my permission in advance.

Examinations: There will be a take-home midterm examination, due at 2:30 p.m. on Tuesday 21 October, and a take-home final examination, due at 2:30 p.m. on Tuesday 16 December under my office door (203-B College of Public Health). The examinations are to be strictly individual efforts; discussion with your classmates is not permitted. Examinations are ordinarily to be submitted in hard copy. However, electronic submission (in Microsoft Word 2003 or PDF) may be allowed under exceptional circumstances *if* you obtain my permission in advance.

Grading: Your grade for the course will be determined by the written assignments (40%), the take-home midterm examination (30%), and the take-home final examination (30%). There may also be opportunities to earn bonus points. The cutoff for an "A" will be no higher than 90%, the cutoff for a "B" will be no higher than 75%, and the cutoff for a "C" will be no higher than 60%.

Late Policy: Cases involving any of the following will be handled individually: University-excused absences, University-prescribed academic accommodations, recommendations for special consideration from the office of an appropriate Dean or the Ombud. Otherwise, a late submission can be accepted only within 24 hours and then only at 75% credit. Such a submission should be left under my office door (203-B College of Public Health).

Accommodations: If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center. If you have not already done so, please register with the Disability Resource Center (Room 2 Alumni Gym, 257-2754, jkarnes@uky.edu) for coordination of campus disability services available to students with disabilities.

Academic Honesty: The Department of Biostatistics, the College of Public Health, and the University of Kentucky place a premium on academic honesty. The Student Rights and Responsibilities document is available at www.uky.edu/StudentAffairs/Code/part2.html.

Unforeseen Contingencies: In the unlikely event that an unforeseen contingency requires additional course policies, you will be promptly notified in an e-mail memorandum.

## *Tentative syllabus*

| **Objective** | **Date** | **Topics** |
|---|---|---|
| 1. Analyzing data with a continuous outcome when the assumptions for ordinary linear regression are not satisfied | 02 September | heteroscedasticity and weighted least squares, multicollinearity and ridge regression |
| | 09 September | non-normal errors and robust regression, nonlinearity and nonparametric regression |
| | 16 September | repeated measures analysis of variance for comparing multiple treatments tested on the same subjects |
| | 23 September | linear mixed modeling as a generalization of repeated measures analysis of variance and linear regression |
| | 30 September | addressing missing data through single imputation, addressing missing data through multiple imputation |
| 2. Analyzing data with an outcome that is neither continuous nor binary | 07 October | polytomous regression for a nominal outcome with more than two classes, proportional odds regression for an ordinal outcome with more than two classes |
| | 14 October | Poisson regression for a count outcome, negative binomial regression for an overdispersed count outcome |
| 3. Analyzing data with a time-to-event outcome using methods besides ordinary proportional hazards regression | 21 October | accommodating time-dependent covariates in proportional hazards regression, performing stratification when the proportional hazards assumption is not satisfied |
| | 28 October | survival analysis with the Weibull model, survival analysis with the log logistic model |
| --- | 04 November | NO CLASS (ELECTION DAY) |
| 4. Applying principles of evidence-based medicine and public health | 11 November | misconceptions about p-values, statistical significance versus practical significance and confidence intervals |
| | 18 November | subgroup analysis and Type I error, meta analysis and publication bias |
| | 25 November | estimating relative risks from case-control data, sensitivity analyses in medicine and public health |
| | 02 December | describing trends in temporal data, discovering patterns in spatial data |
| | 09 December | gathering and analyzing survey data when simple random sampling is not feasible |

*Competency attainment*

Your attainment after completing CPH 931 will be at least the following and perhaps more, depending on the other courses in which you have enrolled. The numbers 0, 1, 2, and 3 indicate Unaware (No information or skill in this area), Aware (Basic mastery; able to identify the concept or skill but with limited ability to perform or apply it independently), Knowledgeable (Intermediate level of mastery; able to apply and describe the concept or skill), and Proficient (Advanced mastery; able to synthesize, critique, or teach the concept or skill).

Biostatistics

1. Describe the roles biostatistics serves in the discipline of public health. (3)
2. Distinguish among the different measurement scales and the implications for selection of statistical methods to be used based on these distinctions. (3)
3. Apply descriptive techniques commonly used to summarize public health data. (3)
4. Describe basic concepts of probability, random variation, and commonly used statistical probability distributions. (2)
5. Apply common statistical methods for inference. (3)
6. Describe preferred methodological alternatives to commonly used statistical methods when assumptions are not met. (3)
7. Apply descriptive and inferential methodologies according to the type of study design for answering a particular question. (3)
8. Interpret results of statistical analyses found in public health studies. (3)
9. Develop written and oral presentations based on statistical analyses for both public health professionals and educated lay audiences. (2)
10. Apply basic informatics techniques with vital statistics and public health records in the description of public health characteristics and in public health research and evaluation. (2)

Interdisciplinary - Communications and Informatics

1. Describe how the public health information infrastructure is used to collect, process, maintain, and disseminate data. (1)
2. Describe how societal, organizational, and individual factors influence and are influenced by public health communications. (0)
3. Discuss the influences of social, organizational, and individual factors on the use of information technology by end users. (0)
4. Apply theory and strategy-based communication principles across different settings and audiences. (0)
5. Apply legal and ethical principles to the use of information technology and resources in public health settings. (0)
6. Collaborate with communication and informatics specialists in the process of design, implementation, and evaluation of public health programs. (1)
7. Demonstrate effective written and oral skills for communicating with different audiences in the context of professional public health activities. (2)
8. Use information technology to access, evaluate, and interpret public health data. (2)
9. Use informatics methods and resources as strategic tools to promote public health. (1)
10. Use informatics and communications methods to advocate for community public health programs and policies. (1)

Interdisciplinary - Diversity and Culture

1. Describe the roles of history, power, privilege, and structural inequality in producing health disparities. (0)
2. Explain how professional ethics and practices relate to equity and accountability in diverse community settings. (0)
3. Explain why cultural competence alone cannot address health disparity. (0)

4. Discuss the importance and characteristics of a sustainable diverse public health workforce. (0)
5. Use the basic concepts and skills involved in culturally appropriate community engagement and empowerment with diverse communities. (0)
6. Apply the principles of community-based participatory research to improve health in diverse populations. (0)
7. Differentiate among availability, acceptability, and accessibility of health care across diverse populations. (0)
8. Differentiate between linguistic competence, cultural competency, and health literacy in public health practice. (0)
9. Cite examples of situations where consideration of culture-specific needs resulted in a more effective modification or adaptation of a health intervention. (0)
10. Develop public health programs and strategies responsive to the diverse cultural values and traditions of the communities being served. (0)

Interdisciplinary – Leadership

1. Describe the attributes of leadership in public health. (0)
2. Describe alternative strategies for collaboration and partnership among organizations, focused on public health goals. (0)
3. Articulate an achievable mission, set of core values, and vision. (0)
4. Engage in dialogue and learning from others to advance public health goals. (0)
5. Demonstrate team building, negotiation, and conflict management skills. (1)
6. Demonstrate transparency, integrity, and honesty in all actions. (1)
7. Use collaborative methods for achieving organizational and community health goals. (0)
8. Apply social justice and human rights principles when addressing community needs. (0)
9. Develop strategies to motivate others for collaborative problem solving, decision making, and evaluation. (1)

Interdisciplinary – Professionalism

1. Discuss sentinel events in the history and development of the public health profession and their relevance for practice in the field. (0)
2. Apply basic principles of ethical analysis (e.g., the Public Health Code of Ethics, human rights framework, other moral theories) to issues of public health practice and policy. (0)
3. Apply evidence-based principles and the scientific knowledge base to critical evaluation and decision making in public health. (2)
4. Apply the core functions of assessment, policy development, and assurance in the analysis of public health problems and their solutions. (1)
5. Promote high standards of personal and organizational integrity, compassion, honesty, and respect for all people. (1)
6. Analyze determinants of health and disease using an ecological framework. (1)
7. Analyze the potential impacts of legal and regulatory environments on the conduct of ethical public health research and practice. (0)
8. Distinguish between population and individual ethical considerations in relation to the benefit, costs, and burdens of public health programs. (0)
9. Embrace a definition of public health that captures the unique characteristics of the field (e.g., population-focused, community-oriented, prevention-motivated, and rooted in social justice) and how these contribute to professional practice. (0)
10. Appreciate the importance of working collaboratively with diverse communities and constituencies (e.g., researchers, practitioners, agencies, and organizations). (0)
11. Value commitment to lifelong learning and professional service including active participation in professional organizations. (0)

Interdisciplinary – Program Planning

1. Describe how social, behavioral, environmental, and biological factors contribute to specific individual and community health outcomes. (2)
2. Describe the tasks necessary to assure that program implementation occurs as intended. (0)
3. Explain how the findings of a program evaluation can be sued. (0)

4. Explain the contribution of logic models in program development, implementation, and evaluation. (0)
5. Differentiate among goals, measurable objectives, related activities, and expected outcomes for a public health program. (1)
6. Differentiate the purposes of formative, process, and outcome evaluation. (0)
7. Differentiate between qualitative and quantitative evaluation methods in relation to their strengths, limitations, and appropriate uses, and emphases on reliability and validity. (0)
8. Prepare a program budget with justification. (0)
9. In collaboration with others, prioritize individual, organization, and community concerns and resources for public health programs. (0)
10. Assess evaluation reports in relation to their quality, utility, and impact on public health. (0)

Interdisciplinary – Public Health Biology

1. Specify the role of the immune system in population health. (0)
2. Describe how behavior alters human biology. (0)
3. Identify the ethical, social, and legal issues implied by public health biology. (0)
4. Explain the biological and molecular basis of public health. (0)
5. Explain the role biology has in the ecological model of population-based health. (0)
6. Explain how genetics and genomics affect disease processes and public health policy and practice. (0)
7. Articulate how biological, chemical, and physical agents affect human health. (0)
8. Apply biological principles to the development and implementation of disease prevention, control, or management programs. (0)
9. Apply evidence-based biological and molecular concepts to inform public health laws, policies, and regulations. (1)
10. Integrate general biological and molecular concepts into public health. (0)

Interdisciplinary – Systems Thinking

1. Identify characteristics of a system. (0)
2. Identify unintended consequences produced by changes made to a public health system. (0)
3. Provide examples of feedback loops and “stocks and flows” within a public health system. (0)
4. Explain how systems (e.g., individuals, social networks, organizations, and communities) may be viewed as systems within systems in the analysis of public health problems. (0)
5. Explain how systems models can be tested and validated. (0)
6. Explain how the contexts of gender, race, poverty, history, migration, and culture are important in the design of interventions within public health systems. (0)
7. Illustrate how changes in public health systems (including input, processes, and output) can be measured. (1)
8. Analyze inter-relationships among systems that influence the quality of life of people in their communities. (1)
9. Analyze the effects of political, social, and economic policies on public health systems at the local, state, national, and international levels. (1)
10. Analyze the impact of global trends and interdependencies on public health related problems and systems. (1)
11. Assess strengths and weaknesses of applying the systems approach to public health problems. (0)