



ROLLINS
SCHOOL OF
PUBLIC
HEALTH
EMORY

DEPARTMENT: Biostatistics
COURSE NUMBER: BIOS 737
CREDIT HOURS: 2.0
COURSE TITLE: Spatial Analysis of Public Health Data

INSTRUCTOR NAME Lance A. Waller, Ph.D.

INSTRUCTOR CONTACT INFORMATION

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SCHOOL ADDRESS OR MAILBOX LOCATION: Room 320, Grace Crum Rollins Building

OFFICE HOURS Tuesday, 10-12pm or by appointment (appointment is usually best)

COURSE DESCRIPTION (3-4 Sentences)

The course introduces statistical methodologies useful in the analysis of spatial data with emphasis on the geographical distribution of disease and exposure. Topics include random spatial processes, spatial prediction (kriging), and methods to detect clustering of rare events. The course also introduces the use of the R statistical package to implement the methodology.

EVALUATION

Homework: 40% (4 assignments, 10% each)

Projects: 60% (2 projects, 30% each)

Projects involve the analysis of a data set to address assigned research questions. Students will write a report describing the data, the methods used to analyze it and their results.

ACADEMIC HONOR CODE

The RSPH requires that all material submitted by a student in fulfilling his or her academic course of study must be the original work of the student.

LEARNING OBJECTIVES OR COMPETENCIES OF THE COURSE

Upon completion of this course, students will:

1. Understand the basic types of spatial data and the basic questions of interest.
2. Be exposed to multiple examples including assessments of patterns of disease incidence, prediction of exposure values, and modeling links between exposure and disease in a spatial setting.
3. Understand the theoretical underpinnings for modeling and predicting spatial data.
4. Become familiar with computational aspects of spatial analysis including data formats, Monte Carlo methods, and specialized statistical computing.
5. Be aware of the impact of spatial correlation on standard methods of statistical analysis.

LEARNING OBJECTIVES OR COMPETENCIES FOR THE DEPARTMENT OR PROGRAM TO WHICH THE COURSE CONTRIBUTES

1. Identify biostatistical aspects in contemporary public health issues.
2. Demonstrate advanced analytic skills within a collaborative setting.
3. Demonstrate technical accuracy with advanced analytic methods.
4. Apply new and existing statistical theory and methods as needed to address public health or medical problems.
5. Conduct complex statistical analyses for a broad range of applications.
6. Use statistical software for both data management and data analysis, including coding of custom techniques.
7. Communicate the results of statistical analysis to a broad audience.

BIOS 737 SPATIAL BIOSTATISTICS

Textbook:

- Waller LA and Gotway CA (2004) *Applied Spatial Statistics for Public Health Data*. Wiley.

Timeline, Topics List, and Due Dates

- 9/3 Labor Day (no class)
- 9/10 Introduction to spatial statistics. Introduction to spatial point patterns.
- 9/17 Spatial point pattern, complete spatial randomness, scale, point processes.
- 9/24 HW 1 due. Monte Carlo testing, intensity and K functions.
- 10/1 Disease clustering: point data.
- 10/8 HW 2 due. Disease clustering: point data and areas.
- 10/15 Fall Break (no class)
- 10/22 Disease clustering: areas.
- 10/29* Project 1 due. Introduction to spatial prediction. Stationarity and isotropy.
- 11/5 Variograms: estimation and modeling.
- 11/12 Kriging and lognormal kriging.
- 11/19 HW 3 due. Introduction to spatial modeling: spatial regression.
- 11/27 Generalized linear and hierarchical spatial models.
- 12/3* HW 4 due. Bayesian modeling and geographically weighted regression.
- 12/10 Project 2 due. Miscellaneous.

Notes on grading:

- Some homework problems will involve "playing around" with data and R functions. Examples of R code will be posted on the course Blackboard page. Usually these examples can be modified to complete assigned problems. You can access R on RSPH computers or (better yet!) download it onto your own computer.
- Homework is due by 10:05am (five minutes into class) on the due date. Homework turned in more than five minutes after class begins on the due date will lose 10% of the possible points. Homework turned in the day after the due date will lose 20% of the possible points. Homework turned in two days or more after the due date will lose 30% of the possible points. Homework more than 10 days late will not receive credit.
- Homework solutions should not merely be "numbers in a box". Homework problems are chosen for several reasons, e.g., applications of methods presented in class, investigations of assumptions and concepts that relate particular methods to others, and examples to give a better idea of when certain methods apply better than others. Please include a *concise* but *thorough* description of your interpretation of numerical results.
- Students are allowed (and encouraged) to work together on homework problems but each student must write up and turn in her/his own copy of homework solutions.
- It is to be understood that project work will be done individually without collaboration with classmates or others.
- For each project, each student will receive a data set and related research questions. A written report outlining the work and summarizing the results will be required.