

Course Title: Spatial Epidemiology

Catalog Description: This course motivates the need for, and describes methods for, the analysis of spatially indexed epidemiological data. Four major topics will be covered: clustering and cluster detection, disease mapping, spatial regression, and an introduction to geographical information systems. Both point-references and spatially aggregated data will be considered.

Syllabus and Reading List: The availability of geographically indexed health, population and exposure data, and advances in computing, geographic information systems, and statistical methodology, have enabled the realistic investigation of spatial variation in disease risk. Each of the population, exposure and health data may have associated exact spatial and temporal information (point data), or be available as aggregated summaries (count data). The following specific topics, with analysis methods listed for each, will be covered:

Clustering and cluster detection:

- Autocorrelation statistics.
- K-functions.
- Scan statistics including the use of the SatScan package, method of Besag and Newell.

Disease mapping:

- Geostatistical smoothing models for point data.
- Kernel density estimation.
- Conditional and joint models for areal data.

Spatial regression:

- Problems with conventional analyses.
- Methods for acknowledgement of residual spatial dependence.

GIS:

- Background to GIS.
- How to draw maps in R.

Pre-requisites: Previous exposure to regression modeling, in particular some familiarity with log-linear or logistic modeling is desirable.

Evaluation: Via course project; final version to be completed by the end of the quarter, with an outline to be handed in approximately halfway through the quarter.

The use of R and WinBUGS packages for analysis will be described. It is envisaged that a teaching assistant, who is familiar with R, will be supplied by the Epidemiology department.

Reading list

Elliott, P., Wakefield, J., Best, N. and Briggs, D. (2000). *Spatial Epidemiology: Methods and Applications*, Oxford University Press.

Waller, L.A. and Gotway, C.A. (2004). *Applied Spatial Statistics for Public Health Data*, Wiley, New York.

Learning Objectives: At the end of the course the student will be able to describe the need for specialized methods for the analysis of spatial data, distinguish between different types of spatial data, and choose an appropriate analysis method.

Justification: This course will provide epidemiologists, statisticians and students from others with the tools to analyze data with a spatial component. In the Statistics Department a special topics class in Spatial Statistics is offered approximately every 2 years, but this has a much more theoretical flavor, and does not provide “hands-on” experience on the analysis of spatial data, and is not specific to epidemiological data.