Course Information

This course motivates the need for, and describes methods for, the analysis of spatially indexed epidemiological data. Major topics to be covered: clustering and cluster detection, disease mapping, spatial regression, methods for infectious disease data, small area estimation and an introduction to geographical information systems. Both point-references and spatially aggregated data will be considered. The use of R packages for analysis will be described.

Syllabus

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.

Disease mapping:

- Geostatistical smoothing models for point data, including prevalence mapping.
- Kernel density estimation.
- Conditional and joint models for areal (aggregate) data.
- Extension to space-time analysis.

Spatial regression:

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

Methods for infectious disease data:

- SIR and related models
- Approximate and exact inference procedures.

Small area estimation (domain estimation)

- Bayesian model-based approaches
- Incorporation of design weights.

GIS:

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

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.

Pre-requisites:

Previous exposure to regression modeling, some familiarity with log-linear or logistic modeling is desirable.

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.

Instructor Information

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