Topic: GIS and spatial information visualization and analysis

Rytokönen, MJP. (2004). Not All Maps Are Equal: GIS and Spatial Analysis in Epidemiology. *International Journal of Circumpolar Health*, 63(1): 9-24.

Presented by Laura Sheble for
INLS 706: Bioinformatics Review
2006-10-30

GIS is a tool for linking and visualizing geographically referenced information using topological (geographical) and attribute data sources. GIS has been used in epidemiology for decision making, planning, disease management and dissemination of information. Common applications of GIS in epidemiology include mapping (1) regional variations in health problems, and (2) environmental risks and use of health services. GIS technologies have been used to reveal abnormal patterns and for surveillance and monitoring of vector-borne and waterborne diseases.

GIS is important to the environmental health field in that it can be used to quantify environmental hazards, thus influencing public health policy and practice. For example, it has been used to model exposure to electromagnetic fields. GIS can also be used to predict traffic accidents and model traffic accident risk, which can also have a direct impact on policy and planning. In Finland, GIS has been used in health services research to detect small-area variation in mortality in an urban area and with mapping studies of non-communicable diseases. The aims and purposes of disease mapping are to: (1) Describe spatial variation in disease incidence for the formulation of etiological hypotheses; (2) identify areas of unusually high risk in order to take preventative action; and (3) provide a reliable map of disease risk in a given region to improve resource allocation and risk assessment. Examples of GIS data used in epidemiology include spatial data, health status of individuals, and environmental data.

In spatial analysis, there is a trade off between specificity and precision, which are determined by the scale of analysis and level of data aggregation. Accordingly, the smaller the area, the more specific and relevant are the findings to the local population. At the same time, when data is analyzed at a detailed scale, there is greater imprecision and potential for bias due to ‘scale effect’, the emergence of different spatial patterns when data is viewed at different spatial levels.

How data should be aggregated also poses challenges. On the one hand, political or administrative boundaries are useful for policy-related issues, communicating findings, and is often inline with human behavior in everyday environments. From a data standpoint, however, a smaller, 1 km by 1 km grid is often best for analysis – though it is expensive to collect data on this scale and there are some potential privacy individuals due to the possibility of identifying individual persons with very fine-grained spatial resolutions.

Several types of maps can be used to visualize GIS data, including dot, Choropleth and flow maps.

In our discussion, we focused on the how we might use GIS and what types of information would be useful to map with a GIS application. We also noted that it would have been helpful for the author to illustrate the different types of maps discussed. The lack of visual examples made it difficult to comprehend the impact of GIS mappings as well. GIS is a powerful tool that can be used to visualize information at different levels of abstraction and during different phases of information exploration. Though the author treated geographical data as a unique type of data, during data analysis, it is important to note that GIS data should be treated like any other data type. We also spent time looking at and discussing online examples of GIS data presentations and a Google Earth data set.