



**What You Can Do With GIS
(Geographic Information System Software)
in Health Services¹**

Jeanne G. Gobalet
Lapkoff & Gobalet Demographic Research, Inc.
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Abstract

GIS (geographic information system) software has various health care applications. It can be used to describe and analyze geographical distributions of diseases and persons at risk of developing diseases. It can also be used to target prevention efforts and to locate treatment sites. The software allows data to be visualized, and can be used in analyses of geographical and longitudinal variation.

GIS maps show the spatial element in disease patterns. This approach improves on non-spatial representations because the proximity or remoteness of geographical units is taken into account. The method does not treat each geographical unit in isolation, but displays it in relation to adjacent areas.

Epidemiologists, public health agencies, and health care providers study the distribution of cases of reportable (and other) diseases. GIS software can be used to combine data from various sources and arrange the units of analysis (pieces of geography) in their true spatial relationships. As a result, the GIS can be very helpful in determining concentrations of persons who have or are at risk of developing specific diseases, especially if data are available for small geographical areas.

For-profit health care providers can use GIS to target markets and locate facilities. When predisposing conditions are known, including social and demographic characteristics like age, gender, race/ethnicity, socioeconomic status, and life style factors, these data can be superimposed on each other in GIS maps. The maps will show at-risk populations and help pinpoint appropriate sites for clinics. Addresses of competing clinics can be address matched, geocoded, and included in analyses.

Finally, when public health officials wish to target areas for services, mount educational campaigns, and decide where to locate clinics, GIS software can be used to combine health and demographic data and to select promising areas.

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Presentation Outline

A. Overview of GIS and Thematic Mapping

1. GIS Technology ("Science")

- geocoding: assigning latitude and longitude coordinates
- TIGER: Topologically Integrated Geographic Encoding and Referencing
- relational databases linked to geographic points, lines, or regions
- data layers
- spatial analysis
- software, hardware options

2. Current applications of GIS (general): data visualization, thematic mapping of resource utilization, planning, targeting markets, site location.... GIS is useful for:

- thematic mapping of one or more variables
- constructing choropleth (ranged), dot density, and proportional maps
- data conversion, aggregation, and disaggregation
- address matching and pin mapping
- ring analysis and corridor analysis for targeting markets (buffers)

B. Map Design Issues ("Art and Technique")

1. Which type of map: choropleth, dot distribution, proportional, or a combination?
2. Which geographical unit(s) of analysis? Census tracts, ZIP codes, cities, counties, states...?
3. Map numbers, rates, or both?
4. Use color? How many colors? Are shades distinguishable?
5. How complex? Is it possible to map two variables simultaneously?
6. Include a legend, scale, title...?

C. Uses of GIS in Health Services

1. Illustrating the spatial distribution of health-related phenomena

- *Map of states' 1992 crude birth rates*
- *Map of births to mothers under age 18, 1990-92, Santa Clara County, California, Human Service Areas*

2. Identifying patterns of distribution/association (bivariate maps)
 - *Data table and maps of California counties' breast cancer rates and urbanization*
3. Epidemiological research
 - *Dot distribution map of 108 Reported Cases (geocoding and mapping reported cases of a disease)*
 - *Map of AIDS death rates in California counties, 1989-90*
4. Targeting key populations (potential clients) for site location
 - *Maps from dermatological laser clinic location project: affluent white households*
 - *Maps of Southeast Asian target population and proposed site using buffers (ring and corridor analysis)*

References

- Campbell, John. *Map Use and Analysis*, Second Edition. Dubuque, Iowa: Wm. C. Brown Publishers, 1993. (Especially Chapter 20, "Geographic Information Systems")
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- Monmonier, Mark. *How to Lie with Maps*. Chicago, Ill.: The University of Chicago Press, 1991.
- Plane, David A. and Peter A. Rogerson. *The Geographical Analysis of Population*. New York, N.Y.: John Wiley & Sons, Inc., 1994. (Especially Chapter 11, "Demographic and Geographic Information Systems for Population Analysis")