Using Spatial Analysis to Improve Health Care Services and Delivery at Baystate Health

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Springfield, MA

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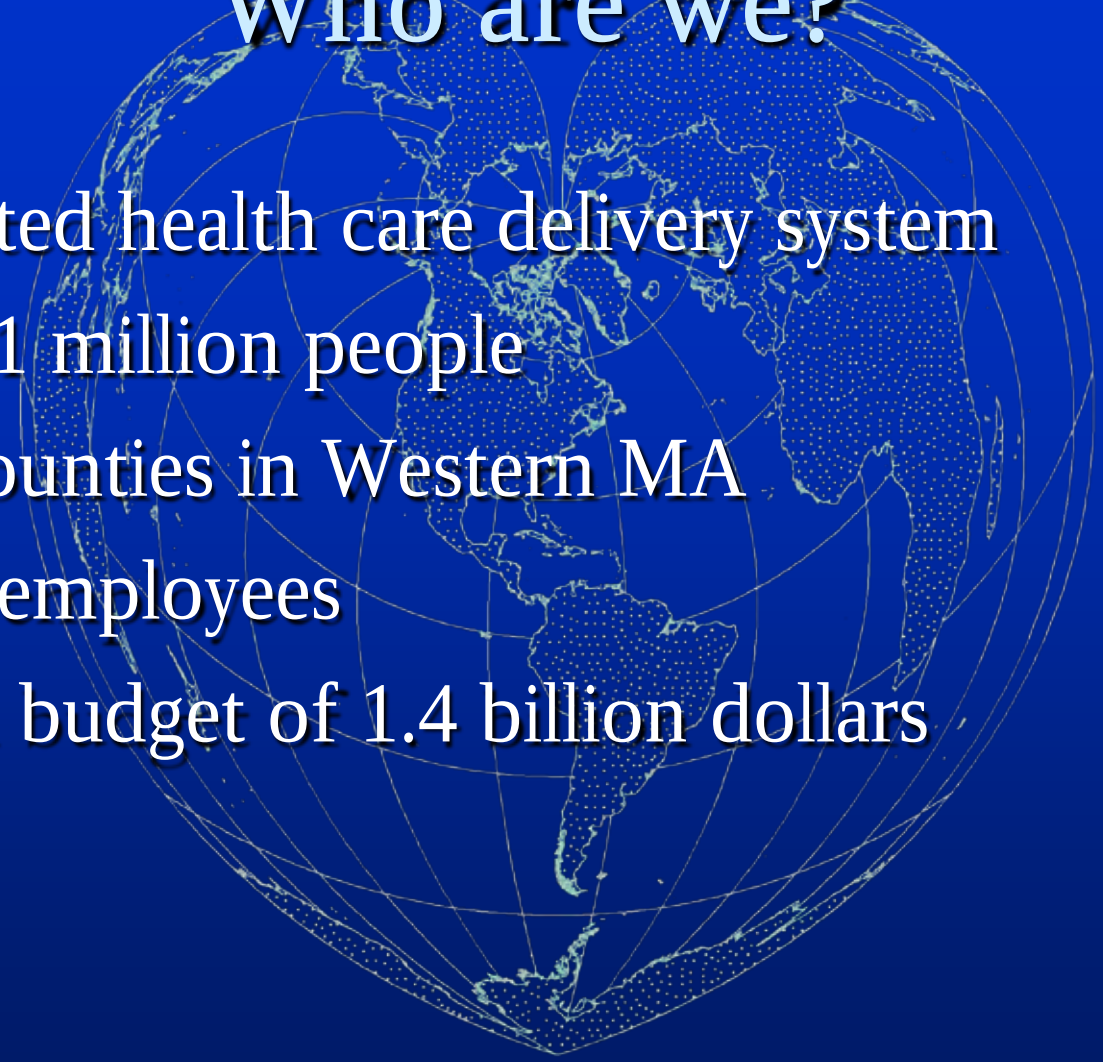
Amherst, MA
May 15, 2013

Baystate Health

Who are we?

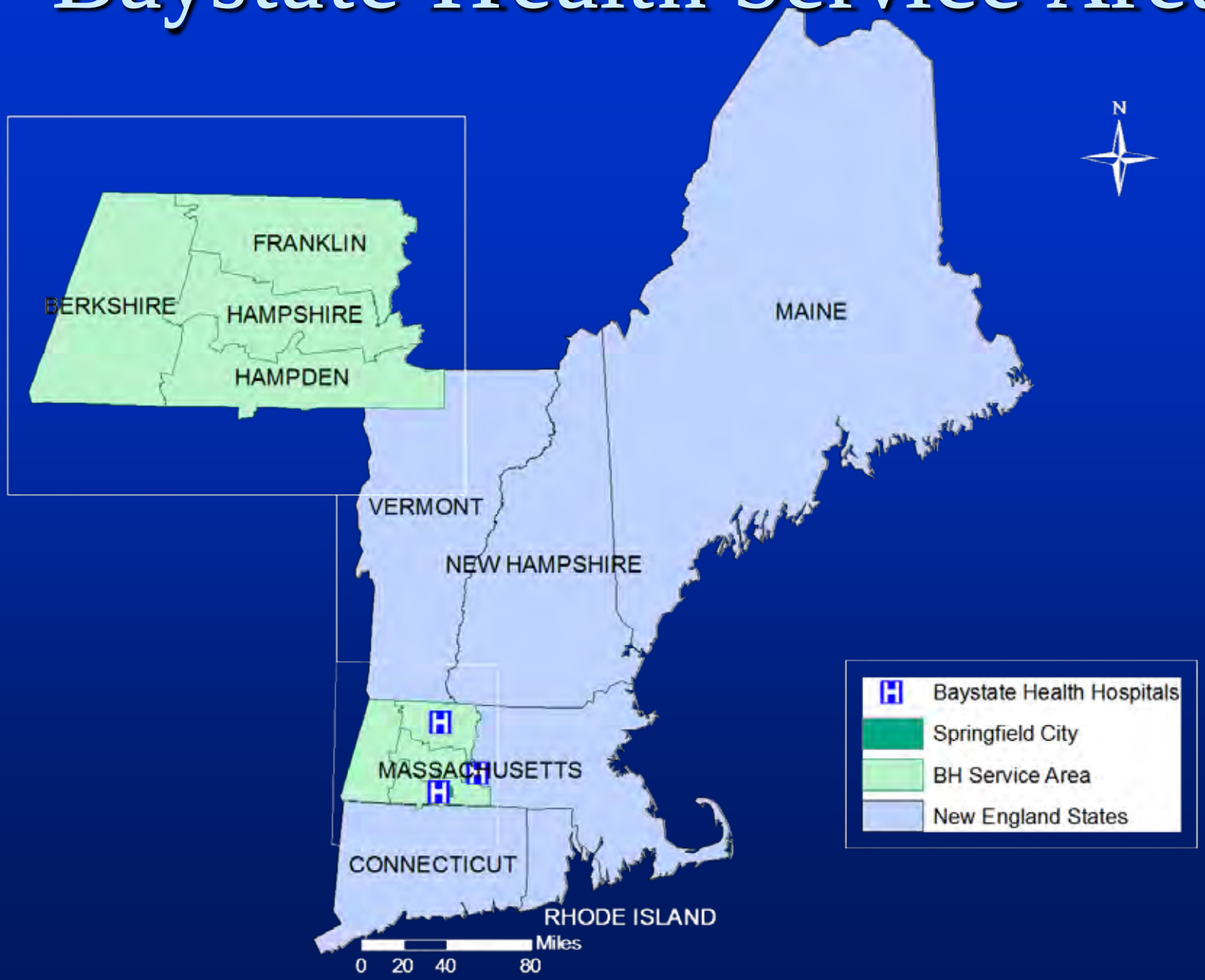


- Integrated health care delivery system
- Serves 1 million people
- Four counties in Western MA
- 10,000 employees
- Annual budget of 1.4 billion dollars

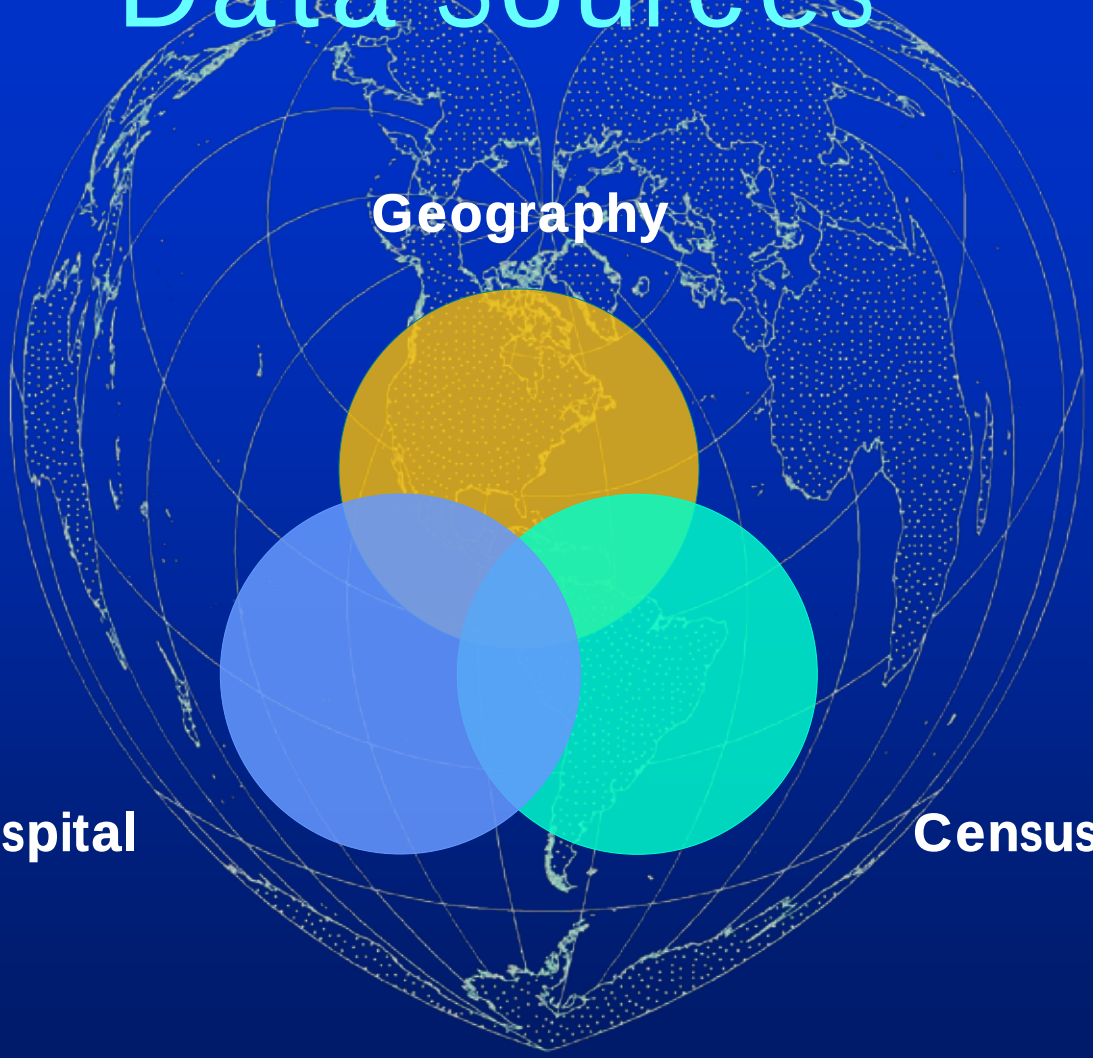
Who are we?

- 3 hospitals
- Outpatient clinics
- Comprehensive cancer care center
- Neuro-diagnostics / sleep center
- VNA and hospice
- Diagnostic labs and radiology facilities
- Respiratory / infusion facilities / services
- Major private practice organization
- For-profit HMO

Baystate Health Service Area



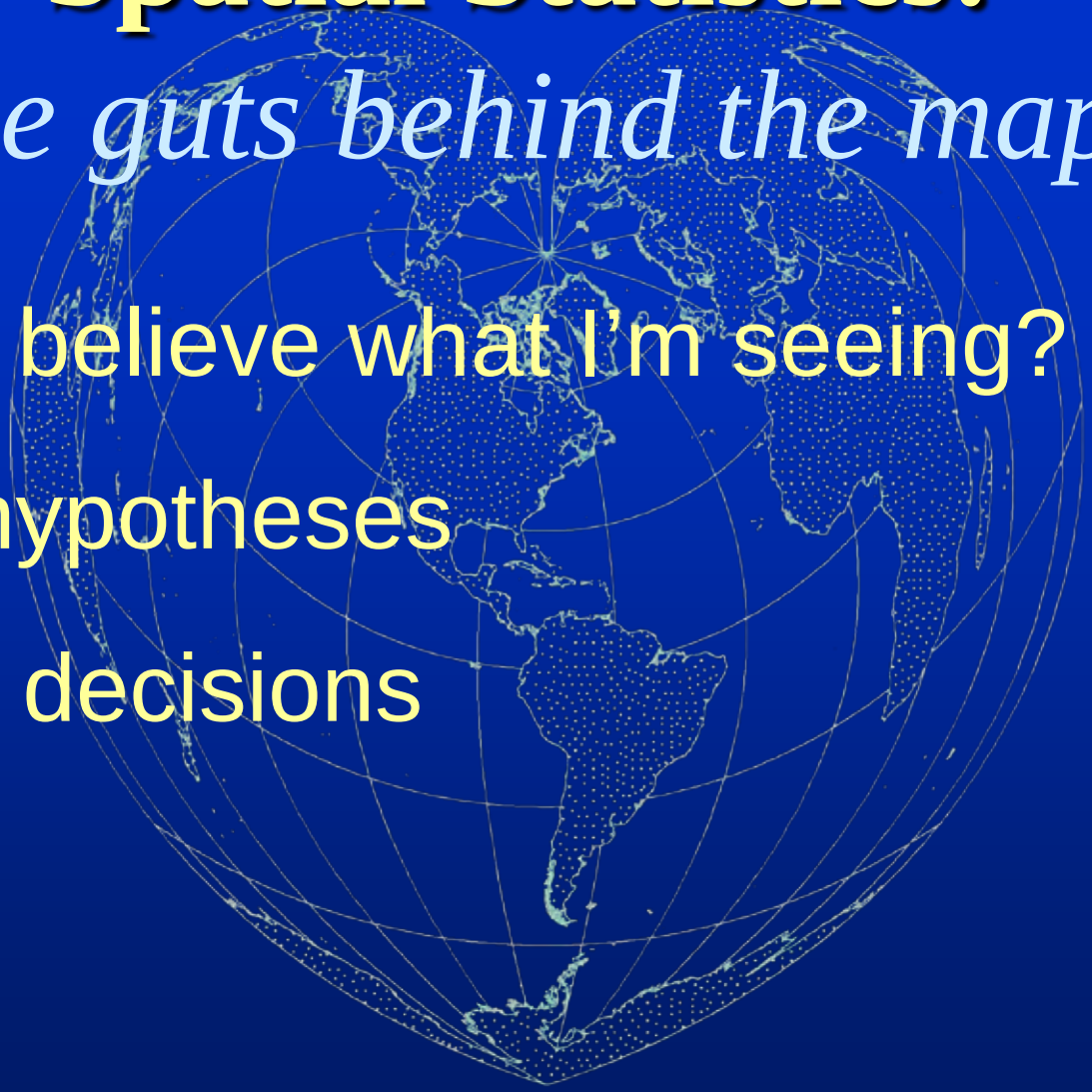
Data Sources



GIS mapping allows
us to visualize
how we are providing healthcare
services and identify areas of
need for services

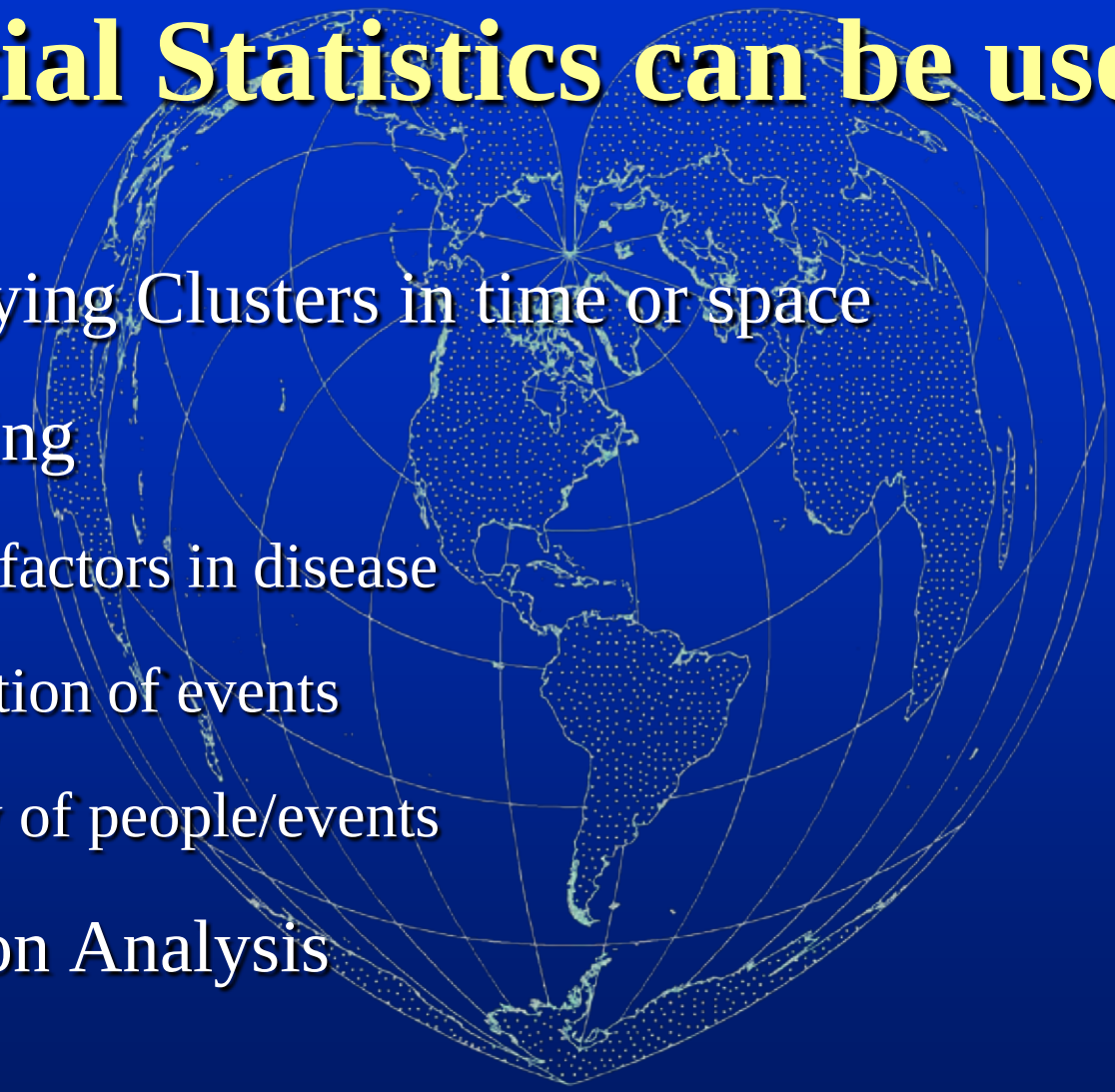
Spatial Statistics:

The guts behind the maps



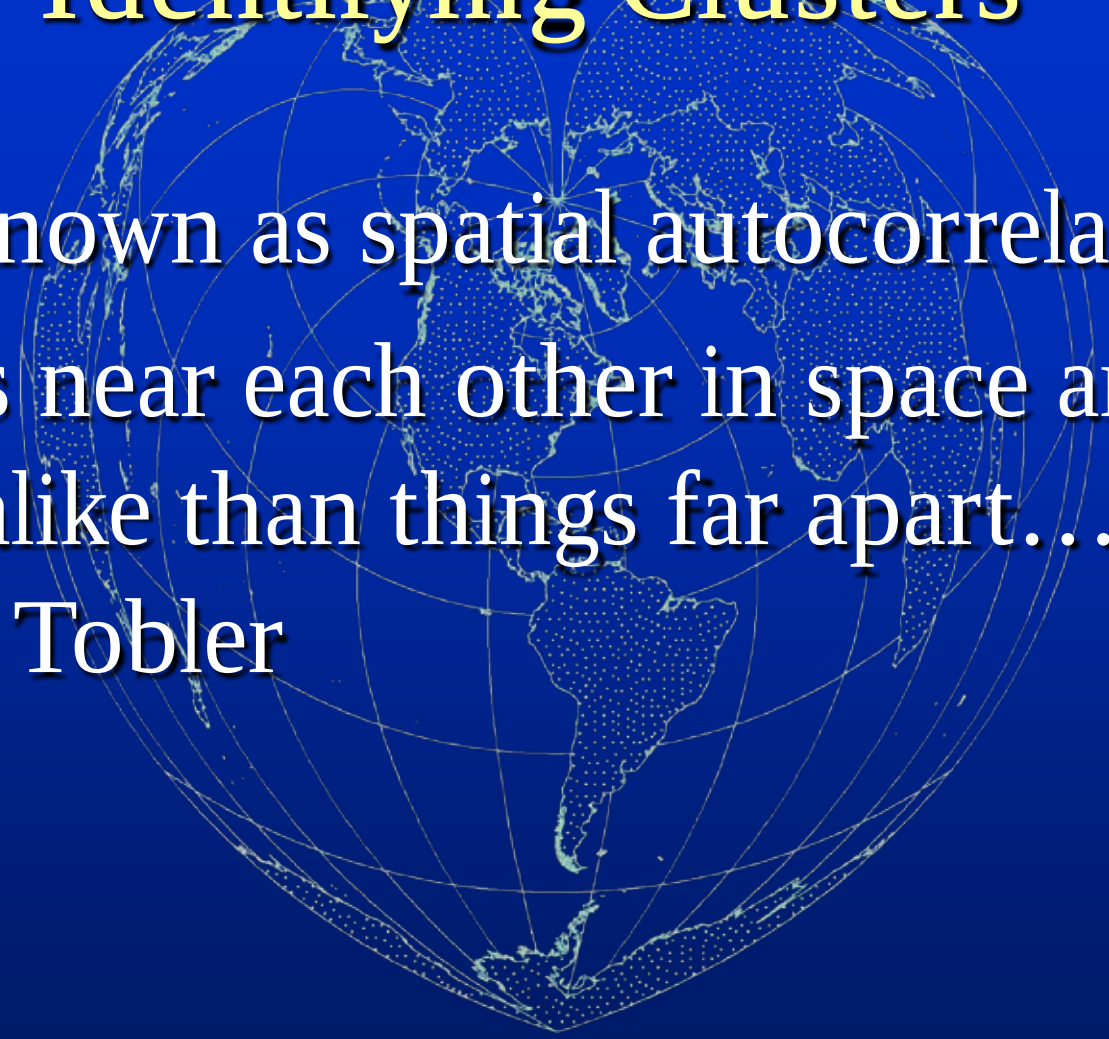
- Can I believe what I'm seeing?
- Test hypotheses
- Make decisions

Spatial Statistics can be used for



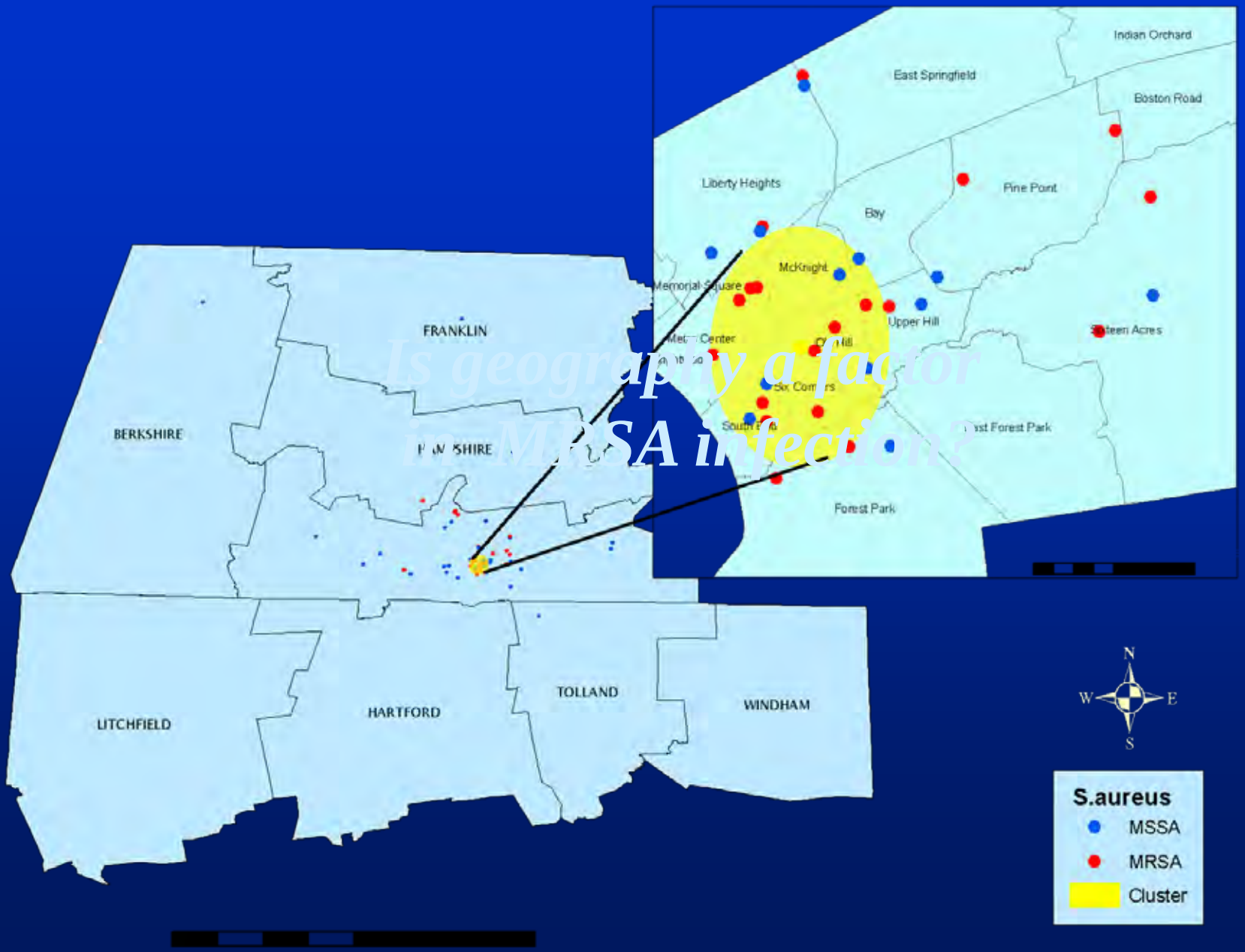
- Identifying Clusters in time or space
- Modeling
  - q risk factors in disease
  - q location of events
  - q flow of people/events
- Decision Analysis

Identifying Clusters



- Also known as spatial autocorrelation
- Things near each other in space are more alike than things far apart… Waldo Tobler

Cluster Analysis



Is geography a factor in MRSA infection?

Cluster Analysis

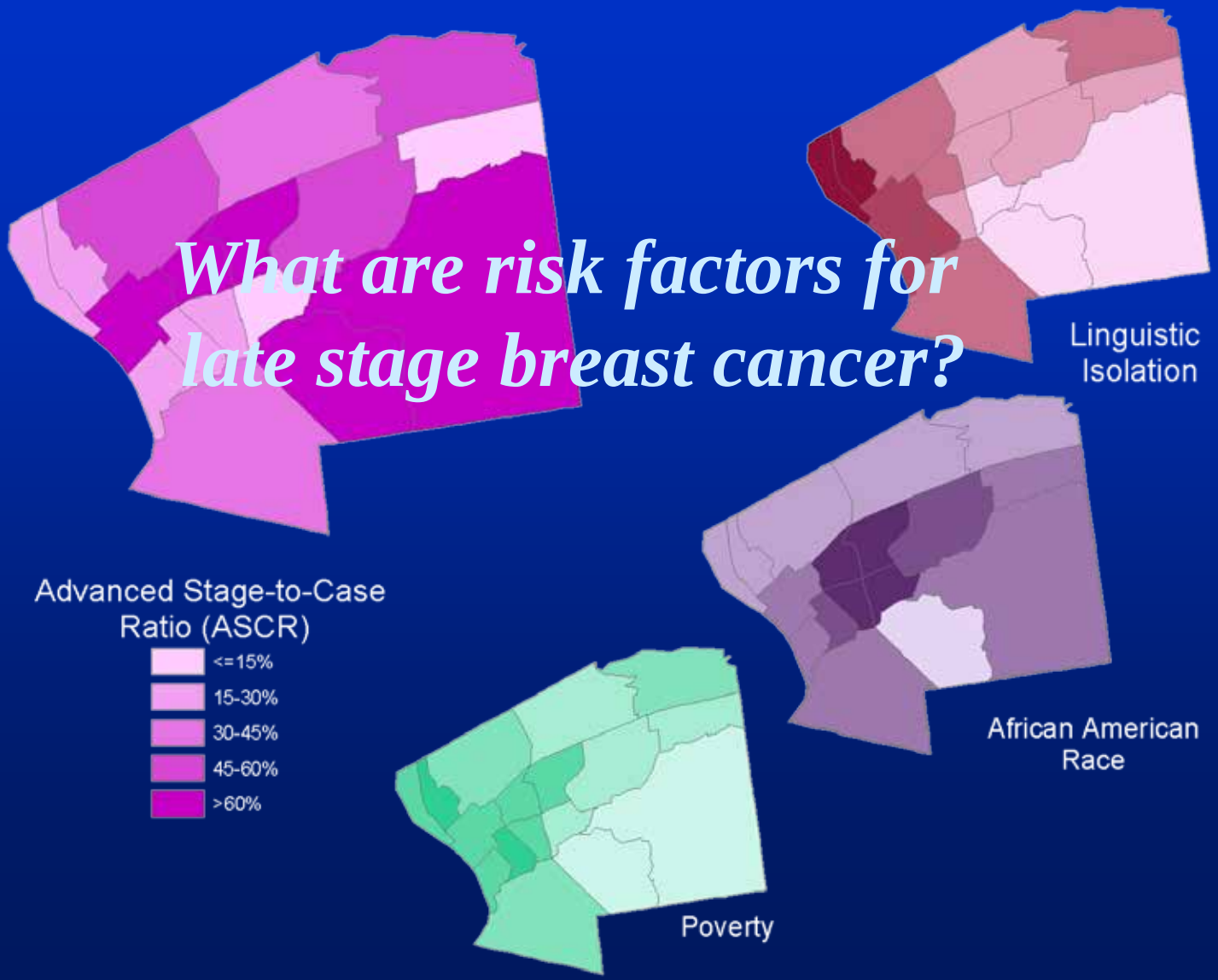
Is there coordinated gene expression?

Genes act in a coordinated fashion based on their spatial organization

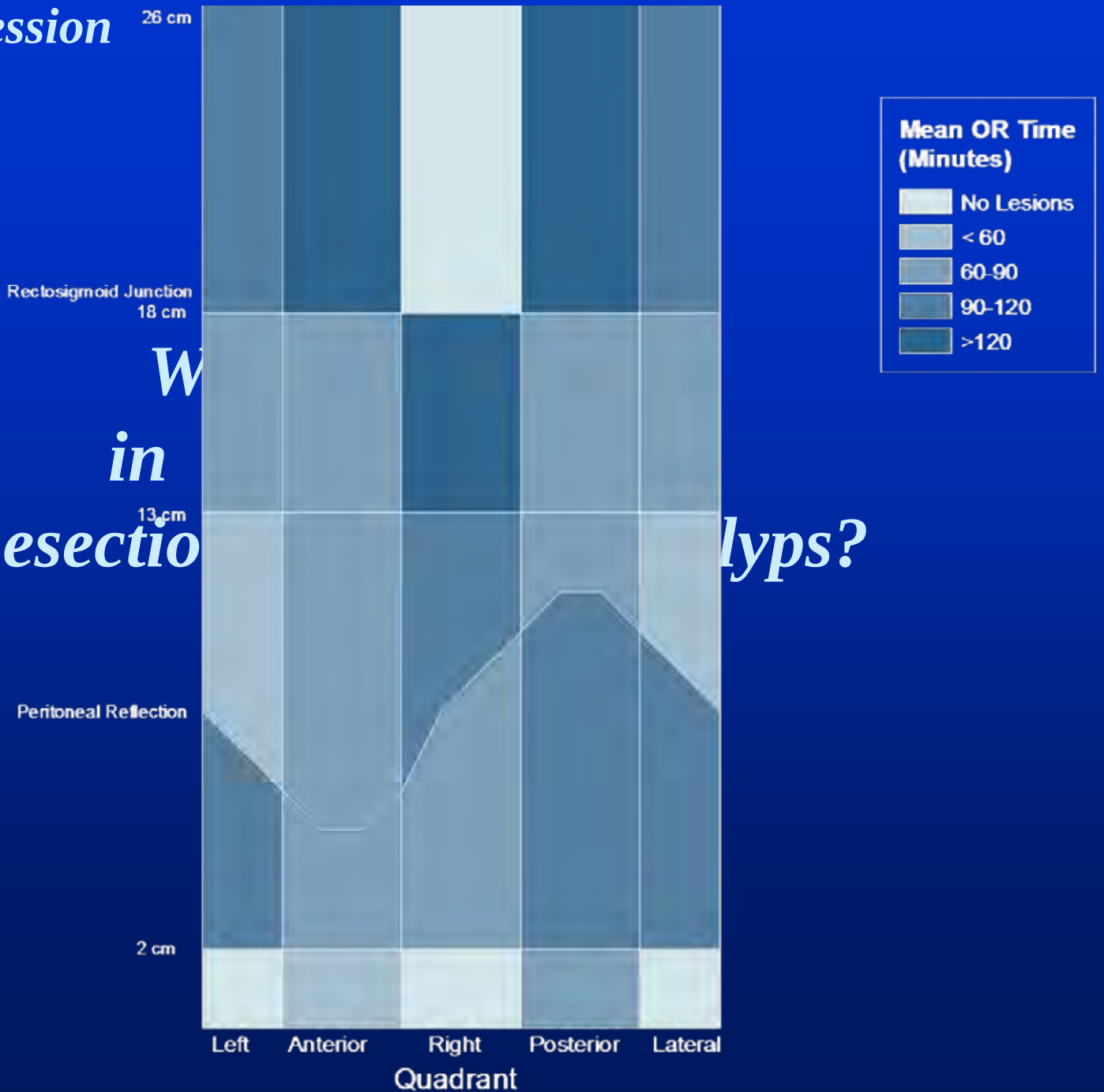
Modeling

- Identify factors in disease development or treatment outcome
- Predict location of events
- Analyze movement of people and events

Risk modeling: Spatial Regression



Spatial Regression



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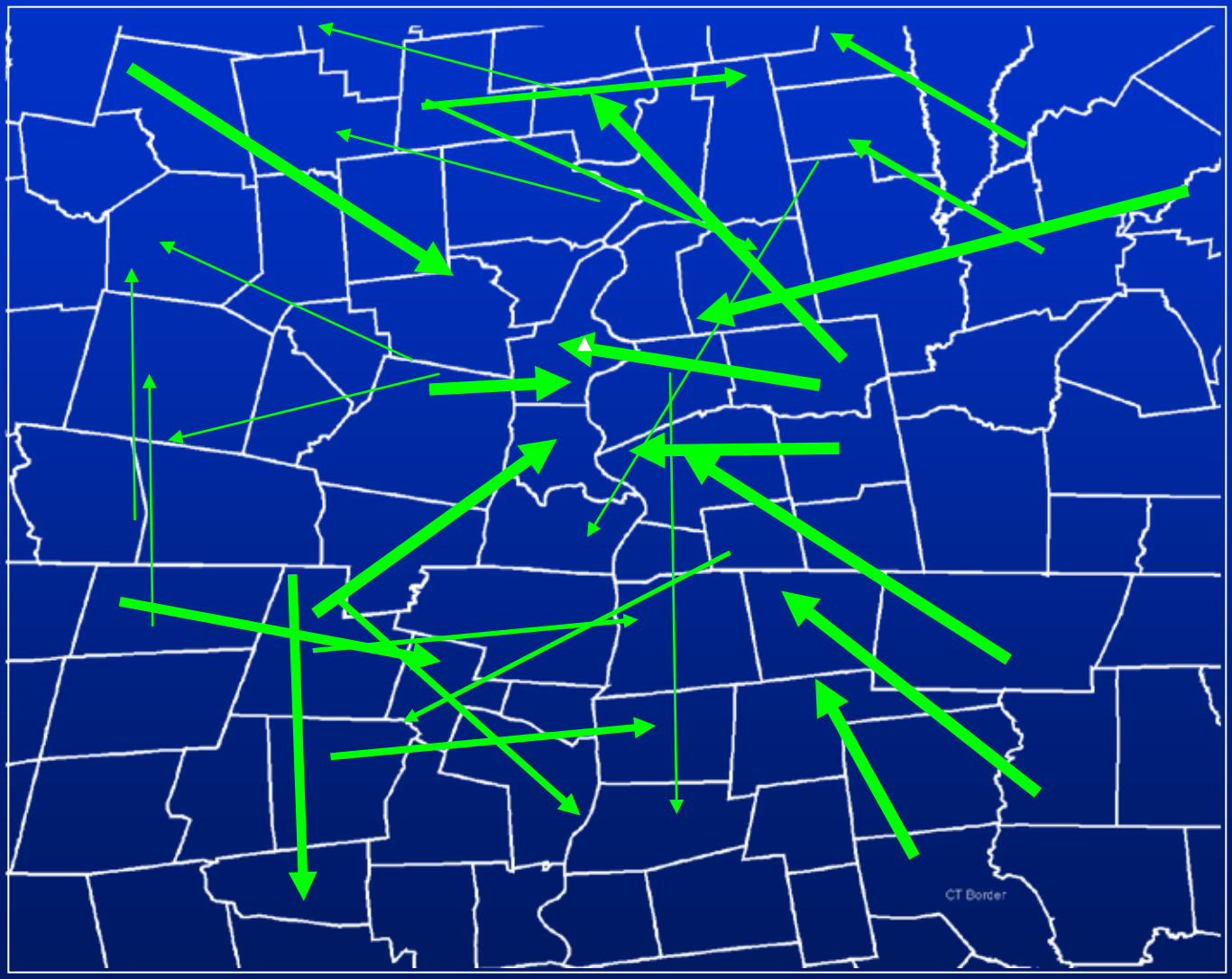
Resectio *lyps?*

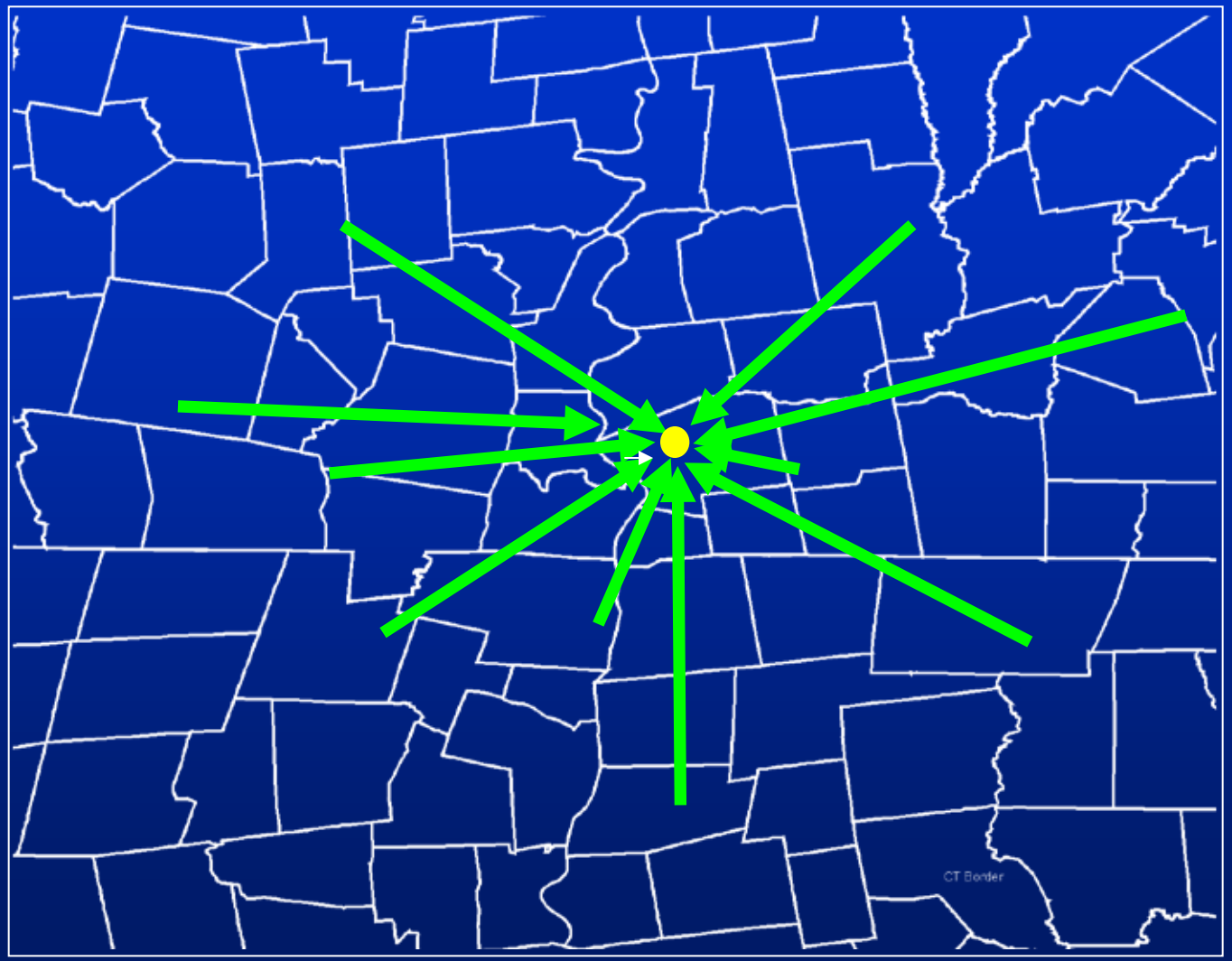
Modeling Flow

The movement of people, events, goods or services from one location to another.

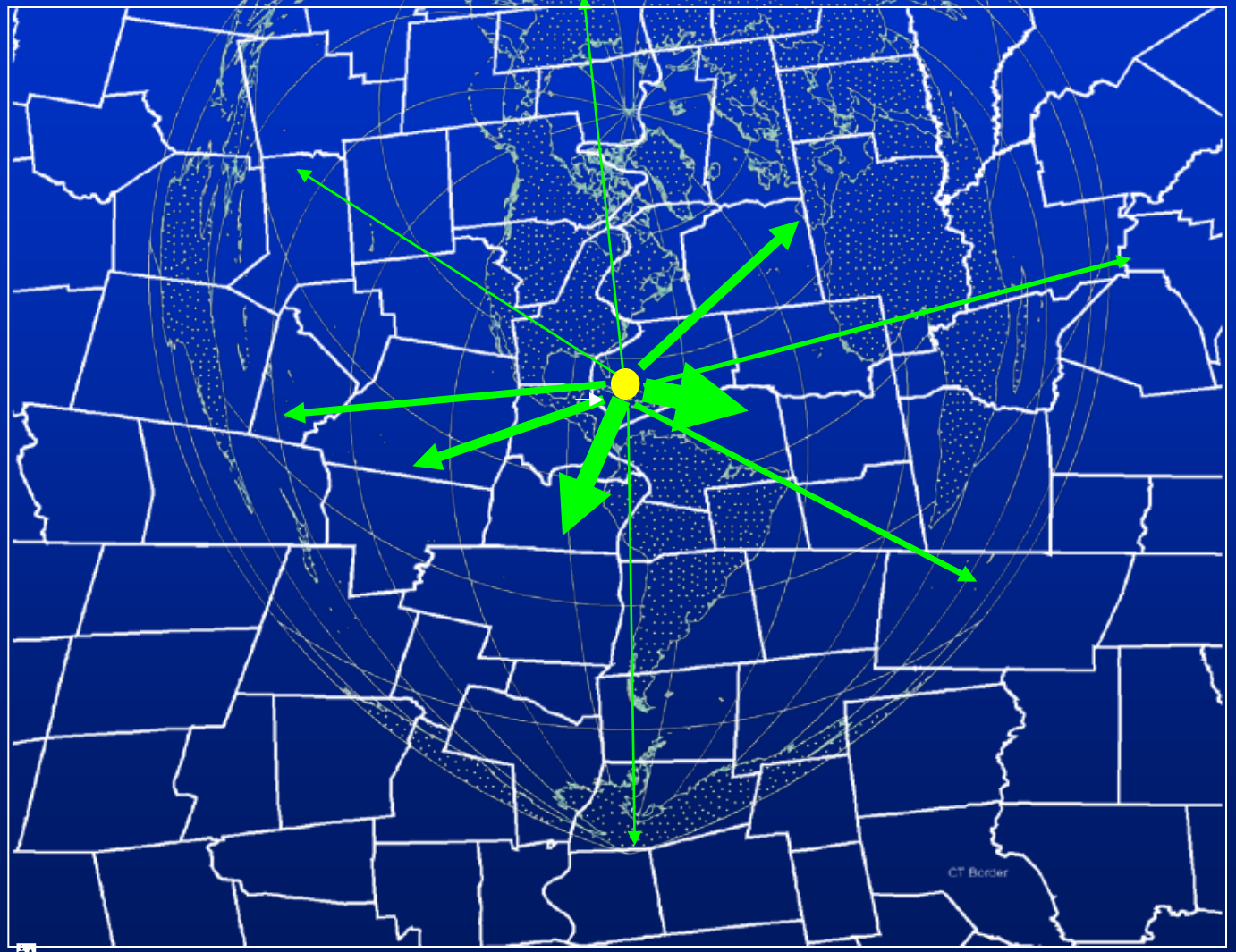
Many-to-Many



Modeling Flow



One-to-Many



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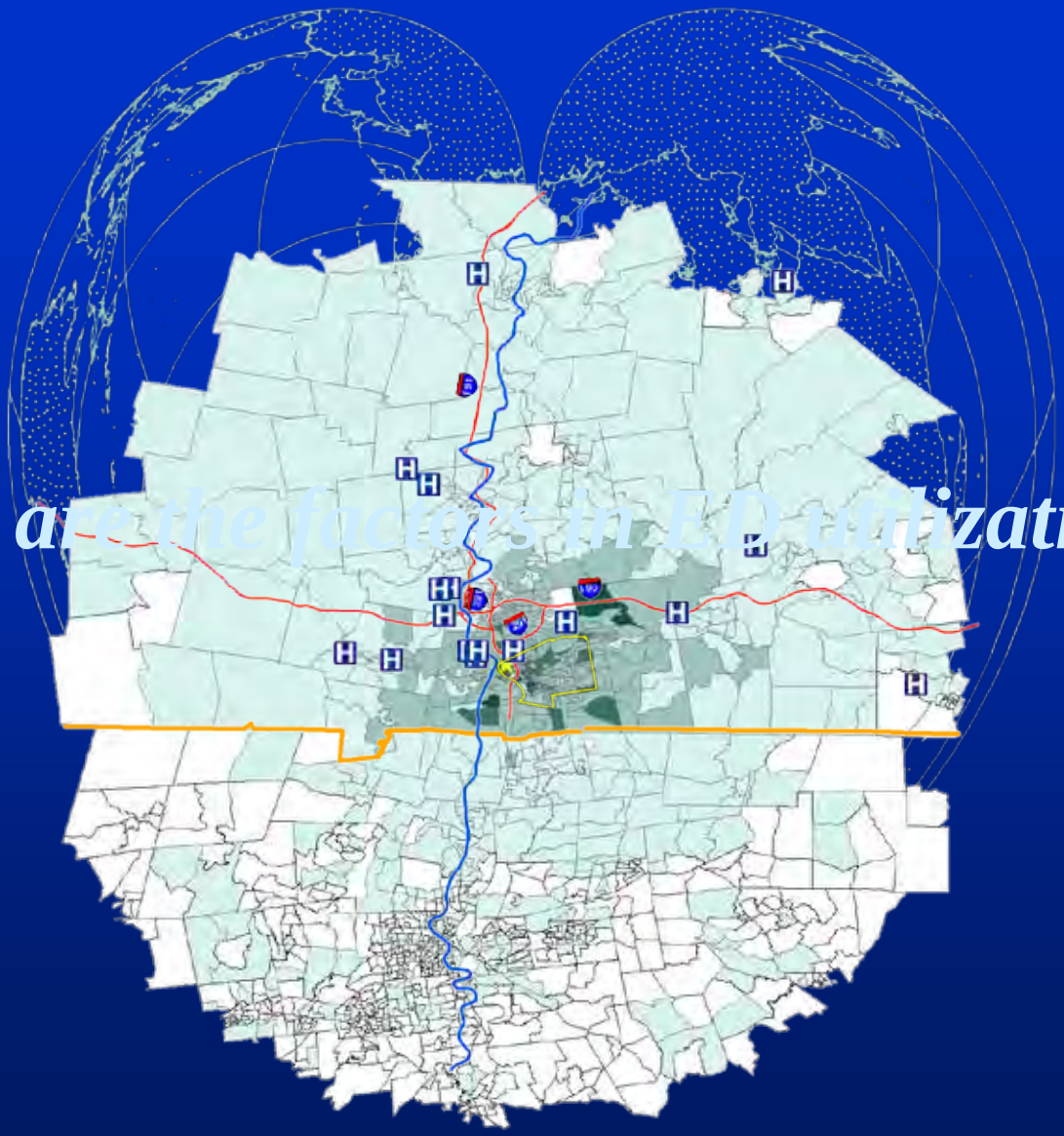
Modeling Flow

We can model the pattern of flow between a series of origins and destinations in terms of demands at the origins, attractiveness of the destinations, and distance between the two (geographical accessibility).

The Gravity Model:

- Size of Origin (Demand)
- Size of Destination (Attractiveness)
- Distance (Accessibility)

Modeling Flow



What are the factors in E.D. utilization

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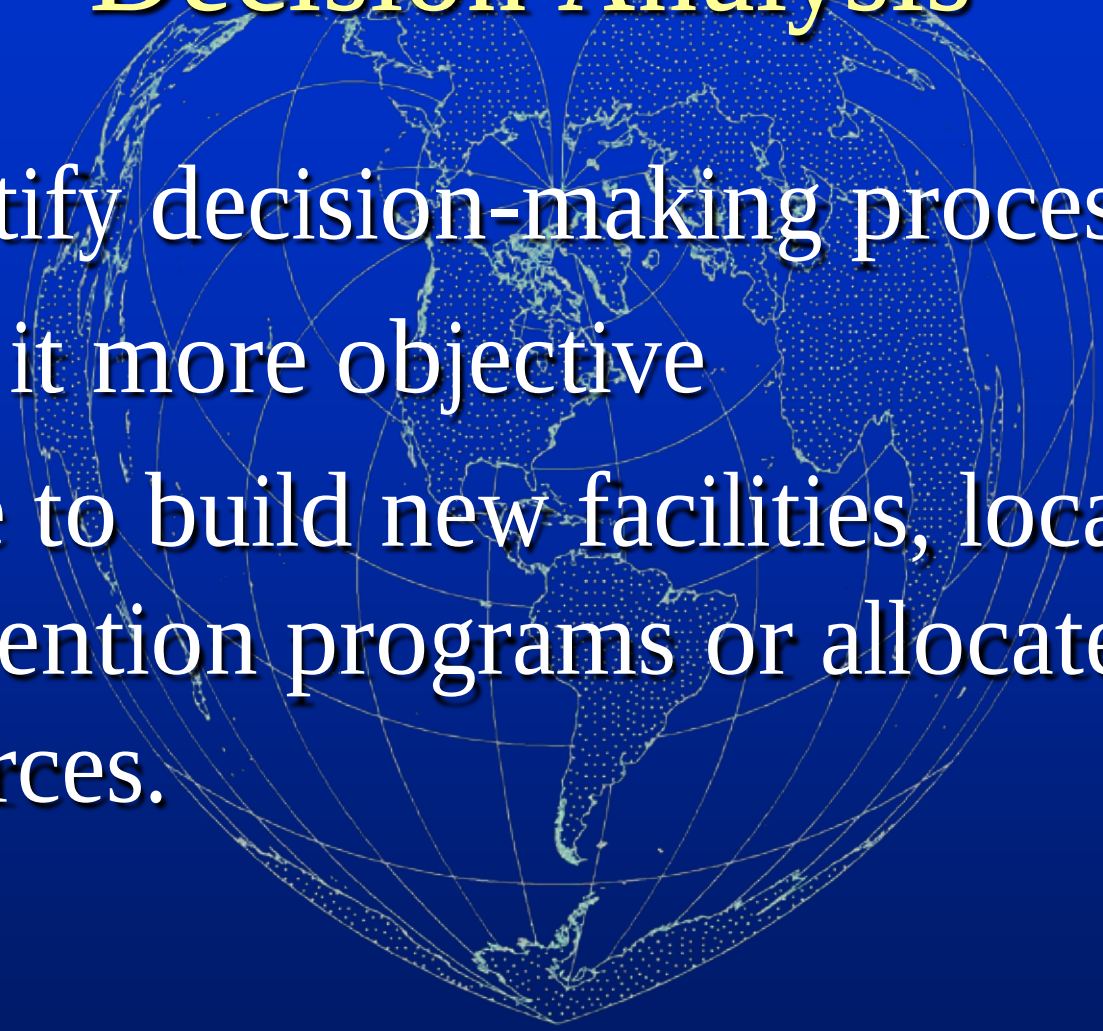
Modeling Flow

Factors in ED Utilization

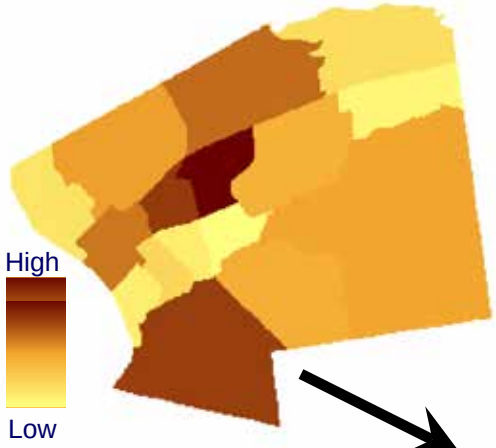
- Size of Origin (Demand)
  - Total population
- Size of Destination (Attractiveness)
- Distance (Accessibility)
  - Distance from BMC
- Barriers
  - West of River
  - In Connecticut
  - Within 1 mile of Competing ED
  - Within Springfield

Decision Analysis

- Quantify decision-making process
- Make it more objective
- where to build new facilities, locate intervention programs or allocate resources.

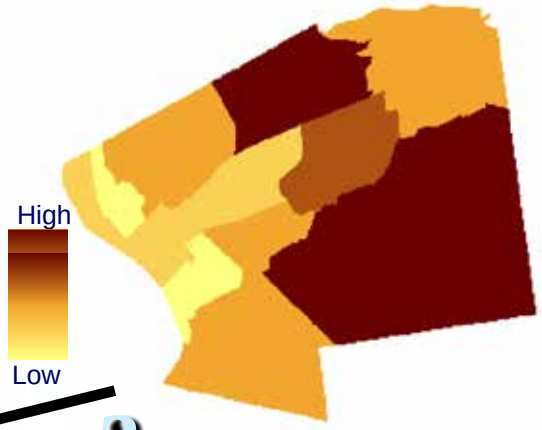


Decision Analysis

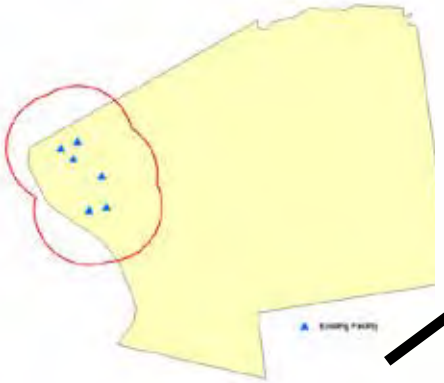


high LSBCA

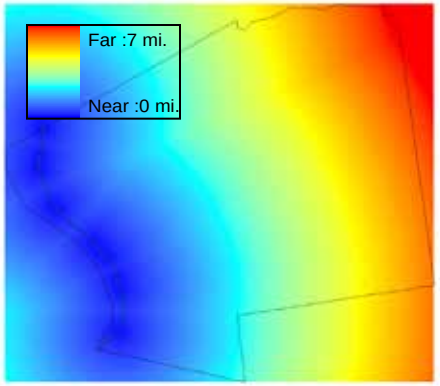
Suitability Ranking



low income

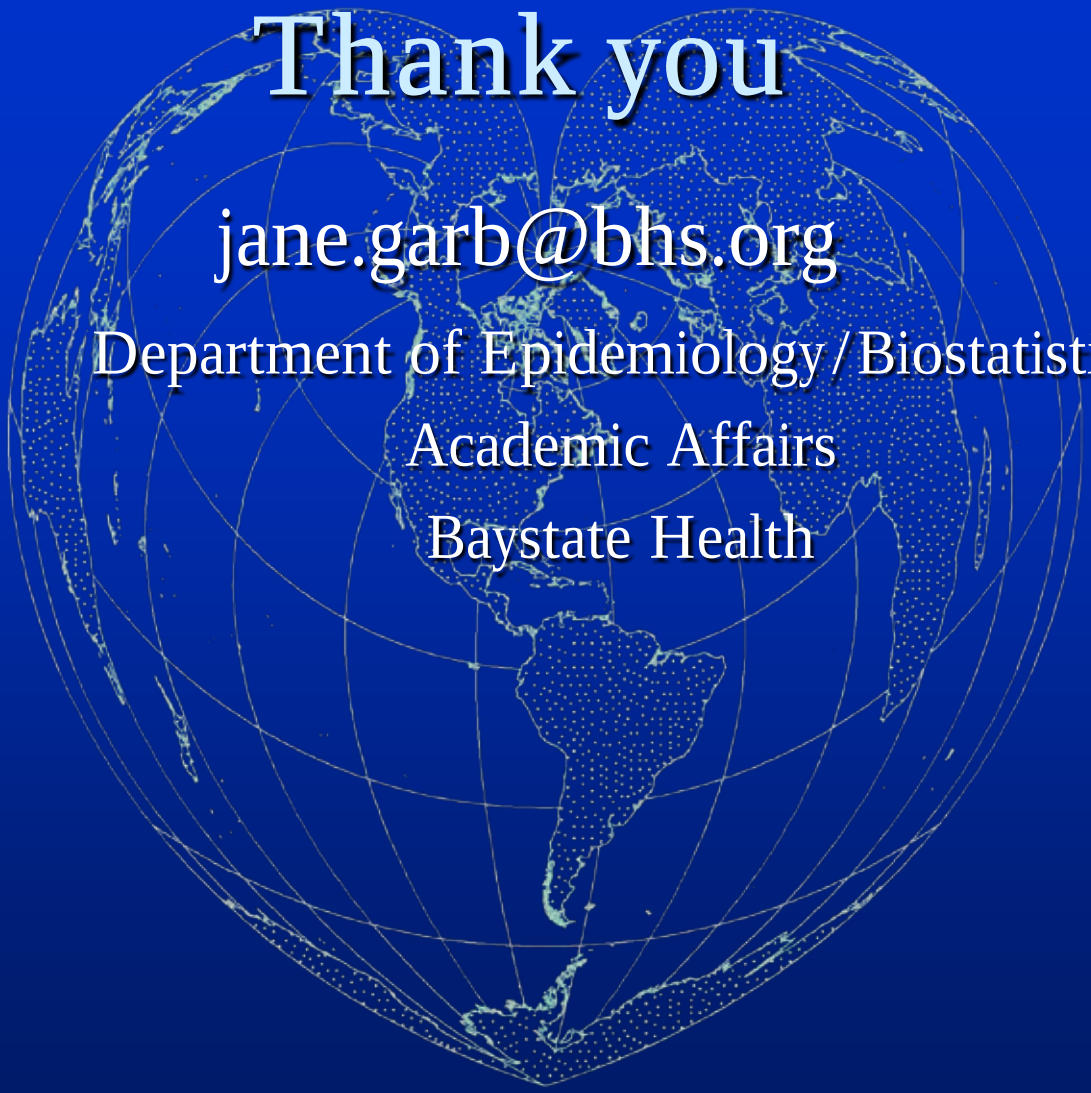


> 2 miles from existing facility



> Distance from I-91

Thank you



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Department of Epidemiology / Biostatistics

Academic Affairs

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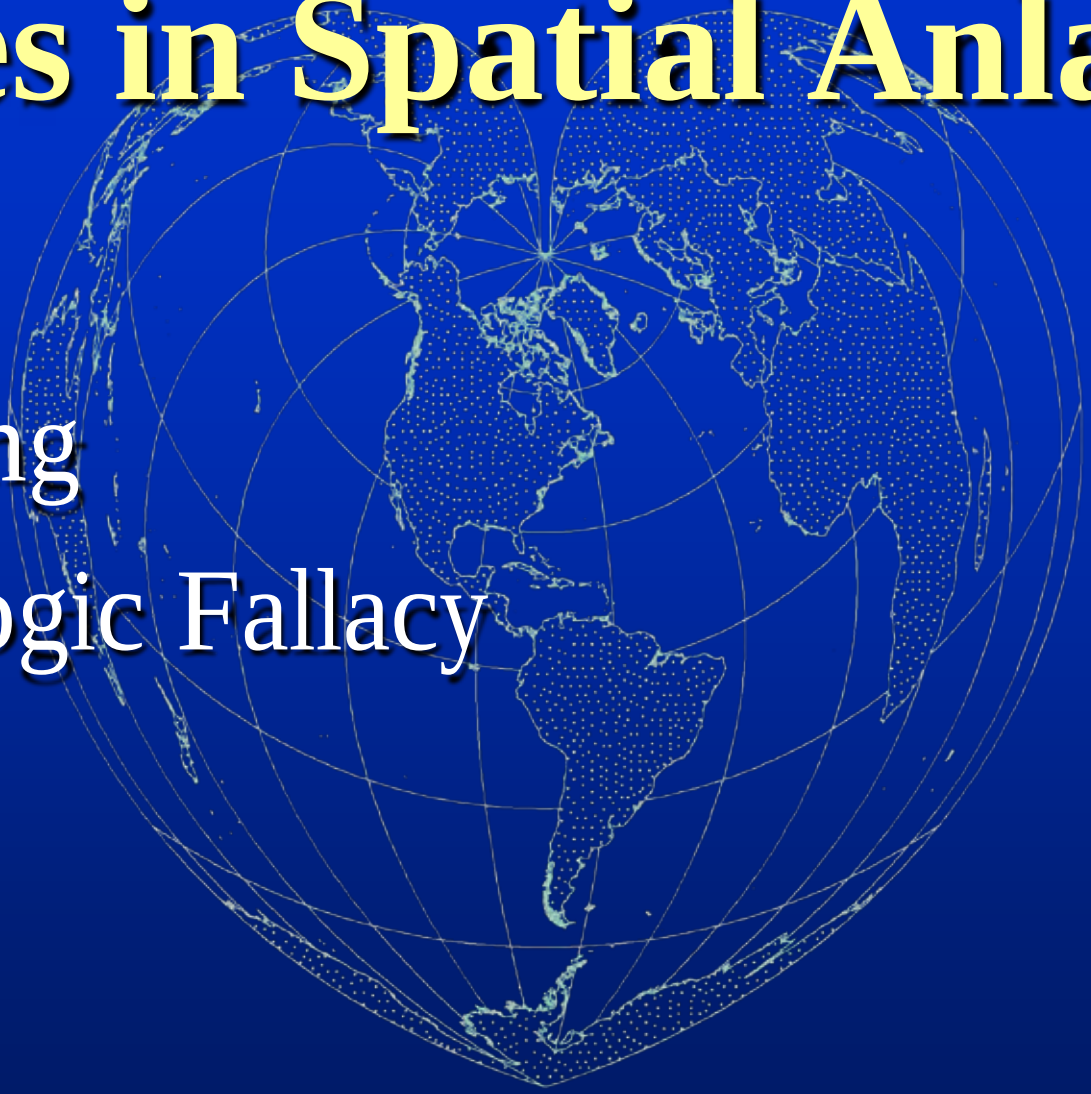
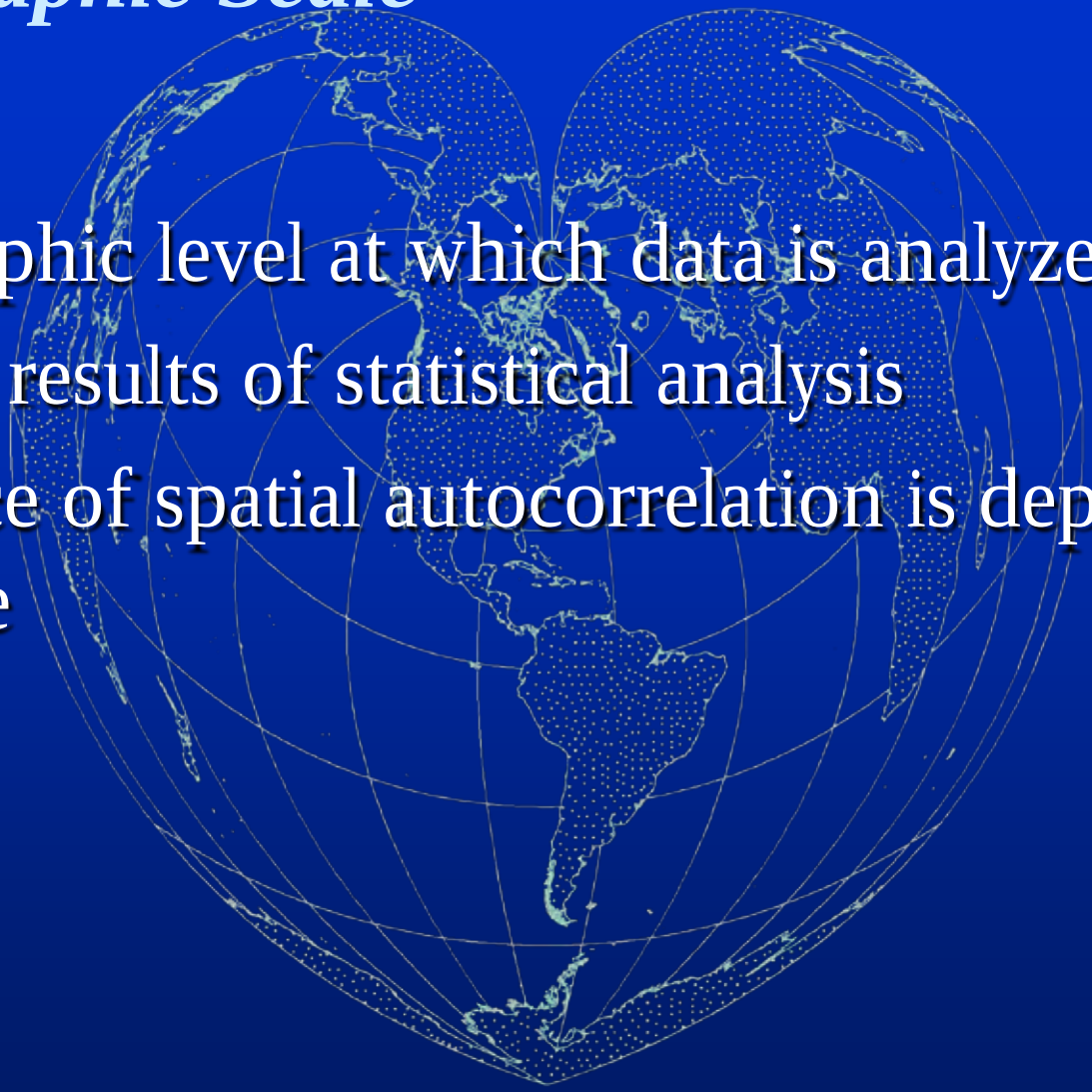
Issues in Spatial Anlaysis



- Scale
- Zoning
- Ecologic Fallacy

Geographic Scale



- Geographic level at which data is analyzed
- Affects results of statistical analysis
- Presence of spatial autocorrelation is dependent on scale

Geographic Zoning

Springfield Tracts
and Neighborhoods

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Ecologic Fallacy

- Problem with aggregate data
- Statements made about groups do not necessarily apply to individuals

Questions??????

Hospital Uses of Spatial Statists

- Direct Patient Care
- Benchmarking outcomes
- Research
- Prevention/Intervention
- Resource Allocation
- Strategic Planning
- Disaster Planning, Preparedness, Response

Outline

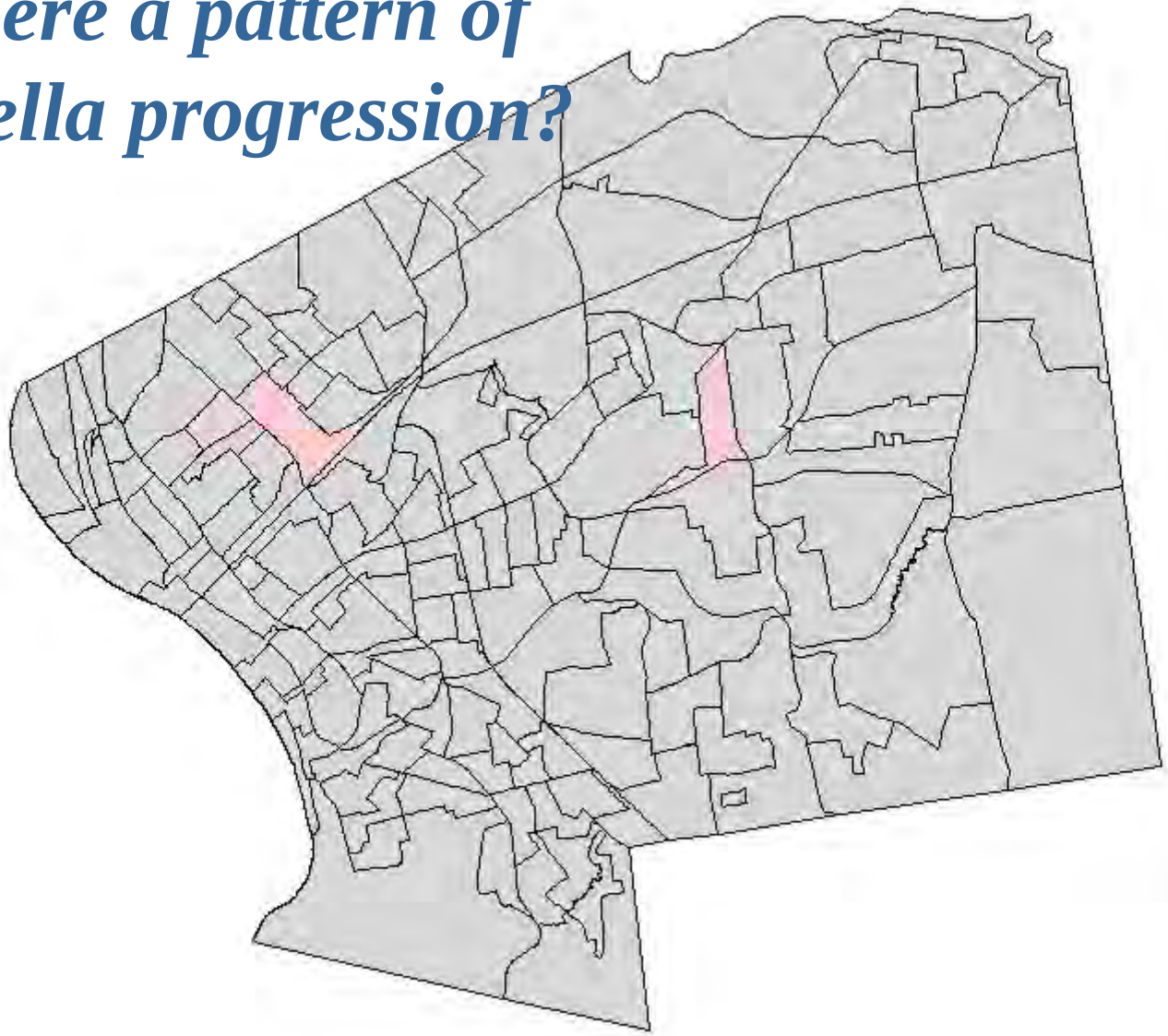
- Data sources
- Spatial analysis Applications
- Examples
- Issues
- Tools

Spatial Regression

Factor	T-test	Significance
Median Household Income	-4.6563	0.0006
Linguistic Isolation	3.7255	0.0029
Hispanic	2.2748	0.0421

Temporal Analysis

Is there a pattern of Shigella progression?

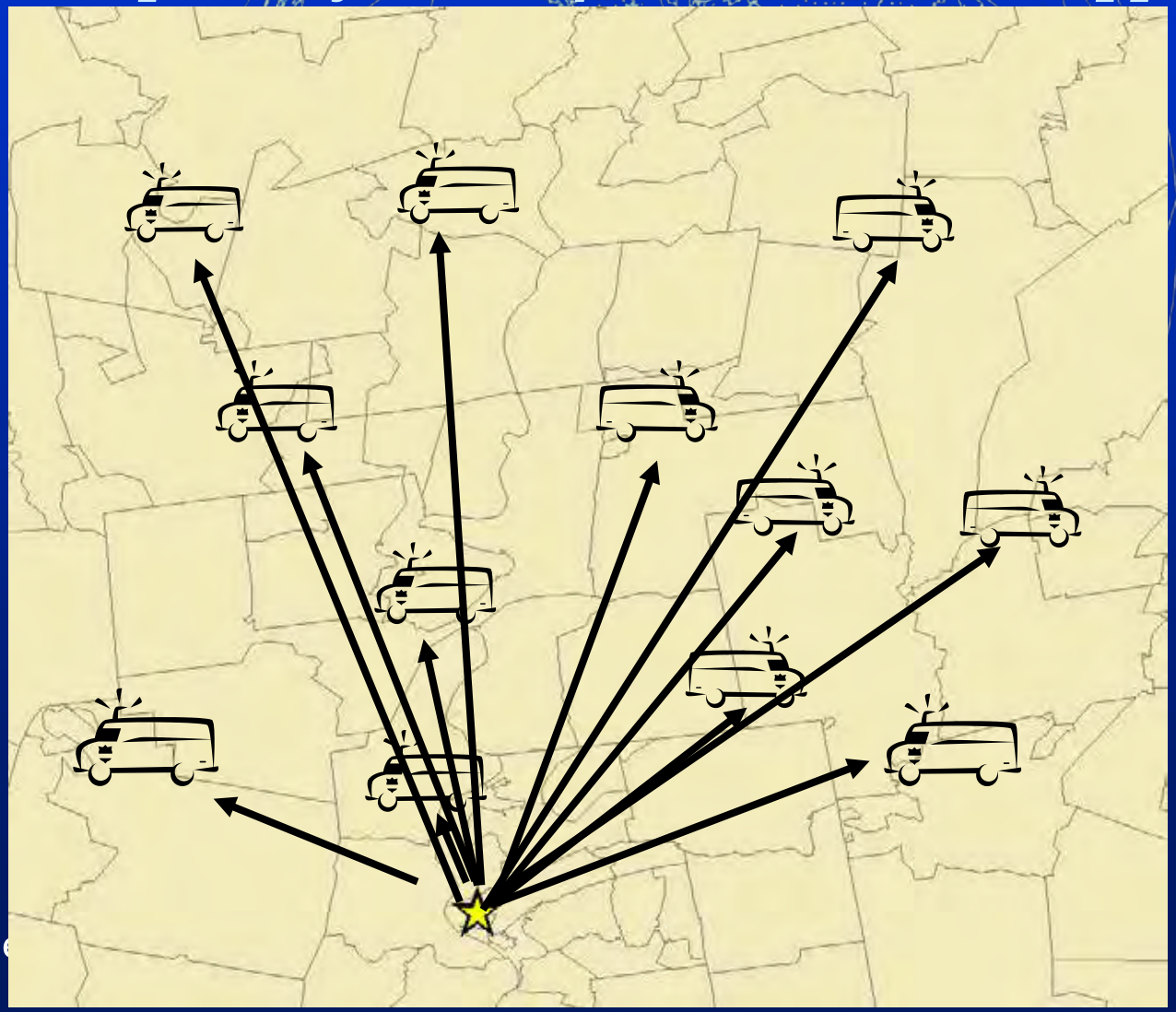


July 1, 1999

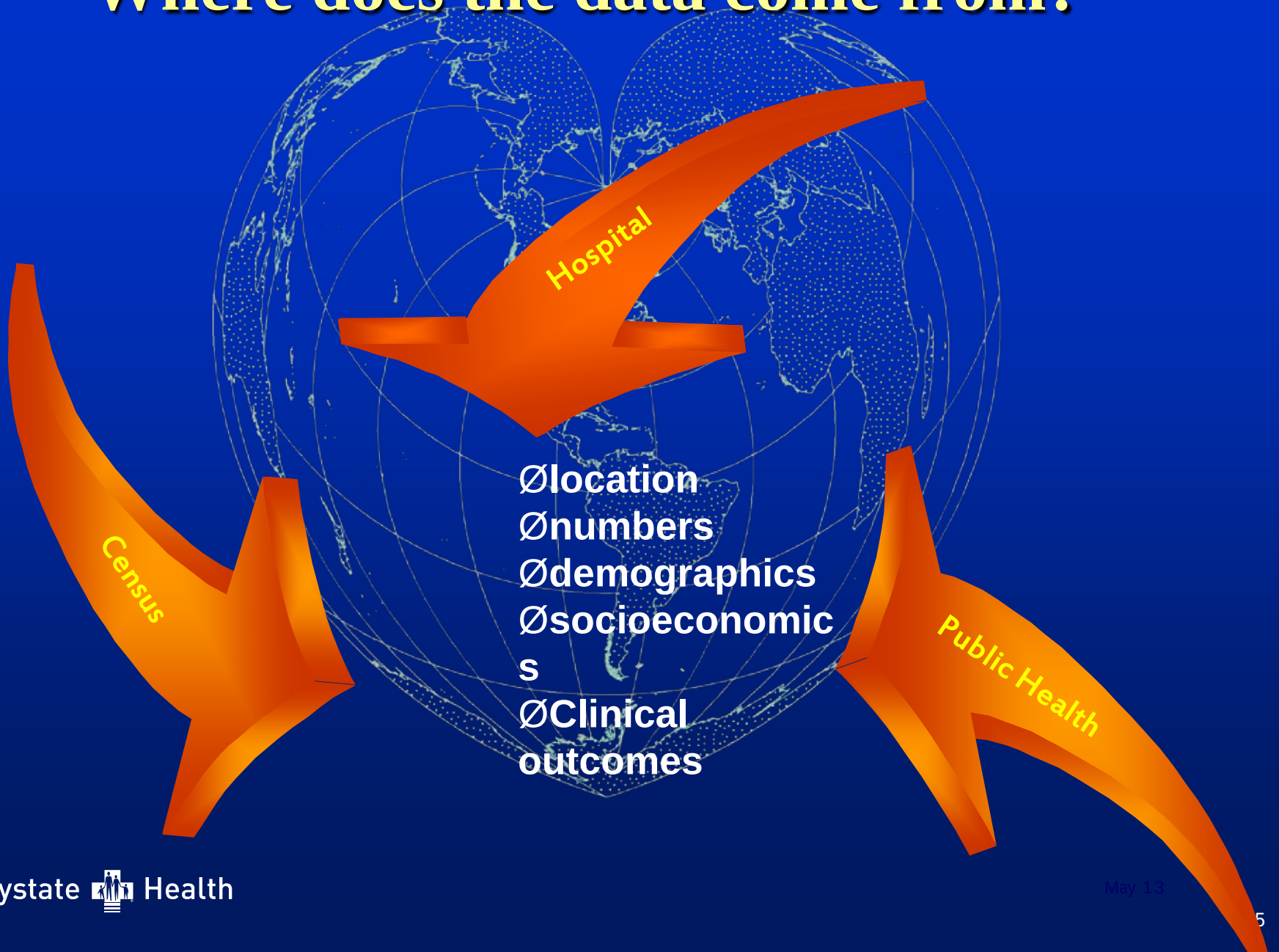
September 30, 1999

Modeling Flow

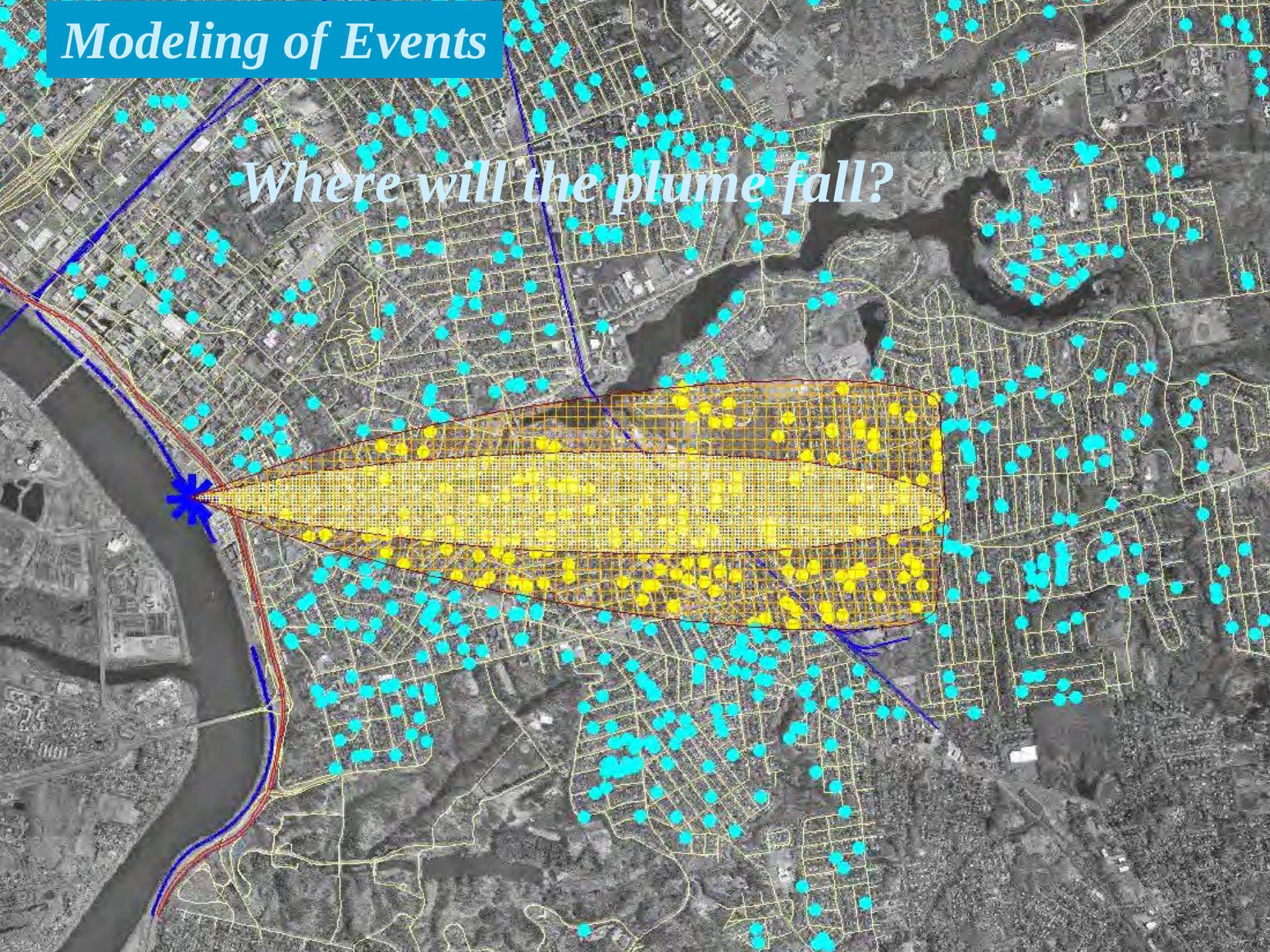
How can we increase the efficiency of Delivery of Respiratory and Infusion Services/Supplies



Where does the data come from?



Modeling of Events



Spatial Regression

What are factors in operative time in Resection of colorectal polyps?