Analyzing Geographical Access to Health Care

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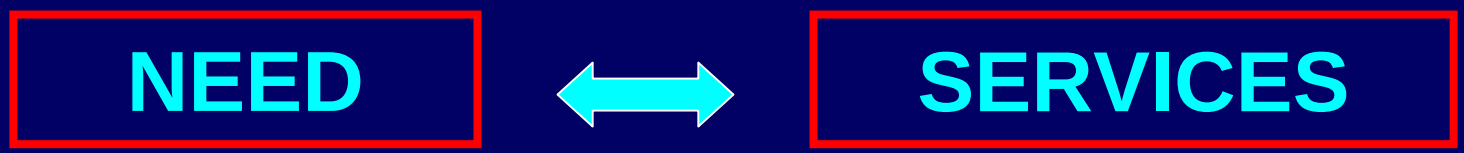
Access

Ability to obtain appropriate health services when needed



Dimensions of Access

- Availability
- Accessibility
- Accomodation
- Affordability
- Acceptability

Accessibility

- Geographical dimension
- Temporal dimension

Types of accessibility

- Revealed -- utilization
- Potential -- opportunities

Organization

- Revealed accessibility -- measurement and examples
- Potential accessibility -- measurement and examples
- Data sets
- Issues for the future

Revealed accessibility: How do people choose a health service?

NEED

SERVICE OPPORTUNITIES

Socio-demographic

Physician referrals

Insurance

CHOICE

Geographic factors

- Distance
- Travel time
- Travel cost
- Familiarity

→ Distance as a surrogate

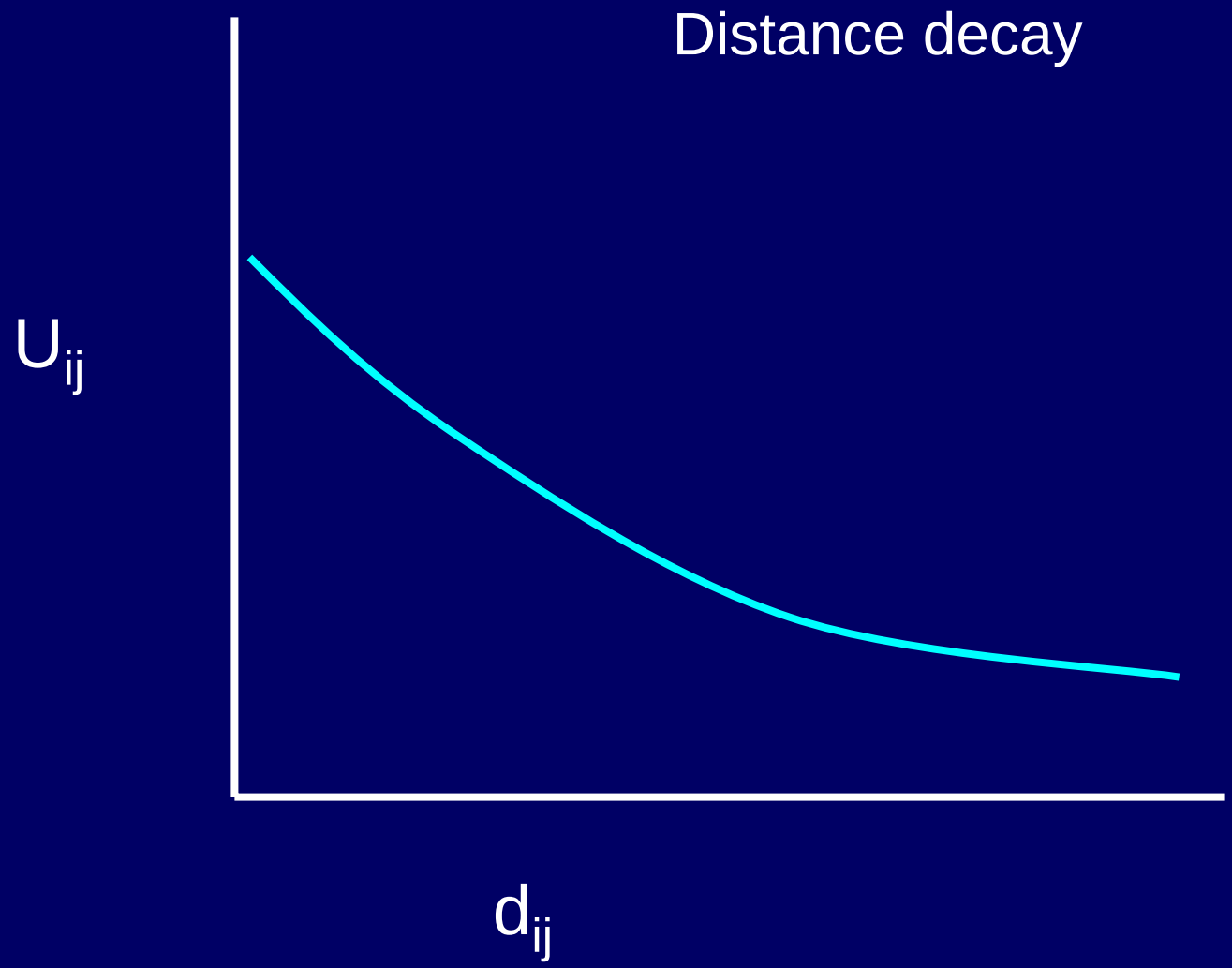
A simple model of choice

i = person

j = service opportunity

U_{ij} = ‘utility’ of opportunity i for person j

d_{ij} = distance from i to j


Distance decay
U_{ij}
d_{ij}

A_{kj} = vector of characteristics of service j

b = vector of parameters

Then:

$$U_{ij} = \prod A_{kj}^{bk} d_{ij}^{bk+1}$$

Probability of choosing j:

$$P_{ij} = U_{ij} \; / \; \sum_{k} U_{ik}$$

Aggregate model:

P_{ij} = flow from origin i to destination j

ORIGIN-constrained spatial interaction model

- Estimate via multivariate statistical methods
- Parameter values indicate effects of distance and other service characteristics on utilization
- Typical values of distance parameter for health services: -1.0 to -3.0

An example

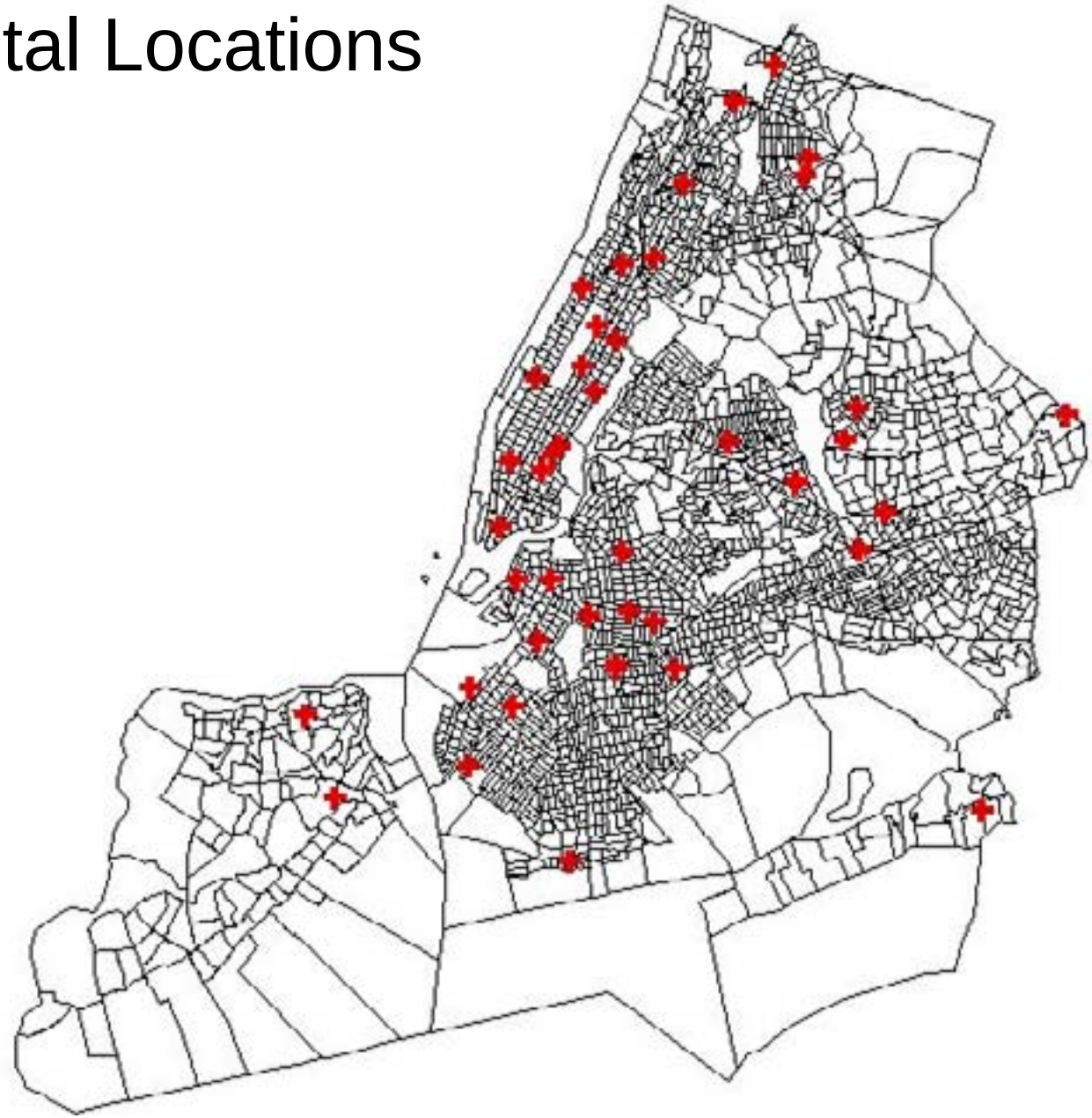
- What factors affect choice of hospital for childbirth in Brooklyn, NY?
- Does the effect of geographical access on choice vary?

Data

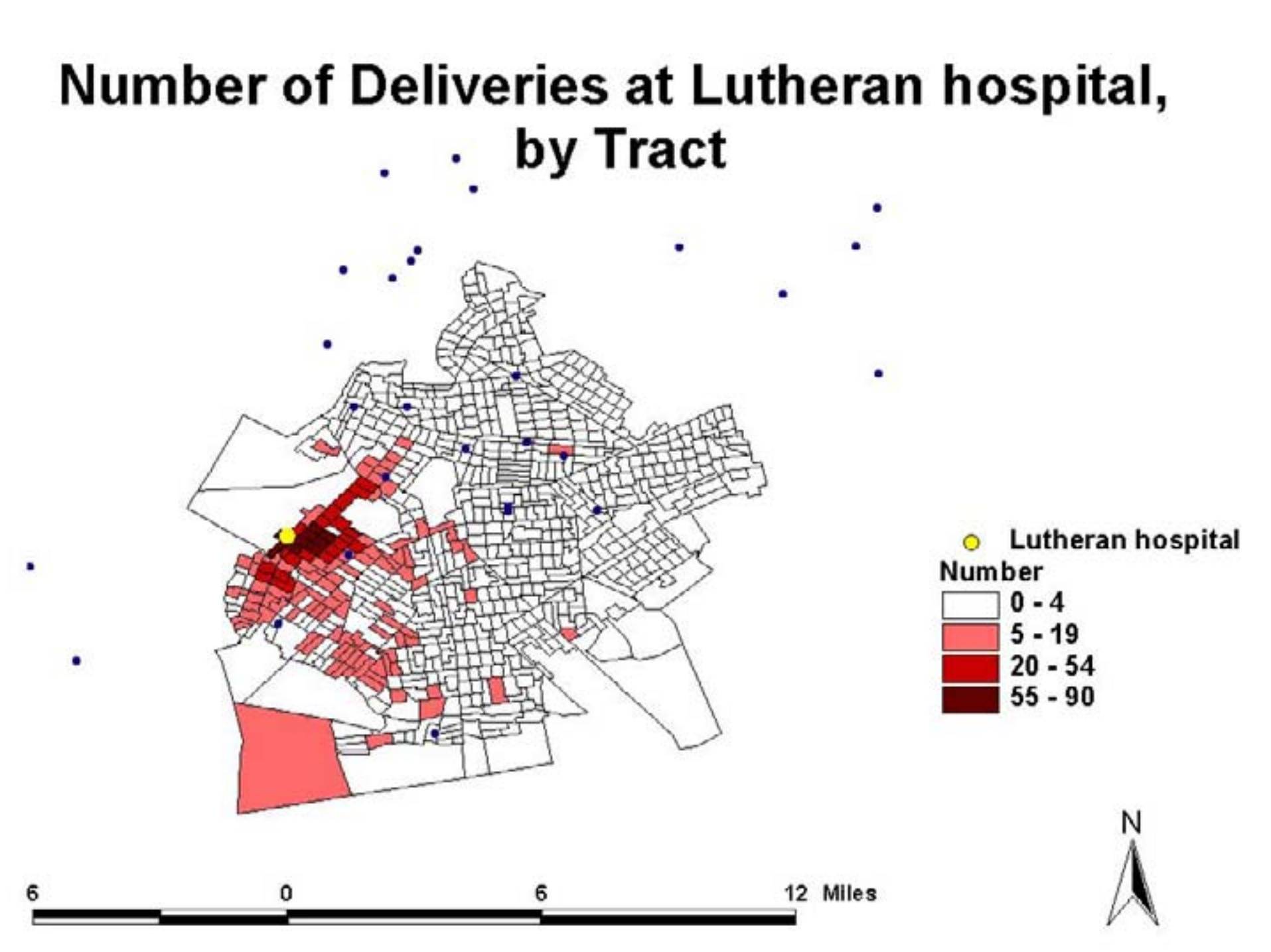
- All births, 1990
- Mother's residence in Brooklyn
- Census tract of residence
- Hospital of birth

Flows from tracts to hospitals

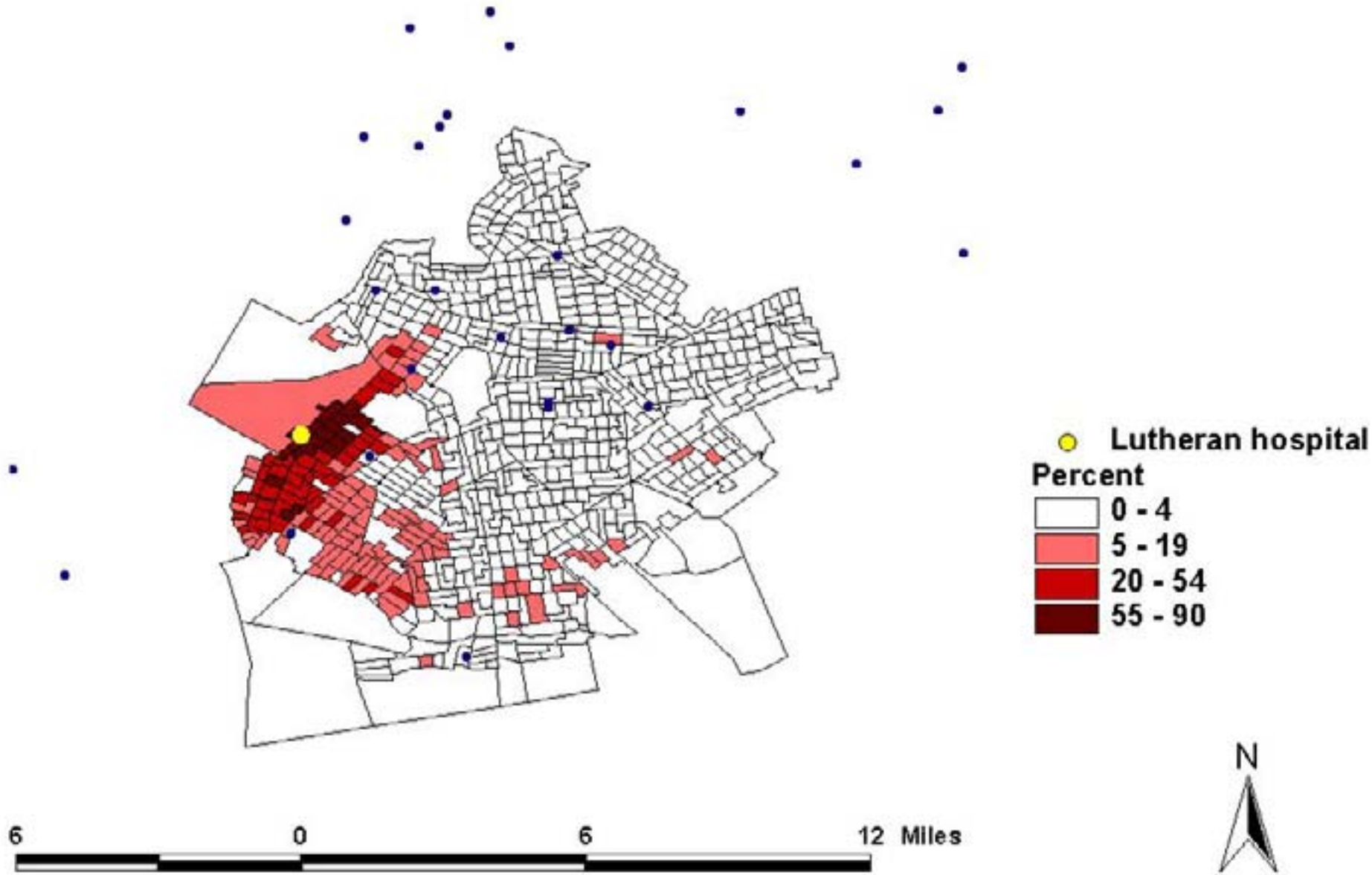
Hospital Locations



Number of Deliveries at Lutheran hospital, by Tract



Percent of Tract Births at Lutheran hospital,

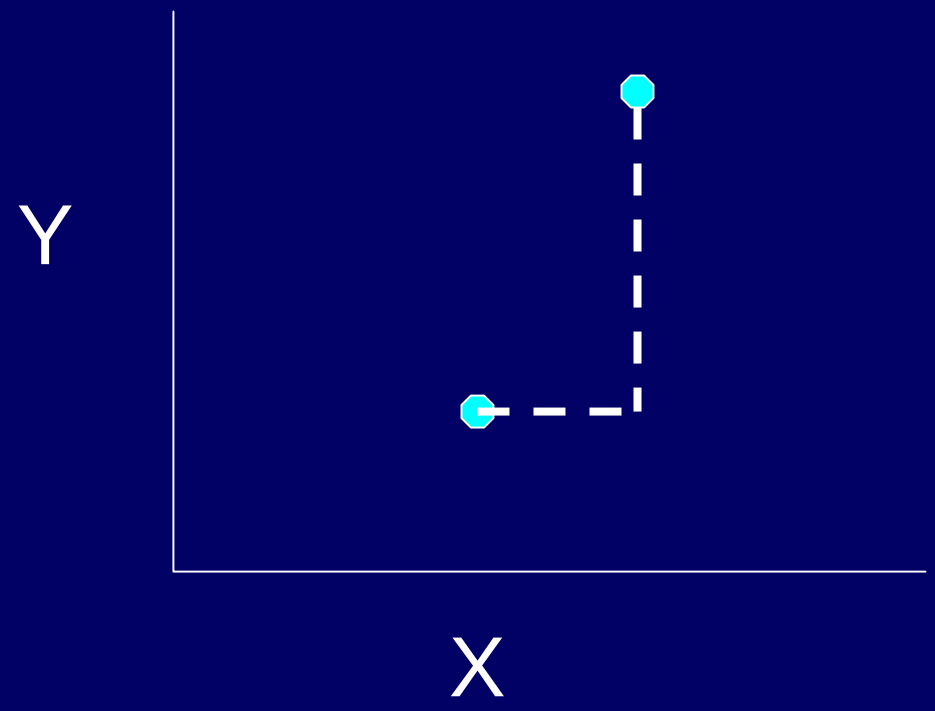


Measuring geographical access by tract

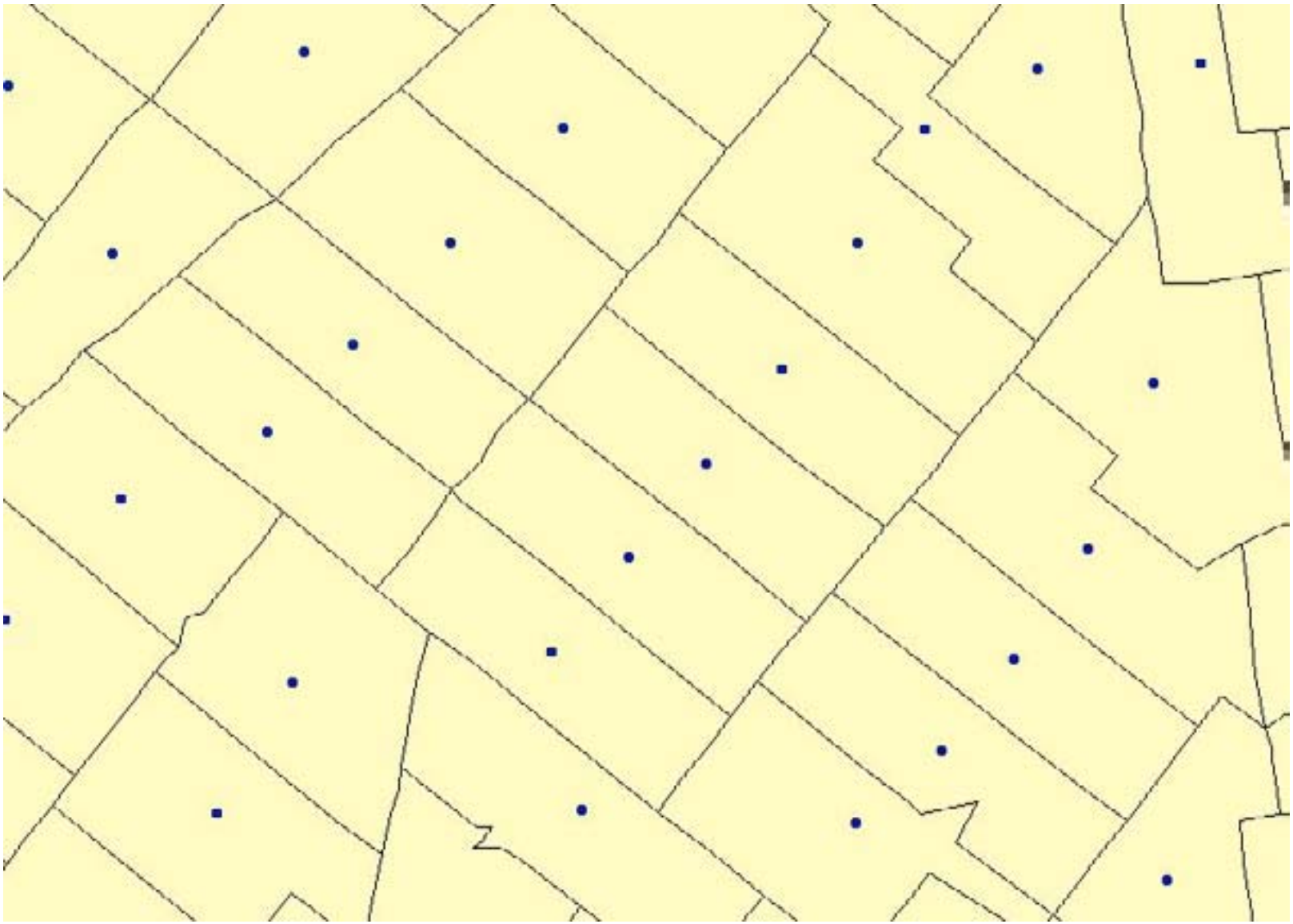
- Manhattan Distance
- GIS operations:
  - Geocode hospital locations
  - Find centroid of each tract
  - Compute Manhattan distance from centroid to each hospital

Manhattan Distance

$$d_{ij} = |X_i - X_j| + |Y_i - Y_j|$$



Tract centroids



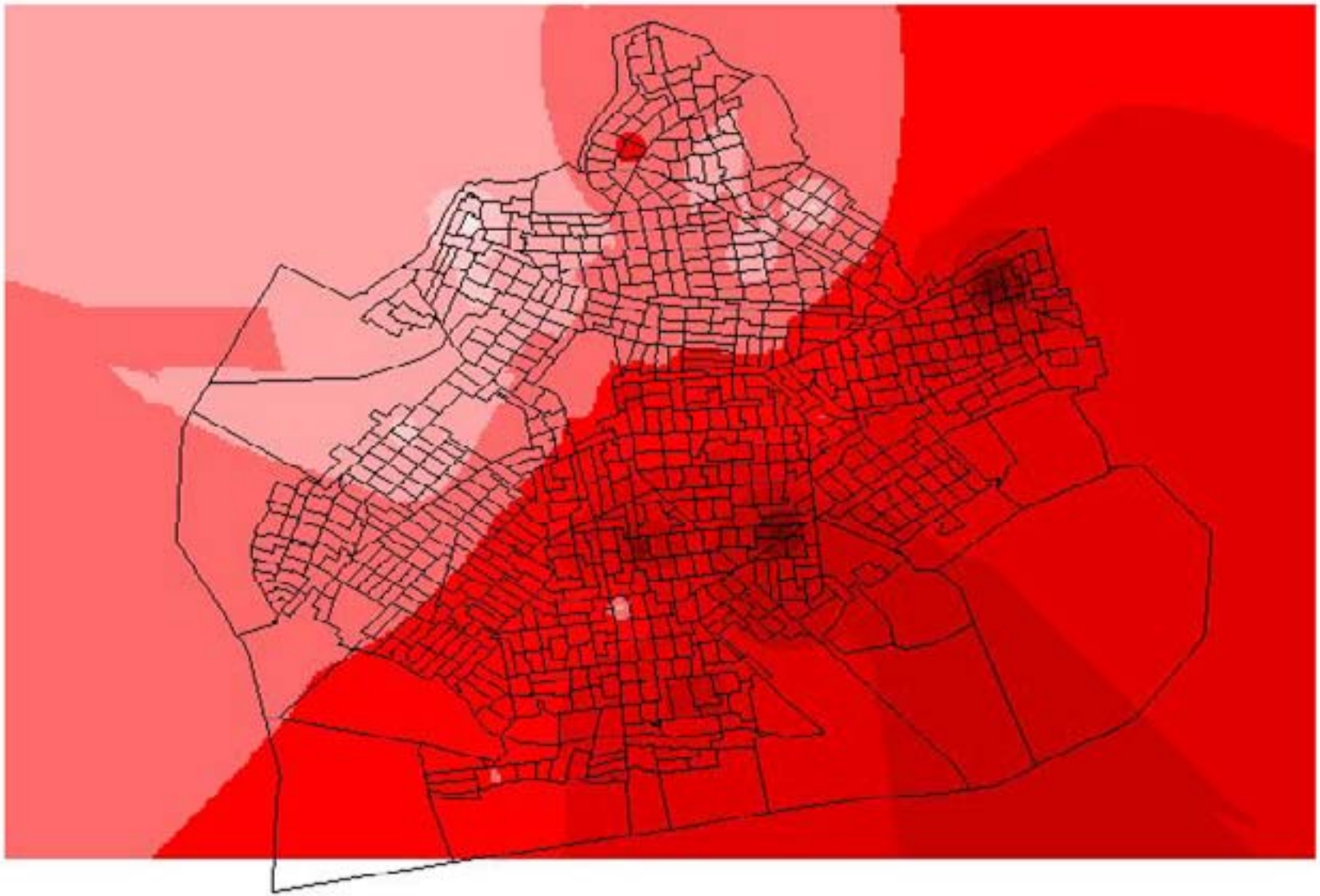
Model variables

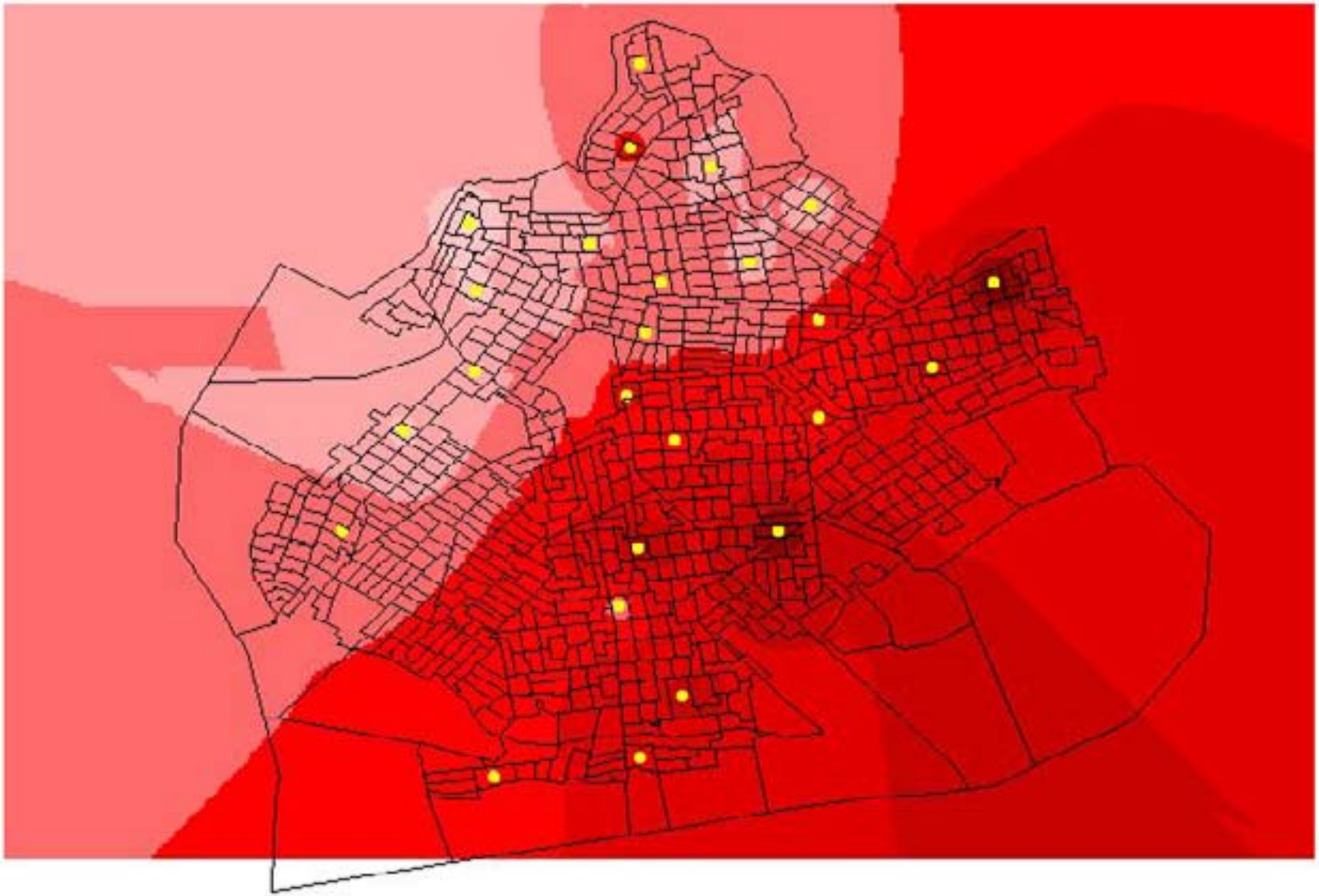
- Distance
- Bridge penalty
- Size -- # obstetrics beds
- Type -- Public vs. non-profit hospital

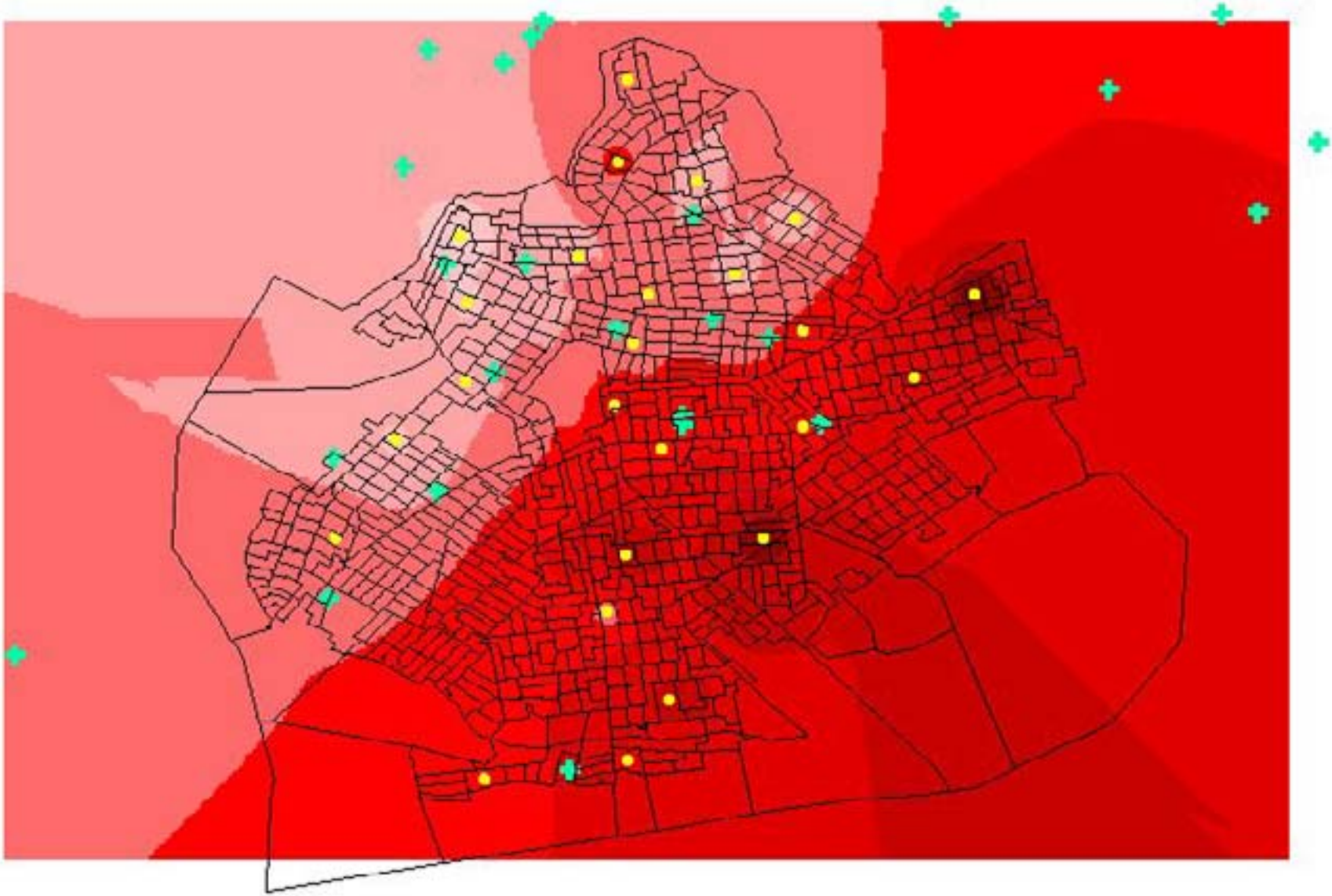
Overall model parameters

Variable	Parameter	Range
Distance	-1.62	-2.8 to -1.3
Size	0.39	-1.6 to +1.4
Type	NS	
Bridge	NS	

Distance parameter







Hospital size parameter

Individual level models

- Distance most important
- Distance decay very steep for:
  - Women covered by Medicaid
  - African-American women

Summary

- Geographical access is important
  - low income and minority populations particularly sensitive to distance in health care choice

- Context matters
  - Choice processes are not homogeneous across space or across population groups
- Context sensitive models
  - Competing destinations model
  - Multilevel models
- Use GIS to characterize contexts at different scales

Potential Accessibility

- Accessibility of opportunity set
- May or may not affect utilization
- Knox (1978), Joseph and Phillips (1984)

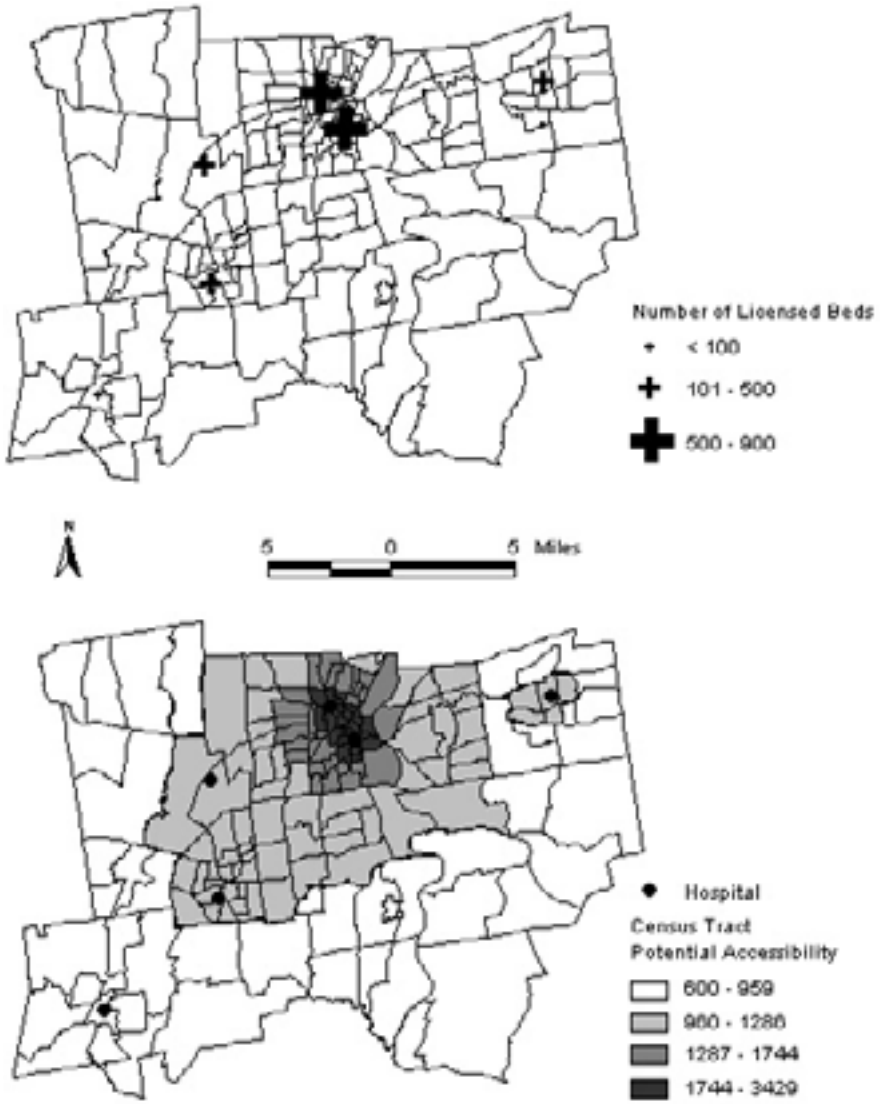
- Area-based measures
  - Ratio of services to population
- Point-based measures
  - Buffer counts
  - Potential measure

Potential Measure

$I_i = \Sigma Aj / d_{ij}^{\ b}$

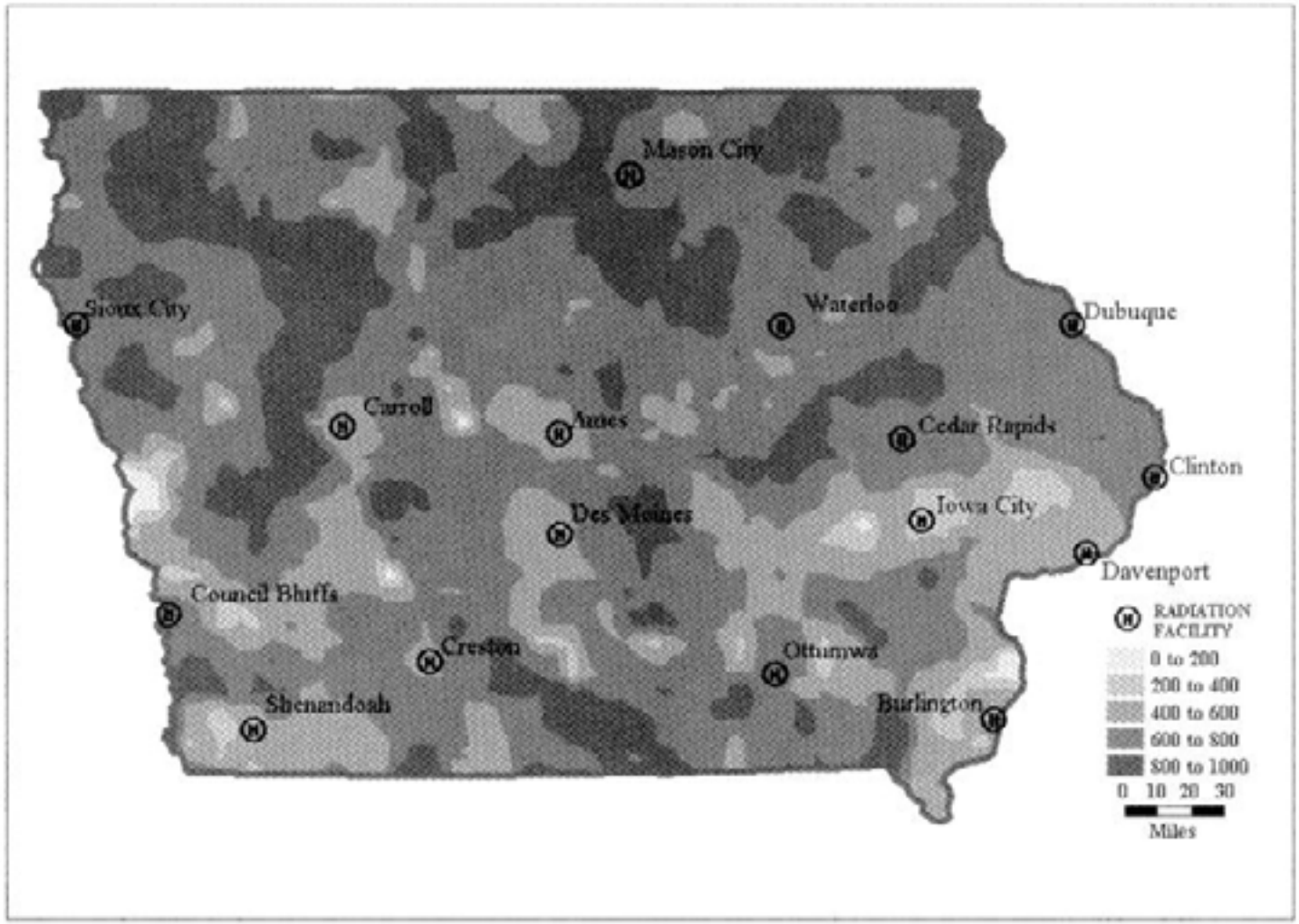
Where:

- i = neighborhood
- j = service facility
- I_i = potential accessibility of i
- Aj = size of j
- d_{ij} = distance
- b = distance decay parameter


Number of Licensed Beds
< 100
101 - 500
500 - 900
5
0
5 Miles
Hospital
Census Tract
Potential Accessibility
600 - 959
960 - 1286
1287 - 1744
1744 - 3429

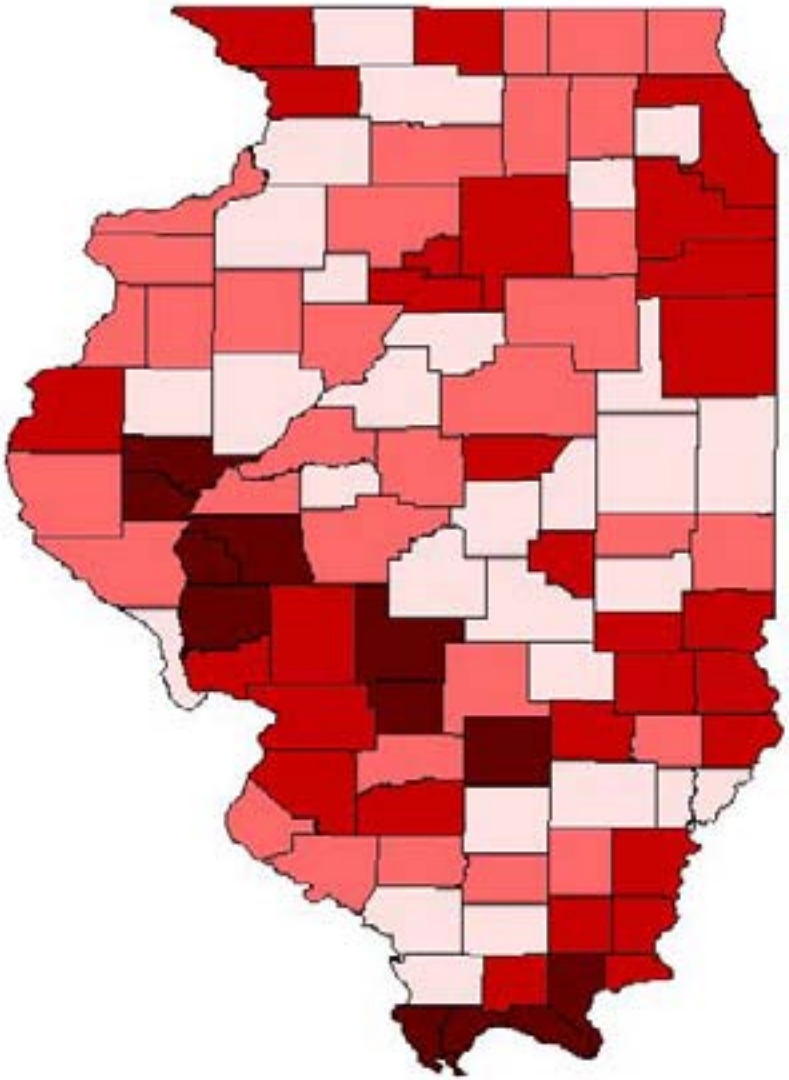
Does potential accessibility affect health outcomes?

Mastectomies per 1,000 cases of localized breast cancer



From Rushton, G and West, M. (1999) Public Health Reports

Percent Late-Stage Breast Cance



% Late Stage

35 - 37

38 - 39

40 - 42

43 - 47

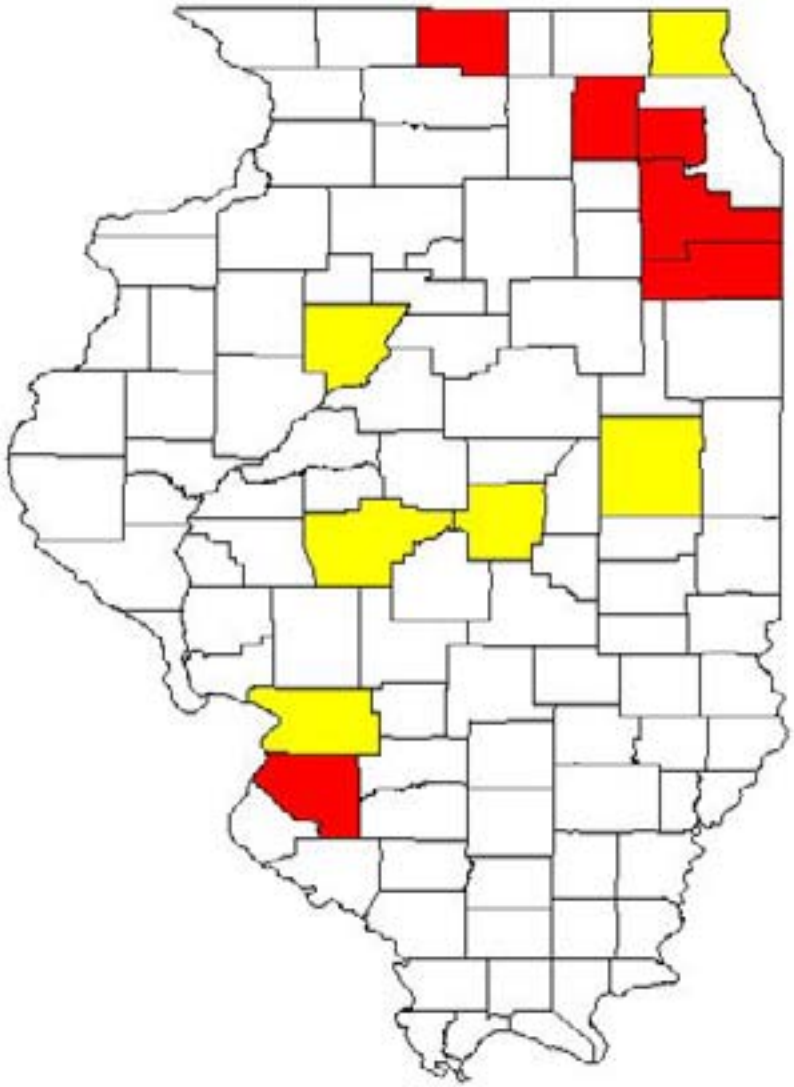
N

Potential accessibility based on:

- Distance
- Mammography and GYN services

- In rural areas, % late-stage is strongly correlated with potential accessibility
- BUT confounders

Race Gap in Localized Breast Cancer



Race Gap
0
Not sig.
Significant

80 0 80 160 Miles

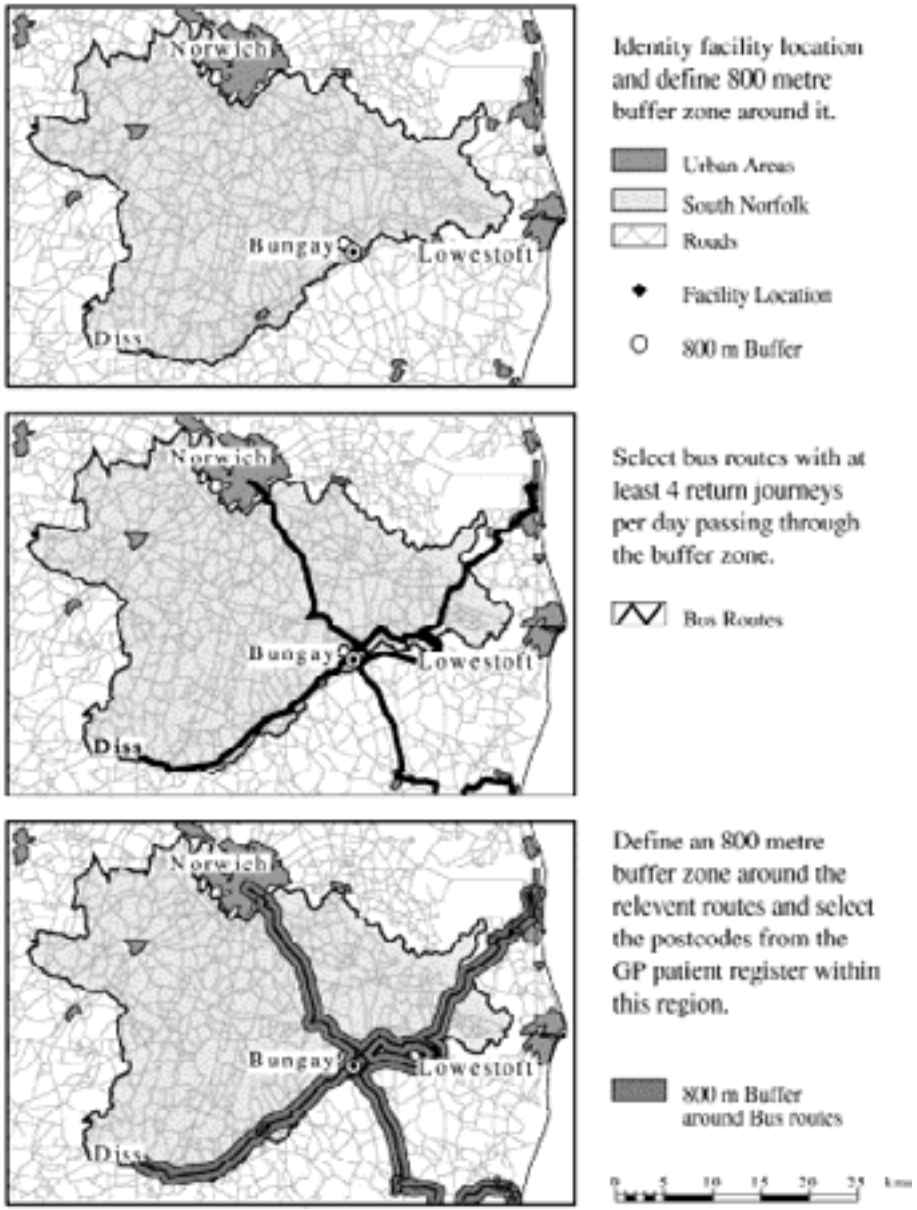
N

Data sources for health care accessibility analysis

- Health outcomes -- vital registries, cancer registries
  - Often don’t include service information
- Hospital utilization
  - SPARCS
- Medicare and Medicaid
  - Dartmouth Atlas of Health Care
- Surveys

Other Issues

1 Better measures of distance/separation



From: A. Lovett et al. (2002) “Car travel time and accessibility by bus to GP services, Social Science and Medicine, 55, 97-111.

2. Link health care accessibility and utilization to outcomes

--Linked data sets
--Outcome measures

3. Privacy and confidentiality

4. Processes in health care delivery

- Mobile services
- Telemedicine
- Role of physician referrals and managed care -- ‘dictated choice’
- Consider full array of health services
- Impact of health care quality information on patient choices

5. Social inequalities and geographical inequalities

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