

Health Care Utilization

Lecture #26 | GEOG 510
GIS & Spatial Analysis in Public Health

Varun Goel

Outline

- Utilization and data
- Andersen's framework
- Geographic topics/theories
- Origin-Destination data
- Some interesting questions

Geo of Health Care Delivery

- Focuses on interactions between populations and health care services
 - Describe, explain, understand, predict, intervene...
 - Often, focus on ability to access services and service use
 - But also...
 - How health care affects health
 - Why health care resources are located where they are
 - How health care systems adapt to change

Utilization (of Health Care)

- Another word for “use”
- Utilization is when the health care system is used
 - Can be measured via interactions
 - e.g., physician visits, days in hospital, MRI scans, etc.

Health Care Utilization

- GIS-based analysis
 - Magnitude of use
 - Descriptive: How much utilization in the past or present
 - Basic geographic variation
 - Explanatory: What factors influence geographic variation in magnitude
 - Population characteristics
 - Delivery system characteristics
 - Predictive: How much utilization in the future

Health Care Utilization

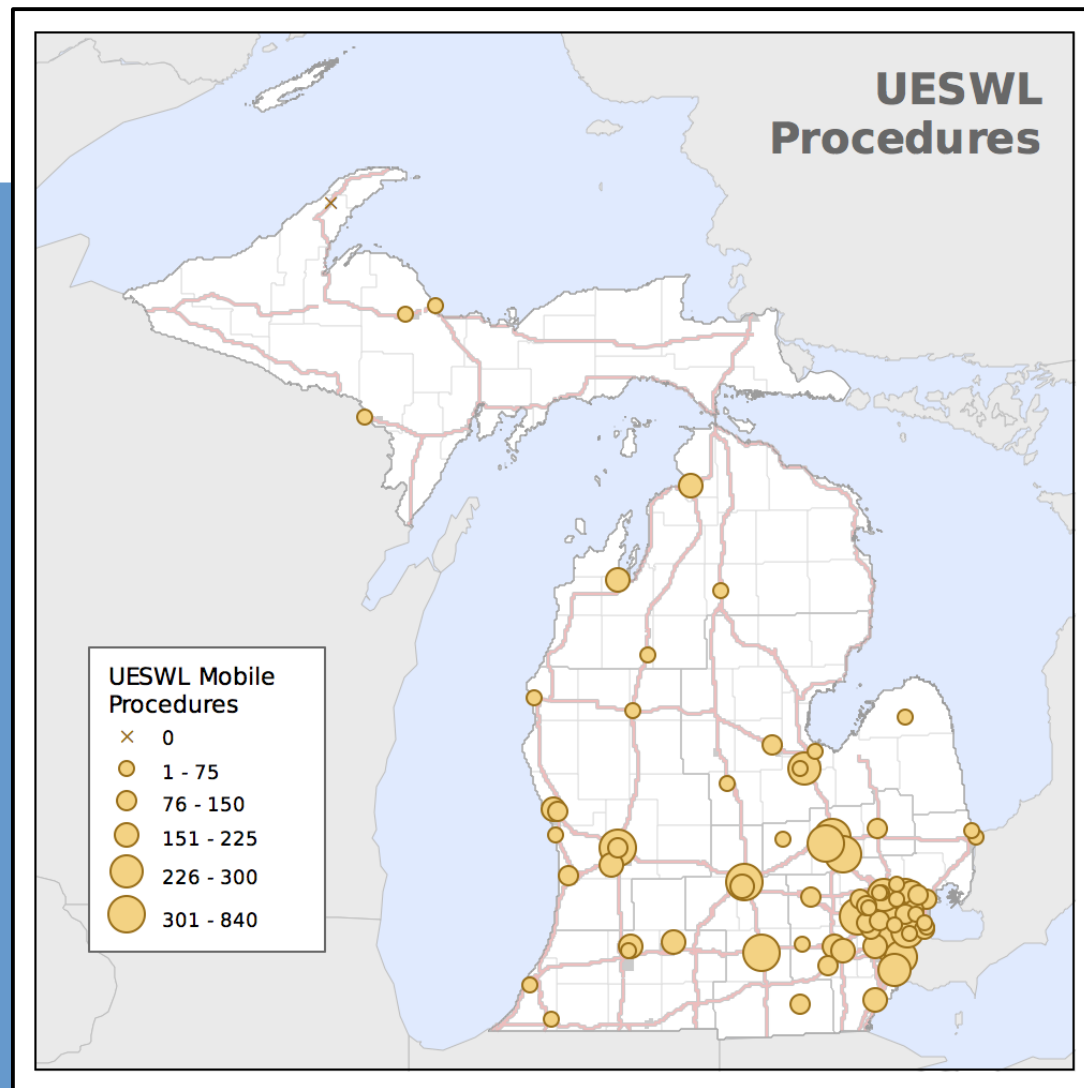
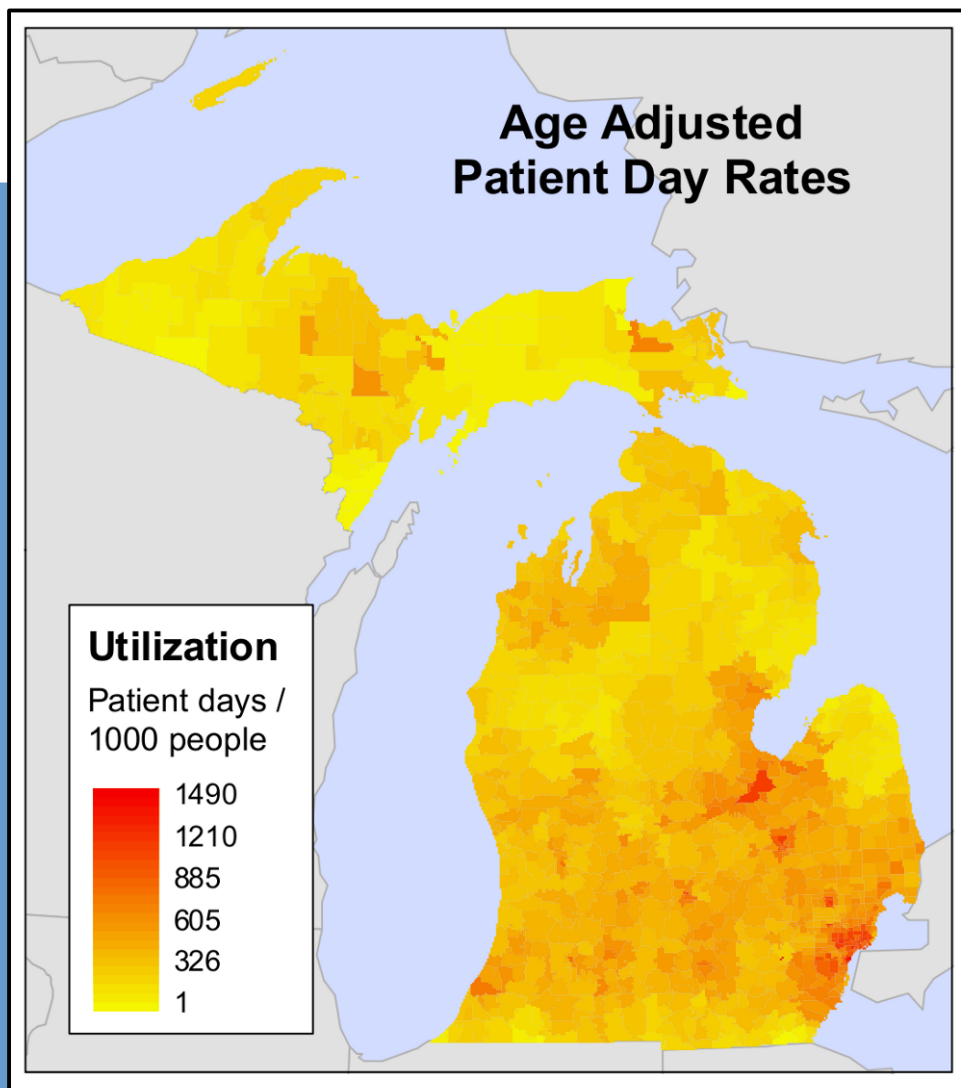
- GIS-based analysis
 - Location of use
 - Descriptive: Where were services used (and at what magnitude)
 - Explanatory: What factors influence where people seek out care
 - Population characteristics
 - Delivery system characteristics
 - Predictive: Where will services be used
 - e.g., given changes to the population/system at some future time

Utilization Data

- Population-level data
 - The number of interactions or the volume of services used, aggregated by areal units
 - Often, expressed in a rate/ratio
 - e.g., days spent in the hospital per 1,000 people
 - Divide count by population
 - Areal units are often administrative units
 - e.g., counties, zip codes, provinces

Utilization Data

- Facility-level data
 - The number of interactions or the volume of services used at each facility
 - Often, expressed in counts
 - e.g., days spent in the hospital, visits, procedures



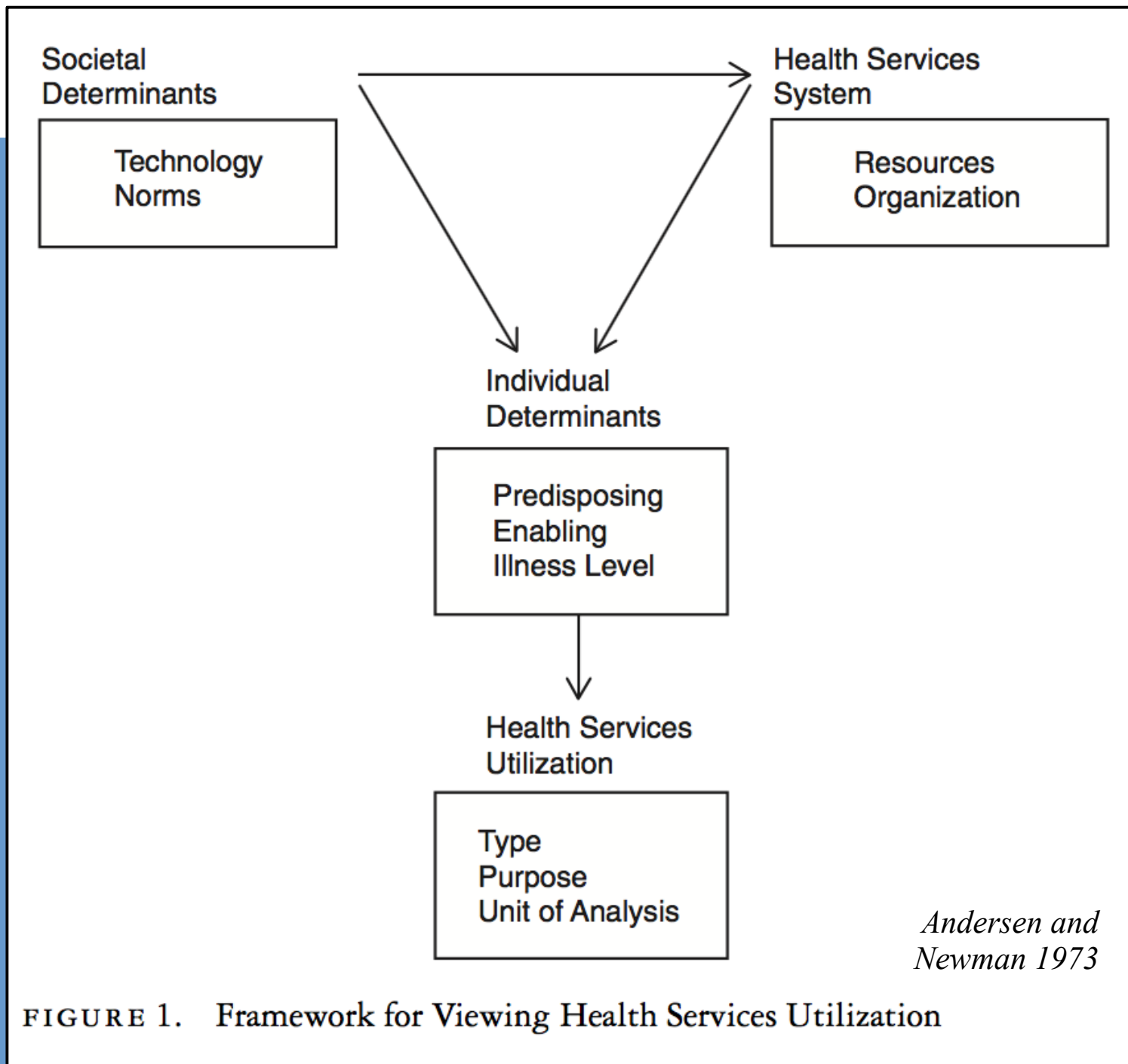
Thinking about the “geography” of people's interactions with the health care system – Can we identify any potential issues with these maps/data?

Utilization Data

- Some issues for geographers with utilization data...
 - Population-level data
 - We do not know where the services were used
 - Facility-level data
 - We do not know where the people that used the services live

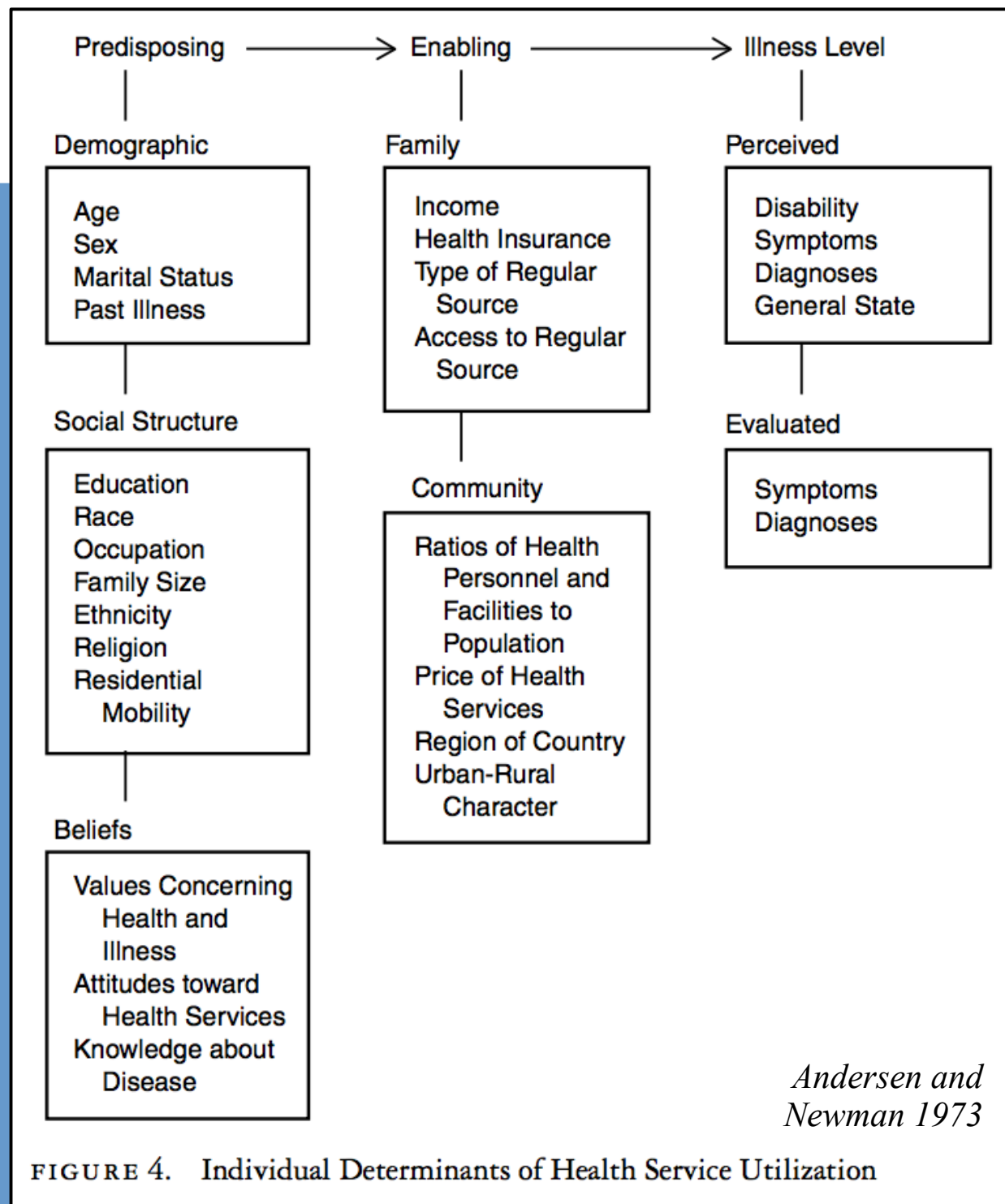
Andersen's Model

- Health care utilization behavioral model
 - Population-focused
 - Provides a theoretical framework to understand which factors affect the magnitude of health care utilization in a place
 - We can then study why it varies geographically



Andersen's Model

- Individual determinants
 - Predisposing, Enabling, and Illness Level (Need)
 - Each factor varies across space and from region to region
 - Each factor affects or influences the magnitude of health care utilization



Roemer's Law

- *Hospital beds that are built tend to be used*
 - Shain and Roemer (1959)
 - Pressure to fill hospital beds
 - Utilization is generated via health care service availability (not population need)
 - Overutilization or supplier-induced demand (SID)

Roemer's Law

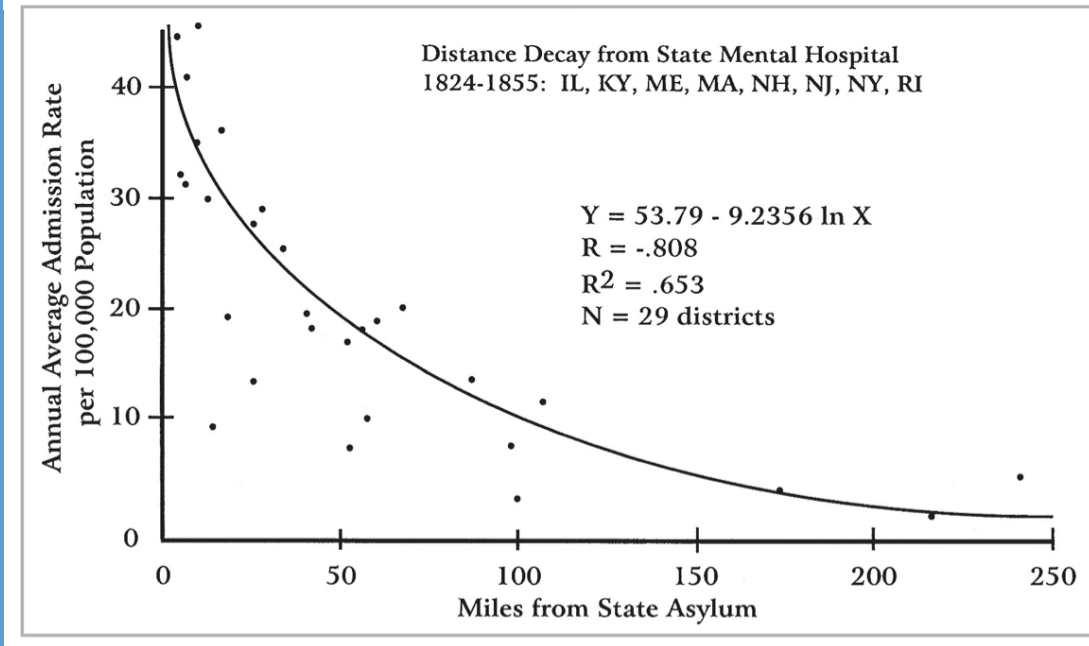
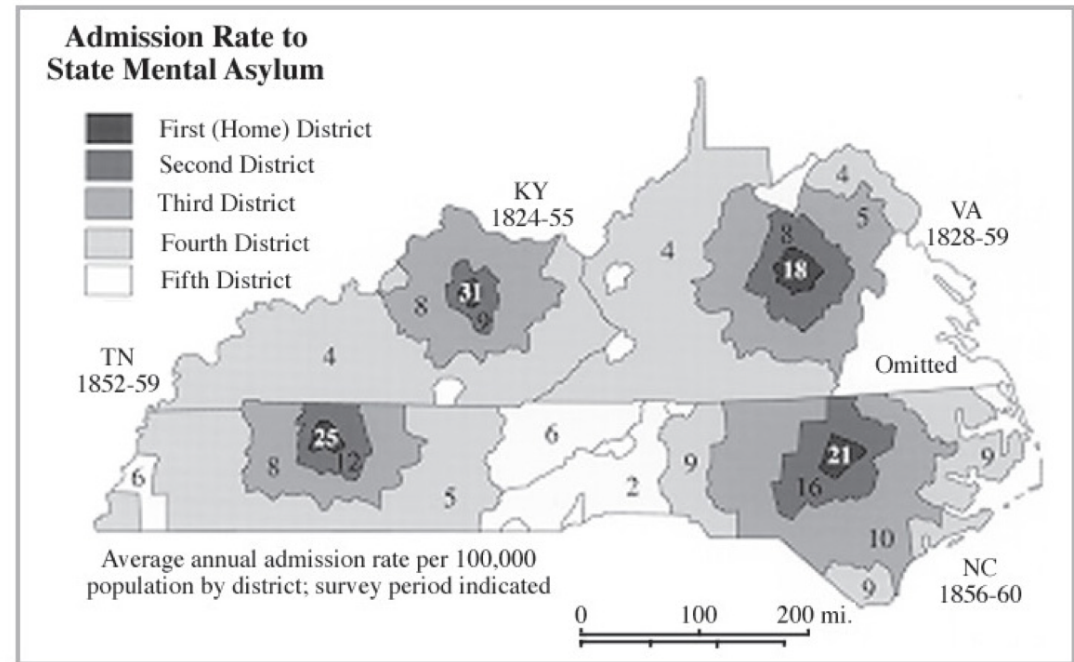
- Ubiquitous belief in health care
 - Justifies controlling, regulating, planning the supply of health care
 - US planning/regulation
 - Certificate of Need (CON)
 - State-level programs (34 states + DC)
 - In a nutshell...
 - Requires population “need” to be demonstrated prior to expanding the volume of a particular health care service (supply)

Jarvis' Law

- Classic example of distance decay in health care utilization
 - 1850s study of admissions to state mental asylums
 - Admission rates were greatest near to the asylum
 - Rates decreased with increasing distance
 - Do more “lunatics” just happen to live near the asylum?

Jarvis' Law

- Distance decay
 - Distance as friction
- Utilization decreases with increased distance to facility
- Many health care services behave in this manner



Hunter, Shannon, and Sambrook 1986

Bypass Behavior

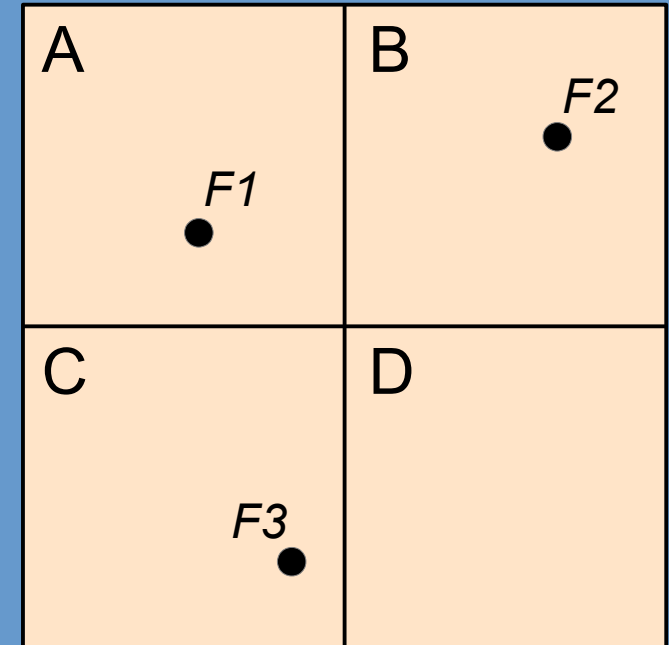
- Considers “where” people use health care services
 - Usually, when given choice of which facility to use from a set (given similar quality or a similar set of services)... people will tend to use the nearest facility
 - Bypass behavior
 - When patients “bypass” the nearest facility to get care at a more distant facility
 - Understanding the genesis
 - Pathways, perceived quality, nearer to other oft-used services

Utilization & Unmet Need

- Utilization of specific services can also indicate problems in access to other services
 - Utilization as a proxy for unmet need
 - Oft-used example for *primary care*
 - Hospitalizations for Ambulatory Sensitive Conditions (ACS)
 - e.g., COPD, bacterial pneumonia, asthma, diabetes, kidney/urinary infection

Origin-Destination Data

- Extremely detailed utilization information
 - Utilization from each population region (origin) to each facility (destination)
 - Visits or counts
 - Origin and destination (O-D) matrix



REGION	F1	F2	F3
A	10	5	25
B	15	10	25
C	10	10	40
D	25	5	15

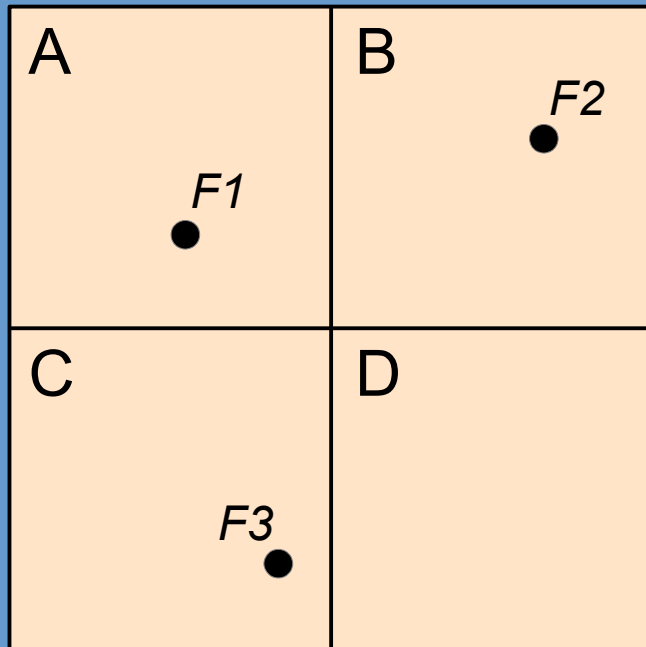
Indices

- Two indices
 - Difference is what information you are trying to understand
 - Relevance Index
 - Percent of a region's utilization at a particular facility
 - Commitment Index
 - Percent of a facility's utilization by a particular region

Relevance Index

- For each region, percent of utilization at each facility out of utilization at all facilities
 - To calculate...
 - Sum all visits for each region
 - Divide visits to each facility by that sum
 - Produces percent of visits to each facility

Relevance Index



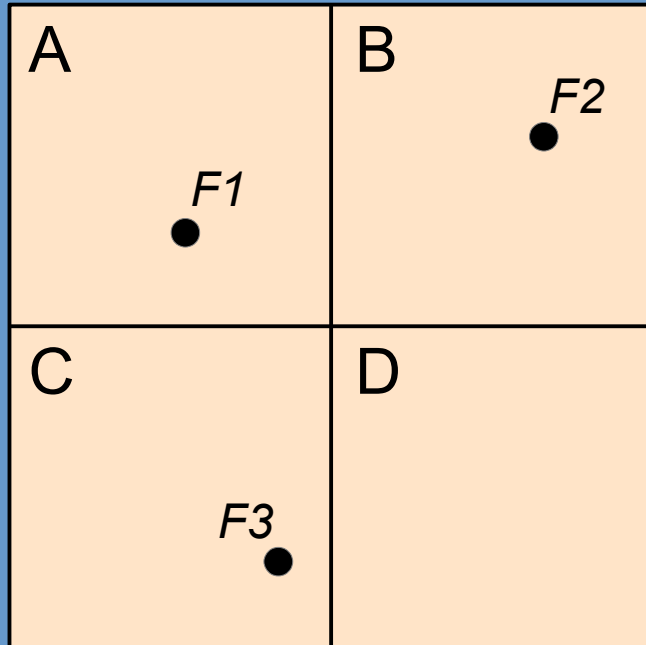
REGION	F1	F2	F3	SUM
A	10	5	25	40
B	15	10	25	50
C	10	10	40	60
D	25	5	15	45

Sum all visits for each region

Divide visits to each facility by that sum (convert to percent)

REGION	F1	F2	F3
A	25%	13%	63%
B	30%	20%	50%
C	17%	17%	67%
D	56%	11%	33%

Relevance Index



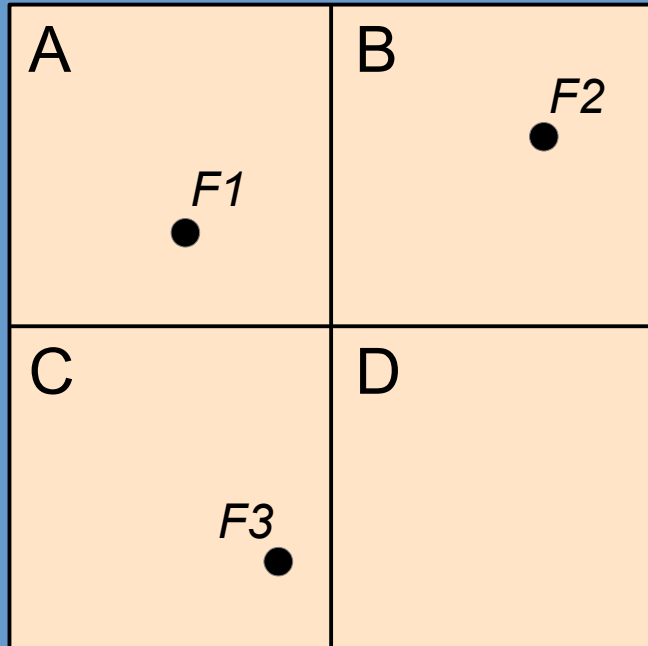
REGION	F1	F2	F3
A	25%	13%	63%
B	30%	20%	50%
C	17%	17%	67%
D	56%	11%	33%



Population perspective:

Assists us in understanding the importance of each facility in providing care for a population unit

Relevance Index



REGION	F1	F2	F3
A	25%	13%	63%
B	30%	20%	50%
C	17%	17%	67%
D	56%	11%	33%



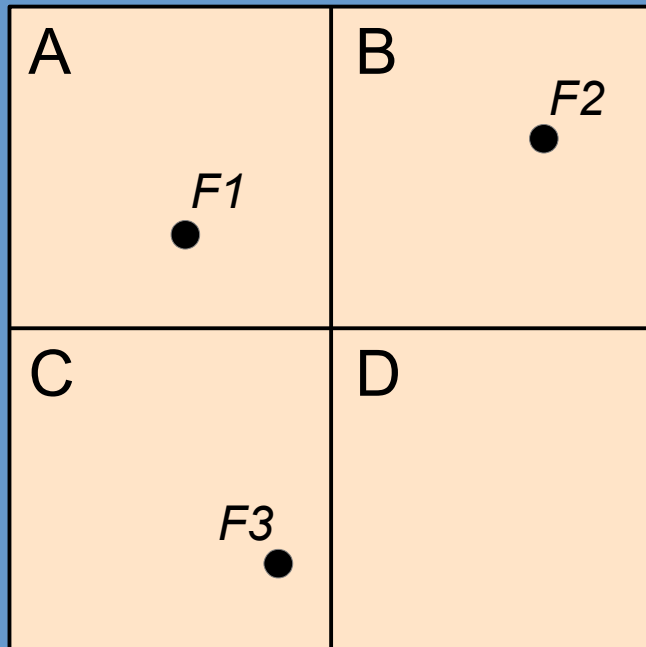
Facility perspective:

Assists us in understanding how important a facility is in providing care for each population unit

Commitment Index

- For each facility, percent of utilization from each region out of utilization from all regions
 - To calculate...
 - Sum all visits for each facility
 - Divide visits to each facility by that sum
 - Produces percent of visits from each region

Commitment Index



REGION	F1	F2	F3
A	10	5	25
B	15	10	25
C	10	10	40
D	25	5	15
SUM	60	30	105

REGION	F1	F2	F3
A	17%	17%	24%
B	25%	33%	24%
C	17%	33%	38%
D	42%	17%	14%



Facility perspective:

Assists us in understanding how important each region is in supplying visits to a facility

Relevance and Commitment

- Relevance

- Helps us to understand importance of facilities (for regions)
 - Sensitive to size of facility, if comparing facilities

- Commitment

- Helps us to understand importance of regions (for facilities)

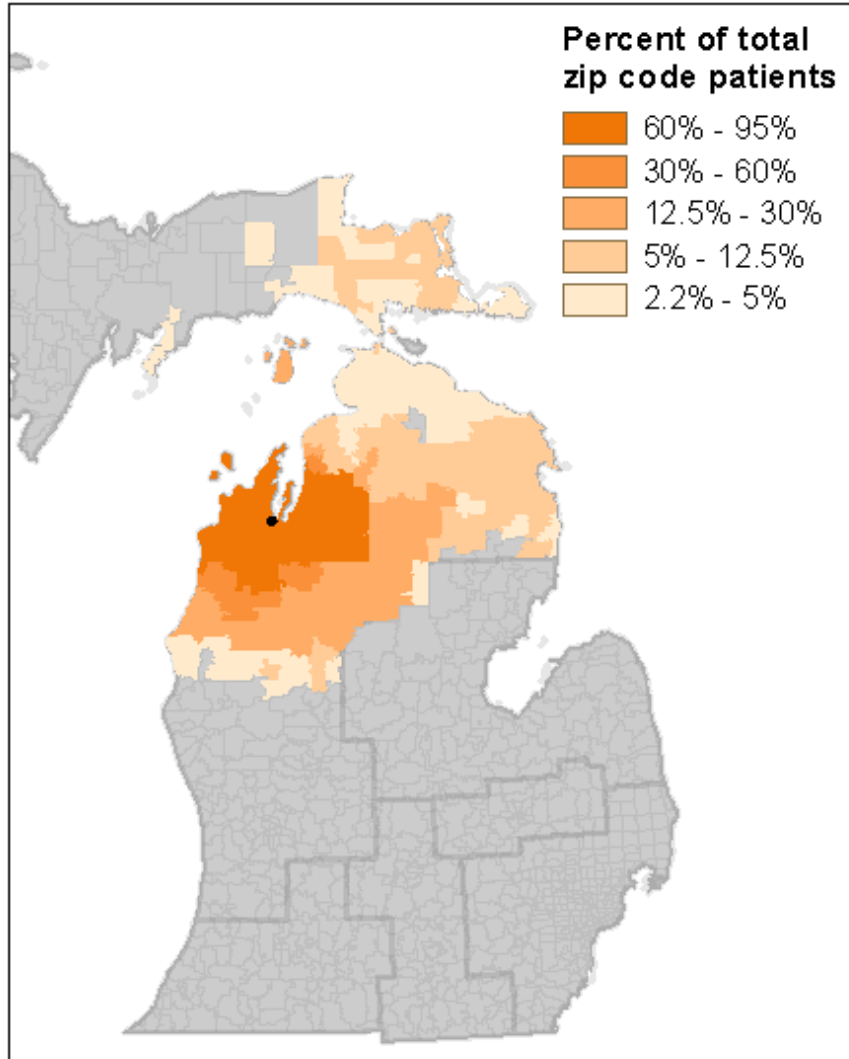
O-D Data

- A quick note...
 - Can get a bit overwhelming, when examining an entire system (population and providers)
 - e.g., in MI, utilization from ~900 Zip Codes to ~140 Hospitals
 - O-D matrix has ~125,000 entries
 - We can only visualize (map) this information for a single facility/region

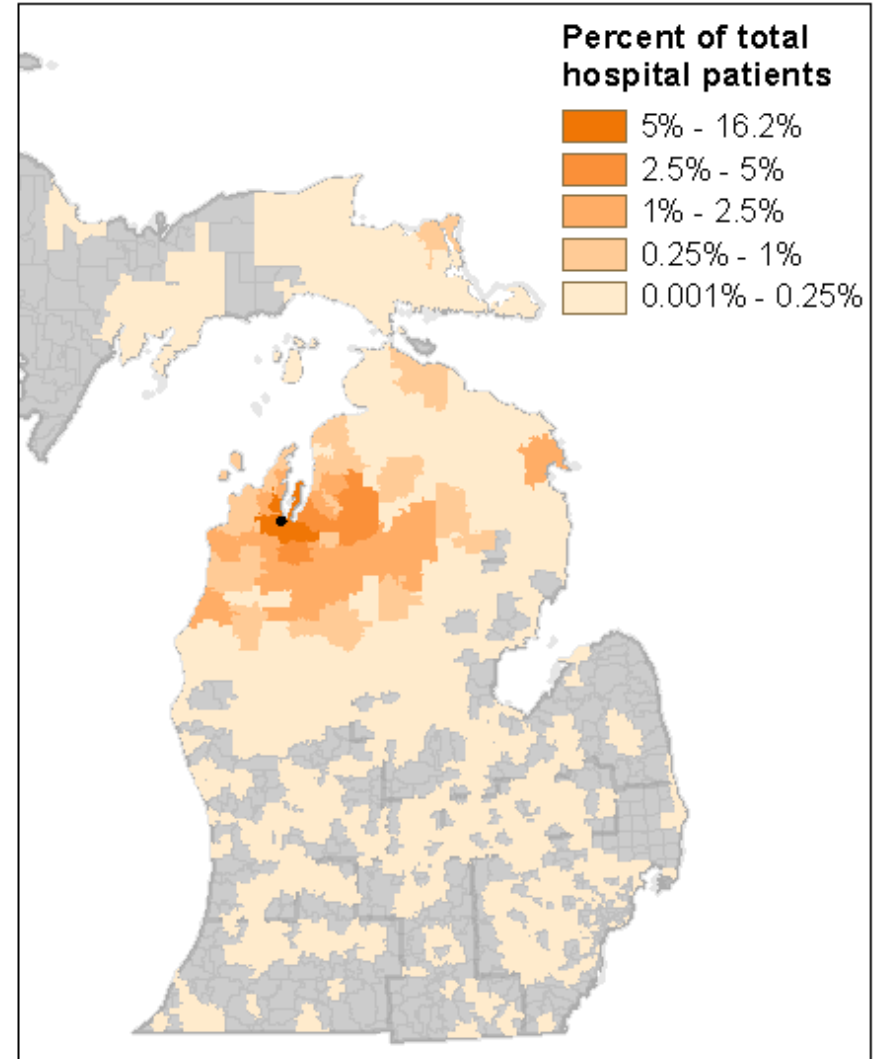
Home Area Definition

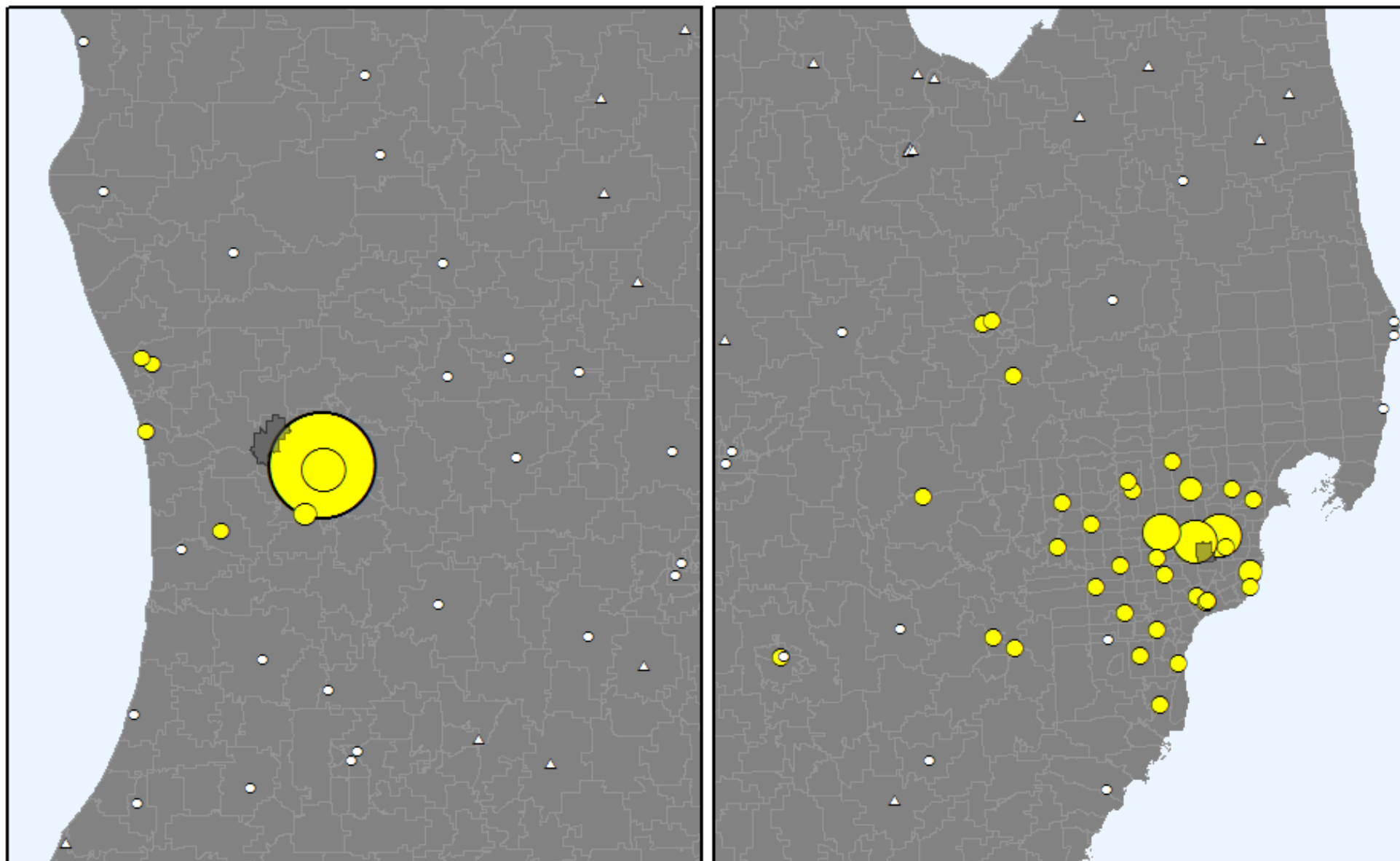
Munson Medical Center

Relevance Index (Griffith Methodology)



Commitment Index





Relevance
Index (RI)
Values (%)



65 - 70
45 - 50
25 - 30
0.1 - 5

○ 0%, within 90 minutes
△ 0%, outside 90 minutes

0 25 50
Miles

Current Research

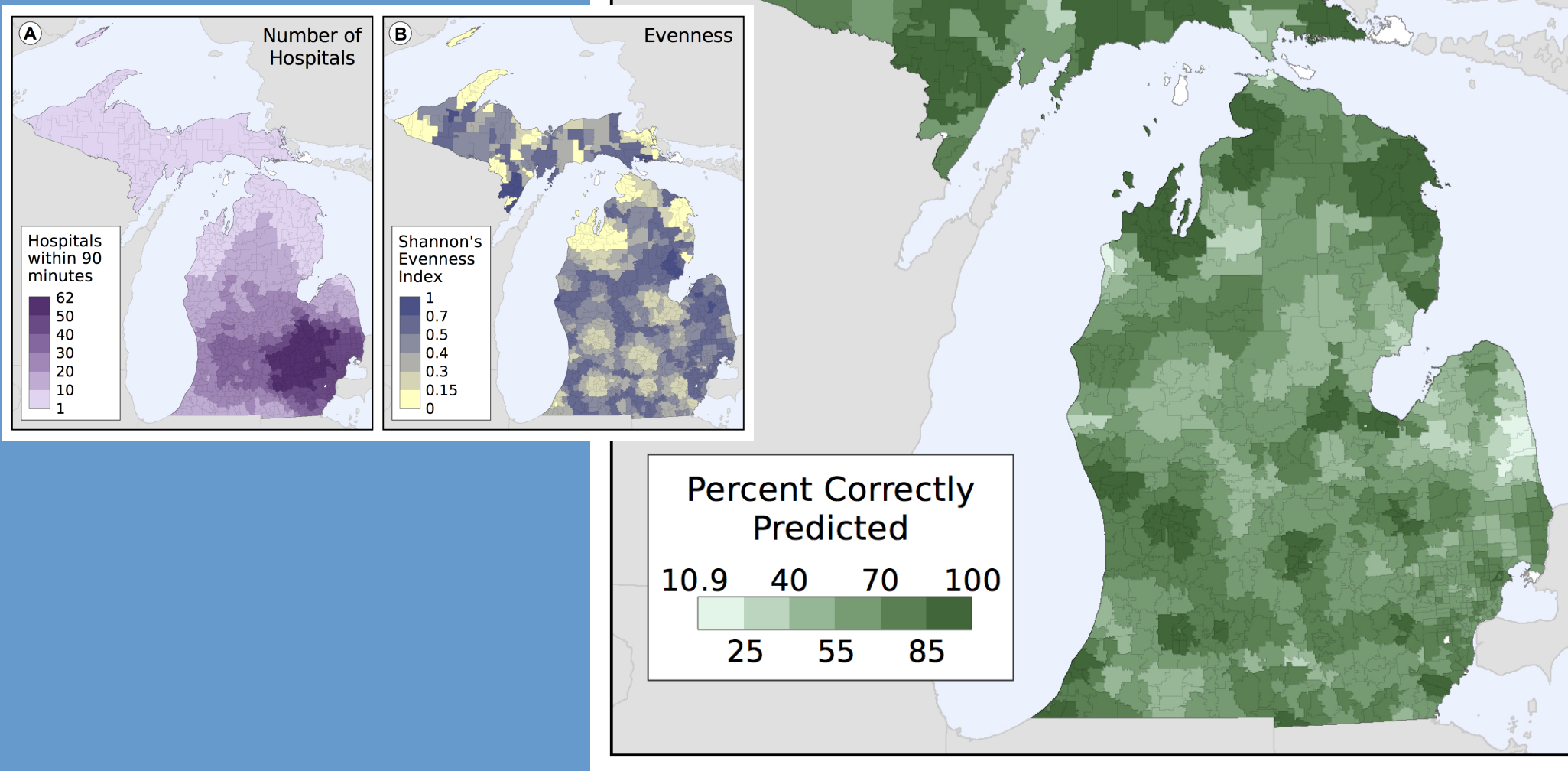
- Given only population totals, facility sizes, and distance... can we predict where people will seek care?
 - Predicting *utilization* patterns using *access*
 - Basically, can we predict the O-D matrix of visits from regions to facilities?
 - Highly important if O-D utilization data are unavailable

Results

- Percent Correctly Predicted (statewide)

METRIC	MEAN (16)	MIN	MAX	RANGE
E2SFCA	60.68	43.88	71.17	27.29
M2SFCA	68.96	58.59	73.84	15.25
3SFCA	69.29	58.88	73.88	15
H3SFCA	57.43	46.29	61.83	15.54
DIST	51.98	34.97	63.92	28.95
HUFF	42.48	28.69	53.98	25.29

Results



Health Care Utilization

- Interesting geographic questions
 - Does utilization (magnitude) vary from place to place?
 - Why?
 - Population or system factors
 - Can we identify places with unmet need or overutilization?

Health Care Utilization

- Interesting geographic questions
 - Does utilization (magnitude) vary among population groups?
 - e.g., social and economic
 - Inequalities in utilization based on race and ethnicity, income, education
 - Why?
 - e.g., by distance from facilities
 - Urban vs rural
 - What are the effects of distance?

Health Care Utilization

- Interesting geographic questions
 - How does utilization affect health outcomes?
 - Is more care better?
 - Are people receiving needed (and quality) care?
 - Does this vary among population groups?
 - Does this vary across space?

Health Care Utilization

- Interesting geographic questions
 - Can we predict utilization?
 - Magnitude
 - e.g., future need for services
 - Location
 - e.g., where services will be used

Keywords

- Utilization
 - Population- and facility-level data
 - Origin-Destination data
 - Relevance and Commitment Index
- Andersen's Model
- Roemer's Law
- Jarvis' Law
- Bypass behavior