The Association of Socioeconomic Status and Late Stage Breast Cancer in Florida:

A Spatial Analysis using Area-Based Socioeconomic Measures

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Outline

- Background and Significance
- Methods
  - *SatScan*
  - Area-Based Measures
- Results
- Conclusions
- Future Research

Axiom of Public Health

"Social Status is one of the Strongest Determinants of Health"

Goal of Research

- Develop a new methodology to assist with the identification of populations that are at high risk of being diagnosed with late stage breast cancer.
- Assess what effect Socioeconomic Status (SES) has on the incidence of late stage breast cancer in Florida.
- Assist Cancer Surveillance and Control professionals to design specific and targeted interventions for these high risk populations.

Background and Significance

Breast Cancer

- Breast cancer is the most common cancer in women in the US and Florida
  - Second leading cancer-related death in women

Breast Cancer in Florida 1998-2002

- Incidence
  - N ~ 64,000 (AAR 125.4/100,000)
    - Late Stage (regional and distant)
      - N ~ 19,000 (AAR 39.3/100,000)
- Mortality
  - N ~ 13,000 (AAR 23.8/100,000)

Socioeconomic Status (SES)

- SES appears to be related to breast cancer incidence, mortality and survival (Baquet, Commiskey)

- Lack of SES data in surveillance data limiting research
  - Overcome this limitation with use of area-based socioeconomic measures

Area-Based Socioeconomic Measures

- Census-derived
- Possible because of geocoding
- Meaningful indicators
  - Analyzed together with individual data
- Information on
  - Area residents
  - Area characteristics

Area-Based SES Measures (con't)

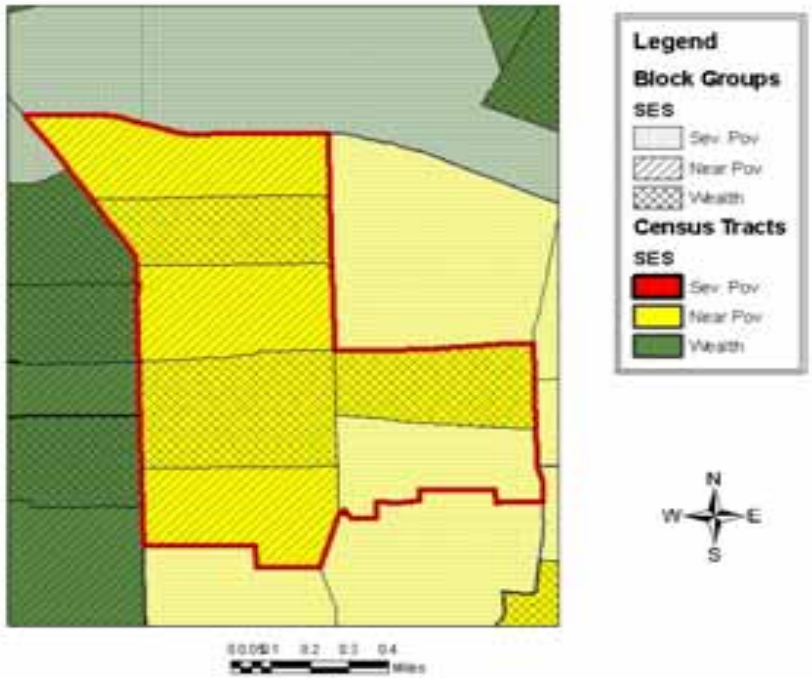
- Strengths
  - Appended to any database with addresses
  - Provides contextual and compositional data
  - Applied equally to all persons
- Weaknesses
  - Not individual data
  - SES at time of case ascertainment
  - Can be outdated - decennial Census

Methods Overview

- Study design
  - Cross sectional
- Dependent variable
  - Incidence of late stage breast cancer
- Independent variables
  - Race/ethnicity, SES, insurance, urban/rural, mammography use
- Unit of analysis
  - Block Group

Disparate Block Group SES within Census tracts

SES Estimations
Census Tract overlayed by Block Group



Duval County Census Tract Key 12031001500

SES Assignment
Census Tract = Near Poverty

Block Group = 1 Poverty
3 Near Poverty
3 Wealth

Study Setting and Population

- State of Florida
  - Cancer data obtained from Florida Cancer Data System
  - Population and area-based measures obtained from the 2000 US Census

Sampling Frame

- Inclusion Criteria
  - Female, Florida resident
  - Diagnosis date between 1998 and 2002
  - Regional or distant (late stage) breast cancer
- Cases in study n = 18,683
  - Valid race (excluded n=31)
  - Valid address geocode (excluded n= 309)
- Block groups in study n = 6,361 (of 9,112 in Florida ~ 70%)

Patient Level and Area-Based Measures

- Patient Level
  - Primary site/stage of disease
  - Race
  - Insurance status
- Area-Based
  - Socioeconomic Status
  - Urban/Rural designation
  - Mammography usage

Insurance Status

- Patient level
  - Uninsured
  - Private
  - Medicare
  - Medicaid

Recoded from 15 different categories

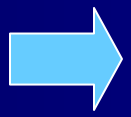
* FCDS data - 92 cases ‘unknown’ insurance status randomly assigned to other 4 categories based on distribution

Socioeconomic Status

"Ratio of Income to Poverty" (9 categories)

Recoded Groups (Krieger, et al)	< 1.0 Severe Poverty	1.0 – 1.99 Near Poverty	2.0+ Non-Poverty
Actual Percentages	79%	17%	4%

Block Group Designation Based on Plurality



Severe Poverty

- **Dade County, Block Group Number 15012 (n=2,474)**

Urban/Rural Designation

- Beale Codes -10 urban-rural county continuum codes
  - Describe counties by their population size, degree of urbanization and nearness to a large metropolitan area
    - Urban – 3 codes
    - Rural – 7 codes
- Dichotomized into urban or rural

Mammography Usage

- Florida Behavioral Risk Factor Survey
  - County level (67 counties)
    - County quartiles
      - Highest to lowest usage

Spatial Analysis - SaTScan

- Developed under the joint auspices of Dr. Martin Kulldorff, the National Cancer Institute and Dr. Farzad Mostashari at the New Your City Department of Health and Mental Hygiene.

- Spatial scan statistic
  - Cluster detection test
    - Detect location of clusters
    - Evaluate their statistical significance

SaTScan Process

- Block group level
  - Race and Age covariates
- Files needed
  - Cases
  - Population
  - Block group centroid

SaTScan

- Monte Carlo techniques
  - Assigns relative risk probabilities to defined block groups
  - Generates a number of random replications of the data set under the null hypothesis
    - Test statistic is calculated for each random replication as well as for the real data set
    - If the real data set is among the 5 percent highest, then the test is significant at the 0.05 level

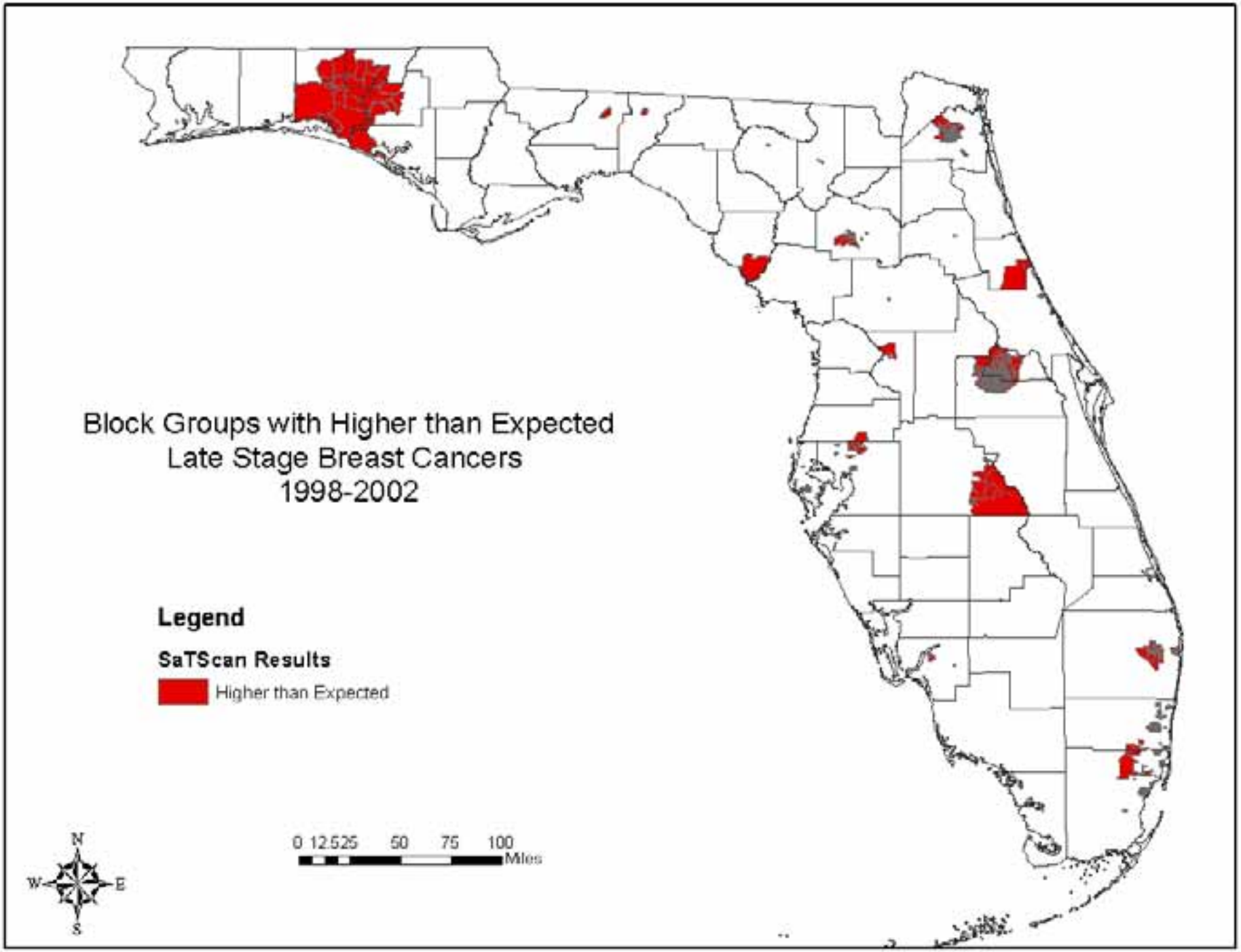
SaTScan (con't)

- Poisson probability model
  - 999 Monte Carlo replications
- Expected n of cases
  - Indirect standardization (State)
- Adjusts for covariates and interaction terms (race and age)
- Spatial analysis only
- Identified areas with higher than expected number of cases

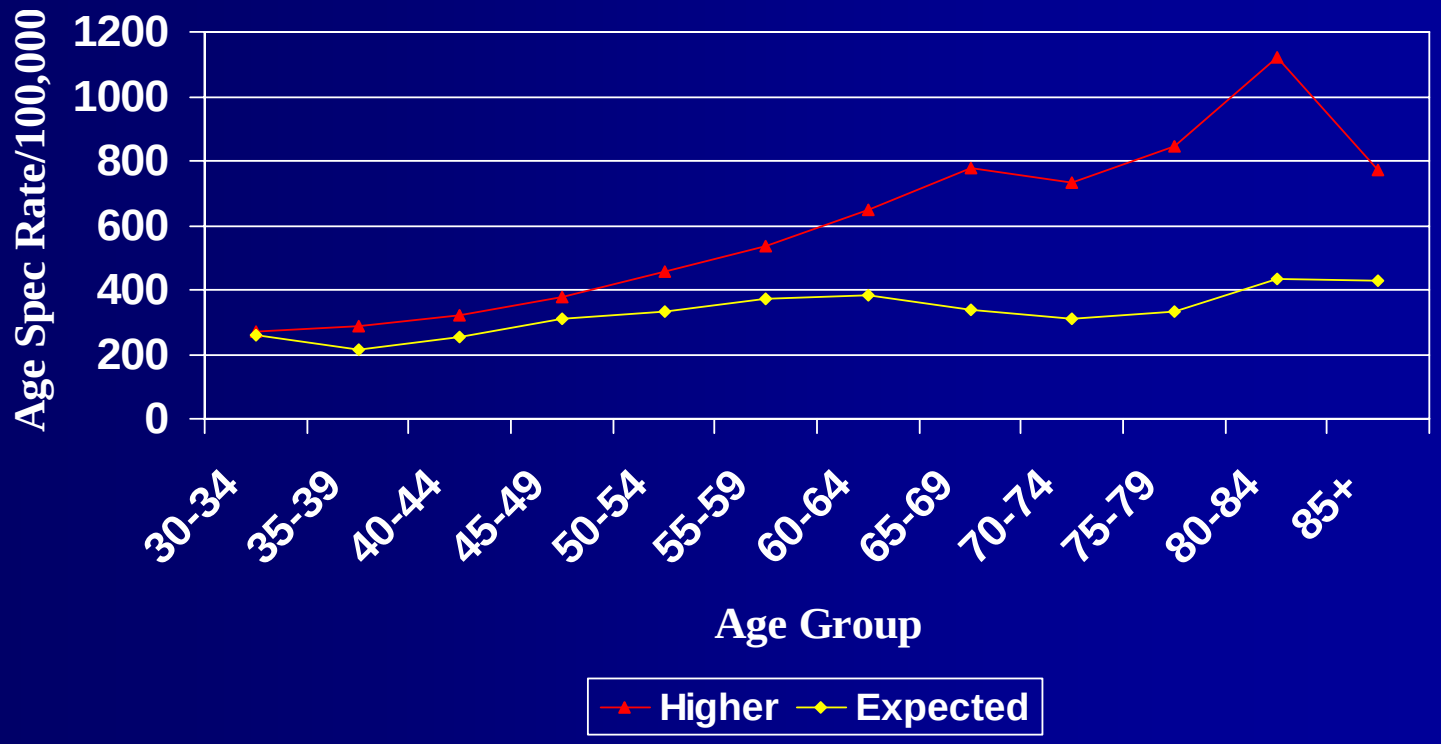
Identify Geographic Area with Higher than Expected Late Stage Breast Cancer

SaTScan Results

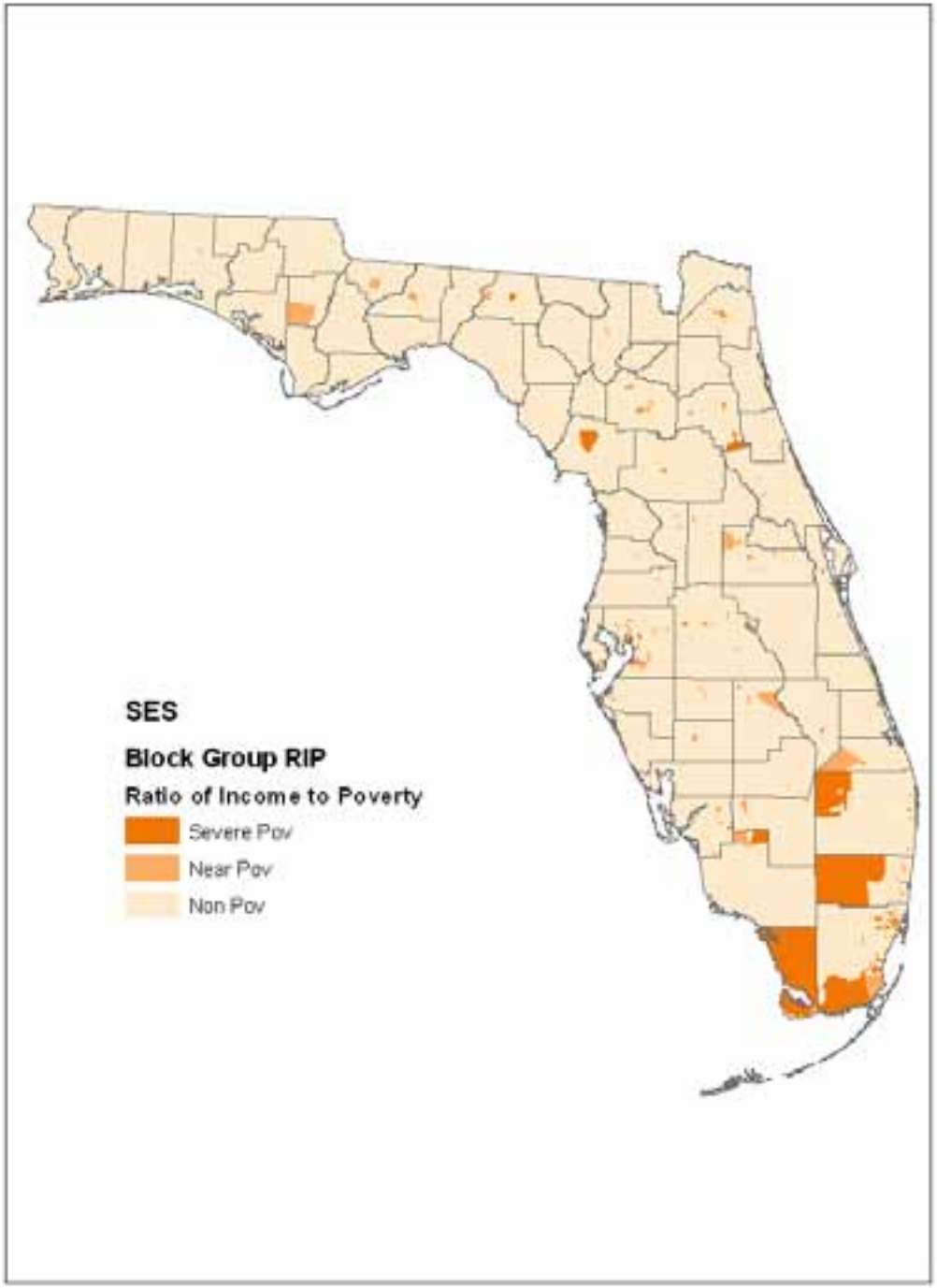
- Block groups
  - Higher than expected incidence – n=767
  - Expected incidence – n=5,444


Block Groups with Higher than Expected
Late Stage Breast Cancers
1998-2002
Legend
SaTScan Results
Higher than Expected
N
W
E
S
0 12.525 50 75 100
Miles

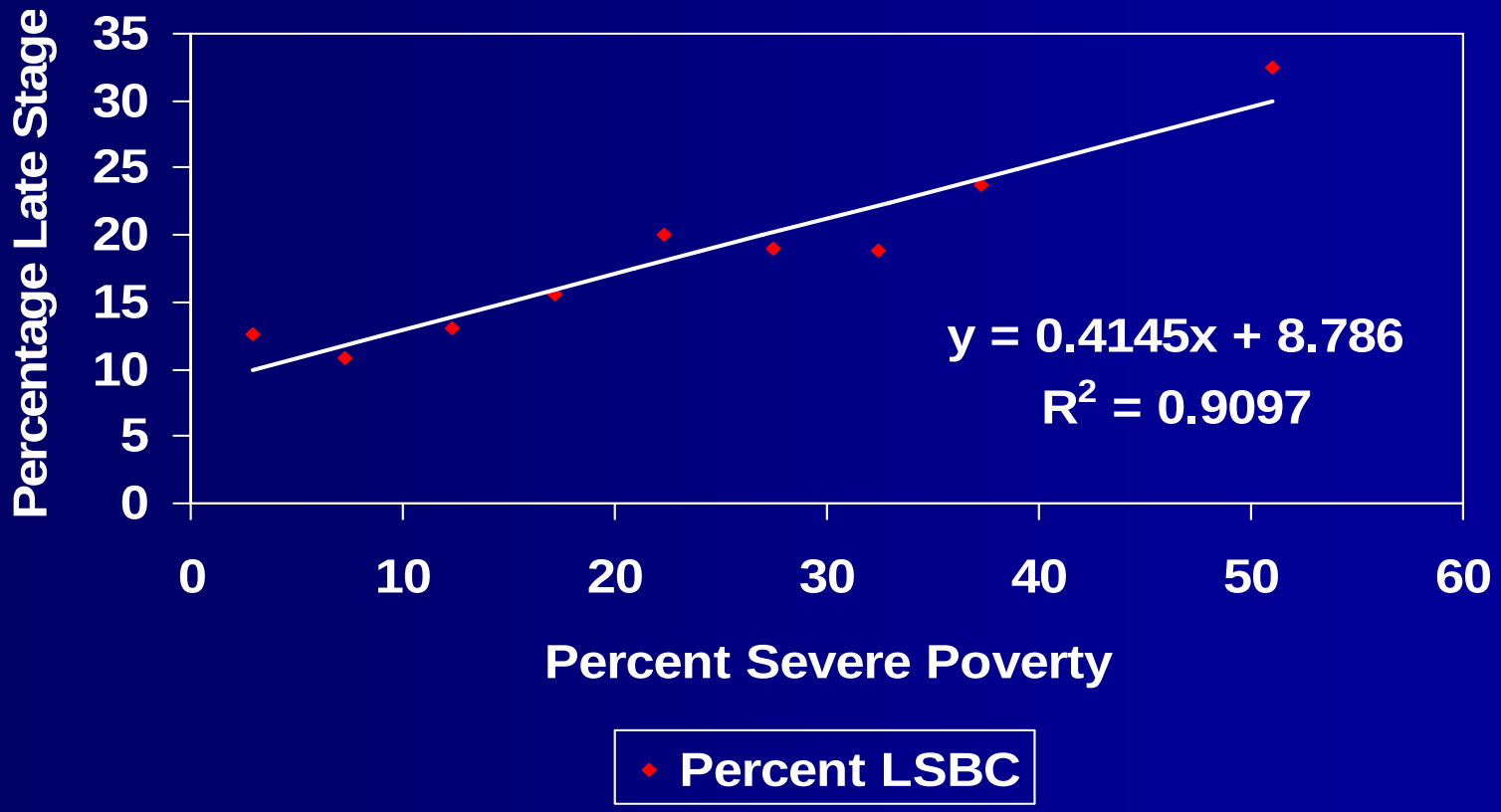
Aggregate Block Group Age Specific Rate by Incidence



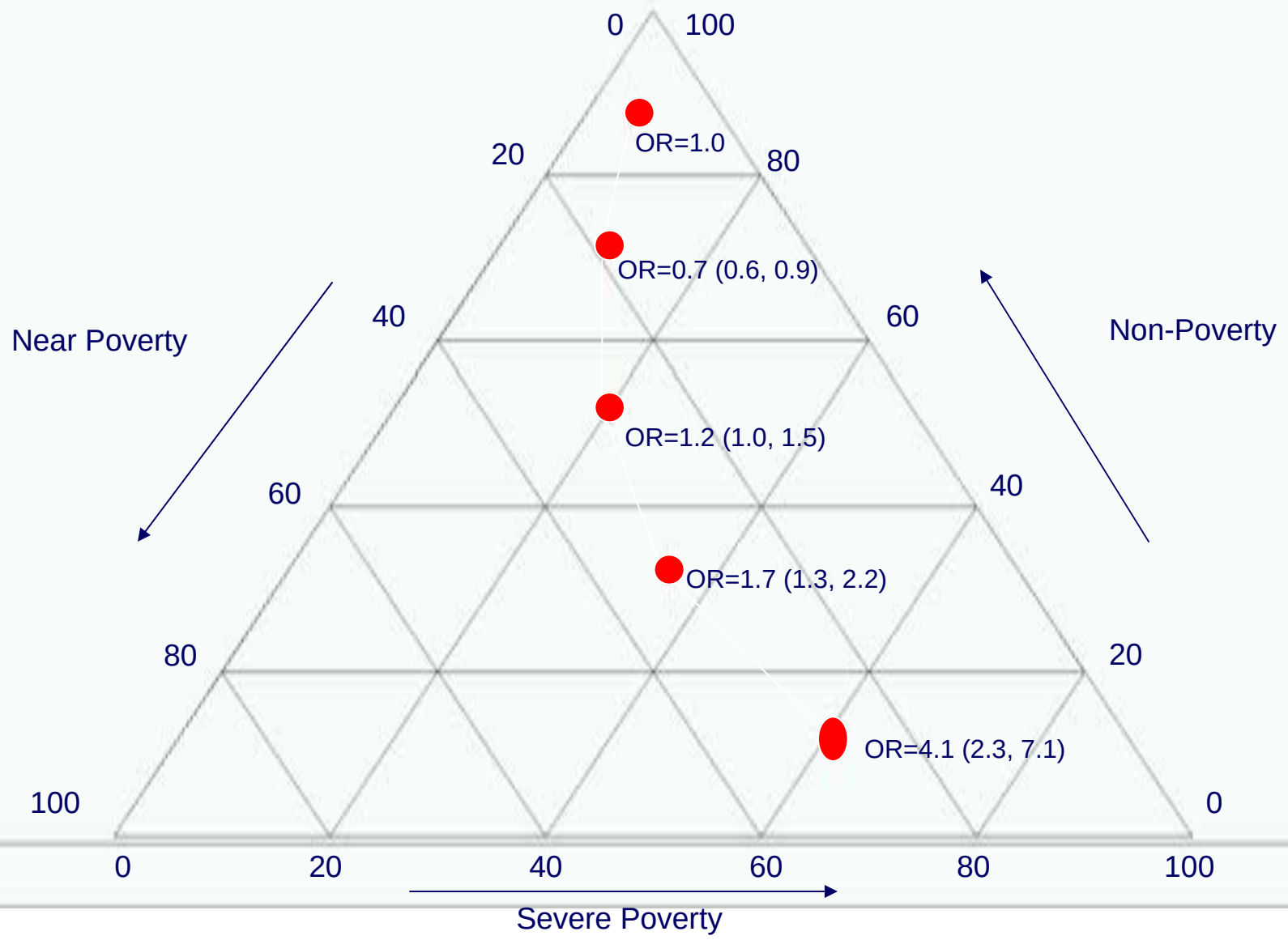
Evaluate the degree to which SES is associated with late stage breast cancer


SES
Block Group RIP
Ratio of Income to Poverty
Severe Pov
Near Pov
Non Pov

Percent Severe Poverty by Rate of Late Stage Breast Cancer (Block Group)



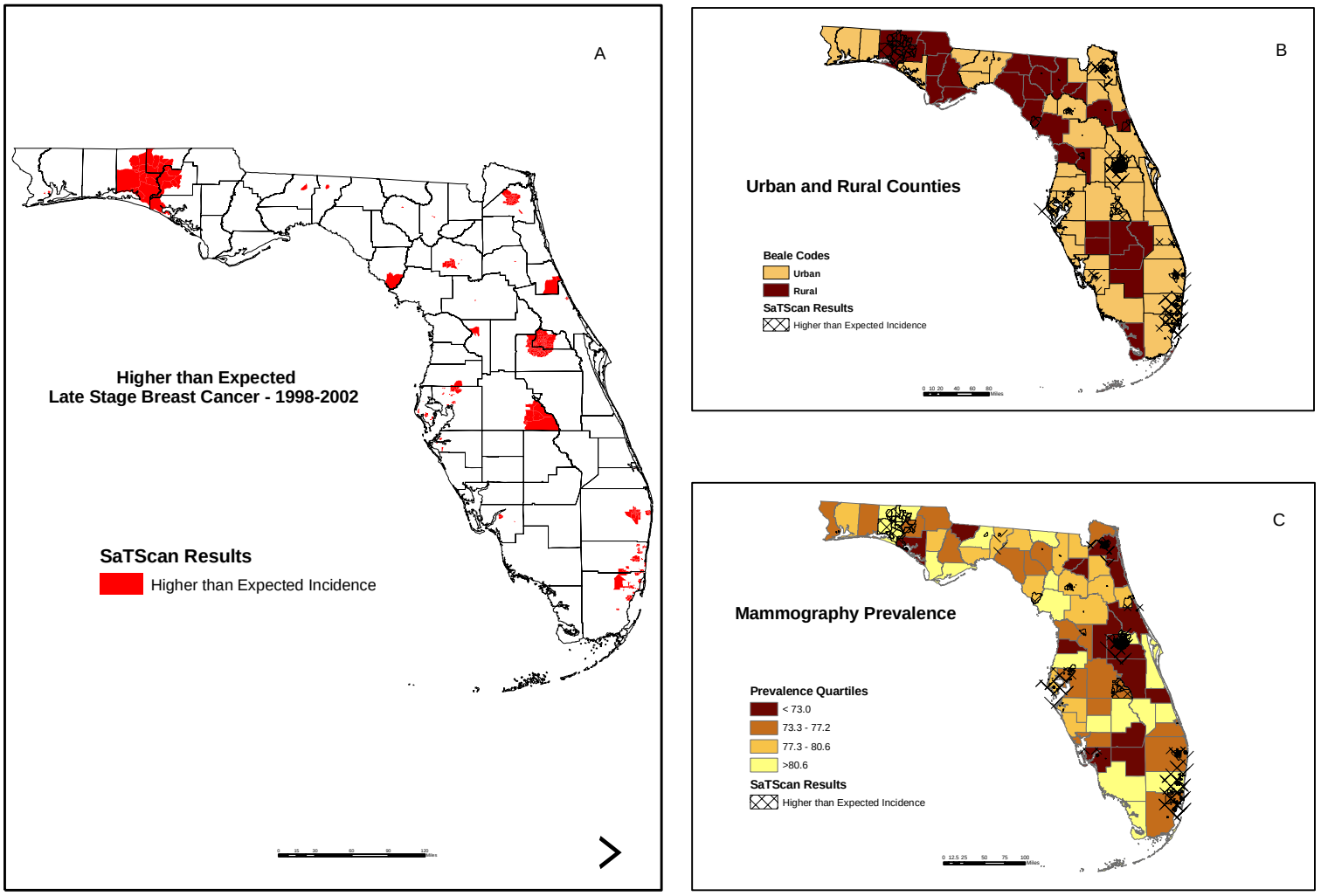
Block Group Odds Ratios and 95% Confidence Intervals of Higher than Expected Late Stage Breast Cancer Stratified by Ratio of Income to Poverty



Final Regression Model

SES		
Wealth	1	---
Near Poverty	**1.6**	**(1.0, 2.6)**
Severe Poverty	**3.0**	**(2.2, 4.0)**
Insurance Status		
Uninsured	1	---
Private	0.9	(0.6, 1.4)
Medicare	**0.6**	**(0.4, 0.9)**
Medicaid	0.9	(0.5, 1.6)
Mammography Use		
Highest Quartile 1	1	---
Quartile 2	**1.3**	**(1.1, 1.6)**
Quartile 3	**3.6**	**(3.0, 4.5)**
Lowest Quartile 4	**6.5**	**(5.1, 8.3)**
Urban / Rural		
Rural	1	---
Urban	**2.9**	**(2.0, 4.2)**

Figure 1 - Areas of Higher than Expected Late Stage Breast Cancer Overlaid with Urban/Rural Counties and Mammography Prevalence



Conclusions

- Area-based measures
  - Robust measures that can augment population-based surveillance systems
- Effect of SES on late stage breast cancer
  - Clear gradient
  - Not confounded by other factors
  - 28% of higher than expected incidence can be attributed to SES

Limitations

- Study design
  - Cross sectional
- Population
  - 2000 Population denominator for all years
- Geocoding
  - Precision
  - Excluded cases
- SES indicator
  - Single variable

Future Research

- Apply methodology to other diseases
  - Esophageal
  - Bladder
- Multi-level modeling
- Survey
  - Truth the SES data
  - Obtain additional psycho/social data
    - Barriers to access and/or utilization

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