

Spatial Clustering in the Incidence of Selected Cancers in New Jersey

Jerald Fagliano MPH PhD

Michael Berry MPH, Barbara Goun MPH PhD, Kevin Henry PhD,
Richard Opiekun MS MA PhD, Lisa Roche PhD

New Jersey Department of Health and Senior Services

Environmental Public Health Tracking Conference
Atlanta, GA
April 2005

Purpose and Context

- Context
 - NJ Cancer Cluster Task Force
 - EPHT demonstration project
- What can we learn from spatial analysis of the incidence of selected cancers in New Jersey?
 - Methods
 - Issues and interpretation

Cancer Types Examined

➤ Spatial and Temporal

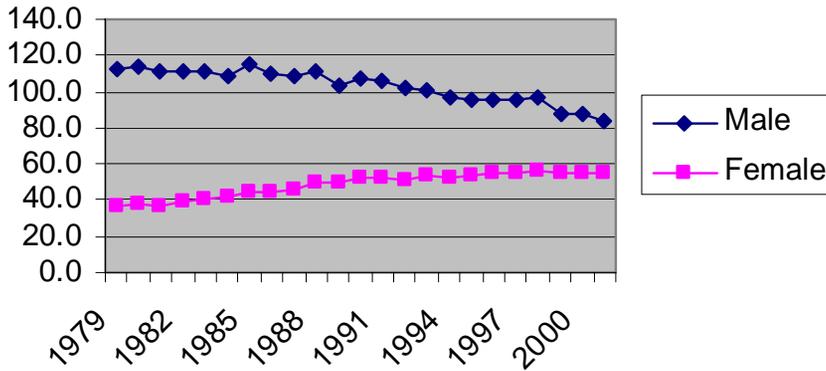
- Mesothelioma
- Leukemias
- Brain and other nervous system
- Thyroid
- Urinary bladder
- Bone and joint

➤ Temporal

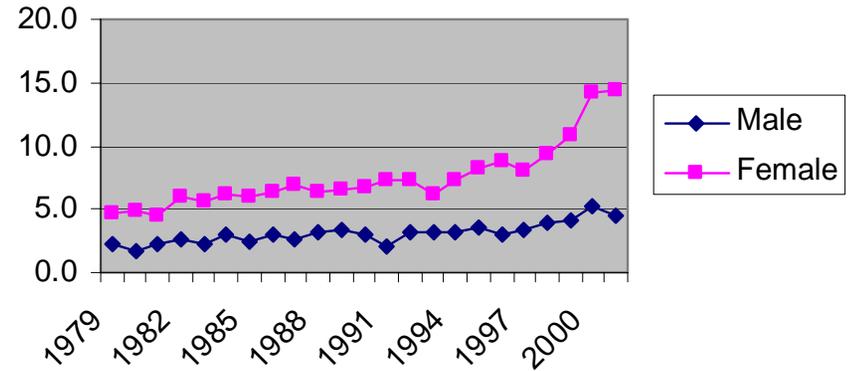
- Soft tissue sarcoma
- Non-Hodgkin lymphoma
- Larynx
- Nasopharynx
- Nose, nasal cavity and middle ear
- Kidney and renal pelvis
- Lung and bronchus
- Liver

Time Trends in Selected Cancers

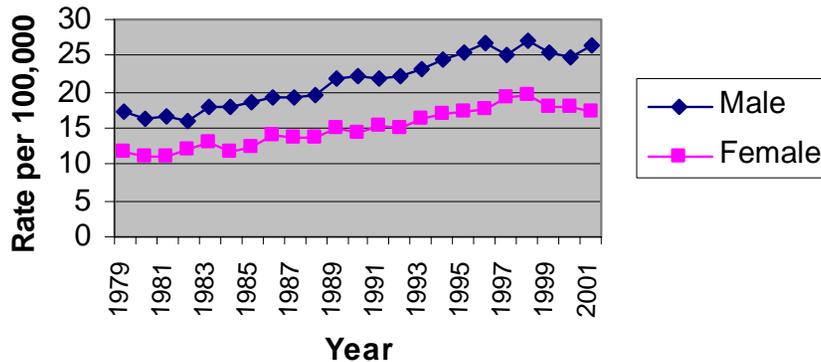
**Lung Cancer Incidence, NJ
1979-2001**



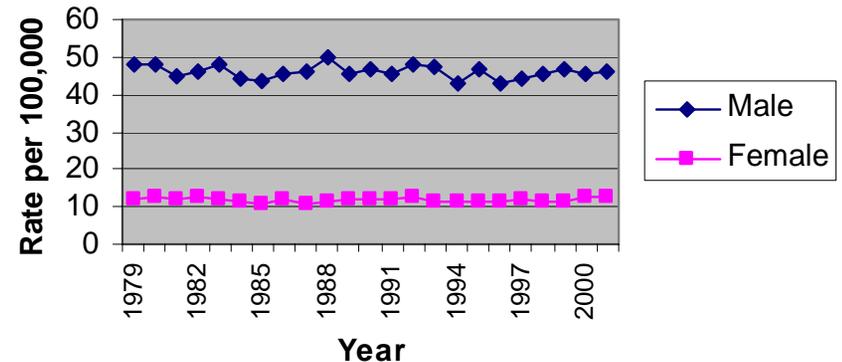
**Thyroid Cancer Incidence, NJ
1979-2001**



**Non-Hodgkin Lymphoma Incidence, NJ,
1979-2001**



**Bladder Cancer Incidence, NJ
1979-2001**



Rates per 100,000, age-adjusted to the year 2000 U.S. standard population

Method to Detect Spatial Clustering

- SaTScan software (Kulldorff 2004)
- Spatial scan statistic tests for “the existence of statistically significant localized clusters while at the same time pinpointing their locations.” (Kulldorff 1999)
- Identifies “the cluster that is least likely to have occurred by chance” and secondary clusters too

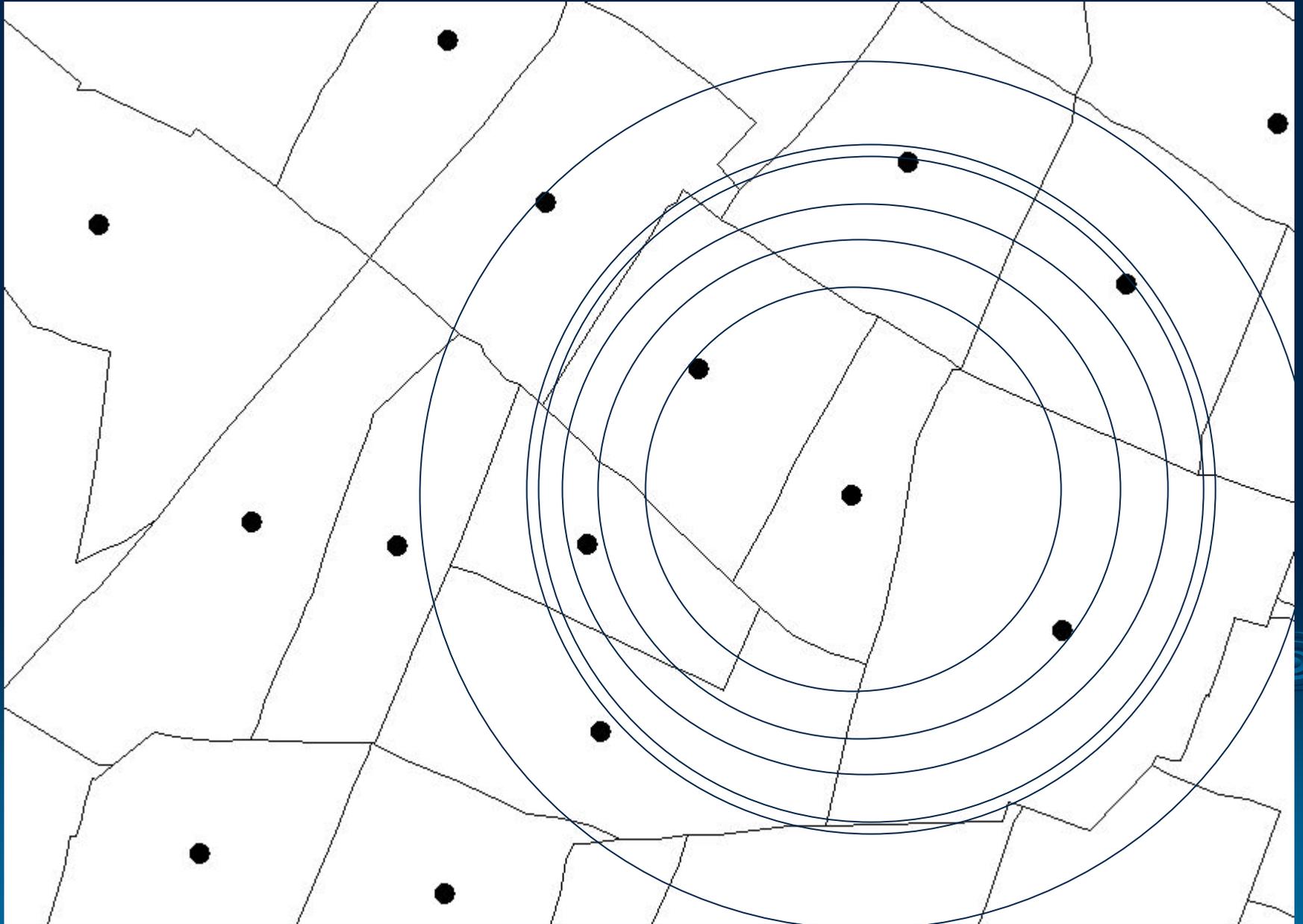
Input Data for SaTScan Analysis

- Case data: NJ State Cancer Registry
 - Incident cases, 1979-2001
 - Geocoding to census tract
- Population data: US Census
 - Census tract by age group and sex
 - GeoLytics, Inc. file, 1980, 1990, 2000
- Coordinate (spatial reference) data
 - Year 2000 census tracts (n=1,950)

SaTScan Settings

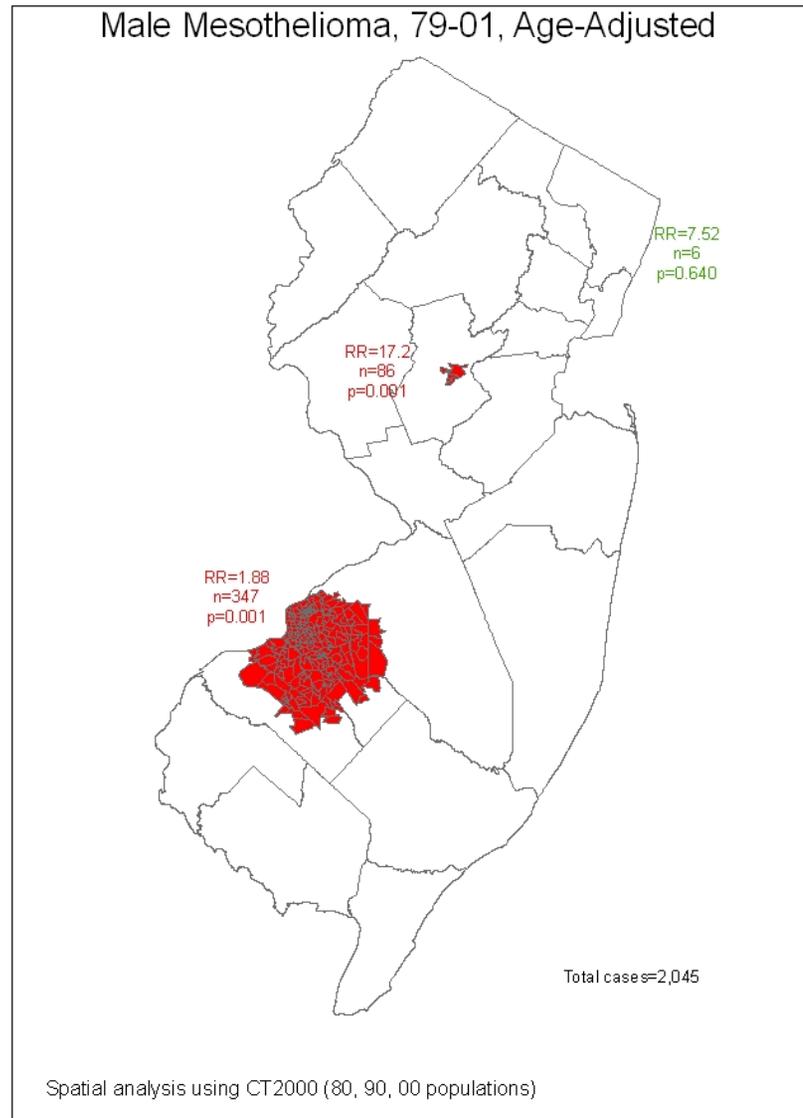
- Spatial and spatial-temporal analyses
- Poisson probability model (SIR)
- Scan for high relative rates
- Monte Carlo simulation generates p-value
- Set maximum cluster size
 - Default 50% of population at risk
- No geographical overlap for secondary cluster reporting

SaTScan Process



Example: Mesothelioma

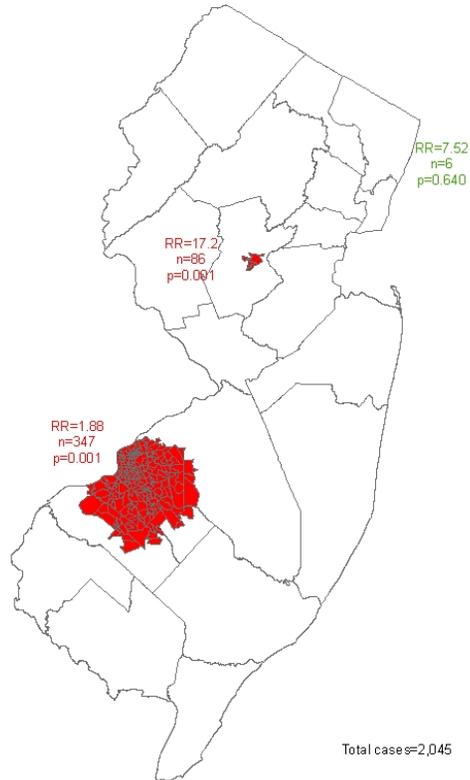
- Known to cluster geographically
- Historic occupational exposures to asbestos



Spatial vs. Spatial-Temporal Clustering

Spatial

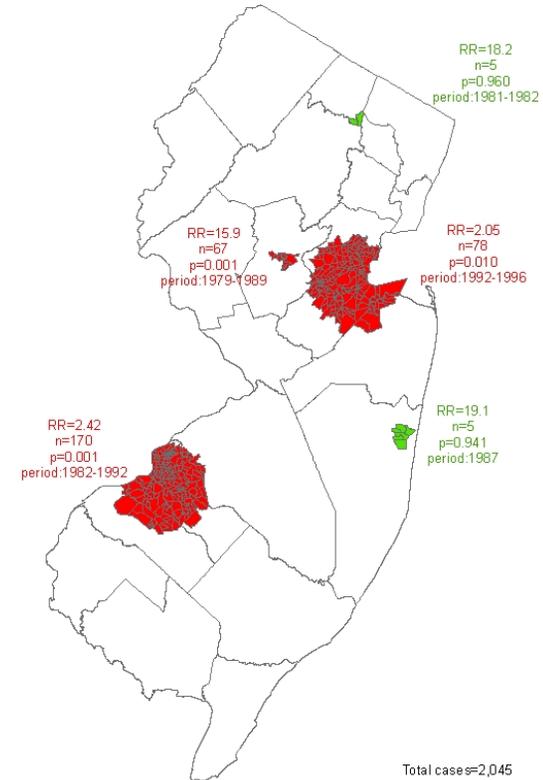
Male Mesothelioma, 79-01, Age-Adjusted



Spatial analysis using CT2000 (80, 90, 00 populations)

Spatial-Temporal

Male Mesothelioma, 79-01, Age-Adjusted

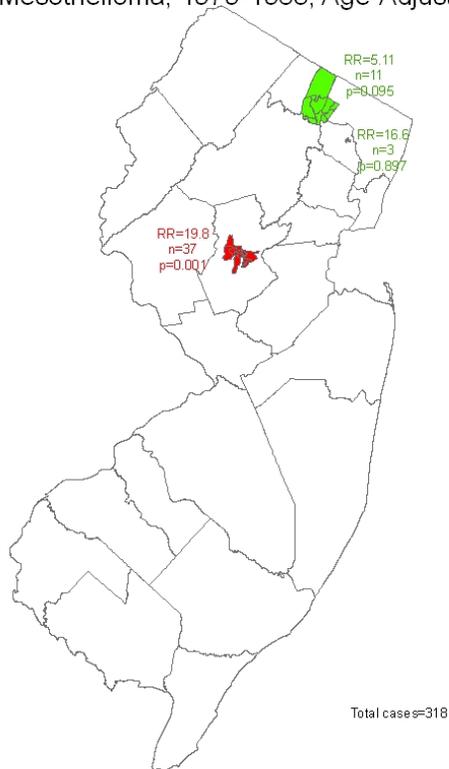


Space-time analysis using CT2000 (80, 90, 00 populations)

Spatial-Temporal vs. Spatial Clustering through Time, I

1979-1983

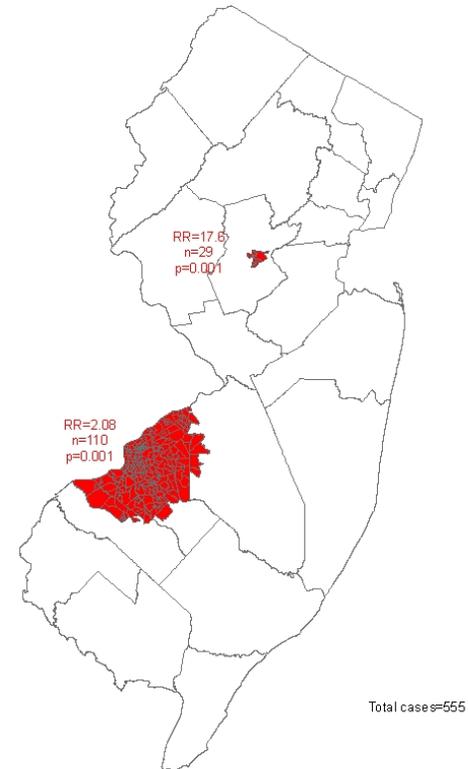
Male Mesothelioma, 1979-1983, Age-Adjusted



Spatial analysis using CT2000 populations

1984-1989

Male Mesothelioma, 1984-1989, Age-Adjusted

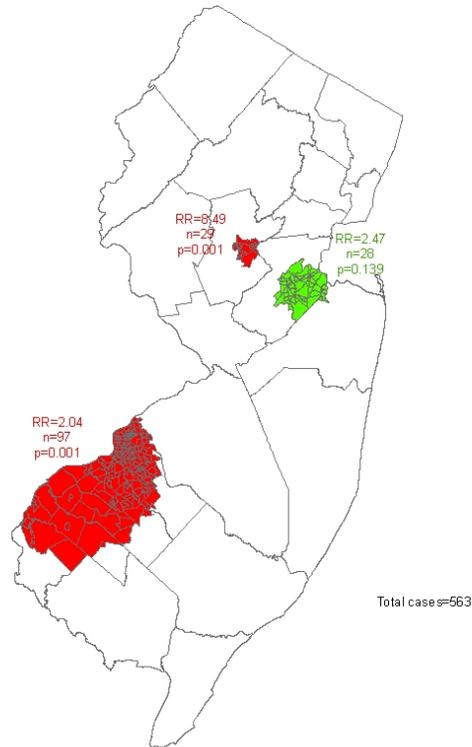


Spatial analysis using CT2000 populations

Spatial-Temporal vs. Spatial Clustering through Time, II

1990-1995

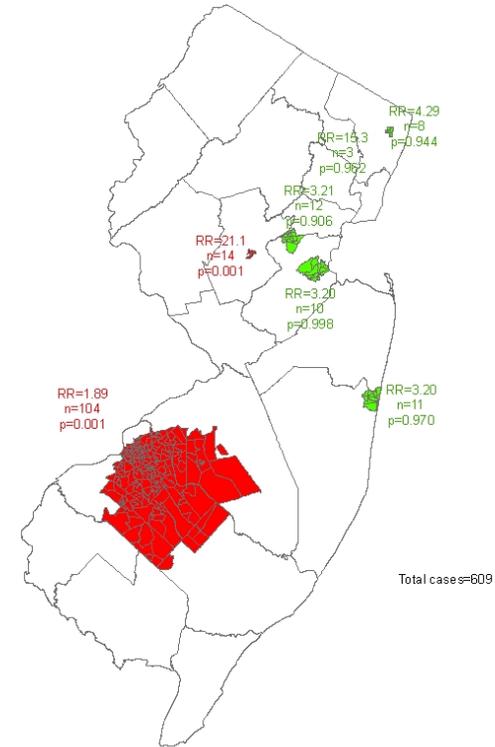
Male Mesothelioma, 1990-1995, Age-Adjusted



Spatial analysis using CT2000 populations

1996 - 2001

Male Mesothelioma, 1996-2001, Age-Adjusted

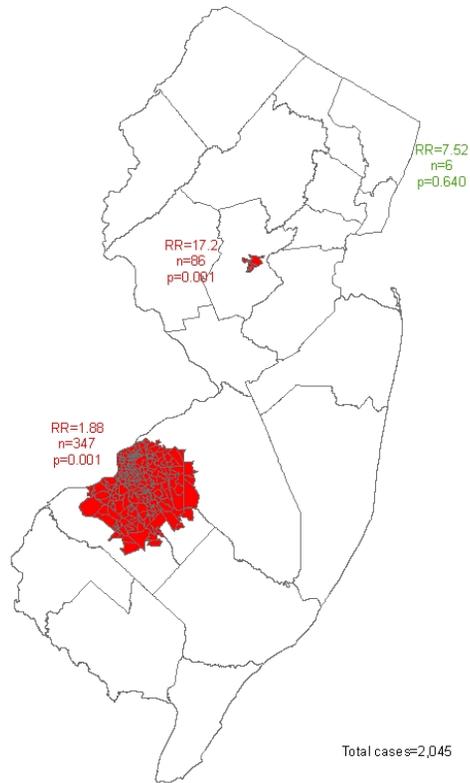


Spatial analysis using CT2000 populations

Spatial Clustering: Setting Maximum Size

Max Cluster Base 50% of Pop

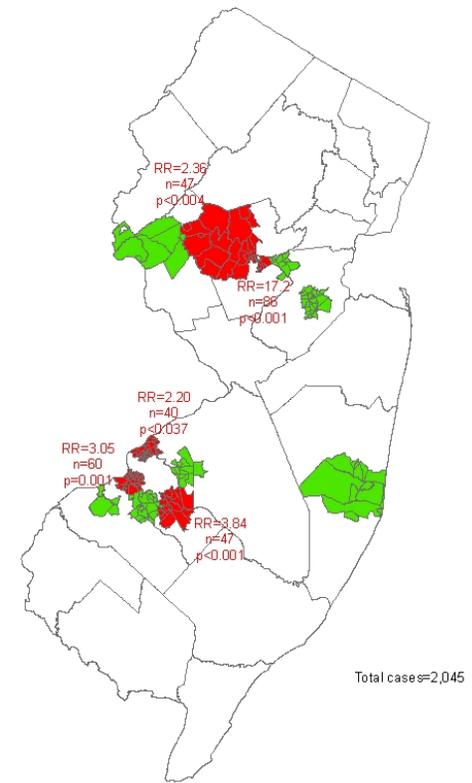
Male Mesothelioma, 79-01, Age-Adjusted



Spatial analysis using CT2000 (80, 90, 00 populations)

Max Cluster Base 1% of Pop

Male Mesothelioma, 79-01, Age-Adjusted

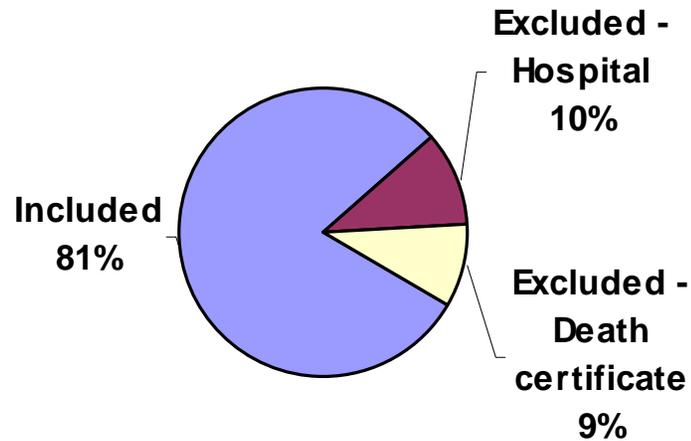


Spatial analysis using CT2000 (80, 90, 00 populations)

Max 1% pop at risk

Loss of Case Data Due to Inaccurate Geocoding

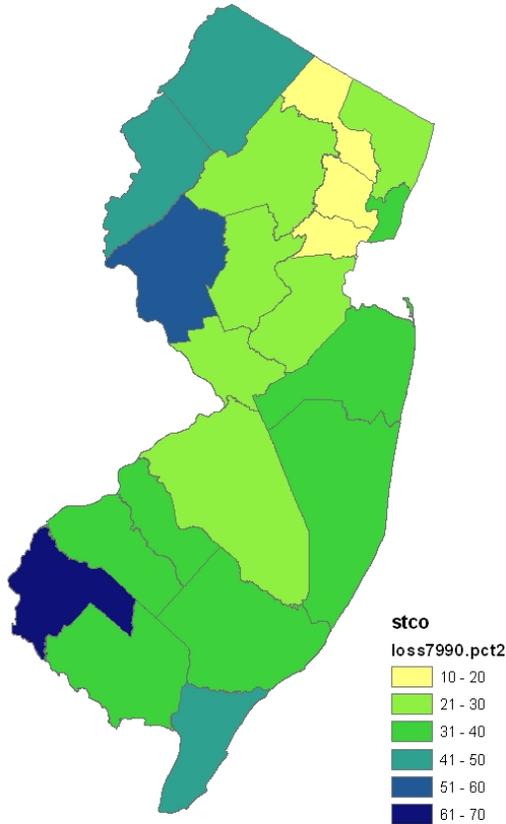
**Leukemia Cases Used in Spatial Analysis,
1979-2001**



Geographic Variation in Loss Due to Geocoding Inaccuracy

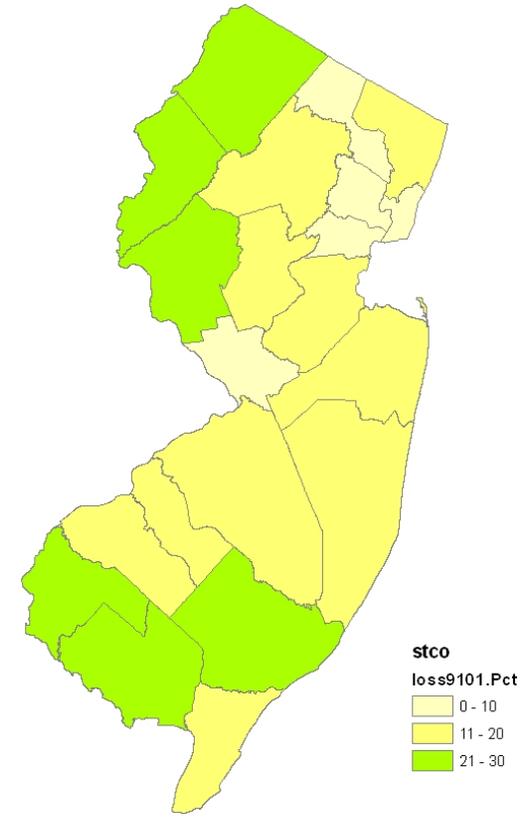
1979-1990

Percent Leukemia Cases Lost from Analysis, 79-90



1991-2001

Percent Leukemia Cases Lost from Analysis, 91-01



Preliminary Spatial Cluster Results

| Cancer Type | Spatial Clustering? |
|--------------------------------|---|
| Mesothelioma | Local clustering, high RR |
| Leukemias | Large area, low increase in RR Children: no significant clusters |
| Brain and Other Nervous System | Large area, low increase in RR Children: no significant clusters |
| Thyroid | Large area, low increase in RR |
| Urinary Bladder | Local clustering, low increase in RR |
| Bone and Joint | No significant clusters |

Conclusions

- Geographic cluster analysis may be informative in combination with other descriptive analyses
- Interpretation and communication issues
- Geocoding is an important technical obstacle for historic cancer incidence data
- Next steps
 - Further investigation of spatial analytic tools
 - Linking (ecologic studies)