Spatiotemporal Trends of Stage-specific Incidence of Non-Small Cell Lung Cancer (NSCLC) in New York State counties, 1995-2016

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Introduction

- Lung cancer is the leading cause of cancer deaths.
- Early detection is particularly important for non-small cell lung cancer (NSCLC) patients as treatment options become limited for advanced stages of NSCLC.
- Understanding the geographic and temporal variations of stage-specific cancer incidence may provide meaningful information to help minimize disease progression and maximize chance of survival.

Methods

- ***Study Design:*** Ecologic study.
- ***Data Sources:*** New York State Cancer Registry (NYSCR) data[1] retrieved from SEER*Stat software[2] for 62 counties during 22 years (1995-2016).
- ***Outcomes:*** County-level age-adjusted incidence rates for NSCLC (all-stage, and by three stages: local, regional, and distant).
- ***Covariates:*** County level socioeconomic index (Yost index),[3] a time-dependent composite score based on Median household income, Median house value, Median rent, Percent below 150% of poverty line, Education Index,[4] Percent working class, and Percent unemployed.
- ***Statistical Methods:*** High/low incidence clusters identified using SaTScan™ with normal model.[5-7]
  - Space-only model, weighted by 1/(Standard error of the age-adjusted incidence rate).
  - Space-time model, adjusting for Yost Index.
- ***Visualization:*** Mapped counties of high/low incidence clusters along with the location of lung cancer screening registry facilities (as of Feb, 2019).[8]

Results

Figure 1. High/low clusters of all-stage NSCLC, space-only model (p=0.001).

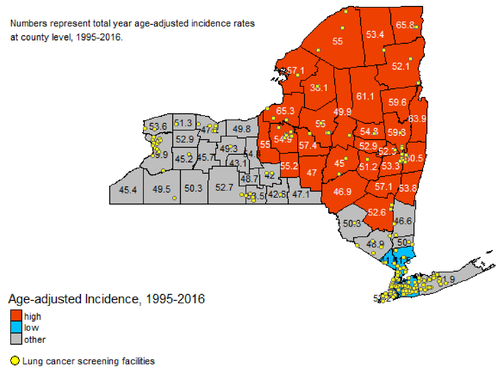


Figure 2. High/low clusters of all-stage NSCLC, space-time model, (p=0.001).

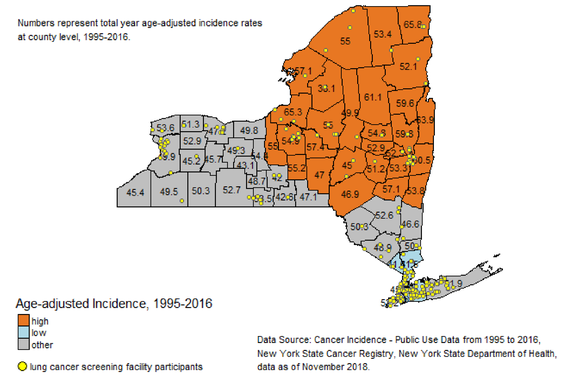


Figure 3. High/low clusters of stage-specific NSCLC, space-only model (p < 0.01).

Local Cancer Stage	Regional Cancer Stage	Distant Cancer Stage

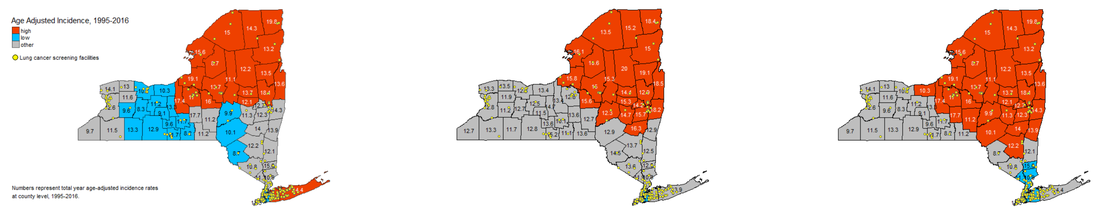
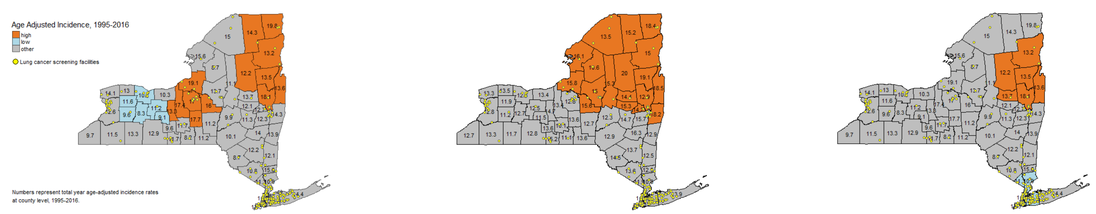


Figure 4. High/low clusters of stage-specific NSCLC, space-time model (p < 0.01).

Local Cancer Stage	Regional Cancer Stage	Distant Cancer Stage



Detailed incidence mapping and ranking and summary statistics for sex-specific and race-specific incidence results are shown on a publically accessible webpage.

Key Findings

1. Significant ($p < 0.01$) high/low incidence clusters were detected, with variations seen in the cluster sizes and locations between all-stage vs stage-specific models.
2. Variations of high/low clusters were also found in the space-only vs space-time models.
3. Regardless of cancer stage, the most likely high-incidence area occurred in the northeast section of the state, while low-incidence cluster around the New York City metropolitan area.

Summary

Implications:

- Cancer prevention strategies for NSCLC may be benefited from a refined approach that meets the needs of a specific geographic region, as there are substantial geospatial variations in the stage-specific incidence rate.
- For example, implementation of mobile lung cancer screening units in areas with high incidence rate but low lung cancer screening facilities, in order to increase early detection, and reduce disparities.

Future steps:

- Modeling the geospatial variation using different geospatial and temporal scales.
- Identifying risk factors other than socioeconomic status.
- Identifying high/low cluster of stage-specific mortality rate.

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