Category: Data Analysis – Work in Progress – Faculty

Utilizing ArcGIS to Discover Geographic Disparities in Lung Cancer Screening

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1. Background

Lung cancer screening has the potential to discover cancer at early stages and reduce mortality. The American College of Radiology (ACR) provides a locator tool for all imaging-based lung cancer screening facilities (LCSFs) in the United States. For organizational purposes, we sought to determine the location of ACR-accredited LCSFs in Florida. After mapping facilities using ArcGIS, we recognized an uneven distribution of facilities that visually coincided with incidence, mortality and the percentage of lung cancer cases diagnosed at late stage. Therefore, we began to investigate how demographic variables and outcomes relevant to lung cancer are linked to LCSF distribution in Florida as a tool to guide the development of screening and care programs.

2. Goals

1. Describe the geographic distribution of lung cancer screening facilities in the clinical catchment for Tampa General Hospital Cancer Institute and Florida.
2. Determine how the geographic distribution of LCSFs relates to county-level demographics.
3. Evaluate relationships between the geographic distribution of LCSFs and lung cancer outcomes in Florida.
4. Identify geographic regions and demographically defined populations in which screening and outreach can be most effectively focused to reduce lung cancer mortality in Florida.

3. Solutions and Methods

Data documenting the LCSF locations were retrieved from publicly accessible databases maintained by the ACR and converted to geographic coordinates using Google Maps API. After mapping these locations, a Florida counties GIS file was overlaid with the locations of lung cancer screening facilities; ArcGIS was utilized to generate facility counts for each county. Data documenting race, ethnicity, income, insurance status, and public health spending were retrieved from U.S. Census and health organizations. Uni- and multivariate regression were used to evaluate relationships between the geographic distribution of LCSFs on lung cancer outcomes.

4. Outcomes

Using ArcGIS to jointly map LCSF locations, the geographic distribution of lung cancer incidence and proportion of late-stage cases revealed a clear, visual anti-correlation between incidence and LCSF distribution in the TGH CI catchment. In univariate analyses, a significant and strong correlation between the number of lung cancer screening locations and lung cancer incidence ($r= -0.24$, $p=0.049$) and mortality ($r= -0.37$, $p=0.002$). However, the proportion of late-stage cases with the geographic distribution of LCSFs was not significantly correlated with LCSF distribution ($r= -0.11$, $p= 0.39$), suggesting that the benefits of LCSFs extend beyond their ability to detect disease at an early stage.

5. Lessons Learned and Future Directions

These findings could have significant implications for public health policy as well as institution-level administrative decisions around how lung cancer screening and care programs should be strategically developed as part of TGH CI outreach efforts. Among other efforts, a multivariate model is being refined

to estimate the effect of lung cancer screening facilities and determine how other demographic factors and issues related to care access interact to influence lung cancer outcomes in our catchment.

Figure

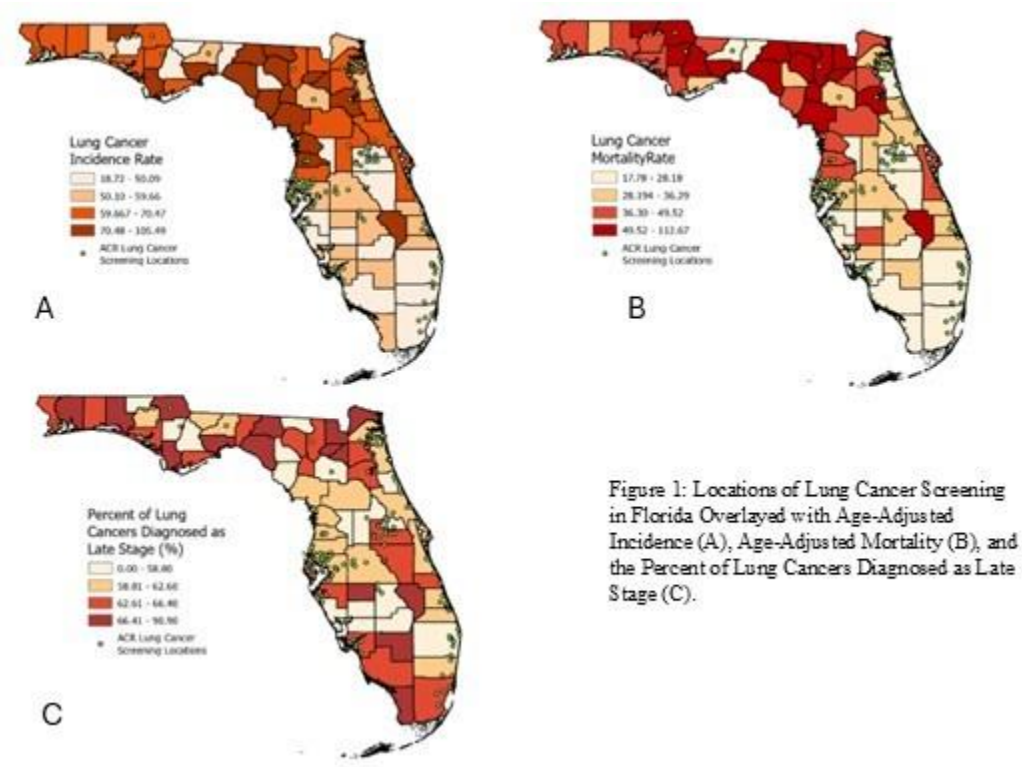

Figure 1: Locations of Lung Cancer Screening in Florida Overlayed with Age-Adjusted Incidence (A), Age-Adjusted Mortality (B), and the Percent of Lung Cancers Diagnosed as Late Stage (C).