Category: Catchment Area Data, Social Determinants of Health, and Equity – Completed Project – Faculty

Catchment Area Geographic Disparities in Colorectal, Prostate, Breast, and Lung Cancer Risk in Alabama

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1. Background
Cancer incidence has increased over several decades for the most common cancers (e.g., breast, prostate, colorectal). Causes of increasing incidence are not fully understood, but changes in risk factors over time may be contributing. Risk factor and incidence patterns have strong geographic variation, with particular disparities in the Southeast and in rural and high poverty areas. As neighborhood-level geospatial studies of cancer burden remain uncommon, local investigation of cancer burden in the Deep South would clarify neighborhoods with higher cancer risk that can be targeted by local public health entities and prevention programs within cancer center catchment areas.

2. Goals
We utilized advanced Bayesian disease mapping methods to examine cancer risk and hot-/cold-spot patterns of census tract-level incidence in Alabama.

3. Solutions and Methods
We utilized adult (≥18 years) incident cases of colorectal, prostate, breast, and lung cancers from 2010-2019 Alabama Statewide Cancer Registry data. We performed Bayesian disease mapping by fitting negative binomial hierarchical spatial Bayesian models via a reparameterization of the Besag-York-Mollié (BYM2) approach. We used posterior estimates to calculate relative risks (RRs) by tract and classified tracts as hot spots, cold spots, or not significantly different based on age-standardized expected case counts at 99-percent credible intervals (CrI). We performed stratified analyses of median RR values using 2010 Rural-Urban Commuting Area codes and 2010-2019 Area Deprivation Index (ADI) quartiles.

4. Outcomes
We identified 7, 9, 3, and 83 hot-spot tracts for colorectal, prostate, breast, and lung cancer incidence, respectively. Colorectal hot spots were largely in rural southwestern Alabama tracts; prostate cancer hot spots were across a band of tracts in south-central Alabama; breast cancer hot spots were localized to Huntsville and Birmingham; and there were widespread rural lung cancer hot spots.

RR maps revealed elevated colorectal cancer (CRC) risk (RRs >1.5) in southwestern Alabama, with weaker increased risk in northwestern and east-central tracts. Metropolitan tracts near major cities had reduced CRC risk with RRs between 0.5 and 1.

For prostate cancer, we observed a band of elevated RRs=~1.5 across rural south-central tracts, northern suburban Birmingham, and more elevated RRs >1.75 in coastal areas. Metropolitan and rural tracts in northern Alabama had reduced prostate cancer risk (RRs=0.5-1).

For breast cancer, there was elevated risk (RRs=~1.5) in suburban tracts of Birmingham and Huntsville and reduced risk (RRs=0.5-0.75) in metropolitan tracts near Tuscaloosa and Auburn-Opelika. RRs for lung cancer demonstrated elevated risk in rural north-central, southern, and coastal tracts (RRs >1.75). Metropolitan tracts near major cities had reduced lung cancer risk (RRs=~0.5).

For CRC, prostate, and lung cancer RRs, there were exposure-response relationships with increasing rurality and we found little evidence of exposure-response relationships with ADI.

5. Lessons Learned and Future Directions

Linking our census tract-level findings with individual-level outcomes in identified hot spots will advance collective efforts to inform statewide cancer prevention and control strategies in reducing geographic cancer incidence disparities in cancer center catchment areas. Future quantitative research should investigate individual-level risk factors driving geographic disparities and qualitative studies should capture contextual factors.