

Exploring Social, Environmental, and Health Correlates of Liver and IBD Cancer Incidence in Houston Methodist Neal Cancer Center

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1. Background

Liver and intrahepatic bile duct (IBD) cancer presents a significant burden in the Houston Methodist Neal Cancer Center (HMNCC) eight-county catchment area, marked by profound geographic and racial disparities that threaten health equity. This region exhibits stark variations in demographics, health resource access, and, notably, industrial exposures, with several counties experiencing disproportionate petrochemical industry presence. Community Advisory Board members and community partners have repeatedly raised concerns about these environmental exposures and their potential health impacts. Responding to these community-identified priorities, we are collaboratively examining the intersection of industrial emissions, social vulnerability, and cancer burden. Characterizing community-level drivers of excess cancer risk is imperative for developing targeted, equity-focused prevention strategies.

2. Goals

- **Measure key associations** between social, health, and environmental factors and lung cancer incidence
- **Identify disparities** by comparing lung cancer rates across demographic and geographic groups

3. Solutions and Methods

County level cancer incidence (2018-2022) was collected via United States Cancer Statistics. The sociodemographic, clinical, behavioral, and environmental factors were obtained from the U.S. Centers for Disease Control and Prevention PLACES project and American Cancer Society five-year estimates. Geographic Information System (GIS) mapping identified the spatial patterns within the eight counties: Harris, Montgomery, Fort Bend, Galveston, Brazoria, Chambers, Liberty, and Jefferson. Weighted Spearman correlations (population-weighted) and weighted univariate linear regressions of the log transformed incidence were used to assess the associations. Holm adjustment controlled for multiple testing.

4. Outcomes

The population-weighted median incidence of liver and IBD cancer in the eight counties was 13.5 per 100,000, with the county-wide rate ranging from 9.27 to 16.74 per 100,000. GIS analyses showed consistently elevated incidence in Liberty, Galveston, and Brazoria counties, with Hispanic residents experiencing the highest race-specific burdens.

Several factors exhibited strong positive correlations with incidence, including high blood pressure ($r=0.974$), American Indian Alaskan Native (AIAN) ($r=0.972$), and social vulnerability index housing ($r=0.775$) (all raw $p \leq 0.05$). After Holm adjustment, high blood pressure and AIAN remained significant.

Strong negative correlations were observed for the population living in housing units with 1000/100 Megabits per second (Mbps) Broadband ($r= -0.965$), advanced degree ($r= -0.963$), and college ($r= -0.747$), although only housing units with 1000/100 Mbps Broadband and advanced degree survived Holm correction.

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In weighted univariate regression, social vulnerability index housing showed the strongest association with incidence ($\beta=0.747$, $p=0.011$), followed by median gross rent ($\beta=-0.0008$, $p=0.016$) and median home value ($\beta=-0.000$, $p=0.017$). Associations for economic segregation ($\beta=-1.30$, $p=0.020$) and college ($\beta=-1.82$, $p=0.022$) were also significant.

Results directly inform our Cancer Prevention and Research Institute of Texas-funded community cancer control infrastructure, guiding certified Community Health Workers to conduct targeted liver cancer screening and evidence-based prevention education through trusted partnerships with Federally Qualified Health Centers. Findings we co-interpreted with community leaders, translated into culturally tailored interventions, and returned to communities to build capacity for environmental health advocacy and cancer prevention. This community engaged approach transforms geospatial data from academic output into actionable community intelligence for health equity.

5. Lessons Learned and Future Directions

Across the HMNCC catchment, liver and IBD cancer incidence clusters geographically and align closely with modifiable and non-modifiable risk indicators. These findings highlight priority communities and population-level factors for targeted prevention, early detection, and community-engaged interventions aimed at reducing inequities in liver cancer burden.

Figure 1: Weighted Spearman Correlations with Liver Cancer Incidence

