# Two Decades of Cancer Burden in a Racially, Ethnically Diverse U.S. Gulf Coast Population: The Joint Roles of Environmental Injustice & Persistent Poverty

Anil Vadathya, MS*; Ranjini (Rini) Ghosh, MPP*; Hung Luu, MD, PhD, MPH; Arica Brandford, PhD, JD, RN; Jennifer Cullen, PhD, MPH
Houston Methodist Neal Cancer Center

*Indicates equal first author contribution*

## BACKGROUND & SIGNIFICANCE

The Houston Methodist Neal Cancer Center (HMNCC) catchment area is a racially/ethnically diverse 8-county Southeastern Texas region (**Table 1**). This region has 20.6% non-Hispanic Black (NHB) and 38% Hispanic/Latino (H/L) residents. Almost one-third (31%) of residents live in poverty and 19% lack health insurance. A Propublica report examining U.S. cancer-causing industrial air pollution found numerous "hotspots" in Texas, including areas within the HMNCC catchment area (1). Climate change in the U.S. Gulf Coast region is likely to exacerbate barriers to cancer prevention and control services, including screening, diagnosis, and timely receipt of cancer care. Notably, U.S. census projections indicate that the non-Hispanic Asian population will double from 9% to 18% by 2030 in the Greater Houston metro area, mostly driven by increases in Vietnamese and Asian-Indian subgroups. Given these unique geographical characteristics and challenges, we will conduct a large-scale data linkage of Texas Cancer Registry cancer rate metrics, environmental factors, social drivers of health (SDOH), and demographic composition of our region to understand current cancer burden, as well as to prepare for anticipated trends in burden.

## GOALS

A **primary study goal** is to build a "cancer exposome" consisting of census tract-level cancer rates, temporal patterns, environmental/behavioral cancer risk factors, demographics, and indices of Social Drivers of Health (SDOHs) (**Figure 1**). This exposome model has been adapted from Juarez et *al*. (2) .

The Texas Cancer Registry (TCR) Institutional Review Board recently granted the HMNCC access to state-wide data on cancer incidence, mortality, stage at diagnosis, treatment, and mortality for overall cancers and by cancer site [*Memorandum of Understanding (MOU) under execution]*. These data will be used to conduct detailed geospatial mapping and hot-spot analysis to inform where targeted services/interventions are most needed to improve cancer burden metrics in our most vulnerable communities. This work will be conducted in close collaboration with the HMNCC Community Outreach and Engagement (COE) leadership team.

This data infrastructure will be strategically leveraged to reduce notable cancer disparities in our region, to help direct necessary COE activities, and to prepare for anticipated changes in future cancer burden that will be impacted by the rapidly shifting demographics (**Figure 2**) and increased climate change anticipated for the HMNCC catchment area region.

Finally, special attention will be given to the cancers that are uniquely burdensome for the HMNCC catchment area, reflected in the five priority cancers, as well as two cancers of emerging prioritization (**Figures 3 and 4**).

## METHODOLOGY

**NOTE: All data sources will be merged at the census-tract level:**

Demographics: U.S. Census Bureau - race/ethnicity and Persistent Poverty (3,4)

Climate Burden & Environmental Cancer Risk: CDC's Environmental Justice Index (5)

SDOHs: Area Deprivation Index and Racial Isolation Index

Cancer Metrics: Texas Cancer Registry (TCR) approval for data access has been granted; data are forthcoming, NCI's Surveillance Epidemiology and End Results (SEER), 2000-21 (6)

Analysis:

- Age-adjusted cancer incidence and mortality rates will be examined for the HMNCC 8 county catchment area, the state of Texas, and the U.S. We will also examine stage at diagnosis, temporal trends, and longitudinal patterns in early-onset cancers.
- Joinpoint regression will be used to model longitudinal patterns in overall, liver, and lung cancer rates, using R and Python.
- ArcGIS will be used for geospatial mapping, data visualization, and hot-spot maps.
- The SEER specialized dataset, "*Incidence Data for Detailed Asian/Pacific Islander Groups Database*", will be accessed and used to examine cancer burden for our rapidly growing Asian population, in a disaggregated manner.

## RESULTS: FIGURES & TABLES

Figure 1. Conceptual Framework of the HMNCC Exposome

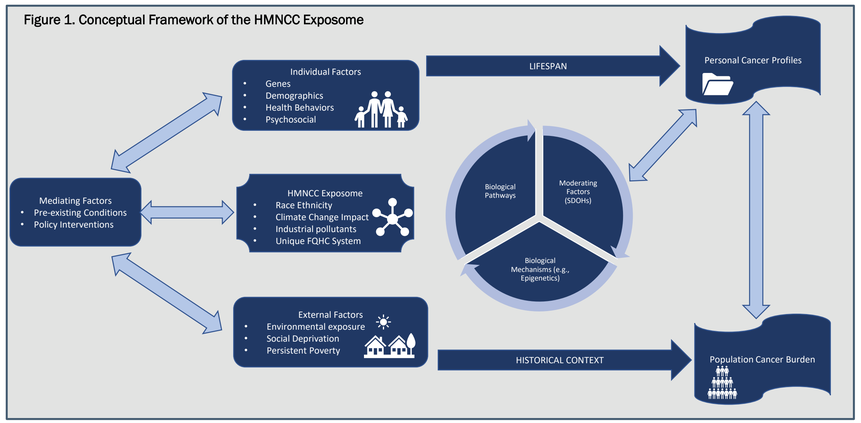



Table 1. Demographic and Cancer Risk Factor Composition of the HMNCC Catchment Area vs. Texas vs. the Nation

| | HMNCC | TX | US |
|---|---|---|---|
| Hispanic or Latino (*any race*) | 38% | 39% | 18% |
| Non-Hispanic Black/African American (AA) | 20.6% | 12% | 13% |
| Non-Hispanic Asian | 9% | 4% | 5% |
| Living in poverty (<200%) | 31% | 34% | 30% |
| Obese (>=30 kg/m$^2$) | 37% | 35% | 33% |
| Uninsured | 19% | 17% | 9% |
| Less than high school graduate | 15% | 16% | 12% |

Figure 3. Age-Adjusted Incidence Rates of the HMNCC Catchment Area Priority Cancers

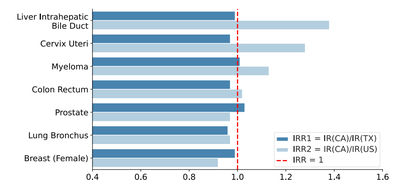



Figure 4. Age-Adjusted Mortality Rates of the HMNCC Catchment Area Priority Cancers

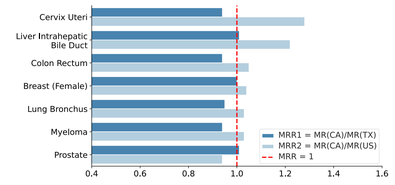



Figure 2. Race/Ethnicity of HMNCC Catchment Area: 2010 vs. 2020

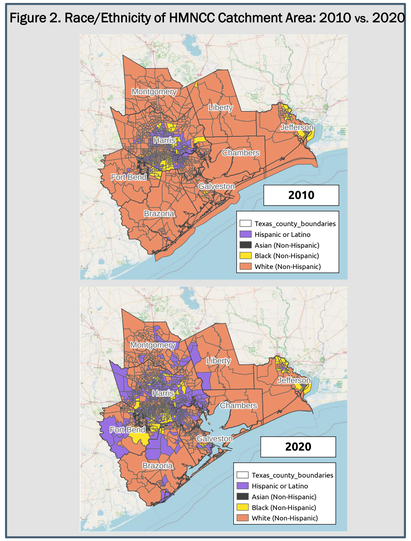



Figure 5. Cancer-causing industrial air pollution in the Houston Area

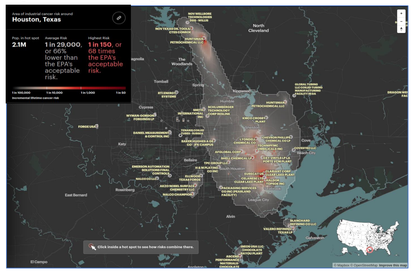



Figure 6. Climate Burden in the HMNCC Catchment Area

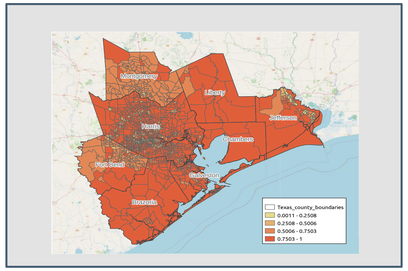



Figure 7. Persistent Poverty in the HMNCC Catchment Area

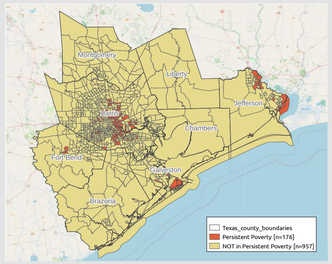



Figure 8. Environmental Pollutants in the HMNCC Catchment Area

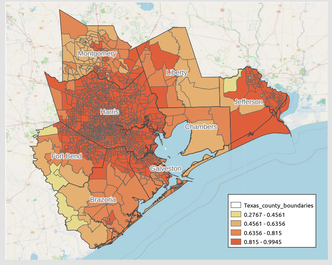
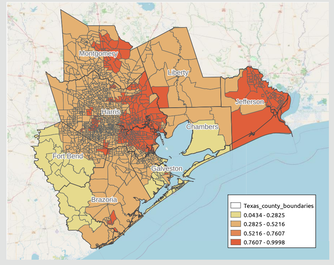



Figure 9. Cancer risk in the HMNCC Catchment Area




## PRELIMINARY OUTCOMES

A **primary outcome** of these efforts is detailed geospatial mapping and interactive data visualizations **to inform targeted cancer prevention and control efforts,** in close partnership with the HMNCC COE leadership team, to identify and intervene in areas of greatest medical need throughout our catchment area.

Our cancer exposome will also give rise to a **project portfolio for training early career investigators** in population science, data science, CPC and cancer disparities research.

Hot-spot mapping and digital visualizations using ArcGIS at the census tract-level data will focus on:

(i) Population demographics in the catchment from 2010 to 2010 **(Figure 2)**
(ii) HMNCC priority cancers, selected due to excess burdens in our region and cancers for which meaningful disparities are observed **(Figures 3-4)**
(iii) Regions of known historical environmental contamination and cancer clusters **(Figures 5, 8)**
(iv) Emerging climate burden of the catchment area **(Figure 6)**
(v) Regions of longstanding or "persistent" poverty **(Figure 7)**
(vi) Cancer risk probabilities in the catchment area **(Figure 9)**

A focus on regions that experience persistent poverty, highest risk of developing cancer, environmental pollutions, and climate emergencies is of critical importance.

## FUTURE DIRECTIONS

Examination of **cancer burden in disaggregated Asian subgroups** will allow us to project, and be ready to address, the concomitant shifts in cancer burden that will occur in our region, as a result of the fast-changing demographic composition of our region. With projections of increased climate change burden and well-documented historical pollution in our region, there is a critical need to prepare for the associated cancer burden experienced as a collective result of these factors.

An excess in hepatocellular carcinoma (HCC) incidence is observed in our region, reflecting the large and growing Hispanic and Asian populations; therefore, HCC will continue to be an HMNCC priority cancer, with growing importance as our catchment area increases even further in racial/ethnic diversity.

Our cancer exposome will help prepare and train a critical cadre of new investigators and health care professionals focused on cancer disparities which will be a critical need to address the emerging cancer burdens in our region.

There is a growing partnership between CPC and COE teams at HMNCC, with initiatives focused on design, development and delivery of interventions and implementation science efforts focused on our most medically vulnerable communities, with sharp attention on how demographic shifts will impact future cancer burden.

Attention must also be placed on the rise in early-onset cancers for several GI/other malignancies observed in our region, similar to the nation.

Finally, this cancer exposome will allow for studies of 'biosocial determinants of health", a term put forward by Turner et *al*. (7).

## REFERENCES

(1) The most detailed map of cancer-causing industrial air pollution in the U.S. (2021) ProPublica. Available at: https://projects.propublica.org/toxmap (Accessed: 06 January 2025).
(2) Juarez PD, Hood DB, Song MA, Ramesh A. Use of an Exposome Approach to Understand the Effects of Exposures From the Natural, Built, and Social Environments on Cardio-Vascular Disease Onset, Progression, and Outcomes. Front Public Health. 2020 Aug 12;8:379. doi: 10.3389/fpubh.2020.00379. PMID: 32903514; PMCID: PMC7437454.
(3) U.S. Census Bureau, "Race and Ethnicity," Redistricting Data (PL 94-171), https://api.census.gov/data/{2020,2010}/dec/pl (Accessed: 21 December 2024).
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