Background

Despite significant advances in cancer screening and treatment, cancer remains a leading and inequitable cause of illness and death in the United States. In Philadelphia, it is the second leading cause of death, with notable differences in incidence and mortality across neighborhoods and population groups. These disparities result from uneven exposure to modifiable risk factors, including tobacco and alcohol use, poor diet, physical inactivity, infectious agents (such as HPV, HBV, and *H. pylori*), environmental and occupational exposures, violence, trauma, and barriers to preventive care.

These factors are influenced by place, race, gender, and socioeconomic status, and are shaped by broader structural conditions such as housing quality, labor environments, environmental regulation, and access to affordable, high-quality healthcare.

Nationally, public agencies, cancer centers, and life sciences organizations are integrating cancer registry data with behavioral, environmental, and social determinants of health to generate population-level, place-based insights into cancer risk and prevention. Deloitte plays a central role in this landscape, partnering with leading cancer centers, life sciences companies, and public-sector health organizations to design and scale analytics and AI-enabled solutions for oncology research, population health strategy, and healthcare transformation, including collaborations such as the Cancer AI Alliance.

Academic institutions are also advancing place-based cancer surveillance and equity research. For example, through initiatives like Cancer in Philadelphia Neighborhoods, the Drexel Urban Health Collaborative integrates cancer registry data with neighborhood-level social and environmental context to examine geographic disparities and inform targeted prevention strategies.

Despite available data, decision-makers often lack an integrated, population-level perspective on the most significant risk factors, where risks are concentrated, which groups face the greatest disparities, and which interventions will most effectively and equitably reduce preventable cancer burden.

Business Challenge

Students will quantify, map, and prioritize modifiable drivers and risk factors for cancer outcomes by geography, population, and cancer type. The goal is to identify high-value, equitable intervention opportunities.

Comparative Focus
All teams will conduct a comparative analysis of the following:

- The status of cancer in Philadelphia
- The status of cancer in Chicago

Teams should use publicly available, downloadable data for comparisons (see Data section below) and clearly document all assumptions and data limitations.

Teams will choose <u>one</u> of the following questions to address in their comparative analysis:

1. **Attributable Burden**
   What share of observed cancer incidence or mortality appears associated with specific modifiable drivers (and combinations of drivers), overall and across subpopulations?

2. **Geographies of Risk**
   Where are the highest-risk neighborhoods, worksites, or community contexts, and how do multiple risks co-occur spatially?

3. **Policy Gaps**
   Which local or state policy conditions (e.g., tobacco pricing and retailer density, environmental regulation, radon codes) appear most strongly associated with observed risk patterns, based on available data and reasonable proxies?

4. **Equity Impact**
   Which interventions are most likely to reduce disparities while also lowering overall cancer burden, and which populations stand to benefit most?

5. **Return on Prevention**
   What is the expected impact of selected prevention strategies over 3-, 5-, or 10-year horizons, using simplified models and evidence-based assumptions from existing research?

Example drivers to use in your analysis:

1. **Behavioral and Metabolic Risks**
    a. Tobacco use (cigarettes, cigars, vaping) and secondhand smoke
    b. Alcohol use patterns
    c. Diet quality, obesity/overweight, and physical inactivity
    d. Indicators may include prevalence, age of initiation, intensity, retailer density, and neighborhood food or physical-activity environments

2. **Environmental and Built Environment**
    a. Air pollution ($PM_{2.5}$, NO_2, diesel)
    b. Radon, UV exposure, and drinking water contaminants
    c. Industrial or toxic releases, traffic density, heat exposure, and greenness
    d. Environmental justice indicators and proximity to exposure sources

3. **Infectious and Biologic Drivers**
    a. HPV, HBV/HCV, *H. pylori*, and HIV-related immunosuppression
    b. Vaccination uptake, screening, and treatment coverage
    (Teams may use prevalence or coverage proxies where direct measures are unavailable.)

4. **Occupational Exposures**
    a. Asbestos, silica, benzene, solvents, and diesel exhaust
    b. Worker protections, enforcement activity, and industry concentration
    (Proxy indicators and industry-level data are acceptable.)

5. **Healthcare Access and System Factors**
    a. Primary care access
    b. Screening uptake (breast, cervical, colorectal, lung where applicable)
    c. Timeliness of care and follow-up after abnormal screening
    d. Insurance coverage and financial barriers

Data Sources

United States Cancer Statistics
https://www.cdc.gov/united-states-cancer-statistics/dataviz/index.html

Chicago Health Atlas
https://chicagohealthatlas.org/indicators/CCR

Drexel University Urban Health Collaborative
https://drexel.edu/uhc/research/projects/community-impact-reducing-cancer/Cancer%20in%20Philadelphia%20Neighborhoods/

Other Sources to Explore on the Web:

- Cancer outcomes: Cancer incidence and mortality data should be obtained from state and national cancer registries, including SEER and the CDC's National Program of Cancer Registries (NPCR), as well as state vital statistics. These sources provide validated measures of cancer burden by cancer type, time period, and geography (typically county-level), and form the foundation for comparing the status of cancer in Philadelphia and Chicago.

- Behavioral risk factors and prevention: Data on modifiable behavioral risks and preventive care may be drawn from national and local health surveys such as BRFSS, YRBSS, and NHIS, as well as local community health surveys where available. These datasets provide information on smoking, alcohol use, obesity, physical activity, and screening behaviors. Where permitted and appropriate, teams may also use aggregated EHR or claims-based indicators (e.g., screening or vaccination rates from systems such as Epic) or immunization registry data to assess gaps in prevention and early detection.

- Environmental exposures: Environmental risk factors can be assessed using data from the EPA Air Quality System (AQS) and AirToxScreen, which provide measures of air pollution and toxic exposure. Additional sources include radon potential maps, public drinking water system sampling data (including contaminants such as PFAS), and satellite-derived measures of UV exposure, heat, and neighborhood greenness. These data enable place-based analysis of environmental conditions associated with cancer risk.

- Social and structural determinants of health: Socioeconomic and structural context may be assessed using the American Community Survey (ACS) and indices such as the CDC/ATSDR Social Vulnerability Index (SVI). Teams may also incorporate local datasets on housing conditions, transportation access, employment, or labor environments to examine how social and structural factors shape cancer risk and disparities across neighborhoods and populations.

Center for Applied AI and Business Analytics
LeBow College of Business

Judges & Evaluation Criteria

Teams will be evaluated using the following criteria:

- Ingenuity and creative thinking: 25%
- Quality of analysis and critical thinking: 35%
- Quality of data interpretation, including limitations and assumptions: 15%
- Presentation of insights that could inform policy decisions, clinical strategies, or community investment: 25%

Judges:

- Anwesha Dutta '03
  Managing Director / Parter
  Deloitte

- Leo Stavchanskiy '05
  Specialist Leader
  Deloitte

- Chris Wogan, MBA '18
  Manager
  Deloitte

- Gus Carlin '16
  Manager
  Deloitte

- Simon Spavound, PhD
  Assistant Clinical Professor, Decision Sciences & MIS

- Murugan Anandarajan, PhD
  Professor, Decision Sciences & MIS
  Vice Dean
  Academic Director, Center for Applied AI and Business Analytics