Exploring Environmental Health Risk Factors Associated with Cancer Incidence in New York State

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Introduction

- Cancer is one of the most common diseases in NYS with high mortality. Every 1 in 4 deaths in NYS is caused by cancer.
- Long-term exposure to carcinogens may increase the risk of cancer.
- Some counties in NYS have consistently higher cancer incidence rate
- We aim to study the potential association of cancer incidence rate among young adults with environment factors such as air and water pollution.

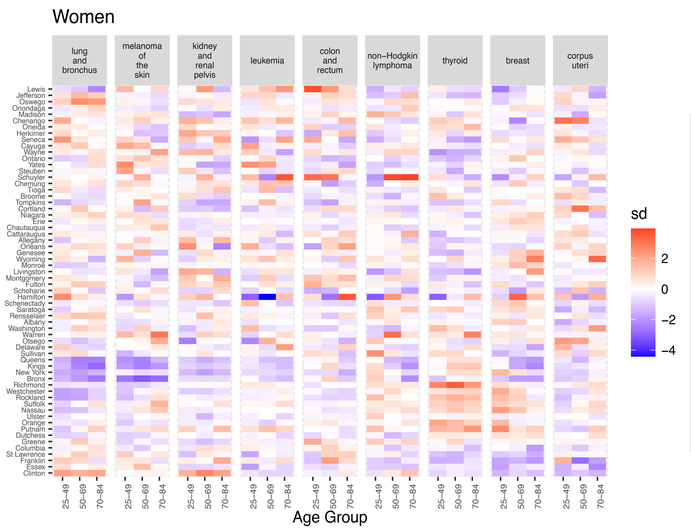

Figure 1. Overview of cancer incidence rate across NYS counties by age group.

Data

SEER Cancer Data (Age:25-49):
- Age standardized cancer incidence rate per 100,000 population in counties in NYS from 2000-2018

Environmental and Behavior Risk Factors:
- Air quality
- Drinking water quality
- Lifestyle
- Screening behavior and health history

Socio-economical Factors:
- Percentage of population living in poverty (control)
- Percentage of population without health insurance (control)
- Percentage of Caucasian in the county (control)
- Urban vs. rural

Methodology

Univariate Analysis
- Determine the model used for both univariate and multivariate analysis (OLS, SAR, Poisson, NB)
- Select risk factors based on p-value (<0.1)
- Preliminary multicollinearity control: risk factor sets with low correlations are included in the multivariate analysis

Multivariate Analysis
- Search through all combinations of risk factors and find the best fit model
- Holm-Bonferroni adjustment to control for FWER

Results

- Black carbon, one of the components of PM2.5, is positively associated with non-Hodgkin lymphoma among women and thyroid cancer.
- High mean concentration of TTHM in drinking water is associated with high kidney and renal pelvis cancer incidence rate among men.
- For younger women, unhealthy lifestyles are significantly associated with high cancer incidence rate.

Limitations

Data uncertainty
- For counties with small population size, the low absolute cancer risk among young adults could result in larger observational error.

Missing data
- Drinking water quality data were missing for some counties around NYC, which reduced the statistical power of our regression analysis.

Future directions

- Introduce time lags to account for the long induction time from exposure to cancer development.
- Extend the analysis to other age groups and to the national level.

Type		Measure	Men	Women	Cancer
v.env	Air Quality	Annual mean BC percentage in PM 2.5	↑		non-Hodgkin lymphoma
			↑	↑	thyroid
	Water Quality	Mean concentration of TTHM (micrograms per liter) by year	↑		kidney and renal pelvis
v.life		Percent of Adults Aged >= 18 Years Sleeping Less Than 7 Hours		↑	kidney and renal pelvis
		Percent of Adults Aged >=18 Years With Current Smoking		↑	lung and bronchus
		Percent of Adults Aged >=18 Years With Obesity		↑	leukemia
				↓	breast

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Type		Measure	lung and bronchus		melanoma of the skin		kidney and renal pelvis		leukemia		colon and rectum		non-Hodgkin lymphoma		thyroid		breast	corpus uteri	prostate	testis
			men	women	men	women	men	women	men	women	men	women	men	women	men	women	women	women	men	men
control		Percent of population living in poverty	0.17	-0.19	0.18	-0.14	-0.36	-0.02	-0.15	-0.15	-0.02	-0.19	0.3	0.19	-0.32	0.21	-0.32	0.15	0.31	-0.5*
		Percent of population without health insurance	-0.33	0.23	-0.51*	0.19	0.19	0.08	0.4*	-0.06	0.23	-0.02	-0.36	-0.32	-0.14	-0.45*	-0.19	0.55*	-0.08	0.03
		percentage of white people in the county	-0.09	0.18	0.37	0.5	0.32	0.55*	0.4*	-0.05	0.09	-0.18	-0.42	-0.04	0.15	0.25	-0.26	0.61*	-0.78*	0.7*
v.env	Air Quality	Annual average ambient concentrations of PM 2.5 in micrograms per cubic meter, based on seasonal averages and daily measurement (monitor and modeled data)								0.46				0.38			0.26	0.33		
		Annual mean BC percentage in PM 2.5				-0.36								0.74*	0.58*	0.82*		-0.34		
		Annual mean SOIL percentage in PM 2.5				0.25														
	Water Quality	Mean concentration of Arsenic (micrograms per liter) by year			-0.2						-0.15									
		Mean concentration of DEHP (micrograms per liter) by year											-0.18		-0.21					-0.17
		Mean concentration of HAA5 (micrograms per liter) by year															-0.19	-0.22		
		Mean concentration of Nitrate (milligrams per liter) by year																		-0.28
		Mean concentration of PCE (micrograms per liter) by year					0.32												0.19	
		Mean concentration of Radium (picoCuries per liter) by year												-0.3		0.11				
		Mean concentration of TTHM (micrograms per liter) by year				0.16	0.43*													-0.26
	Other	Maximum pre-mitigation radon level in tested buildings																		0.24
		Percent of children tested with confirmed blood lead levels of 10 µg/dL or greater				0.1					0.2	0.28							-0.28	
		Rate of Injuries and Fatalities due to Reported Acute Toxic Substance Release Incidents per 100,000 population	0.28						-0.26	0.3								-0.24		
v.health		Percent of Adults Aged >=18 Years With Visits to the Doctor for Routine Checkup							0.25											
v.life		Percent of Adults Aged >= 18 Years Sleeping Less Than 7 Hours			-0.29			0.49*							0.25			0.34		
		Percent of Adults Aged >=18 Years Who Binge Drink											-0.32							
		Percent of Adults Aged >=18 Years With Current Smoking	0.43	0.68*																
		Percent of Adults Aged >=18 Years With Obesity								0.45*							-0.38*			
v.ses		Classification of county from rural to urban (two category scale)										0.75								