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Governor Cuomo's Cancer Research Initiative

Cancer Incidence Investigation

August 2019

Purpose of the Governor's Cancer Research Initiative

- Learn more about the patterns of cancer in New York
- Identify any reasons for these patterns
- Enhance prevention and screening efforts
- Support access to appropriate high-quality health care services

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Timeline and Milestones

October 2017: initiative announced in Warren County and Staten Island

October – June 2018: other two study areas identified; cancer maps updated

July 2018: regional meetings held with elected officials, stakeholders and public

November 2018: study update posted on DOH website and emailed to attendees of July meetings

July 2018 – August 2019: data analyzed and reports drafted

September 2019: reports released; regional webinars and meetings to share study findings

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Selection of Four Study Areas

- **Warren County**: highest overall cancer rate in NYS, 2011-2015
- **Staten Island**: highest overall cancer rate among 5 NYC boroughs, 2011-2015
- **East Buffalo/West Cheektowaga (EBWC):**
  where six high clusters overlap (colorectal, esophagus, kidney, lung, oral, prostate)
- **Centereach, Farmingville, Selden (CFS)**: where four high clusters overlap (bladder, leukemia, lung, thyroid)

Location of the Four Study Areas in the Governor's Cancer Research Initiative

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Review of Risk Factors

Cancer Type	Known Risk Factors	Included in Evaluation			
		CFS	EBWC	SI	WC
Bladder	Smoking; workplace exposures; certain cancer treatments; arsenic; family history	X			
Brain & other nervous system	Hereditary conditions; family history; ionizing radiation				X
Colorectal	Hereditary conditions; family history; personal history of inflammatory bowel disease or intestinal polyps; obesity; physical inactivity; diet; smoking; alcohol		X		X
Esophagus	Tobacco use; alcohol consumption; obesity; gastroesophageal reflux disease (GERD); Unhealthy diet; ionizing radiation; workers in the dry cleaning and rubber industries		X		X
Kidney	Obesity; cigarette smoking; physical inactivity; medical conditions; family history; hereditary conditions		X		
Larynx	Smoking; alcohol consumption; occupational exposure				X
Leukemia	Ionizing radiation; genetic conditions; certain cancer treatments; workplace exposures; smoking (AML and possibly CML), obesity (AML), family history (CLL)	X			X
Lung	Smoking and secondhand smoke; ionizing radiation; family history; radon; urban air pollution; workplace exposures	X	X		X
Melanoma	UV radiation; people with light complexions, blue eyes, and red hair; people with large, unusual, or numerous moles or birthmarks				X
Oral cavity and pharynx	Tobacco use; alcohol consumption; human papillomavirus (HPV) infection; family history; occupational exposure; Epstein Barr Virus (EBV) infection; ionizing radiation; sunlight		X		X
Prostate	Age; race; family history		X		
Thyroid	Medical care factors (overdiagnosis); ionizing radiation; family history; some hereditary conditions; obesity; diet	X		X	X

Approach

Approach

- Literature review on the risk factors for cancers of interest
- Examination of cancer trends and elevation patterns
- Assessment of sociodemographic, behavioral, healthcare and occupational factors at the population level
- Evaluation of environmental data (e.g. outdoor air quality, radon in indoor air, drinking water quality from community water systems, remedial sites, and traffic)
- Interpretation and discussion

Sources of Data

- New York State Cancer Registry
- National Cancer Institute's (NCI) County Population Estimates
- Expanded New York State Behavioral Risk Factor Surveillance System (e-BRFSS)
- New York State Statewide Planning and Research Cooperative System (SPARCS)
- US Census's American Community Survey (ACS)
- US Environmental Protection Agency's (USEPA) Air Quality System
- National Air Toxics Assessment (NATA)
- New York State Radon Program
- Safe Drinking Water Information System (SDWIS)
- 3rd Unregulated Contaminant Monitoring Rule (UCMR 3) Occurrence Data
- Environmental Site Remediation Database
- New York State Traffic Monitoring Program
- Other Area-Specific Datasets

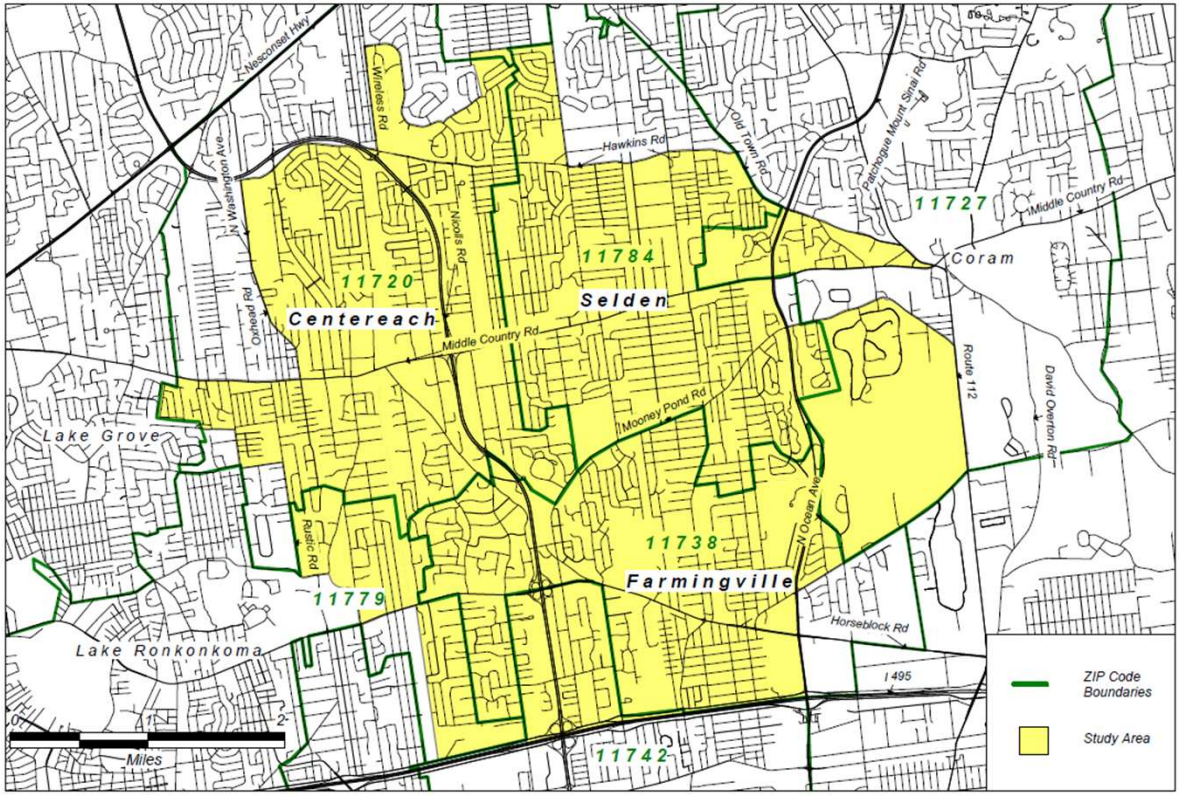
Limitations

- **General Consideration**
  - ✓ Latency and population migration
  - ✓ Pathway, magnitude, frequency and duration of exposure to carcinogens
  - ✓ Interaction among multiple risk factors
  - ✓ “False positive" findings in statistical tests
- **Cancer Registry**
  - ✓ The completeness and accuracy of the data depend upon reporting from many sources.
  - ✓ There may also be differences in how cancer is diagnosed, treated, and recorded in different areas of the state.

- **Survey Data**
  - ✓ ACS has a wide margin of error in small areas.
  - ✓ Sample size of the e-BRFSS was small, and often the differences were not statistically significant.
  - ✓ SPARCS was created for administrative purposes.
- **Environmental Data**
  - ✓ Limited availability over time and geographic area of interest
  - ✓ Inadequate to quantify individual exposures to environmental hazards
  - ✓ Lacking past exposure information
  - ✓ Difficult to evaluate chemical mixtures' effects

Findings and Conclusions – CFS Study Area

Centereach/Farmingville/Selden Study Area



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Demographics

- The CFS study area is more similar to NYS excl. NYC than to NYS. Further analyses were therefore based on NYS excl. NYC as the comparison population.
- When the more appropriate comparison population is used, expected numbers and percent excesses change. All differences remain statistically significant.

Observed and expected number of cancer cases, 2011-2015, the Centereach/Farmingville/Selden study area, with expected numbers of cases calculated based on two standards

Cancer type	CFS Study Area	NYS Standard		NYS excl. NYC Standard	
	Observed	Expected	Excess (%)	Expected	Excess (%)
Lung/bronchus	311	199.3	*56	222.0	*40
Urinary Bladder (incl. in situ)	112	74.8	*50	86.3	*30
Thyroid	98	68.5	*43	67.3	*46
Leukemia	87	53.1	*64	57.7	*51

** Significant difference between observed and expected at the $p < 0.05$ level (two-sided)*

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Lung Cancer

- Lung cancer has been elevated in the CFS study area as far back as 1993-1997.
- Numbers of cases were elevated in both males and females.
- Older adults (65+) accounted for most of the excess.
- All major cell types of lung cancer were diagnosed in greater-than-expected numbers.
- Most people with lung cancer had a history of smoking at some time in their lives.
- The percent of lung cancers in the study area diagnosed at an early stage was similar to the comparison population.
- Deaths from lung cancer were greater than expected in the CFS study area.

Bladder Cancer

- In the 2005-2009 cancer maps, the elevation in the CFS study area was similar to that in Suffolk County as a whole.
- Numbers of cases were elevated in both males and females.
- Older adults (65+) accounted for most of the excess.
- Most cases were of the transitional cell type. This type accounted for most of the excess.
- Most people with bladder cancer had a history of smoking at some time in their lives.
- Deaths from bladder cancer were not statistically higher than expected.

Thyroid Cancer

- Thyroid cancer has been elevated in the CFS study area as far back as 1996.
- Numbers of cases were elevated in both males and females. The percent elevation was greater in males than in females.
- Numbers of cases were elevated in almost all age groups, with the greatest excess among older adults (ages 65+).
- Cancers of the papillary cell type and tumors 2 cm or less in greatest dimension accounted for most of the excess cases.
- Death from thyroid cancer is rare. Thyroid cancer deaths were not elevated.

Leukemia

- Leukemia was not elevated in 2005-2009.
- Numbers of cases were significantly elevated in males only.
- Numbers of cases were elevated among children ages 0-19 and adults ages 65+.
- Most of the excess was accounted for by cases of ALL and CLL.
- Most of the children with leukemia had ALL. About half of the children with leukemia were diagnosed in 2015.
- More of the cases of CLL in the CFS study area were reported only by independent (non-hospital) laboratories compared to CLL cases in the comparison area.
- The number of deaths from leukemia was not elevated.

Behavioral Factors

- **Tobacco Use**
  - ✓ BRFSS and SPARCS data suggested a greater prevalence of tobacco use in the CFS study area compared with NYS excl. NYC.
  - ✓ The incidence of many other tobacco-related cancers (oral cavity, pancreatic, cervical and kidney) was also elevated.
- **Obesity**
  - ✓ BRFSS and SPARCS data suggested a greater prevalence of obesity.
  - ✓ The incidence of some other obesity-related cancers (pancreatic and kidney cancers) was also elevated.
- **Healthcare Coverage**
  - BRFSS data suggested a greater proportion of respondents with healthcare coverage.

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Occupational Factors

- A slightly greater percentage of people in the study area worked in occupations with greater probability of workplace exposures to elevated levels of hazardous substances than in NYS excl. NYC or NYS.
- Previous studies found an elevated incidence of thyroid (and prostate) cancers among rescue and recovery workers (predominantly male) at the World Trade Center. This elevated incidence has been attributed mostly to enhanced medical monitoring. Stony Brook University Hospital, located just outside the CFS study area, conducts medical monitoring of workers who worked at the World Trade Center site. It is likely that many rescue and recovery workers live in or near the CFS study area. However, even with increased risk, the probability of any one person being diagnosed with thyroid cancer is small.

Environmental Factors

- **Outdoor Air Quality**
  - ✓ Criteria air pollutant (e.g. NO_2, SO_2, and CO) concentrations in or near the CFS study area showed a downward trend. Currently, the area is in compliance with USEPA National Ambient Air Quality Standards for all criteria air pollutants except ozone.
  - ✓ Air toxics (e.g. benzene, 1,3-butadiene, and carbon tetrachloride) at the Holtsville station (just south of the study area) were above annual guideline concentrations. However, these do not stand out from elsewhere in NY.

Environmental Factors

- **Outdoor Air Quality**
  - ✓ Focused on five known/probable carcinogens with mean estimates above the one-in-one-million cancer risk level across NYS census tracts.
  - ✓ Estimated cancer risks in the study area are generally similar to estimated risks for Suffolk County and NYS excl. NYC, and less than those for the entire state.

NATA 2011 Estimated Total Cancer Risk (per million), Centereach/Farmingville/Selden study area, Suffolk County, New York State Exclusive of New York City, and New York State

Pollutant	CSF Study Area	Suffolk County	NYS excl. NYC	NYS
1,3-Butadiene	1.99	1.97	1.96	3.51
Acetaldehyde	3.18	3.15	3.31	4.20
Benzene	5.19	5.35	5.81	8.47
Carbon tetrachloride	3.28	3.28	3.28	3.28
Formaldehyde	15.60	15.32	15.26	20.51

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Environmental Factors

- **Radon in Indoor Air**
  - ✓ Average radon concentrations are generally lower than Suffolk County and the rest of the state.
  - ✓ Radon concentrations in tested homes may not be representative of other homes in the neighborhood.
- **Public Drinking Water Supply**
  - ✓ Since 1999, over 120,000 samples from 37 points in the CFS study area were tested for 120+ different analytes.
  - ✓ The only violations issued were for iron and manganese, and for lead and copper.
  - ✓ UCMR 3 contaminants were all below reference levels set by the USEPA.
- **Private Wells**
  - ✓ Private water sources tested have generally met drinking water standards.

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Environmental Factors

- **Industrial or Inactive Hazardous Waste Disposal Sites**
  - ✓ No sites were identified within the boundaries of the CFS study area.
  - ✓ Review of available data did not find any exposures to people in the study area to contaminants from the Northville pipeline or the spill at the Northville Terminal in East Setauket.
- **Pesticides**
  - ✓ Commercial applications in ZIP Codes approximating the study area were smaller in quantity per square mile and per household than in a comparison area of western Suffolk County.
- **Proximity to Traffic**
  - ✓ The study area had a similar distribution of people living within 500 m of roads of average daily traffic volumes compared to NYS excl NYC.

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Conclusions

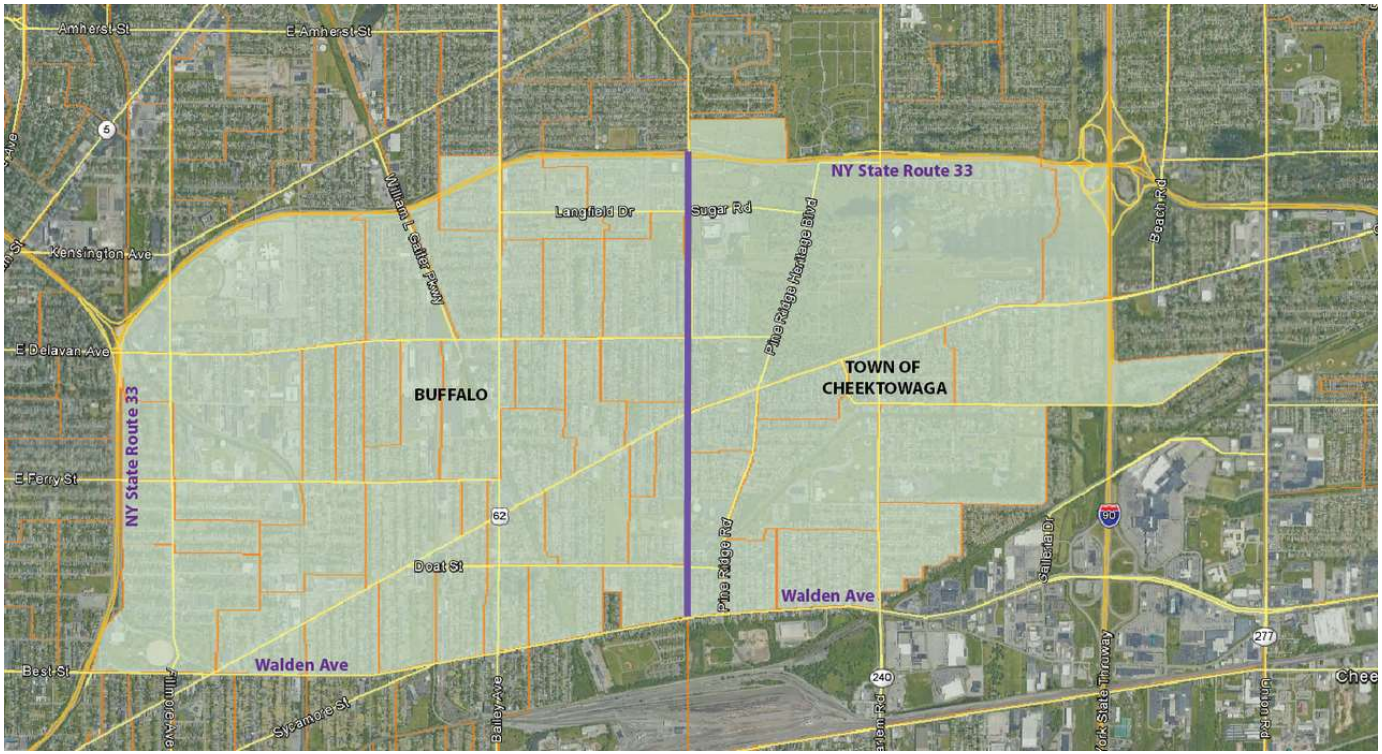
- It is likely that higher rates of tobacco use contributed to the elevated rates of lung and bladder cancer in the CFS study area.
- Available information did not indicate any particular occupation or workplace that may have played a role in the elevations of lung and bladder cancers and leukemia, although this information was limited.
- Most of the increased incidence of thyroid cancer is likely due to the increased detection of small papillary tumors by imaging and other medical techniques.
- An increased prevalence of obesity could have also made a small contribution to the increased incidence of thyroid cancer.
- The contribution from people who had spent time in rescue and recovery efforts at the World Trade Center to the excess of thyroid cancers in the CFS study area is likely small.

Conclusions

- The excess of chronic leukemias might be related to greater reporting of cancers by independent laboratories. It might also be related to medical care factors such as healthcare coverage or greater contact with the health care system.
- This investigation uncovered no factors that might account for the elevated number of childhood leukemias. DOH will continue to monitor the incidence of childhood leukemia in the CFS study area.
- Results from the environmental investigation did not show any unusual environmental exposures that could explain the excess of cancer incidence in the CFS study area.

Findings and Conclusions – EBWC Study Area

East Buffalo/West Cheektowaga Study Area



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Demographics

- The EBWC study area is more similar to NYS excl. NYC than to NYS on some key factors. Further analyses were therefore based on NYS excl. NYC as the comparison population.
- When the more appropriate comparison population is used, expected numbers and percent excesses change. All significant differences remain statistically significant.

Observed and expected number of cancer cases, 2011-2015, the Centereach/Farmingville/Selden study area, with expected numbers of cases calculated based on two standards

Cancer type	EBWC Study Area	NYS Standard		NYS excl. NYC Standard	
	Observed	Expected	Excess (%)	Expected	Excess (%)
Oral	27	22.2	22	24.2	12
Esophagus	19	10.0	90 *	11.2	70 *
Lung	188	135.1	39 *	150.8	25 *
Colorectal	122	88.1	38 *	87.2	40 *
Prostate	190	129.6	47 *	127.5	49 *
Kidney	66	36.2	82 *	39.1	69 *

** Significant difference between observed and expected at the $p < 0.05$ level (two-sided)*

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Oral Cancer

- Small total number of observed oral cancers during the period of study (2011-2015).
- The study area is part of a larger area of excess oral cancer.
- In the Study Area the excess was not statistically significant, as the number of cases observed was not different than what might be expected by random variation alone.
- Incidence of oral cancer in Erie County has been higher than NYS excl. NYC since 1996.
- Most people with oral cancer had a history of smoking at some time in their lives.

Esophageal Cancer

- Small total number of observed esophageal cancers during the period of study (2011-2015).
- The excess was statistically significant in the 0-64 year old age group (age and sex groups were combined to maintain confidentiality), although a large majority of observed cases were among males age 50-64.
- Incidence of esophageal cancer in Erie County has been higher than NYS excl. NYC since 1996.
- Most people with esophageal cancer had a history of smoking at some time in their lives.

Lung Cancer

- Excess was specific to males.
- Adults age 50-64 accounted for most of the excess.
- Excess primarily in the non-Hispanic black and other race group.
- Adenocarcinoma and large cell carcinoma were diagnosed in greater-than-expected numbers.
- Most of the excess cancers were distant stage diagnoses.
- Most people with lung cancer had a history of smoking at some time in their lives.
- Incidence of lung cancer in Erie County has been higher than NYS excl. NYC since 1996.
- Lung cancer incidence in the City of Buffalo was about 30% higher than NYS excl. NYC in the 2011-2015 time period.

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Colorectal Cancer

- Numbers of cases were elevated in males.
- Adults age 50-64 accounted for most of the excess.
- Adenocarcinomas, the most common subtype, were diagnosed in greater-than-expected numbers.
- Excess of cancers classified as having occurred in the proximal colon.
- Most of the excess cancers were distant stage diagnoses.

Prostate Cancer

- The excess was statistically significant in the 50-64 year old age group.
- Adenocarcinomas, the most common subtype, accounted for nearly all of the excess.
- Accounting for race and ethnicity decreased the magnitude of the excess, which was similar (about 20%) both for non-Hispanic black and other races and for non-Hispanic whites.
- Excess cancers observed for localized and distant stage diagnoses.
- Incidence of prostate cancer in Erie County has been higher than NYS excl. NYC since 2001.
- Decline in incidence of prostate cancer since 2006 has been slower in Erie County than in the rest of NYS.

Kidney Cancer

- Relatively small number of observed cases during the period of study (2011-2015).
- Numbers of cases were elevated in both males and females.
- Numbers of cases were elevated among ages 50 and older.
- Renal cell carcinoma, the most frequently diagnosed type, accounted for most of the excess.
- Majority of the excess in localized and regional stage cancers.

Behavioral Factors

- **Tobacco Use**
  - ✓ BRFSS and SPARCS data showed a greater prevalence of tobacco use in the EBWC study area compared with NYS excl. NYC.
  - ✓ Five of the six elevated cancers in the EBWC study area are considered tobacco-related cancers (i.e. oral, esophageal, lung, kidney, and colorectal).
- **Alcohol Use**
  - ✓ BRFSS survey showed that 21.6% of respondents in EBWC study area ZIP codes report binge drinking, compared with 16.9% in NYS excl. NYC.
  - ✓ SPARCS data showed a greater prevalence of alcohol use indicators in people from the EBWC study area compared with NYS excl. NYC, with larger differences in middle-aged adults ages 50-64 than in older adults ages 65 and older.

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Behavioral Factors

- **Obesity**
  - ✓ BRFSS and SPARCS data showed a greater prevalence of obesity, particularly younger adults ages 21-49 and middle-aged adults ages 50-64.
- **Physical Activity**
  - ✓ BRFSS data showed a lower proportion of respondents in the EBWC study area get leisure time physical activity relative to NYS excl. NYC.

Health Care Factors

- **Colorectal Cancer Screening**
  - ✓ BRFSS survey suggested a greater prevalence of respondents in the EBWC study area had received recommended colorectal cancer screening.
  - ✓ SPARCS data showed a slightly higher prevalence of colonoscopy indicators.
- **Health Insurance**
  - ✓ BRFSS data showed a lower proportion of respondents in the EBWC study area had healthcare coverage relative to NYS excl. NYC.

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Occupational Factors

- As of the 2000 Census, a greater percentage of people in the EBWC study area worked in occupations with greater probability of workplace exposures to elevated levels of hazardous substances than in NYS excl. NYC or NYS.

Access to Healthy Food

- The modified Retail Food Environmental Index (mRFEI) measures the proportion of food stores more likely to have healthy food options among all food stores in an area.
- The EBWC study area is similar to the rest of Erie County and NYS as a whole, but there is variation within the study area. Parts of the East Buffalo portion of the study area score lower (i.e., less access to healthy food) on the mRFEI.

Environmental Factors

- **Outdoor Air Quality**
  - ✓ Criteria air pollutant (PM_{10}, $PM_{2.5}$, NO_2, SO_2, CO , O_3) concentrations in or near the EBWC study area showed a downward trend. Currently, the area is in compliance with USEPA National Ambient Air Quality Standards for all criteria pollutants.
  - ✓ Air toxics (e.g. benzene, acetaldehyde, 1,3-butadiene, carbon tetrachloride, and formaldehyde) at the Dingens St. monitoring station (just south of the study area) were above annual guideline concentrations, but do not stand out from elsewhere in NY.

Environmental Factors

- **Outdoor Air Quality**
  - ✓ Focused on five known/probable carcinogens with mean estimates above the one-in-one-million cancer risk level across NYS census tracts.
  - ✓ Estimated cancer risks for the EBWC study area are generally similar to estimated risks for Erie County and NYS excl. NYC, and less than those for the entire state.

NATA 2011 Estimated Total Cancer Risk (per million), the East Buffalo/West Cheektowaga study area, Erie County, New York State Exclusive of New York City, New York State, and New York City

Pollutant	CBWC Study Area	Erie County	NYS excl. NYC	NYS	NYC
1,3-Butadiene	2.33	1.56	1.96	3.51	5.65
Acetaldehyde	3.25	3.07	3.31	4.20	5.42
Benzene	5.80	5.25	5.81	8.47	12.12
Carbon tetrachloride	3.28	3.28	3.28	3.28	3.28
Formaldehyde	14.54	13.23	15.26	20.51	27.70

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Environmental Factors

- **Radon in Indoor Air**
  - ✓ Average radon levels generally lower in study area than in Erie county and rest of state (based on 212 test results).
  - ✓ Radon concentrations in tested homes may not be representative of other homes in the neighborhood.
- **Public Drinking Water Supply**
  - ✓ Since 1999, no violations were issued for regulated analytes.
  - ✓ Chlorate, an unregulated analytes, was detected in EBWC public water systems at levels above the reference concentration but below exposures that cause health effects in animals.

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Environmental Factors

- **Industrial or Inactive Hazardous Waste Disposal Sites**
  - ✓ For many sites in the study area, actions to identify, control, and/or remove existing contamination have been implemented and completed.
  - ✓ In some cases, on-site contamination exists but is not causing off-site exposure. For other sites, information continues to be gathered.
  - ✓ There is no information suggesting that contamination from existing and known remedial sites is causing widespread exposures in the EBWC study area. population.
- **Proximity to Traffic**
  - ✓ The study area had a similar distribution of people living within 500 m of roads by average daily traffic volume compared to NYC, another urban area of NYS.

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Conclusions

- It is likely that higher prevalence of tobacco use contributed to the elevated rates of oral cancer, esophageal cancer, and lung cancer, and to a lesser extent colorectal cancer and kidney cancer, in the EBWC study area.
- Obesity and alcohol use may have contributed to the excess in esophageal cancer.
- Obesity and lack of physical inactivity may have contributed to the excess in colorectal cancer.
- Some of the excess prostate cancer may result from increased detection associated with screening.
- Employment trends information suggests workers in the EBWC study area may have been employed in high-risk occupations in higher proportions than in other areas of NYS. However, available information did not indicate any particular occupation or workplace that may have played a role in the elevations and detailed occupational information was unavailable.

Conclusions

- Results from the environmental investigation did not show any unusual environmental exposures that could explain the excess of cancer incidence in the EBWC study area.
- In parts of the study area, there may be less access to healthy food options.

Findings and Conclusions – Richmond County Study Area

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Study Setting

- Staten Island is demographically more similar to NYS excl. NYC than the other four boroughs of NYC.

Key demographic and socioeconomic characteristics by region, American Community Survey, 2011-2015

Characteristics		Staten Island	Other 4 Boroughs	NYS excl. NYC	NYS
Race (%)	White alone	75.3	41.4	80.5	64.6
	Black alone	10.5	25.3	8.9	15.6
	Asian, Pacific Islander, Am. Indian, Alaskan Native	8.3	14.3	0.4	0.4
	Other	5.8	19.0	3.8	8.0
Ethnicity - Hispanic (%)		17.8	29.6	10.5	18.4
High School/College Diploma, age 25+ (%)		88.7	79.9	89.7	85.6
Foreign Born (%)		21.6	38.2	11.4	22.5
Below Poverty (%)		12.5	21.1	11.9	15.7

Selection Criteria

- The incidence rate for the cancer type was higher on Staten Island than in the other four boroughs combined and in NYS excl. NYC.
- The elevated incidence rate was statistically significant.
- The elevated incidence rate had public health significance.

Type of Cancer Selected for Study – Thyroid Cancer

Age-adjusted cancer incidence rates[1] for thyroid cancer, Staten Island vs. comparison areas, 2011-2015

Sex	Rate			Percent difference	
	Staten Island	Other 4 Boroughs	NYS excl. NYC	Other 4 Boroughs	NYS excl. NYC
Male & Female	33.2	19.9	19.6	66.9*	69.5*
Male	18.3	9.6	10.3	90.3*	77.4*
Female	47.0	29.0	28.6	61.9*	64.1*

[1] Rates are per 100,000 and age-adjusted to the 2000 US Standard population.

[*] Statistically significantly higher

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Thyroid Cancer Risk Factors

- Medical system
- Exposure to ionizing radiation, particularly at a young age
- Diet low in iodine
- Excess body fat
- Hereditary conditions
- Family history of thyroid cancer

Incidence Trend

- Beginning in 2003, incidence rates on Staten Island began to increase much more rapidly than the rest of NYS.
- Since 2008, the gap between Staten Island and the rest of NYS has remained stable.

Tumor Characteristics

- Nearly all the increase in thyroid cancer has been of the papillary subtype.
- 85% of the difference in rates is among tumors ≤2 centimeters.

Behavioral Factors

- Obesity probably explains little of the Staten Island excess of thyroid cancer.
- Thyroid cancer is not known to be smoking-related.

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Healthcare Factors

- **Diagnostic Imaging**
  - ✓ Medicare data showed that neck ultrasounds doubled statewide from 2004 to 2012, but tripled on Staten Island.
  - ✓ Medicaid data suggested that Staten Island lagged somewhat behind the statewide increase of neck ultrasounds between 2006 and 2015.
- **Screening**
  - ✓ Some residents of Staten Island have received free thyroid cancer screening at screening events, though no national organizations in the US currently endorse this practice.
- **Surgery**
  - ✓ Thyroid surgery is performed more frequently on Staten Island than elsewhere in NYS. But this is probably not an important factor for the
  - ✓ excess on Staten Island.

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Occupational Factors

- **First responders, firefighters, and rescue and recovery workers**
  - Exposures in World Trade Center first responders likely had a very small influence on thyroid cancer rates on Staten Island.
  - The latency periods for thyroid cancer is measured in decades, so exposures from the World Trade Center alone could not have resulted in the excess thyroid cancers developing in such a short time.
  - Previous study suggested higher incidence may be due to enhanced medical surveillance first responders received.
  - As nearly the entire firefighter cohort are men, this offers no explanation for the similar elevations in thyroid cancer incidence among women on Staten Island.
  - Other cancers known to be associated with specific occupational exposures do not have rates that are higher than the rest of NYC or NYS.

Other Factors

- **Disease Reclassification**
  - Some thyroid cancers have recently been reclassified as non-cancers. The impact of this change in histopathologic nomenclature is estimated to be a 2-5% decrease.
- **Physician Behaviors**
  - It is possible that a higher proportion of doctors on Staten Island tend to “round up” ambiguous findings to the level of cancer.
- **Chernobyl Nuclear Accident**
  - Immigration from Russia, Belarus and Ukraine does not appear to have influenced thyroid cancer rates on Staten Island.

Environmental Factors

- **Outdoor Air Quality**
  - ✓ Focused on five known/probable carcinogens with mean estimates above the one-in-one-million cancer risk level across NYS census tracts.
  - ✓ For each of these five HAPs, Staten Island had similar or lower risks than the rest of NYC, similar or higher risks than NYS excl. NYC, and similar risks to NYS.
  - ✓ None of these pollutants has been associated with thyroid cancer.

Estimated Total Cancer Risk (per million) for USEPA-designated Hazardous Air Pollutants in Staten Island, Other Four Boroughs in New York City, New York State excluding New York City, and New York State, NATA 2011

HAPs	Staten Island	Other 4 Boroughs	NYS excl. NYC	NYS
1,3-Butadiene	3.6	5.7	2.0	3.5
Acetaldehyde	4.3	5.4	3.3	4.2
Benzene	8.2	12.1	5.8	8.5
Carbon Tetrachloride	3.3	3.3	3.3	3.3
Formaldehyde	22.5	27.7	15.3	20.5

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Environmental Factors

- **Radon in Indoor Air**
  - ✓ No studies have found an association between radon and thyroid cancer.
  - ✓ Radon does not appear to be a significant issue on Staten Island.
- **Public Drinking Water Quality**
  - ✓ Analysis revealed no MCL violation from 1997 through July 2018.
  - ✓ UCMR 3 contaminants were all below reference levels set by the USEPA.
- **Proximity to Traffic**
  - ✓ Compared to NYC, Staten Island has a lower percentage of people who live close to heavily trafficked roads.
  - ✓ The NATA results are consistent with these traffic density results.
  - ✓ We are unaware of any studies linking thyroid cancer with vehicular traffic.

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Environmental Factors

- **Industrial and Inactive Hazardous Waste Disposal Sites**
  - ✓ The Fresh Kills landfill
    - ATSDR 2000: chemical hazards presented little to no public health hazard.
    - NYC-DHMH 2000: “these analyses do not indicate consistent evidence of elevated cancer rates specific to the landfill area”
    - NYC-DHMH 2018: (not released yet)
  - ✓ Other existing and known remedial sites
    - No information suggests that contamination causes widespread exposures.
    - In some cases, on-site contamination exists but is not causing off-site exposure.
    - For many sites, actions to identify, control, and/or remove existing contamination have been implemented and completed.
    - For other sites, information continues to be gathered.

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Conclusions

- Thyroid cancer is the only cancer that is significantly elevated on Staten Island.
- There is strong consensus in the scientific literature that the primary risk factors for thyroid cancer relate to medical system practices. These include the use of diagnostic imaging, cancer screening, and post-surgery thyroid cancer diagnoses.
- The literature also shows that screening events and overuse of diagnostic imaging can increase local thyroid cancer rates because they identify insignificant cancers where active treatment is not the standard of care. Some people residing on Staten Island have received free thyroid cancer screening at screening events, though no national organizations in the US currently endorse this practice.
- The findings of the environmental evaluation showed no unusual environmental exposures that could explain the excess in thyroid cancer incidence on Staten Island.

Findings and Conclusions – Warren County Study Area

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Cancer Sites Examined for Warren County

Cancer Types and Percent Elevations in Incidence Rates,[1] Warren County versus New York State excluding New York City and New York State, by Sex, 2011-2015

Cancer Site	Warren vs. NYS excl. NYC[2]			Warren vs. NYS[3]		
	All	Male	Female	All	Male	Female
Oral cavity and pharynx	33.9					
Esophagus				48.0	62.4	
Colorectal			24.7			
Larynx	87.7	80.5				
Lung and bronchus	18.4	24.4				
Melanoma of the skin				41.6	45.2	
Brain & other nervous system	66.8		115.4			
Thyroid	30.4		37.0			
Leukemia						48.5

[1] *Incidence rate was age-adjusted to the 2000 US standard population.*

[2] *Values with significant elevations are shown.*

[3] *Values with significant elevations of at least 40% are shown.*

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Oral Cancer

- The incidence rate in Warren County was statistically significantly higher relative to NYS excl. NYC in the latest three time periods (1996-2000, 2001-2005, & 2006-2010).
- About 60% of the excess oral cancer in Warren County was in men.
- Most of the excess occurred among individuals aged 50-64.
- The incidence rate of HPV-associated oral cancers in Warren County was significantly higher than in NYS excl. NYC.
- About 60% of oral cancer cases were reported to the NYSCR as either current or former tobacco users.

Colorectal Cancer

- The observed excess of colorectal cancer in Warren County during the 2011-2015 period was entirely in females.
- In both Warren County and NYS excl. NYC, about 3% of the female patients were diagnosed with 2-4 primary colorectal cancers between 2011 and 2015.
- 52% of the excess in female colorectal cancer incidence was among older women aged 75+ years, and 45% was among young adult women aged 20-49 years.
- The excess among older women was largely due to an increased incidence of colon cancer (68%), while most (56%) of the excess among young adult women was due to an increased incidence of rectal cancer.
- A higher proportion of young women were diagnosed with local-stage tumors in Warren County (60%) than in NYS excl. NYC (37%).

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Lung Cancer

- Incidence in Warren County was elevated compared to NYS excl. NYC in all four periods examined, but statistically significant only in the most recent period.
- About 70% of the excess lung cancer in Warren County was in men.
- Almost 60% of the excess was in young (aged 20-49 years) and middle-aged adults (50-64 years).
- The incidence rates for squamous, small cell, and large cell carcinomas were significantly elevated in Warren County.
- 84% of lung cancer patients in Warren County were reported as current or prior users of tobacco.
- Similar proportions of patients in both regions were ever exposed to radiation treatment for a prior tumor.

Cancers of the Brain and Other Nervous System (ONS)

- The incidence of cancers of the brain and ONS in Warren County did not differ significantly from the incidence in NYS excl. NYC until the 2011-2015 period.
- The rate among females in Warren County was statistically higher by 115%.
- Rates for Warren County were elevated for all age groups, but only statistically significantly higher among persons under age 20.
- 75% of the excess in brain and ONS cancers observed for individuals under 20 years of age in Warren County can be attributed to pilocytic astrocytomas.
- The benign to malignant rate ratio for Warren County (0.9) differed significantly from the rate ratio for NYS excl. NYC (2.0).
- The prevalence of prior cancers among individuals with cancers of the brain or ONS was similar in Warren County and NYS excl. NYC.

Other Cancers of Interest

- **Esophageal Cancer**: low incidence; excess in men and distant-stage disease; history of tobacco consumption
- **Laryngeal Cancer**: low incidence; excess in men (esp. <65 years) and localized stage disease; history of tobacco consumption
- **Melanoma of the Skin**: not statistical elevated among non-Hispanic whites
- **Thyroid cancer**: faster growth of incidence rate; excess in female (esp. 65+ years), localized stage disease, and small papillary tumors
- **Leukemia:** highly variable incidence rate; not statistical elevated among non-Hispanic whites

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Health Behavior and Lifestyle Factors

- A significantly greater prevalence of women in Warren County were overweight or obese than in NYS excl. NYC.
- A significantly higher proportion of adults (especially women) in Warren County were current smokers.
- Residents of Warren County (females in particular) were significantly more likely to engage in leisure time physical activity.
- A significantly higher percentage of adults in Warren County have health care coverage.
- Warren County was frequently ranked in the lower half among the 57 counties in NYS excl. NYC on the Health Behaviors measure.

Healthcare Factors

- A significantly higher percentage of adults in Warren County have health care coverage.
- Warren County ranked high with respect to Clinical Care Factors among the 57 counties in NYS excl. NYC by the County Health Rankings & Roadmaps Program.

Occupation and Industry Factors

- There was a shift of major industries in Warren County over time.
- Recent ACS data showed a slightly greater percentage of people in Warren County work in occupations with greater probability of workplace exposures to elevated levels of hazardous substances than in NYS excl. NYC.
- Results of asbestosis hospitalization rate analysis didn't suggest elevated past exposure to asbestos in Warren County.

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Environmental Factors

- **Outdoor Air Quality**
  - ✓ Warren County is in compliance with USEPA National Ambient Air Quality Standards for all criteria pollutants.
  - ✓ Using NATA database, focused on five known/probable carcinogens with mean estimates above the one-in-one-million cancer risk level across NYS census tracts.

Estimated Total Cancer Risk (per million) for USEPA-designated Hazardous Air Pollutants in Warren County, New York State excluding New York City, and New York State, NATA 2011

HAPs	Warren County	NYS excl. NYC	NYS
1,3-Butadiene	1.4	2.0	3.5
Acetaldehyde	3.1	3.3	4.2
Benzene	5.4	5.8	8.5
Carbon Tetrachloride	3.3	3.3	3.3
Formaldehyde	14.1	15.3	20.5

- NATA data showed that the estimated cancer risk due to inhalation in Warren County is either lower than or similar to NYS excl. NYC and to NYS.
- NATA estimates suggest that residential wood combustion contributed about 12% to average inhalation cancer risk in Warren County.

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Environmental Factors

- **Radon in Indoor Air**
  - ✓ Average radon concentrations in Warren County were lower relative to the rest of state.
  - ✓ Radon concentrations in tested homes may not be representative of other homes in the neighborhood.
- **Public Drinking Water Quality**
  - ✓ 31 active public water systems serve ~80% of the population in Warren County
  - ✓ 7 MCL violations were issued for disinfection byproducts (i.e. TTHMs and HAA5) in two public water systems.
  - ✓ 11 violations were issued for aesthetic properties in two public water systems.
  - ✓ UCMR 3 contaminants were all below reference levels set by the USEPA.

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Environmental Factors

- **Industrial and Inactive Hazardous Waste Disposal Sites**
  - ✓ A total of 22 sites were identified in Warren County.
  - ✓ In some cases, on-site contamination exists but is not causing off-site exposure.
  - ✓ For other sites, information continues to be gathered.
  - ✓ For many sites, actions to identify, control, and/or remove existing contamination have been implemented and completed.
  - ✓ Overall, based on a review of available data, there is no information suggesting that contamination from existing and known remedial sites is causing widespread exposures in Warren County.
- **Proximity to Traffic**
  - ✓ Warren County has a smaller proportion of its population living near heavily trafficked roads than both NYS excl. NYC and NYS.

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Conclusions

- It is likely that a higher proportion of current and former tobacco use contributed to the elevated rates of lung, laryngeal, esophageal, and oral cancers in Warren County, which are four cancers most strongly associated with tobacco use. In 2011-2015, the elevations in the rates for these cancers were more often observed in men.
- Alcohol consumption, independently or through a synergistic effect with tobacco use, might have contributed to the excess of oral, esophageal, and laryngeal cancers in Warren County, particularly among men.
- HPV infection may also have contributed to the oral cancer excess.
- Most of the elevation in thyroid cancer incidence among women in Warren County is likely due to increased detection of small papillary tumors by medical imaging and other diagnostic techniques.

Conclusions

- The higher proportion of overweight or obese women in Warren County may also have contributed to the excess in female thyroid cancer incidence as well as the excess in female colorectal cancer incidence.
- The excess in leukemia rates among women in Warren County may represent a time-limited anomaly.
- The investigation found no factors that might account for the elevated incidence of cancers of the brain and ONS in Warren County. DOH will continue to monitor the incidence of brain and ONS cancers in Warren County.
- Results from the environmental investigation did not show any unusual environmental exposures that could explain the elevated cancer incidence rates in Warren County.

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Recommendations

Recommended Actions Based on Specific Cancers Elevated in the Study Areas

Health Promotion and Cancer Prevention

- Tobacco prevention [1,2,4]
- Alcohol prevention [2,4]
- Healthy nutrition [1,2,4]
- Physical activity [1,2,4]
- HPV vaccination [2,4]
- UV exposure [4]

Cancer Screening and Early Detection

- Lung cancer screening [1,2,4]
- Colorectal cancer screening [2,4]
- Prostate cancer screening [2]
- Thyroid cancer screening (*against*) [1,3,4]

Healthy and Safe Environment

- Radon testing and mitigation [1,2,4]
- Radiation from medical imaging [1,3,4]
- Safety in the workplace [1,2,4]

1: CFS study area
2: EBWC study area
3: Staten Island study are
4: Warren County study area

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Recommended Actions to Reduce the Burden of All Cancers Statewide

For All New Yorkers

It is not always possible to know why one person develops cancer while another person does not. But the following are things that all individuals can do to reduce their risk of cancer:

- If you use tobacco, quit. If you don't use tobacco, don't start.
- Eat nutritious meals that include fruits, vegetables and whole grains.
- Get moving for at least 30 minutes a day on five or more days each week.
- Use sunscreen, monitor sun exposure and avoid tanning salons.
- Limit alcohol use.
- For women of child-bearing age, know the benefits of breastfeeding and, if possible, breast-feed infants exclusively for at least the first six months of life.
- Discuss with your healthcare provider what cancer screening tests might be right for you.
- Get cancer-preventive vaccines such as hepatitis B and HPV.
- Learn your family health history (if possible).
- Test your home for radon.

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Health Promotion and Cancer Prevention: Resources for New Yorkers

New York State Smokers' Quitline

- Free coaching, tips, tools, nicotine replacement therapy
- 1-866-NY-QUITS (1-866-697-8487) or www.nysmokefree.com

Vaccines for Children (VFC) Program

- Vaccines at no cost to eligible children
- Ask your health care provider or county health department about the VFC Program

Cancer Services Program

- Free breast, cervical and colorectal cancer screening to eligible men and women
- 1-866-442-CANCER (1-866-442-2262)

Radon Testing

- Low cost radon test kits for your home
- 518-402-7556 or email: radon@health.ny.gov

New York State of Health

- Get financial assistance to lower the cost of your health coverage
- 1-855-355-5777 (TTY: 1-800-662-1220)
- https://info.nystateofhealth.ny.gov/resources

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Recommended Actions to Reduce the Burden of All Cancers Statewide

NYS Department of Health and Partner Organizations

Cancer Surveillance – NYS Cancer Registry

- Continue to meet the highest cancer registry standards for timeliness, completeness and quality of data, and make these data available to researchers, clinicians, public health officials, legislators, policymakers, community groups and the public.

Environmental Health

- Continue to identify and assess potential exposures throughout the state and take action to reduce those exposures.
- Continue to support programs to promote and maintain clean air, clean water and reduce human exposures to environmental hazards
- Promote awareness of programs and initiatives to reduce environmental hazards in our communities.

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Recommended Actions to Reduce the Burden of All Cancers Statewide

NYS Department of Health and Partner Organizations

Statewide Initiatives

Overarching goal is to reduce the burden of cancer by:

- decreasing the number of new cancer cases,
- decreasing the number of cancers diagnosed at late stages,
- improving the quality of life of those diagnosed with cancer, and
- decreasing the number of deaths caused by cancer.

These efforts are detailed in two State plans:

- *New York State 2018-2023 Comprehensive Cancer Control Plan*
- *New York State Prevention Agenda 2019-2023*

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Acknowledgments

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Discussion of Next Steps and Regional Meetings

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Next Steps – Tentative Schedule

- **Briefings**
  - ✓ NYSDOH conducts webinar briefings with elected officials and stakeholders in each of the four regions (9/4)
- **Press release**
  - ✓ NYSDOH issues PR/meeting advisory and Executive Summaries for all four regions (9/5)
- **Regional public information meetings**
  - ✓ Staten Island – CUNY Staten Island (9/16)
  - ✓ Long Island - Stony Brook auditorium (9/18)
  - ✓ Buffalo - Museum of Science (9/24)
  - ✓ Warren County - SUNY Adirondack (9/26)

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Regional Meeting Teams

- DOH Moderator
- DOH Public Affairs Group representative
- DOH Office of Governmental and External Affairs
- DOH Program experts (Epidemiology and Environmental Health)
- DEC representative(s)
- DOH regional office representative(s)
- Logistical support

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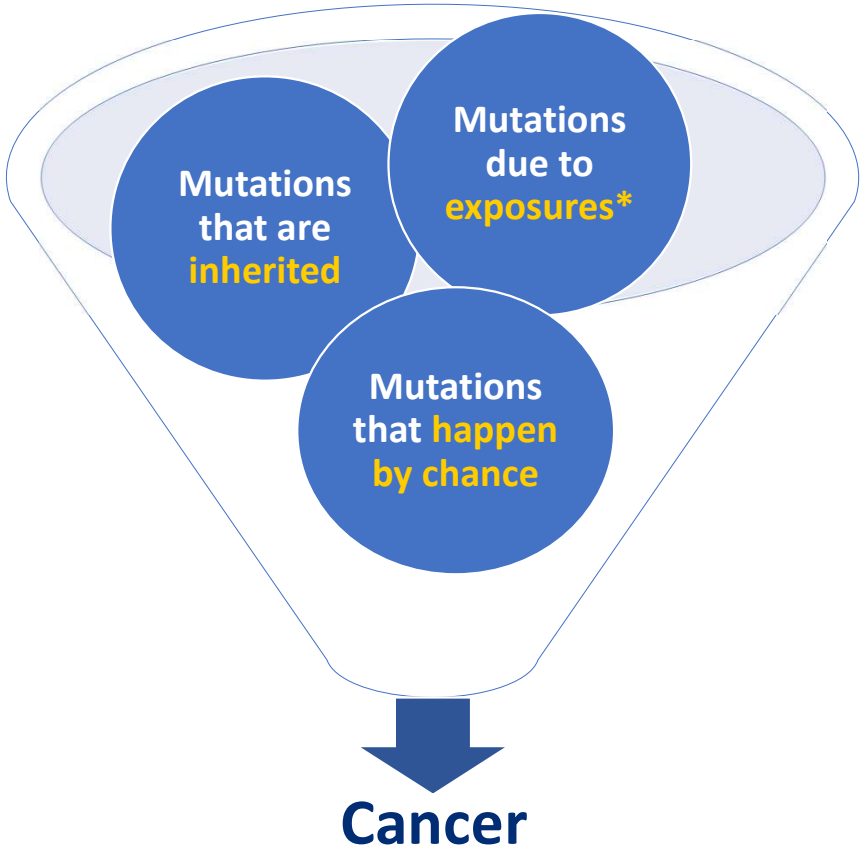
Q&A Session

EXTRA SLIDES

What causes cancer?

- Cancer begins when the genes in a cell are damaged (mutations) and the cells grow out of control.
- Mutations may be ones you are born with (inherited), or that happen due to chance when cells grow and divide, or that happen after exposure to a cancer-causing substance.
- Several mutations may need to occur in a person to lead to cancer.
- Some people with several risk factors may never develop cancer, while other people with no known risk factors do.



*Exposures: UV radiation, smoking, alcohol, certain chemicals, etc.

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What causes cancer?

- Different cancers have different causes and risk factors.
- Anyone can get cancer; there are many factors that affect a person's chances of getting cancer.
- Some cancer risk factors can be changed, and others cannot:
  - ✓ Family history, genetics, race and ethnicity
  - ✓ Lifestyle factors: smoking, unhealthy diet, excessive alcohol, physical inactivity
  - ✓ Other exposures: Ultraviolet radiation from sunlight and indoor tanning devices, x-rays, certain chemicals that may be found in the air, water, food, drugs and workplace
  - ✓ Chronic inflammation, infectious agents, immunosuppression
  - ✓ Often multiple interacting factors

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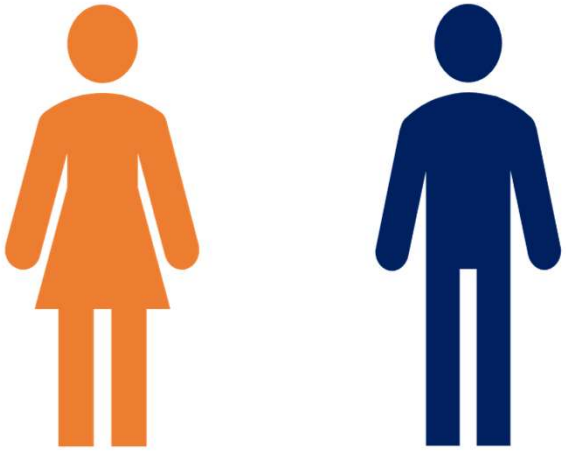
Most Frequently Diagnosed Cancer Types in Females and Males, New York State, 2012-2016

Females	
Cancer Type	**New Cases***
Breast	15,932
Lung	6,979
Colorectal	4,396
Uterine	4,090
Thyroid	3,138
All sites	56,389



Males	
Cancer Type	**New Cases***
Prostate	13,767
Lung	6,824
Colorectal	4,585
Bladder	3,988
Lymphoma^	2,645
All sites	56,389

** Average annual incident cases*
^ Non-Hodgkin Lymphoma

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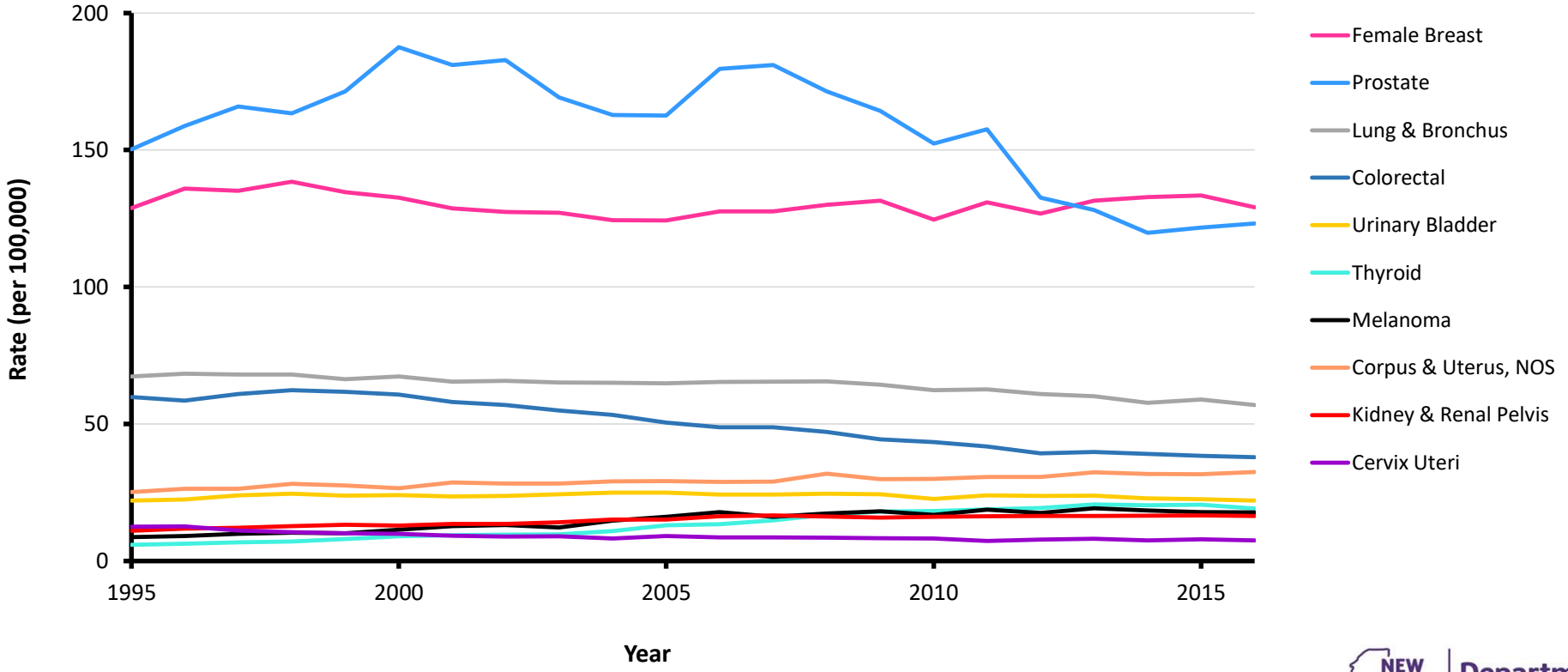
Cancer incidence* by selected site for males and females New York State, 1995-2016



** Incidence rate was age-adjusted to the 2000 US standard population.*
Source: New York State Cancer Registry

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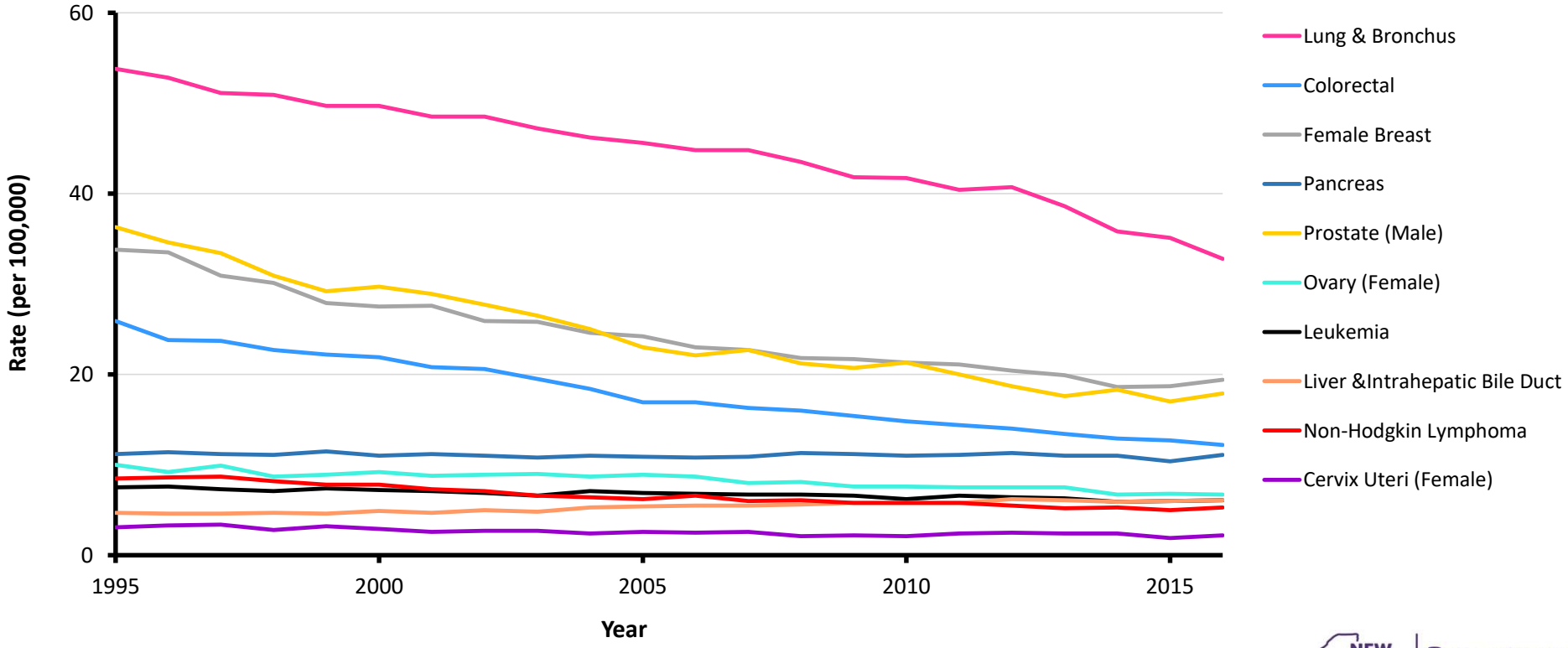
Cancer mortality* by selected site for males and females New York State, 1995-2016



** Morality rate was age-adjusted to the 2000 US standard population.*
Source: New York State Cancer Registry

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