DELAWARE HEALTH AND SOCIAL SERVICES
Division of Public Health

Secondary Analysis of Delaware's Census Tracts with Elevated All-Site Cancer Rates in 2005-2009, April, 2013

In April, 2013, the Delaware Division of Public Health (DPH) released its annual Cancer Incidence & Mortality Report, 2005 - 2009. This report includes updated cancer statistics for the most recent five-year time periods, 2004-2008 and 2005-2009. As part of the report, and in accordance with Delaware legislation, DPH calculated both 2004-2008 and 2005-2009 all-site cancer incidence rates for each of Delaware's census tracts. This report summarizes the 2005-2009 cancer incidence analyses of the census tracts.

In Delaware, all-site cancer incidence rates measure the overall cancer burden for an area over a five-year time period. Cancer incidence rates are calculated by dividing the total number of cancer cases in an area by the total number of people living in that area and are expressed as the average annual number of new cases diagnosed per year per 100,000 people. Since Census 2010 population data were available, DPH was able to compute census tract population totals for the intervening years 2001-2009 by extrapolating between the Census 2000 and Census 2010 population estimates. As of the 2010 Census, Delaware was reorganized into 214 census tracts, rather than the 197 tracts in effect as of the Census 2000.

The all-site cancer incidence rate for each census tract was compared to the all-site cancer incidence rate for Delaware as a whole. DPH used standard statistical procedures to determine if the difference between each census tract rate and the state rate reached the threshold of statistical significance. If a census tract rate is significantly different from the state rate, the difference between the rates would be interpreted as statistically significant; i.e. "larger than would be expected by chance alone" or "smaller than would be expected by chance alone." If a census tract rate is not significantly different from the state rate, it is interpreted as "no meaningful difference" between the two rates.

Results for 2005–2009 show that:

- ☒ In nine of Delaware's 214 census tracts, the overall cancer incidence rate was statistically significantly higher than Delaware's average 2005–2009 incidence rate (516.0 per 100,000).
- ☒ In 16 census tracts, the overall cancer incidence rate was significantly lower than Delaware's average incidence rate (516.0 per 100,000).

Secondary Analysis of Elevated Census Tracts for 2005-2009

DPH analyzed cancer data within each of the nine elevated census tracts to determine the local need for screening and prevention services. Further, unique patterns could suggest an environmental, occupational or other unusual cause. The following analyses were conducted on the census tracts with elevated all-site cancer incidence:

Sex distribution
Age at diagnosis
Types of cancers elevated
Cancers with suspected environmental or chemical etiology

Sex Distribution of Cases for 2005-2009

To determine if the elevated overall cancer rate in a census tract affected males and females differently, age-adjusted all-site cancer incidence rates were calculated separately by sex for each of the nine census tracts. Male- and female-specific rates for each census tract were compared to those at the state level. The nine census tracts fell into one of the following four categories compared to Delaware as a whole:

One census tract (11%) had a significantly elevated all-site cancer incidence rate for both males and females.
One census tract (11%) had a significantly elevated all-site cancer incidence rate for males only.
Two census tracts (22%) had a significantly elevated all-site cancer incidence rate for females only.
Six census tracts (55%) did not have a significantly elevated all-site cancer incidence rate for either males or females. Rather, minor (non-significant) elevations in the male and female cancer rates produced a significantly-elevated overall cancer rate for both sexes combined.

Age at Diagnosis of Cases for 2005-2009

The median age of diagnosis for all cancer cases diagnosed during 2005-2009 in Delaware was 65. In other words, half of all Delawareans diagnosed with cancer during this time period were younger than 65 years; the other half were older than 65 years. The median age of cancer cases in each census tract was compared to the median age of cancer cases at the state level for the same time period. A younger median age at diagnosis in the census tract could suggest a unique exposure, such as from the environment or an occupation. Statistical significance was determined by the "sign test." Of the nine census tracts analyzed:

One census tract (11%) had a significantly lower median age at diagnosis than the state's median age at diagnosis.
One census tract (11%) had a significantly higher median age at diagnosis than the state's median age at diagnosis.
Seven census tracts (77%) had a median age at diagnosis that did not differ significantly from the state's median age at diagnosis.

Number of Significantly Elevated Cancer Types for 2005-2009

Cancer is a generic term used to describe more than 100 different diseases. For each of the census tracts with a significantly elevated all-site cancer incidence rate, incidence rates were calculated for the 24 most-commonly diagnosed cancers. These analyses helped to determine which specific cancers, if any, contributed to the higher-than-expected overall cancer rate. Results are as follows:

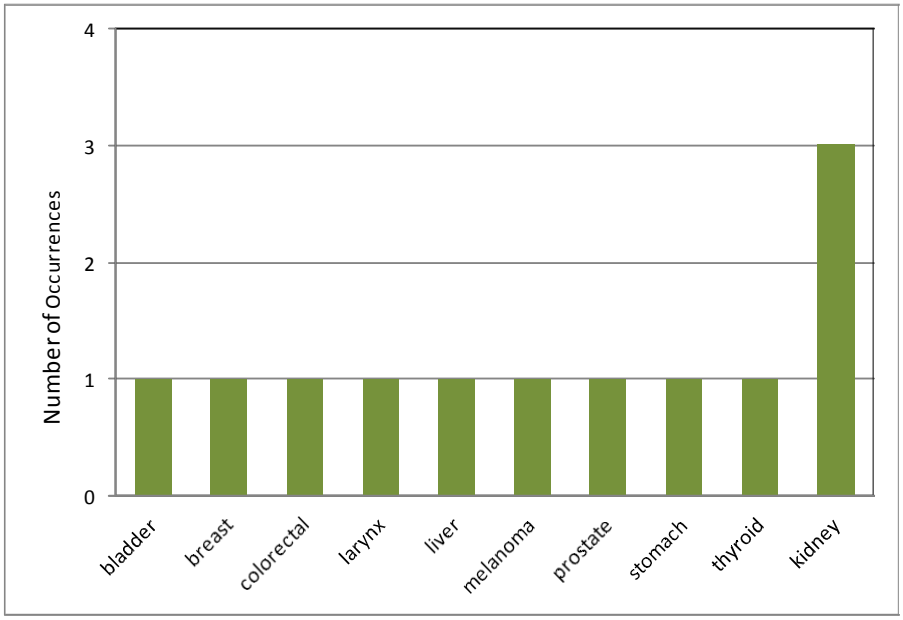
- One census tract (11%) did not have any cancer type that was significantly elevated.
- Four census tracts (44%) had one specific cancer type that was significantly elevated.
- Four census tracts (44%) had two specific cancer types that were significantly elevated.

None of the nine census tracts were significantly elevated for more than two specific cancers.

Types of Cancers Elevated for 2005-2009

Although nine of Delaware's 214 census tracts had a significantly elevated all-site cancer incidence rate during 2005-2009, it is important to note that these census tracts were not elevated for every individual cancer type. The higher-than-expected cancer incidence rates are confined to several cancer types. The figure below shows which specific cancer types were most often significantly elevated within the nine census tracts analyzed in this report. Note that the frequencies in the figure do not sum to nine because four of the nine census tracts under review had two or more cancer types that were significantly elevated.

Figure 1. Number of Occurrences of Elevated Cancer within Consistently Elevated Census Tracts by Cancer Type, Delaware 2005-2009



Kidney cancer is the most frequently elevated cancer in these nine census tracts. Breast, colorectal and prostate cancers, each elevated in one of the nine census tracts, can be detected in their early stages via reliable screening tests (i.e. colonoscopy/sigmoidoscopy, mammogram, and prostate-specific antigen (PSA) test).

Risk factors for the cancers that were elevated in one more of the nine census tracts are listed in Table 1. When a census tract has an elevated rate for a cancer type with many risk factors, it is difficult to pinpoint any single causal factor. Rather, the elevated cancer rate is likely due to a mix of non-modifiable, modifiable or unidentified risk factors. Adding to the complexity is that the interaction of several risk factors may increase a person's cancer risk more than the sum of the individual risk factors. For example, the American Cancer Society cites 19 substantiated risk factors for breast cancer alone: 12 of these risk factors are non-modifiable (e.g., age, family history); the remaining seven are modifiable (e.g., lack of exercise, being overweight/obese). The impact of other potential breast cancer risk factors is still under scientific review.

Cancer sites with environmentally-suspected cause(s) for 2005-2009

The Delaware Cancer Consortium identified seven cancer types with substantiated environmental risk factors:

brain/central nervous system cancer
Hodgkin lymphoma
leukemia
liver cancer
non-Hodgkin lymphoma
thyroid cancer
urinary bladder cancer

It is important to note that while these seven malignancies have been known to be associated with environmental risk factors, they may also be related to modifiable risk factors. For example, in addition to chemical exposures in the manufacturing of dyes, rubber and leather, tobacco use is the primary risk factor for bladder cancer.

Among the nine census tracts, results related to these seven cancer types are:

- Three census tracts (33%) had significantly elevated rates for one of the seven cancer types with substantiated environmental risk factors.
- Six census tracts (66%) did not have a significantly elevated rate for any of the seven cancer types with substantiated environmental risk factors.

Of the seven cancers with environmentally–suspected causes,

Liver cancer was elevated among females in census tract 156.00.
Thyroid cancer was elevated among males in census tract 421.00.
Urinary bladder cancer was elevated among males in census tract 428.00.

While some of the elevated cancer types in these census tracts were those with environmental risk factors, some other cancer types without these risk factors were also significantly higher compared to the state average. These may simply be statistical aberrations resulting from the very small number of cancer cases in these communities, or, especially when combined with unusual sex and age distributions, there may be underlying occupational or environmental causes. Further investigation of these concerns cannot be conducted with data routinely collected by DPH.

In Table 1 is a summary of the results of secondary analyses for the nine census tracts that were significantly elevated for all cancer sites combined during 2005-2009.

Known risk factors associated with cancer types that are elevated in these secondary analyses are in Table 2.

DPH will work with communities to address risk factors for the elevated cancer types and address any concerns. In summary, DPH will:

Educate residents about findings in this report.
Seek guidance from the Environment Committee of the Delaware Cancer Consortium regarding the policy implications of this report.
Ensure awareness of and access to screening and prevention services, including promotion of healthy lifestyles that decrease risk of cancer.
Address environmental and occupational concerns of residents or other agencies, including exploration of possible known sources of environmental carcinogens.
Where appropriate, collect and analyze additional information, as feasible.

Table 1. Characteristics of Nine Census Tracts with Statistically Significantly Elevated Cancer Rates: Delaware, 2005-2009

Census Tract	Ave. Cases / year	All-Site Age-Adjusted Cancer Incidence Rates per 100,000, 2005-2009[1]				Significantly Elevated Cancer Site(s) and Sex[2]	Median Age at Diagnosis		Area(s) of Concern
							DE	CT[3]	
152.00	35		**All**	**Male**	**Female**	Colorectal - M	65	***63***	Screening Prevention
		DE	515.3	608.2	445.2				
		CT	***618.2***	707	563.9				
156.00	18		**All**	**Male**	**Female**	Kidney - All ***Liver - F***	65	63	Prevention Cancer type
		DE	515.3	608.2	445.2				
		CT	***651.4***	716.7	590.7				
159.00	24		**All**	**Male**	**Female**	Kidney - M	65	70	Prevention
		DE	515.3	608.2	445.2				
		CT	***637.5***	724.9	561.4				
163.01	30		**All**	**Male**	**Female**	none	65	63	
		DE	515.3	608.2	445.2				
		CT	***626.4***	704.2	566.4				
417.01	41		**All**	**Male**	**Female**	Prostate - M	65	68	Sex distribution Screening
		DE	515.3	608.2	445.2				
		CT	***639.2***	***838.6***	481.3				
421.00	29		**All**	**Male**	**Female**	Kidney - F ***Thyroid - M***	65	66	Sex distribution Prevention Cancer type
		DE	515.3	608.2	445.2				
		CT	***660.7***	751.7	***602.1***				
428.00	48		**All**	**Male**	**Female**	***Urinary bladder – M*** Larynx - All	65	64	Cancer type Prevention
		DE	515.3	608.2	445.2				
		CT	***673.1***	***790.8***	***575.6***				
501.05	32		**All**	**Male**	**Female**	Breast – F Stomach - M	65	66	Screening Prevention
		DE	515.3	608.2	445.2				
		CT	***635.5***	741.8	554.6				
511.01	11		**All**	**Male**	**Female**	Melanoma - F	65	75	Sex distribution Prevention Screening
		DE	515.3	608.2	445.2				
		CT	***782.1***	787.2	***810.0***				

[1] Age-adjusted incidence rate in bold and italics indicates that the census tract rate is significantly elevated compared to the state rate.

[2] A cancer type in bold and italics represents one of the seven cancer types considered by the Delaware Cancer Consortium to have environmentally-substantiated risk factors.

[3] A median age at diagnosis in bold and italics indicates that the census tract's median age at diagnosis is significantly lower than that of the state.

Table 2. Known Risk Factors among Elevated Cancer Types, 2005-2009[4]

Cancer Type	Known Risk Factors
breast	age - increasing, alcohol abuse, family history, genetic mutations, benign breast conditions, early menarche, hormone therapy, high-fat diet, recent birth control pills, smoking (cigarettes, cigars or pipes), secondhand smoke
colon/rectum	age 50 and older, alcohol abuse, diabetes – type 2, family history, high-fat diet, history of bowel disease, physical inactivity, smoking (cigarettes, cigars or pipes), overweight or obesity
esophagus	age 55 and older, alcohol abuse, chemicals used in dry cleaning, chewing tobacco, combined use of tobacco and alcohol, diet, gastroesophageal reflux disease, gender – male, overweight or obesity, smoking (cigarettes, cigars or pipes),
kidney	advanced kidney disease with long-term dialysis, cigar or cigarette smoking, family history, gender – male, hypertension, certain medications, overweight or obesity, workplace exposures
larynx	alcohol abuse, combined alcohol and tobacco use, diet , gastroesophageal reflux disease, gender – male, genetic syndromes, human papilloma virus, poor nutrition, secondhand smoke, smoking (cigarettes, cigars or pipes),workplace exposure
liver	alcohol abuse, arsenic in drinking water, cirrhosis of liver, diabetes – type 2, genetics, infection with hepatitis B or hepatitis C virus, obesity, race – Asian American or Pacific Islander, steroids, viral hepatitis, workplace exposures
melanoma	excessive ultraviolet light, fair skin, family history, having many moles, history of sunburn before age 20, increasing age, race – Caucasian, weakened immune system
prostate	African American race, age – over 50, diet high in red meat and high-fat dairy, ethnicity - non-Hispanic, family history, gene mutations, inherited DNA changes, obesity, workplace exposures
stomach	age 50 and older, diet low in fruits and vegetables, diet high in smoked foods, and salted fish and meats, ethnicity – Hispanic, family history, gender – male, obesity, infections, race – African American or Pacific Islander, residence (China, Japan, Eastern Europe, South and Central America), smoking (cigarettes, cigars or pipes)
thyroid	age (40 - 50 in women, 60 and older in men), diet low in iodine, gender – female, genetic conditions, lack of iodine, race – Caucasian, radiation – environmental and medical
urinary bladder	age 55 and older, arsenic in drinking water, chemotherapy (alkylating agents), cigarette smoking, ethnicity – Hispanic, family history, gender – male, genetic syndromes, race – Caucasian, radiation therapy to bladder, workplace exposures

[4] Listed in alphabetical order, not by priority or magnitude of impact.