



## SECONDARY ANALYSIS OF DELAWARE'S CENSUS TRACTS WITH ELEVATED ALL-SITE CANCER INCIDENCE RATES IN 2012-2016 (October 2020)

In October 2020, the Delaware Department of Health and Social Services (DHSS), Division of Public Health (DPH) released its annual cancer incidence and mortality (I&M) report. In accordance with Delaware legislation, DPH calculated the 2012-2016 all-site cancer incidence rates for each of Delaware's 214 census tracts and these results are included in the [Cancer Incidence and Mortality in Delaware \(I&M\) Report, 2012-2016](#). This report summarizes the secondary analyses for the 18 census tracts with a significantly elevated all-site cancer incidence rate for 2012-2016 (New Castle County: 21.00, 29.00, 135.05, 148.05, 149.03, 149.04, 163.01, 164.01, 166.02, 166.04, 166.08, 168.04; Kent County: 401.00, 402.03, 417.01, 422.02; and Sussex County: 508.02, 508.03). Refer to Appendices F and G in the *Cancer Incidence and Mortality in Delaware (I&M) Report, 2012-2016* for important information on cancer incidence by census tract and interpreting these rates.

In Delaware, all-site cancer incidence rates measure the total cancer burden for an area over a five-year period. Crude 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. Crude incidence rates are then age-adjusted to the 2000 U.S. standard population and expressed as the average annual number of new cases diagnosed per year per 100,000 people. The age distribution of a population is an important determinant of the burden of cancer. Because cancer incidence and mortality increase with age, crude rates cannot be used for comparisons of cancer statistics between sexes, racial or ethnic groups, or geographic entities across different time spans. U.S. Census Bureau data were used to estimate populations in each census tract.

The 2012-2016 all-site cancer incidence rate for each of Delaware's 214 census tracts were compared to the all-site cancer incidence rate for the entire state. DPH used standard statistical procedures to determine if the difference between each census tract's all-site cancer incidence rate and the state all-site cancer incidence rate reached the threshold of statistical significance. If a census tract's all-site cancer incidence rate is significantly higher than the state all-site cancer incidence rate, the difference between the rates is interpreted as "larger than would be expected by chance alone." If a census tract's all-site cancer incidence rate is significantly lower than the state all-site cancer incidence rate, the difference is interpreted as "smaller than would be expected by chance alone." If a census tract's all-site cancer incidence rate is not significantly different from the state all-site cancer incidence rate, the difference between the rates is interpreted as "not meaningfully different." For additional details pertaining to rate calculation methodology and testing for statistical significance, refer to the 2012-2016 I&M Report.

**There is an inherent instability in calculating cancer incidence rates at the census tract level.** In a small group, such as a census tract, the snapshot changes considerably from year to year. If one case of cancer is diagnosed in a census tract one year, and three cases of cancer are diagnosed in the same census tract the next year, the cancer rate for that census tract will change dramatically from one year to the next. These large fluctuations do not typically occur in larger populations. If we compare the cancer rate for a census tract to the cancer rate for the whole state of Delaware for a given time period, it would not be unusual to find the comparison different (perhaps even reversed) in the following time period.

When cancer incidence data are assessed by census tract, the occurrence of cancer may differ across census tracts for a variety of reasons. For example, lifestyle behaviors may cluster in a homogeneous community. In addition, the presence or absence of exposure to an environmental or occupational carcinogen(s) is often limited to a defined geographic area. In addition, residents in certain geographic areas may be more impoverished than other residents, affecting access to health care, including cancer



screening services. Population changes, such as residents moving into, or out of, a census tract, can also affect the cancer rates. Finally, chance or random variation can also influence whether a census tract's all-site cancer incidence rate is significantly different from the overall state all-site cancer incidence rate. Statistically speaking, 5% of all numerical comparisons are significantly different due to chance alone.

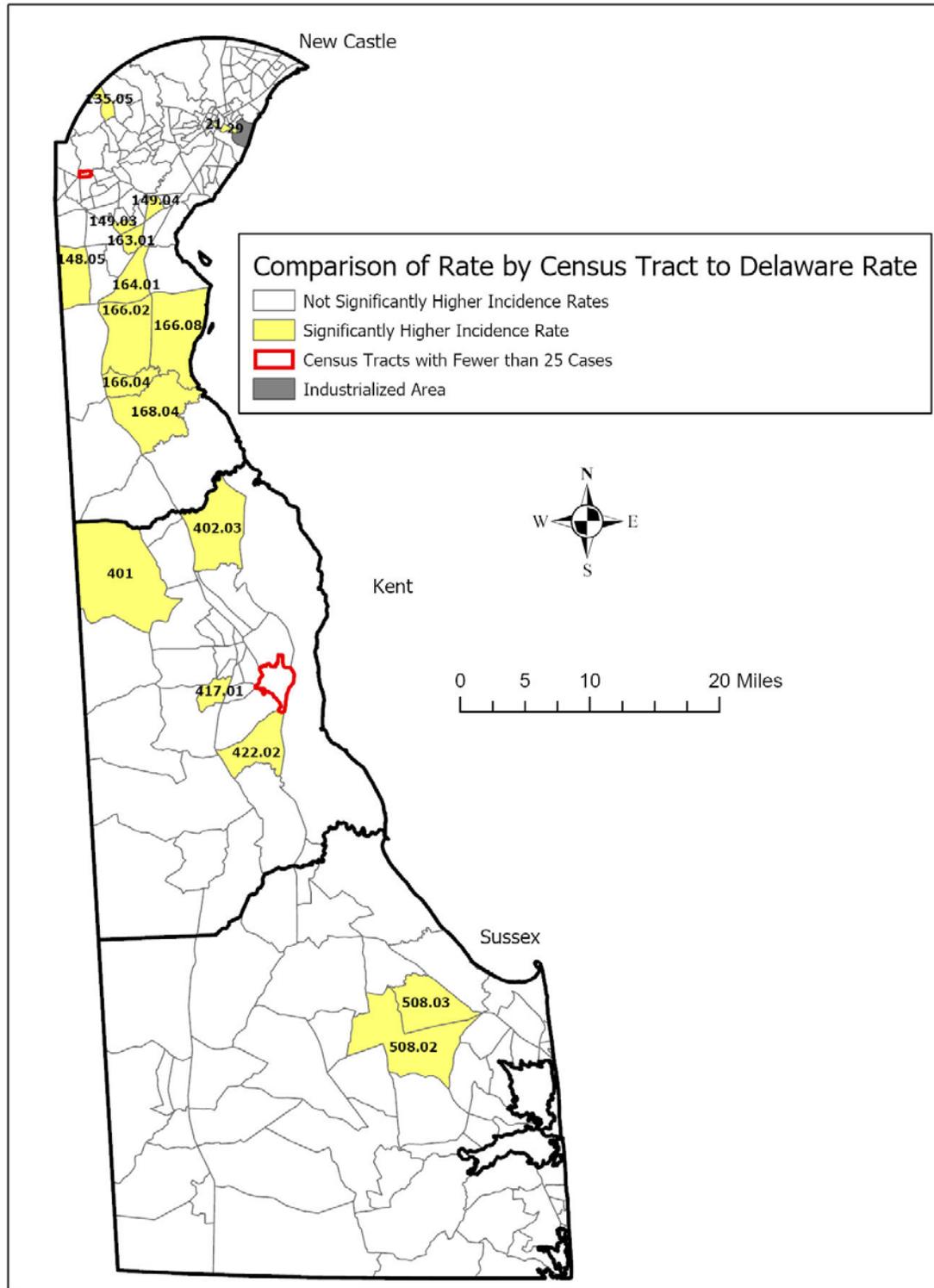
Results for 2012-2016 show that:

- In 18 of Delaware's 214 census tracts, the 2012-2016 all-site cancer incidence rates were statistically significantly higher than Delaware's 2012-2016 all-site cancer incidence rate (491.5 per 100,000).
- In 12 census tracts, the 2012-2016 all-site cancer incidence rates were significantly lower than Delaware's 2012-2016 all-site cancer incidence rate (491.5 per 100,000).

For a list of Delaware's cancer incidence rates per census tract, including if they were statistically significantly higher or significantly lower than Delaware's 2012-2016 all-site cancer incidence rate, view Table H-1 in the [\*Cancer Incidence and Mortality in Delaware \(I&M\) Report, 2012-2016\*](#).



**FIGURE 1: FIVE-YEAR AGE-ADJUSTED ELEVATED CANCER INCIDENCE RATES BY CENSUS TRACT, DELAWARE, 2012-2016**



Source: Delaware Department of Health and Social Services, Division of Public Health, Delaware Cancer Registry, 2019.

Source: 2010 U.S. Census county and tract shapefiles: <https://www.census.gov/geographies/mapping-files/time-series/geo/carto-boundary-file.2010.html>



### **Secondary Analysis of Elevated Census Tracts for 2012-2016**

DPH analyzed cancer data within each of the 18 elevated census tracts to determine unique patterns that could suggest an environmental, occupational, or other unusual cause. DPH conducted the following analyses on census tracts with an elevated overall cancer incidence rate:

- Sex distribution
- Age at diagnosis
- Types of cancers elevated within the elevated census tracts

### **Distribution of Cases for 2012-2016 by Sex**

To determine if the all-site cancer incidence 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 18 elevated census tracts. Male- and female-specific rates for each census tract were compared to those at the state level. The 18 census tracts fell into one of the following four categories compared to the state of Delaware:

- None of the census tracts had significantly elevated all-site cancer incidence rates for males and for females.
- Six census tracts (33%) had a significantly elevated all-site cancer incidence rate for males only.
- Eleven census tracts (61%) had a significantly elevated all-site cancer incidence rate for females only.
- One census tract (6%) did not have a significantly elevated all-site cancer incidence rate for either males or females. Rather, minor (i.e. not statistically significant) elevations in male and female all-site cancer incidence rates produced a significantly elevated all-site cancer incidence rate for both sexes combined.

### **Age at Diagnosis of Cases for 2012-2016**

The median age at diagnosis for all cancer cases diagnosed during 2012-2016 in Delaware was 67. Therefore, half of all Delawareans diagnosed with cancer during this time period were younger than 67 years; the other half were older than 67 years. The median age at diagnosis for cancer cases in each census tract was compared to the median age at diagnosis for 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, since older age is a risk factor for cancer. Of the 18 census tracts analyzed:

- Thirteen census tracts (72%) had a lower median age at diagnosis compared to the state's median age at diagnosis (67 years).
- One census tract (6%) had a median age at diagnosis identical to the state's median age at diagnosis (67 years).
- Four census tracts (22%) had a higher median age at diagnosis compared to the state's median age at diagnosis (67 years).

### **Significantly Elevated Site-Specific Cancer Types for 2012-2016**

Cancer is a generic term that describes a number of different diseases that vary by cancer site and histology. Eighteen of Delaware's 214 census tracts had a significantly elevated all-site cancer incidence rate for 2012-2016. It is important to note that these census tracts were not elevated for every individual cancer type. To investigate specific patterns of cancer diagnoses within the 18 census tracts with elevated all-site cancer incidence rates, DPH calculated site-specific incidence rates for the 24 most commonly diagnosed cancers. These analyses helped to determine which cancers, if any, contributed to the higher-than-expected all-site cancer incidence rate. Results for the 16 census tracts are as follows:



- Two census tracts (11%) did not have any cancer type that was significantly elevated.
- Five census tracts (27%) had **one** cancer type that was significantly elevated.
- Nine census tracts (50%) had **two** cancer types that were significantly elevated.
- One census tract (6%) had **three** cancer types that were significantly elevated.
- One census tract (6%) had **four** cancer types that were significantly elevated.

The higher-than-expected all-site cancer incidence rates among the 18 elevated census tracts were confined to 12 cancer types (Table 1). Note that the frequencies in Table 1 total 30 because 11 of the 18 census tracts under review were significantly elevated for more than one cancer type.

**TABLE 1: NUMBER OF OCCURRENCES OF SIGNIFICANTLY ELEVATED SITE-SPECIFIC CANCER TYPES WITHIN THE 18 CENSUS TRACTS WITH ELEVATED ALL-SITE CANCER INCIDENCE RATES, DELAWARE, 2012-2016**

Site-Specific Cancer Type	Number of Occurrences of Significantly Elevated Site-Specific Cancer Type
Kidney	4
Malignant Melanoma of the Skin	4
Pancreas	4
Prostate	4
Breast	3
Lung	3
Stomach	2
Thyroid	2
Bladder	1
Liver	1
Hodgkin’s Lymphoma	1
Uterine	1
<b>TOTAL</b>	<b>30</b>

Source: Delaware Cancer Registry, Delaware Department of Health and Social Services, Division of Public Health, 2019.

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. In these instances, the elevated cancer rate is likely due to a mix of non-modifiable, modifiable, and/or unidentified risk factors. For example, of the 19 substantiated risk factors for breast cancer cited by the American Cancer Society, 12 are non-modifiable (e.g., age, family history), and 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. 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 acting separately. For example, research shows that while alcohol use and tobacco use are both individual risk factors for laryngeal cancer, their joint effect is greater than the sum of the two risk factors acting separately (i.e., when they occur together, the two risk factors exert a multiplicative, rather than additive, effect).<sup>1</sup>

Tables 2 through 4 summarize results of the secondary analyses for the 18 census tracts that were significantly elevated for all-site cancer in 2012-2016 for each of Delaware’s three counties. Table 5 summarizes substantiated risk factors for the 12 different site-specific cancers with significantly elevated cancer incidence rates among the 18 census tracts in this analysis. Table 6 displays census tracts that are consistently elevated over two or more of the five-year periods from 2002-2006 through 2012-2016.

<sup>1</sup> Pelucchi, C., Gallus, S., Garavello, W., Bossettie, C., & La Vecchia, C. (2008). Alcohol and tobacco use, and cancer risk for upper aerodigestive tract and liver. *European Journal of Cancer Prevention*, 17(4), 340-4.



**TABLE 2: CHARACTERISTICS OF NEW CASTLE COUNTY, DELAWARE CENSUS TRACTS WITH STATISTICALLY SIGNIFICANTLY ELEVATED ALL-SITE CANCER INCIDENCE RATES, 2012-2016**

Census Tract	Avg. Cases/year	Overall Age-Adjusted All-Site Cancer Incidence Rates per 100,000, 2012-2016**			Significantly Elevated Cancer Site(s) by Sex	Median Age at Diagnosis		Area(s) of Concern
		All	Male	Female		DE	CT	
<b>DELAWARE</b>	<b>5,716</b>	<b>491.5</b>	<b>542.9</b>	<b>455.4</b>				
<b>21.00</b>	13	667.4	705.5	697.4	• None	67	66	• Prevention • Screening
<b>29.00</b>	22	649.3	740.6	625.7	• Liver (overall, male) • Pancreas (overall) • Kidney (overall, male, female) • Hodgkin’s Lymphoma (overall)	67	63	• Prevention • Sex distribution • Cancer type
<b>135.05</b>	23	633.7	693.3	562.6	• Melanoma (overall, male)	67	69	• Prevention • Cancer type
<b>148.05</b>	48	634.2	706.2	573.7	• Breast	67	63	• Prevention • Screening • Sex distribution • Cancer type
<b>149.03</b>	29	670.5	637.4	710	• Uterine	67	64	• Prevention • Sex distribution • Cancer type
<b>149.04</b>	28	603.3	893	425.6	• Stomach (overall, male) • Bladder (male)	67	65	• Prevention • Sex distribution • Cancer type
<b>163.01</b>	36	609.9	758.4	514.6	• Pancreas (overall, male) • Lung (overall, male)	67	65	• Prevention • Screening • Sex distribution • Cancer type
<b>164.01</b>	33	604.6	658	590.4	• Stomach (overall, female)	67	63.5	• Prevention • Sex distribution • Cancer type
<b>166.02</b>	41	679	672.8	683	• Thyroid (overall, female) • Prostate	67	60	• Prevention • Screening • Sex distribution • Cancer type
<b>166.04</b>	56	623.4	661.2	598.8	• Kidney (overall) • Prostate	67	63	• Prevention • Screening • Sex distribution • Cancer type
<b>166.08</b>	29	626.1	668.6	618	• None	67	65	• Prevention • Screening
<b>168.04</b>	34	627	598.4	615.2	• Pancreas (male) • Breast	67	63	• Prevention • Screening • Sex distribution • Cancer type

\*\* Age-adjusted incidence rate in bold indicates that the census tract rate is significantly elevated compared to the state rate.

CT=Census Tract

“Melanoma” refers to malignant melanoma of the skin

Rates are per 100,000 and age-adjusted to 2000 U.S. standard population

Source: Delaware Cancer Registry, Delaware Department of Health and Social Services, Division of Public Health, 2019.



**TABLE 3: CHARACTERISTICS OF KENT COUNTY, DELAWARE CENSUS TRACTS WITH STATISTICALLY SIGNIFICANTLY ELEVATED ALL-SITE CANCER INCIDENCE RATES, 2012-2016**

Census Tract	Avg. Cases / year	Overall Age-Adjusted All-Site Cancer Incidence Rates per 100,000, 2012-2016**			Significantly Elevated Cancer Site(s) by Sex	Median Age at Diagnosis		Area(s) of Concern
		All	Male	Female		DE	CT	
<b>DELAWARE</b>	<b>5,716</b>	<b>491.5</b>	<b>542.9</b>	<b>455.4</b>				
<b>401.00</b>	50	644.1	780.8	515.5	<ul style="list-style-type: none"> <li>• Kidney (overall, male, female)</li> <li>• Prostate</li> </ul>	67	65	<ul style="list-style-type: none"> <li>• Prevention</li> <li>• Screening</li> <li>• Sex distribution</li> <li>• Cancer type</li> </ul>
<b>402.03</b>	36	655.5	757.4	573.4	<ul style="list-style-type: none"> <li>• Thyroid (overall)</li> <li>• Prostate</li> </ul>	67	68	<ul style="list-style-type: none"> <li>• Prevention</li> <li>• Screening</li> <li>• Cancer type</li> </ul>
<b>417.01</b>	51	604	673.9	556.6	<ul style="list-style-type: none"> <li>• Kidney (male)</li> <li>• Pancreas (female)</li> </ul>	67	72	<ul style="list-style-type: none"> <li>• Prevention</li> <li>• Sex distribution</li> <li>• Cancer type</li> </ul>
<b>422.02</b>	59	566.1	555.9	578.1	<ul style="list-style-type: none"> <li>• Melanoma (female)</li> </ul>	67	65	<ul style="list-style-type: none"> <li>• Prevention</li> <li>• Sex distribution</li> <li>• Cancer type</li> </ul>

\*\* Age-adjusted incidence rate in bold indicates that the census tract rate is significantly elevated compared to the state rate.

CT=Census Tract

“Melanoma” refers to malignant melanoma of the skin

Rates are per 100,000 and age-adjusted to 2000 U.S. standard population

Source: Delaware Cancer Registry, Delaware Department of Health and Social Services, Division of Public Health, 2019.



**TABLE 4: CHARACTERISTICS OF SUSSEX COUNTY, DELAWARE CENSUS TRACTS WITH STATISTICALLY SIGNIFICANTLY ELEVATED ALL-SITE CANCER INCIDENCE RATES, 2012-2016**

Census Tract	Avg. Cases / year	Overall Age-Adjusted All-Site Cancer Incidence Rates per 100,000, 2012-2016**			Significantly Elevated Cancer Site(s) by Sex	Median Age at Diagnosis		Area(s) of Concern
		All	Male	Female		DE	CT	
<b>DELAWARE</b>	<b>5,716</b>	<b>491.5</b>	<b>542.9</b>	<b>455.4</b>				
508.02	48	654.2	630.2	676.3	<ul style="list-style-type: none"> <li>• Lung (overall, male)</li> <li>• Melanoma (overall, male, female)</li> <li>• Breast</li> </ul>	67	67	<ul style="list-style-type: none"> <li>• Prevention</li> <li>• Screening</li> <li>• Sex distribution</li> <li>• Cancer type</li> </ul>
508.03	77	612.3	638.9	595.6	<ul style="list-style-type: none"> <li>• Lung (female)</li> <li>• Melanoma (overall, female)</li> </ul>	67	69	<ul style="list-style-type: none"> <li>• Prevention</li> <li>• Screening</li> <li>• Sex distribution</li> <li>• Cancer type</li> </ul>

\*\* Age-adjusted incidence rate in bold indicates that the census tract rate is significantly elevated compared to the state rate.

CT=Census Tract

“Melanoma” refers to malignant melanoma of the skin

Rates are per 100,000 and age-adjusted to 2000 U.S. standard population

Source: Delaware Cancer Registry, Delaware Department of Health and Social Services, Division of Public Health, 2019.



**TABLE 5: KNOWN RISK FACTORS\*\* OF ELEVATED CANCER TYPES AMONG THE 18 DELAWARE CENSUS TRACTS WITH SIGNIFICANTLY ELEVATED ALL-SITE CANCER INCIDENCE RATES, 2012-2016**

CANCER TYPE	KNOWN RISK FACTORS
<b>BLADDER</b>	Age (risk increases with age), arsenic in drinking water, bladder birth defects, chronic bladder irritation and infections, gender (more common in males), not drinking enough fluids, personal history of bladder or other urothelial cancer, prior chemotherapy, race and ethnicity (White), smoking
<b>BREAST</b>	Age (risk increases with age), alcohol abuse, benign breast conditions, birth to children (giving birth after age 30 or not at all increases risk), breastfeeding (not breastfeeding increases risk), dense breast tissue, exposure to diethylstilbestrol, family history, genes, hormone therapy after menopause, menopause after age 55, menstruation before age 12, overweight or obesity, personal history, physical inactivity, oral contraceptive use, race (African American), radiation to the chest, tobacco use
<b>HODGKIN LYMPHOMA</b>	Age (early adulthood and late adulthood at higher risk), gender (more common in males), family history, higher socioeconomic status, infection with Epstein-Barr, mononucleosis, or HIV
<b>KIDNEY</b>	Advanced kidney disease with long-term dialysis, cigar or cigarette smoking, family history, gender (male), hypertension, certain medications, overweight or obesity, workplace exposures
<b>LUNG</b>	Asbestos, diet low in fruits and vegetables, family history, radiation therapy, radon exposure, secondhand smoke, smoking (cigarettes, cigars, or pipes), tuberculosis, workplace exposures
<b>MELANOMA</b>	Age (risk increases with age), fair skin, freckling and light hair, family history of melanoma, gender (males are more at risk), moles on the skin, personal history of melanoma, UV exposure, weakened immune system, Xeroderma pigmentosum (rare inherited condition that affects skin cells' ability to repair damage to their DNA)
<b>ORAL CAVITY AND PHARYNX</b>	Age (55 and older), alcohol use, diet low in fruits and vegetables, gender (male), genetic syndromes (Fanconi anemia, Dyskeratosis congenital), Graft-vs-Host disease (GVHD), Lichen planus (disease that affects the skin mainly in middle-age people), weakened immune system, HPV infection, tobacco use, UV exposure
<b>PANCREAS</b>	Age (45 and older), chronic pancreatitis, diabetes, family history, gender (male), <i>Helicobacter pylori</i> infection, inherited genetic syndromes (hereditary breast and ovarian cancer syndrome, familial atypical multiple mole melanoma (FAMMM) syndrome, familial pancreatitis, Lynch syndrome, Peutz-Jeghers syndrome, Von Hippel-Lindau syndrome, Neurofibromatosis type 1, multiple endocrine neoplasia type I (MEN1)), liver cirrhosis, overweight and obesity, race (African American), tobacco use, workplace exposure to chemicals
<b>PROSTATE</b>	Age (50 and older), diet high in red meat and high-fat dairy, ethnicity (non-Hispanic), family history, gene mutations, inherited DNA changes, obesity, race (African American)
<b>STOMACH</b>	Age (risk increases with age), Common variable immune deficiency, diet (consumption of smoked foods), Epstein-Barr virus infection, ethnicity (Hispanics, African Americans, Asian/Pacific Islanders are at higher risk), family history of stomach cancer, gender (males at higher risk), geography (more common in Japan, China, and Southern and Eastern Europe), <i>H. pylori</i> infection, Menetrier disease (excess growth of stomach lining), inherited cancer syndromes, overweight or obese, pernicious anemia, previous stomach surgery, some types of stomach polyps, tobacco, Type A blood; work in the coal, metal, and rubber industries
<b>THYROID</b>	Age (younger females and older males at increased risk), diet low in iodine, family history, hereditary conditions, radiation
<b>UTERINE</b>	Age (50 and older), obesity, taking estrogen by itself (without progesterone) for hormone replacement during menopause, having had trouble getting pregnant or having had fewer than five periods in a year before starting menopause, taking tamoxifen, family history, pelvic radiation therapy, race (African American), retinoblastoma gene changes

\*\*Cancer-specific risk factors are listed in descending alphabetical order and do not necessarily represent descending order of relative risk factor strength.

"Melanoma" refers to malignant melanoma of the skin

Sources: American Cancer Society ([www.cancer.org](http://www.cancer.org)), Centers for Disease Control and Prevention (<https://www.cdc.gov/cancer/>), National Cancer Institute ([www.cancer.gov](http://www.cancer.gov)).



**TABLE 6: CONSISTENTLY ELEVATED\*\* ALL-SITE CANCER INCIDENCE RATES BY DELAWARE CENSUS TRACTS, BY COUNTY AND TIME PERIOD, DELAWARE: 2002-2006 TO 2012-2016**

COUNTY	CENSUS TRACT	2002-2006	2003-2007	2004-2008	2005-2009	2006-2010	2007-2011	2008-2012	2009-2013	2010-2014	2011-2015	2012-2016
NEW CASTLE	6.02	X	X	X								
	29.00							X	X	X	X	X
	139.01	X	X	X								
	148.10						X	X	X			
	149.03							X	X	X	X	X
	156.00		X	X	X							
	159.00				X	X			X			
	160.00	X	X									
	163.01				X	X	X	X		X	X	X
	166.01								X	X		
	166.04								X	X	X	X
	166.08							X	X	X		X
	169.01	X	X								X	X
169.04	X	X										
KENT	401.00					X	X	X	X	X	X	X
	402.03								X	X	X	X
	417.01				X	X		X	X	X	X	X
	417.02						X	X	X			
	418.01						X	X	X	X	X	
	421.00			X	X	X						
	422.02					X	X			X		X
	428.00	X		X	X	X	X	X	X	X		
	430.00						X	X	X	X		
	432.02						X	X	X			
SUSSEX	501.03					X	X	X	X			
	501.05		X	X	X							
	504.01					X	X	X				
	504.05							X	X			
	504.08									X	X	
	507.04							X	X	X	X	
	508.03									X	X	X
	513.02	X	X	X								
	517.01		X	X		X						
	518.01					X	X					

\*\*Two or more adjacent time periods with a significantly elevated overall cancer incidence rate. Source: Delaware Cancer Registry, Delaware Department of Health and Social Services, Division of Public Health, 2019.

For questions or comments related to any information found in this report, call the Delaware Comprehensive Cancer Control Program at 302-744-1020.

This report and the full *Cancer Incidence and Mortality in Delaware (I&M) Report, 2012-2016* can be found on the DPH website: <http://www.dhss.delaware.gov/dhss/dph/dpc/cancer.html>.