CANCER IN CONNECTICUT

A Report on the Burden of Cancer in the State

March 2019

Raul Pino, MD MPH

Commissioner

Contents

Acknowledgements

This report is dedicated to all Connecticut residents whose lives are touched by cancer.

We would like to extend special thanks to the staff of the Tumor Registry and to the cancer registrars and other persons responsible for cancer data collection throughout the state of Connecticut for all of their dedication and hard work.

The Connecticut Tumor Registry is supported by a contract (No. HHSN2612018000021) between the National Cancer Institute and the Connecticut Department of Public Health.

We are grateful to the following colleagues for their invaluable contributions to this report:

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Suggested Report Citation:

Swett, K., Gonsalves, L., and Mueller, L.M. 2019. *Cancer in Connecticut*. Hartford, CT: Connecticut Department of Public Health. Health and Surveillance Section, Connecticut Tumor Registry.

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Cancer Incidence In Connecticut

In 2015,

20,413

new cancer cases were diagnosed among Connecticut residents.

Top 3 Among Men

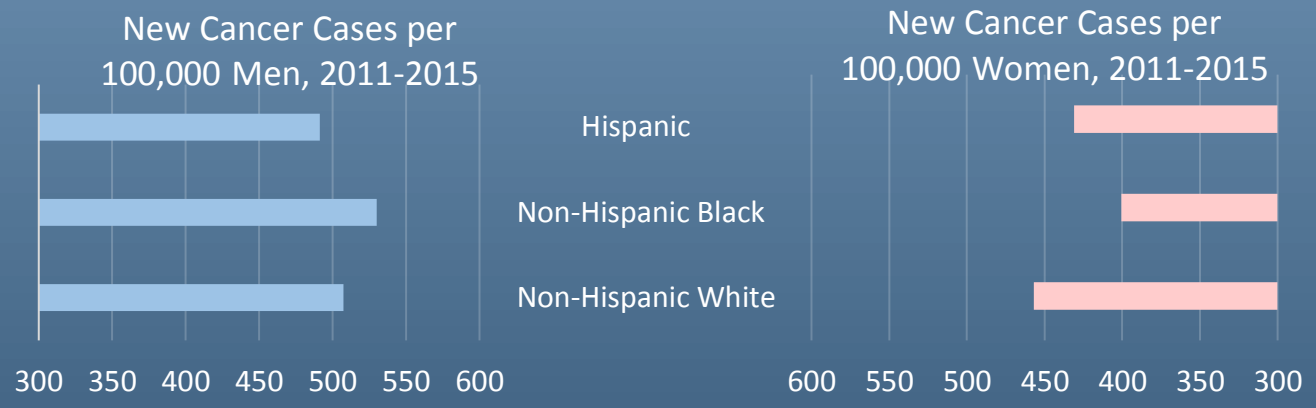
- 9% **Bladder**
- 12% **Lung**
- 24% **Prostate**

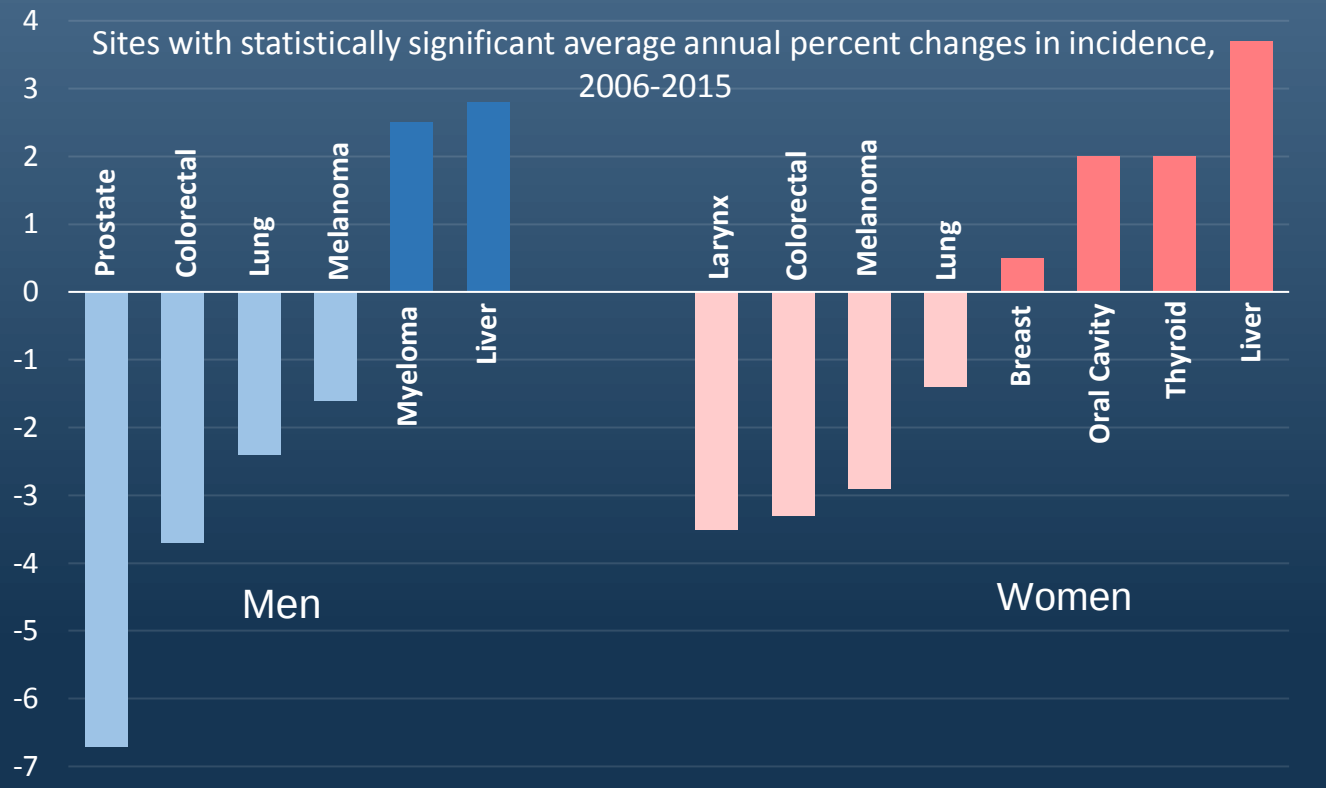
10,030 New cancer cases among males in Connecticut in 2015

Top 3 Among Women

- **Colorectal** 8%
- **Lung** 13%
- **Breast** 32%

10,383 New cancer cases among females in Connecticut in 2015





Incidence of all new cancers declined significantly for females (-0.4% per year), and for males (-2.5% per year).

Cancer Mortality In Connecticut

In 2015,

6,666

Connecticut residents died from cancer.

Top 3 Among Men

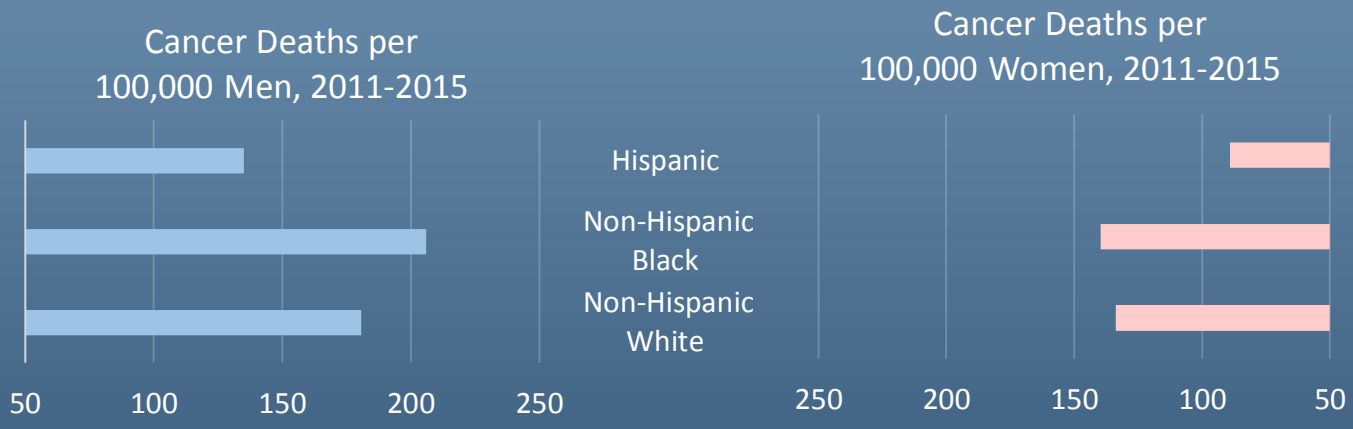
- 8% **Colorectal**
- 10% **Prostate**
- 23% **Lung**

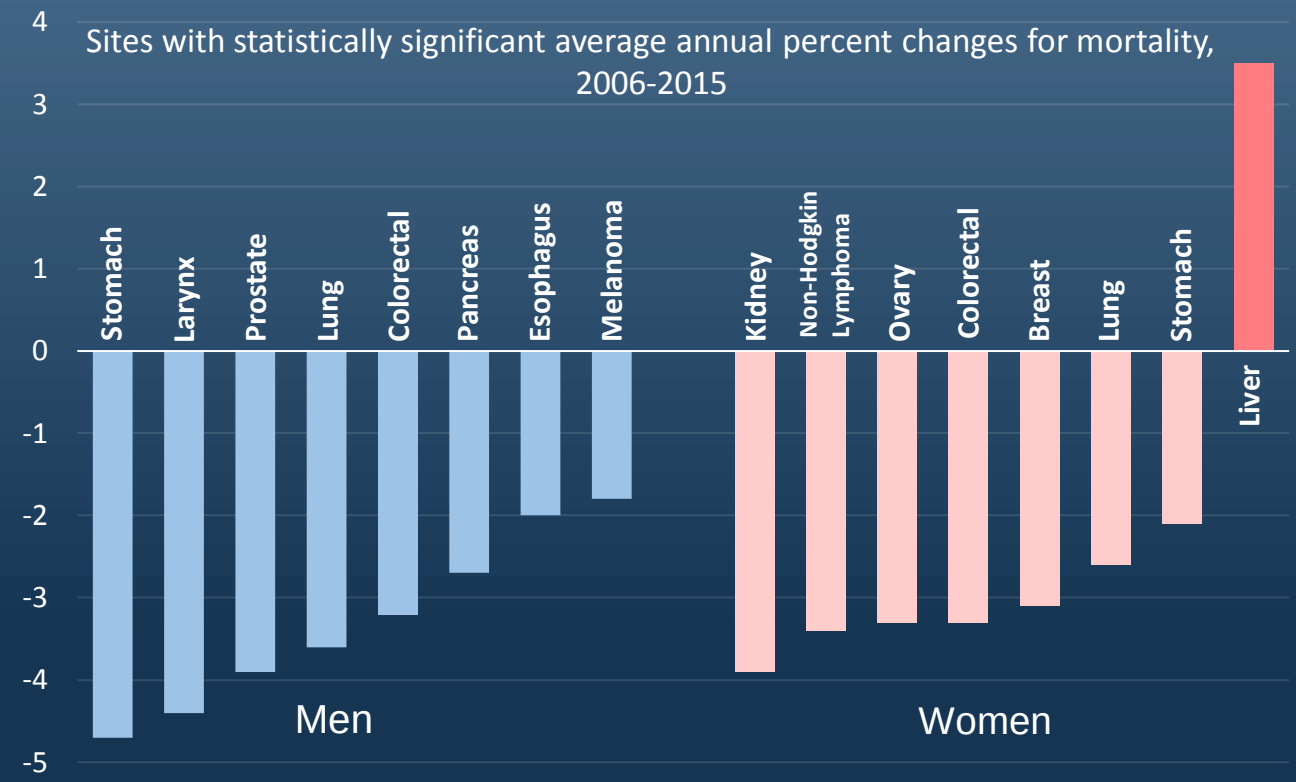
3,365 Cancer deaths among males in Connecticut in 2015

Top 3 Among Women

- **Colorectal** 8%
- **Breast** 13%
- **Lung** 24%

3,301 Cancer deaths among females in Connecticut in 2015





Mortality due to all cancers declined significantly for females (-2% per year), and for males (-2.2% per year).

Key Report Findings

This report describes the impact of cancer on the people of Connecticut. Cancer incidence and mortality rates and trends are presented, as well as the cancer stage at diagnosis and the years of potential life-years lost due to cancer (a measure of premature mortality). Cancer-related risk behaviors in Connecticut residents are also summarized.

Cancer Incidence (New Cases)

- From 2011 to 2015, 101,736 new cancers were diagnosed in Connecticut. The incidence rate of all invasive cancers was 508 per 100,000 persons in men, and 449 per 100,000 persons in women.
- Among women in Connecticut, the incidence rate for all cancers combined was highest in non-Hispanic white women (457 per 100,000), followed by Hispanic women (430.9 per 100,000) and lowest in non-Hispanic black women (400 per 100,000).
- Among men in Connecticut, the incidence rate for all cancers combined was highest among non-Hispanic black men (530 per 100,000), followed by non-Hispanic white men (507 per 100,000) and lowest in Hispanic men (491 per 100,000).
- The most commonly diagnosed cancer in Connecticut women was breast cancer, accounting for approximately three out of every ten cancers diagnosed. The incidence rate of breast cancer was highest in non-Hispanic white women (144 per 100,000) and lowest in non-Hispanic black women (127 per 100,000).
- The most commonly diagnosed cancer in Connecticut men was prostate cancer, accounting for approximately one out of every four cancers. The incidence rate of prostate cancer was highest in non-Hispanic black men (172 per 100,000) and lowest in non-Hispanic white men (106 per 100,000).
- The stage of cancer at diagnosis is an important prognostic indicator; cancers usually respond better to treatment and have better outcomes when they are diagnosed early whereas late stage cancers generally show poorer outcomes. About 1 in 20 breast cancers diagnosed in Connecticut women were late stage cancers, while almost half of all lung cancers and around 1 in 5 colorectal cancers in Connecticut residents were diagnosed at a late stage.
- Tracking cancer incidence rates over time allows us to monitor where progress has been made and highlight areas for future efforts. For all cancers combined, the incidence rate decreased by 2.5% per year in men and 0.4% per year in women over the period 2006-2015. Significant declines in the incidence of new cancers were observed in prostate cancer, colorectal cancer, lung cancer, and melanoma in men; and larynx cancer, colorectal cancer, melanoma, and lung cancer in women. In contrast, the rates of liver cancer in men and women increased significantly over the same period (by 3.7% and 2.8% per year, respectively). Incidence rates also increased significantly for myeloma in men and cancers of the breast, oral cavity & pharynx, and thyroid in women.

Cancer Mortality (Deaths)

- From 2011-2015, 33,424 Connecticut residents died from their cancers. The mortality rate of all cancers was 178 per 100,000 persons in men, and 131 per 100,000 persons in women.
- Among women in Connecticut, the mortality rate for all cancer deaths combined was highest in non-Hispanic black women (140 per 100,000), despite their lower incidence rates. Mortality rates were lower among non-Hispanic white women (134 per 100,000) and significantly lower in Hispanic women (89 per 100,000).
- Among men in Connecticut, the mortality rate for all cancer deaths combined was significantly higher in non-Hispanic black men (206 per 100,000) compared to non-Hispanic white men (181 per 100,000) and Hispanic men (135 per 100,000).
- The leading cause of cancer death was lung cancer, accounting for nearly one in every four cancer deaths in both men and women. Lung cancer mortality rates were highest in non-Hispanic black men and non-Hispanic white women (51 per 100,000 and 35 per 100,000, respectively) and lowest in Hispanic men and women (30 per 100,000 and 15 per 100,000, respectively).
- The second leading cause of cancer death in Connecticut was prostate cancer in men and breast cancer in women. The prostate cancer mortality rate was highest in non-Hispanic black men (32 per 100,000) and lowest in Hispanic men (15 per 100,000). The breast cancer mortality rate was highest in non-Hispanic black women (21 per 100,000), despite their lower incidence rates compared with non-Hispanic white women, and lowest in Hispanic women (10 per 100,000).
- Monitoring cancer mortality rates over time allows us to determine where progress has been made and to identify areas where efforts to reduce death from cancer should be focused. Notable decreases were seen in mortality from colorectal cancer and female breast cancer, due in part to screening tests for the early detection of these cancers, as well as advances in treatment. Significant declines were also observed in mortality from cancers of the kidney, ovary, lung, stomach, and non-Hodgkin lymphomas in women. However, the mortality rate for liver cancer in women increased significantly between 2006-2015 at a rate of 3.5% per year. Among men, there were significant declines in mortality for cancers of the stomach, larynx, prostate, lung, pancreas, esophagus, and melanoma.
- Examining potential life-years lost (PLL) gives emphasis to premature deaths, where interventions that extend life expectancy will have the greatest impact. For both men and women, brain/central nervous system cancer is one of the most common causes of premature cancer mortality, reflecting the younger age at diagnosis and death for this disease. PLL has declined for many cancers over recent years, including significant decreases in lung cancer in both men and women, due in part to improved diagnosis and treatment. In addition, significant decreases were observed for pancreatic cancer in males and breast

cancer and leukemia in females. Conversely, PLL due to liver cancer has increased in women over the period 2005-2015.

Cancer-Related Risk Behaviors in Connecticut Residents

- The Behavioral Risk Factor Surveillance System (BRFSS) is an annual health survey that allows us to monitor health risk behaviors in the population. A number of cancer risk factors may be examined through the BRFSS including tobacco use, excessive alcohol consumption, diet, physical activity and obesity. In addition, use of preventive services such as cancer screening can be explored.
- While smoking prevalence in Connecticut adults is in decline, 13% of adults in the state are current smokers.
- In 2016, 21% of adults reported no leisure time physical activities or exercises, including running, calisthenics, golf, gardening, or walking within the last 30 days.
- 27% of men and 25% of women in Connecticut are obese. (Obesity is defined as having a body mass index of 30 or higher.)
- 25% of adults with an income of <$35,000 reported consuming vegetables less than once daily in 2015; the percentage that reported consuming fruit less than once daily was slightly higher at 39%.
- In 2016, 17% of Connecticut adults reported binge drinking (men drinking 5 or more alcoholic drinks within a short period of time or women drinking 4 or more drinks within a short period of time) within the past 30 days.
- In 2016, 377 cancers were attributed to infection with Human Papillomavirus (HPV).
- In 2016, about 15% of Connecticut women aged 18 years or older reported not having a pap test in the past 3 years.
- In 2016, approximately 75% of Connecticut adults ages 50-75 had ever previously had a sigmoidoscopy or colonoscopy, and 9% had had a fecal occult blood test in the past year.
- In 2016, 41% of Connecticut men aged 40 years or older reported having a PSA test within the past 2 years.

The Connecticut Tumor Registry

The Connecticut Tumor Registry (CTR), located within the Department of Public Health in Hartford, Connecticut, is the oldest statewide, population-based cancer registry in the United States, with cancer reports dating back to 1935. Cancer is a reportable disease in Connecticut, as described in Connecticut General Statute 19a-72.

Although all licensed medical providers are required by law to report cancer cases, the CTR receives the overwhelming majority of its cases from acute care hospitals and private clinical laboratories. In addition, the Registry has reciprocal cancer-reporting agreements with all of the adjacent states and several other states (including Florida). These agreements improve the quality of the registry data by allowing identification of Connecticut residents who are diagnosed or treated in other states, which is important in obtaining accurate estimates of cancer rates among Connecticut residents. The CTR adheres strictly to protecting the confidentiality and security of the data it collects.

History of the CTR

The CTR was established in 1941, due in large part to early surveillance in New Haven, funded by the New Haven Community Chest. In 1930, the Cancer Committee of New Haven surveyed the three local hospitals, and in 1935, urged the continued compilation and analysis of cancer statistics to further the primary purpose of cancer control. Upon its establishment, early registry efforts were focused on ensuring complete data collection retrospectively to 1935. Cancer surveillance and research progressed locally through the 1950s, and in 1956 the CTR joined the National Cancer Institute's (NCI) End Results Group (ERG). In 1973, CTR became part of the NCI's Surveillance, Epidemiology and End Results (SEER) program (seer.cancer.gov).

CTR Data

The Connecticut Tumor Registry collects information on all invasive cancers (those that have penetrated into cells beyond the layer of tissue in which they developed) and in situ cancers (early cancers that have not spread to neighboring tissue), with the exception of non-melanoma skin cancers and in situ cancers of the cervix. The registry also collects information on certain benign (non-cancerous) tumors including benign tumors of the brain and central nervous system (CNS), as these produce similar clinical effects to malignant brain and CNS tumors and can be life-threatening. Data collected include the clinical characteristics of the tumor (site, histology, behavior, extent of disease), details of the first course of treatment and also sociodemographic information on the cancer patient (age, gender, race, Hispanic ethnicity).

CTR staff process approximately 33,000 patient reports plus an equivalent number of supplemental reports, resulting in approximately 23,000 consolidated cancer cases. In addition to processing reports of cancer, staff work to ensure that patients are followed at least annually for life, and that various data quality standards are met. The registry has a comprehensive quality assurance program in place to ensure that the data are complete, accurate and timely. The CTR consistently meets the standards to achieve "gold certification" by the North American Association of Central Cancer Registries (NAACCR www.naaccr.org). This is the highest standard for completeness, timeliness and accuracy of cancer registry data.

Uses of CTR Data

The purpose of collecting the CTR data (and other cancer registry data) is to help us reduce cancer incidence, morbidity and mortality, identify new and emerging cancer challenges, and chart our progress toward those goals. The systematic collection of these data for all Connecticut residents helps make this possible. CTR data are used for: monitoring trends in cancer incidence, stage at diagnosis, treatments and outcomes for Connecticut residents; conducting and assisting in research projects to identify cancer's underlying causes and risk factors; assisting in cancer prevention and control activities; and responding to inquiries from researchers, public health professionals, and the general public.

Data from the Connecticut Tumor Registry are included in annual publications of national cancer statistics, including the 'Annual Report to the Nation on the Status of Cancer' and the NCI's 'Cancer Statistics Review', as well as in the 'Cancer in North America' series of publications from NAACCR. The Connecticut Tumor Registry has provided data to the Central Brain Tumor Registry of the United States (CBTRUS) since 1992. The Connecticut Tumor Registry also contributes data to the International Agency for Research on Cancer (IARC) series of publications 'Cancer Incidence in Five Continents', which is updated regularly. Data from the Connecticut Tumor Registry have been used in hundreds of scientific publications by researchers worldwide. A full publication list, updated periodically, can be downloaded from the registry website: www.ct.gov/dph/TumorRegistry

Selected Research Studies

A few selected research studies undertaken by the Connecticut Tumor Registry, or using Connecticut Tumor Registry data, are described in brief below.

SEER Patterns of Care

The SEER Patterns of Care (POC) studies aim to evaluate the diffusion of state-of-the-art cancer therapy into community practice, to disseminate findings in scientific journals and through professional meetings, and to work with professional organizations to develop educational opportunities to increase the use of state-of-the-art cancer therapy and quality of care in community practice. Each year since 1987, NCI has selected different cancer sites to be included in the POC studies and randomly samples cases from those ascertained by the SEER registries.

In the most recently completed study, the cancers under study were ovarian cancer, mesothelioma, metastatic melanoma, astrocytoma/oligodendroglioma and pediatric neuroblastoma, diagnosed in 2011 (and 2010 for pediatric neuroblastoma). Hospital and physician reports were obtained in order to verify and supplement information on the first course of treatment.

Additionally, POC questionnaires were mailed to more than 300 physicians in the state. Other information, including insurance status and co-morbidity, was also collected for the patients. The CTR has participated in all of the SEER POC studies conducted by the SEER Program. Further information about the SEER Patterns of Care Studies is available at: healthservices.cancer.gov/surveys/poc/

NCI Cancer Match Studies

The Transplant Cancer Match Study uses electronically linked data from the Scientific Registry of Transplant Recipients (SRTR) and cancer registries to study the epidemiology of cancer in the U.S. transplant population. This study is the largest study of cancer risk in solid organ transplant recipients in the world. A major goal of the study is to determine the overall pattern of cancer in transplant recipients and identify key risk factors for individual cancer types. These findings will yield information on the role of the immune system in the development of cancer.

The HIV/AIDS Cancer Match Study examines cancer risk in people living with HIV infection or AIDS. The study utilizes data collected by state and regional HIV/AIDS and cancer registries throughout the United States. By studying the patterns of cancer risk among people with HIV and AIDS, the investigators seek to better understand how the immune system protects people from developing cancer. Another goal of the study is to look for trends in cancer risk in the HIV and AIDS populations and identify important opportunities for cancer prevention.

Both studies are led by Dr. Eric Engels from the NCI's Division of Cancer Epidemiology & Genetics. Further information about these studies is available at: transplantmatch.cancer.gov and hivmatch.cancer.gov

WTC Health Studies

The National Institute for Occupational Safety and Health at the Centers for Disease Control and Prevention leads the federal government's efforts to track health effects following the attacks on the World Trade Center (WTC) on September 11, 2001. The CTR undertakes regular linkages with several WTC health monitoring programs including the WTC Health Registry and the WTC Medical Monitoring and Treatment Programs in order to monitor cancer incidence in WTC Health Program members. Further information about the WTC Health Programs is available at: www.cdc.gov/wtc/ www.nyc.gov/html/doh/wtc and https://www1.nyc.gov/site/911health/enrollees/wtc-health-program.page

Cancer Incidence in Connecticut

Cancer incidence is a measure of the new occurrence (diagnosis) of cancer in a population and is one indicator of the cancer burden in that population.

Most Commonly Diagnosed Cancers

The ten most commonly diagnosed cancers in Connecticut males are shown below.

Table 1: The ten most commonly diagnosed cancers in males in Connecticut in 2015.

Cancer Site	Count	Percent
Prostate	2,380	23.7%
Lung and Bronchus	1,245	12.4%
Urinary Bladder	876	8.7%
Colon and Rectum	799	8.0%
Melanoma of the Skin	530	5.3%
Non-Hodgkin Lymphoma	526	5.2%
Kidney and Renal Pelvis	459	4.6%
Oral Cavity and Pharynx	390	3.9%
Pancreas	323	3.2%
Leukemia	312	3.1%
Other Cancers	2,190	21.8%
All Cancers Combined	10,030	100.0%

The five most common cancers accounted for approximately 6 out of every 10 cancers diagnosed in males in Connecticut in 2015.

The ten most commonly diagnosed cancers in Connecticut females are shown in Table 2.

The five most common cancers accounted for more than 6 out of every 10 cancers diagnosed in females in Connecticut in 2015.

Table 2: The ten most commonly diagnosed cancers in females in Connecticut in 2015.

Cancer Site	Count	Percent
Female Breast	3,322	32.0%
Lung and Bronchus	1,335	12.9%
Colon and Rectum	779	7.5%
Corpus and Uterus, NOS	724	7.0%
Thyroid	518	5.0%
Non-Hodgkin Lymphoma	442	4.3%
Melanoma of the Skin	353	3.4%
Pancreas	306	2.9%
Ovary	293	2.8%
Urinary Bladder	280	2.7%
Other Cancers	2,031	19.6%
All Cancers Combined	10,383	100.0%

Incidence rates[1] for the most common cancers, by racial and ethnic group, are shown in Table 3. There is considerable variation in cancer incidence between racial/ethnic groups.

Compared with non-Hispanic white men, non-Hispanic black men have significantly higher incidence rates of prostate cancer, liver cancer, myeloma, stomach cancer, and colorectal cancer, and significantly lower rates of bladder cancer, brain cancer, melanoma, testicular cancer, thyroid cancer, non-Hodgkin lymphoma and leukemia. Similarly, Hispanic men have significantly higher incidence rates of liver and stomach cancer, and lower incidence rates of bladder cancer, testicular cancer, and malignant melanoma when compared with non-Hispanic white men.

[1] The incidence rate is the number of new cancer cases in a given population per year and is expressed per 100,000 population at risk. Incidence rates are usually age-adjusted which takes into account differences in the age distributions in different populations or in a population over time.

Compared with non-Hispanic white women, non-Hispanic black women have significantly higher incidence rates of liver cancer, myeloma, and stomach cancer, and significantly lower rates of all invasive cancers, bladder cancer, breast cancer, lung cancer, leukemia, melanoma, non-Hodgkin lymphoma, oral cavity & pharynx cancer, and thyroid cancer. Hispanic women have significantly higher incidence rates of cervical cancer, liver cancer, stomach cancer, and non-Hodgkin lymphoma, and lower rates of all invasive cancers, bladder cancer, breast cancer, lung cancer, and melanoma, when compared to non-Hispanic white women.

The reasons for these differences in rates are complex and vary for different cancer sites. Contributory factors include variations in cancer screening rates, prevalence of risk factors (modifiable and non-modifiable) and access to health insurance and health care services.

Table 3: Age-adjusted incidence rates for the ten most commonly diagnosed cancers in males and females in Connecticut, 2011-2015

	Total				Non-Hispanic White				Non-Hispanic Black					Hispanic				
	N	AAIR*	95% LCL	95% UCL	N	AAIR*	95% LCL	95% UCL	N	AAIR*	95% LCL	95% UCL		N	AAIR*	95% LCL	95% UCL	
FEMALE																		
All Cancers Combined	51,987	448.5	444.6	452.5	42,824	456.9	452.3	461.5	3,770	400.5	387.6	413.7	-	3,883	430.9	416.5	445.7	-
Female Breast	16,000	140.2	137.9	142.4	13,096	143.9	141.3	146.5	1,216	126.6	119.5	134.0	-	1,200	127.5	120.0	135.4	-
Lung and Bronchus	6,788	56.2	54.8	57.6	5,991	59.2	57.6	60.7	411	44.5	40.2	49.1	-	293	40.9	36.1	46.1	-
Colon and Rectum	4,063	33.4	32.3	34.4	3,329	32.9	31.7	34.1	335	35.9	32.1	40.0		285	33.3	29.3	37.7	
Corpus and Uterus, NOS	3,503	29.0	28.0	30.0	2,870	28.9	27.9	30.1	271	27.4	24.2	31.0		275	29.7	26.1	33.7	
Thyroid	2,819	29.0	27.9	30.1	2,094	29.7	28.4	31.1	175	18.3	15.6	21.2	-	363	32.0	28.6	35.6	
Non-Hodgkin Lymphoma	2,052	17.3	16.6	18.1	1,691	17.3	16.4	18.2	97	10.5	8.5	12.8	-	200	23.9	20.5	27.7	+
Melanoma of the Skin	1,858	16.4	15.7	17.2	1,708	19.6	18.6	20.6	15	1.7	1.0	2.9	-	57	5.6	4.2	7.4	-
Pancreas	1,506	12.1	11.5	12.7	1,241	11.8	11.1	12.5	124	14.0	11.6	16.8		107	14.0	11.3	17.1	
Urinary Bladder	1,488	12.0	11.3	12.6	1,334	12.7	12.0	13.4	76	8.7	6.8	10.9	-	58	8.1	6.0	10.6	-
Ovary	1,393	12.0	11.3	12.6	1,164	12.2	11.4	12.9	97	10.3	8.3	12.6		90	9.4	7.5	11.8	
MALE																		
All Cancers Combined	49,749	507.6	503.0	512.2	41,292	507.2	502.2	512.3	3,661	530.0	511.8	548.6		3,244	491.3	472.2	510.9	
Prostate	11,821	112.8	110.7	114.9	9,355	106.3	104.1	108.5	1,251	172.3	162.3	182.7	+	741	115.9	106.9	125.4	
Lung and Bronchus	6,520	67.9	66.2	69.6	5,611	68.5	66.7	70.4	464	75.3	68.2	83.0		330	61.6	54.5	69.3	
Urinary Bladder	4,381	46.6	45.2	48.0	3,990	49.4	47.9	51.0	132	22.9	18.9	27.4	-	180	35.4	29.9	41.5	-
Colon and Rectum	4,140	42.9	41.6	44.3	3,350	41.9	40.4	43.4	341	51.9	46.1	58.1	+	317	48.0	42.1	54.4	
Melanoma of the Skin	2,551	26.8	25.8	27.9	2,401	30.7	29.4	32.0	4	0.6	0.2	1.6	-	43	6.5	4.4	9.0	-
Non-Hodgkin Lymphoma	2,466	26.1	25.0	27.1	2,067	26.3	25.2	27.5	138	19.3	16.0	23.0	-	183	24.8	20.7	29.3	
Kidney and Renal Pelvis	2,191	22.2	21.3	23.2	1,808	22.4	21.4	23.5	171	21.7	18.4	25.3		151	21.1	17.4	25.3	
Oral Cavity and Pharynx	1,777	17.2	16.4	18.0	1,519	17.9	17.0	18.9	104	14.4	11.6	17.7		100	14.0	11.1	17.3	
Leukemia	1,756	18.7	17.8	19.6	1,459	18.8	17.8	19.8	89	12.6	10.0	15.8	-	133	18.1	14.5	22.2	
Pancreas	1,504	15.4	14.6	16.2	1,282	15.4	14.6	16.3	115	17.1	13.9	20.7		77	13.1	10.1	16.7	

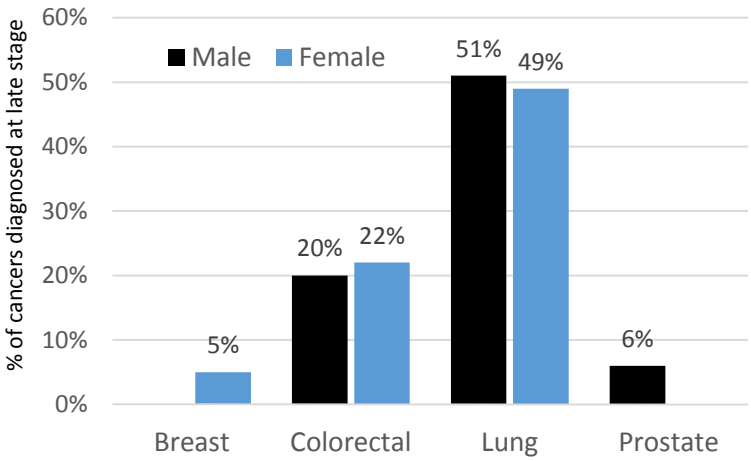
* Rates are age-adjusted to the 2000 US standard population and are expressed per 100,000 persons. Rates not reported for cancer sites with fewer than 15 cases. LCL: 95%lower confidence limit; UCL: 95% upper confidence limit.
+ denotes the rate is significantly higher than the rate for non-Hispanic white males/females (95% significance level); - denotes the rate is significantly lower than the rate for non-Hispanic white males/females (95% significance level).

Stage at Diagnosis

The stage of a cancer describes how far it has spread at the time of diagnosis, and is an important prognostic indicator. Cancers that are diagnosed early respond better to treatment and lead to improved survival outcomes, whereas late stage cancers generally have poorer outcomes.

Figure 1 below shows the percentage of late stage diagnoses for the 4 most commonly diagnosed cancers in Connecticut residents.

Figure 1: The percentage of late stage cancers for the four most commonly diagnosed cancers in Connecticut residents, diagnosed 2011-2015.



Half of all lung cancers were diagnosed at a late stage, whereas one in five colorectal cancers and one in twenty female breast and prostate cancers were late stage cancers.

This is primarily because colorectal, prostate and female breast cancers can be detected early through cancer screening tests. There is currently no screening test for the early detection of lung cancer in the general (asymptomatic) population. Recently, low-dose computed tomography (LDCT) has been shown to be effective in screening a small, well-defined fraction of the population who are at increased risk for developing lung cancer. Current guidelines therefore only recommend LDCT screening for certain high-risk individuals (see Table 10 for more details).

The Connecticut Department of Public Health (DPH), in collaboration with the Centers for Disease Control and Prevention (CDC), offer early detection programs for breast, cervical and colorectal cancers which are free to eligible residents. Further details are available on the DPH web site https://portal.ct.gov/dph or by calling 860-509-7804.

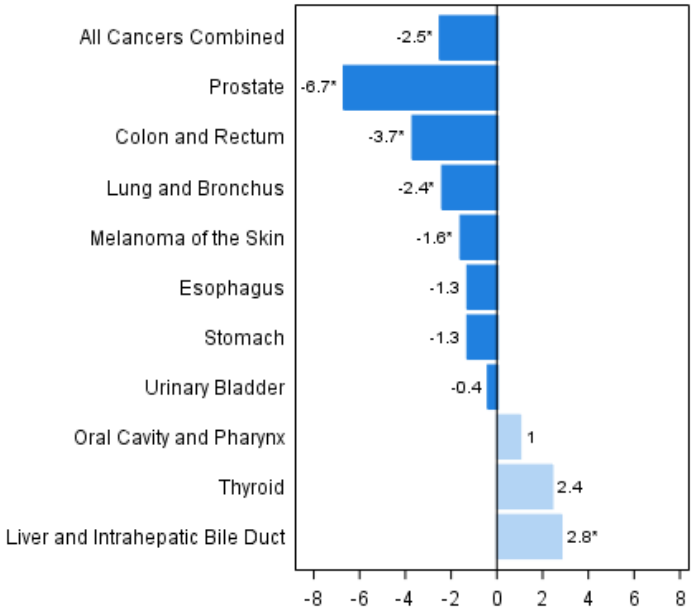
Changes in Cancer Incidence Over Time

Cancer continues to impose a significant burden on the nation and in Connecticut. It is estimated that one in two men and one in three women in the US will develop cancer during their lifetimes. While advances in cancer prevention and detection have led to declines in the incidence of some cancers, rates of other cancers continue to increase year on year. Monitoring cancer incidence rates over time allows us to determine where progress has been made and to identify areas where efforts to reduce the cancer burden should be focused.

Figures 2 and 3 show the annual percentage change in the incidence rates of commonly diagnosed cancers in men and women in Connecticut over the ten-year period 2006-2015. Clearly, great progress has been made in reducing the burden of many major cancers, including cancers of the colon and rectum, prostate, lung and bronchus, and melanoma. These decreases have been driven in part by public health efforts: cancer screening for cancers of the colon and rectum, and tobacco control activities for lung and bronchus cancer.

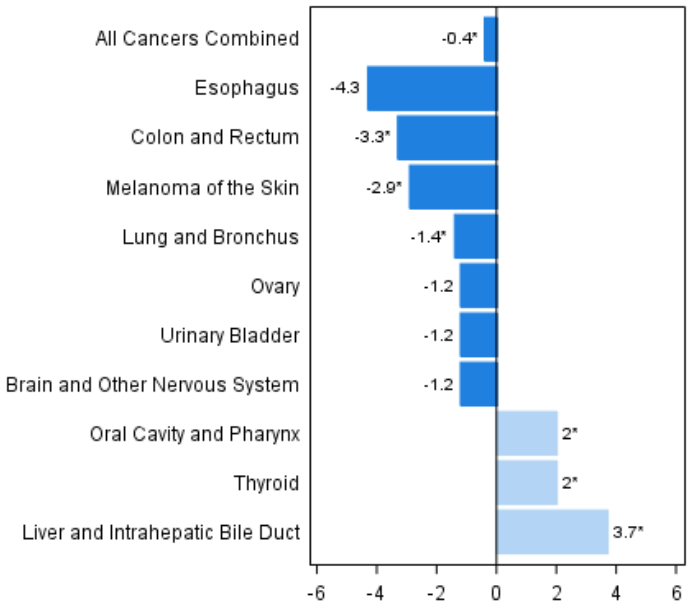
However, incidence rates of some cancers are still increasing, most notably liver cancer had significant increases for both men and women between 2006 and 2015 (2.8% and 3.7%, respectively). Among women, cancers of the thyroid and oral cavity & pharynx increased significantly over this time period. Continued efforts in tobacco control, as well as promoting a healthy weight would likely lead to decreases in the incidence of these cancers.

Figure 2: Annual percentage change (APC) for common cancers diagnosed 2006-2015 in Connecticut males.



Annual percentage change (APC)
***Indicates that the APC is significantly different from zero (p<0.05)**

Figure 3: Annual percentage change (APC) for common cancers diagnosed 2006-2015 in Connecticut females.



Annual percentage change (APC)
***Indicates that the APC is significantly different from zero (p<0.05)**

Cancer Mortality in Connecticut

Cancer mortality is another indicator of the cancer burden in a population.

Leading Cancer Causes of Death

The ten most common site-specific causes of cancer death in Connecticut males are shown below.

Table 4: The ten most common causes of cancer death in males in Connecticut in 2015.

Cancer Site	Count	Percent
Lung and Bronchus	776	23.1%
Prostate	327	9.7%
Colon and Rectum	256	7.6%
Pancreas	228	6.8%
Liver and Intrahepatic Bile Duct	192	5.7%
Urinary Bladder	168	5.0%
Non-Hodgkin Lymphoma	145	4.3%
Leukemia	144	4.3%
Esophagus	135	4.0%
Brain and Other Nervous System	119	3.5%
Other Cancers	875	26.0%
All Malignant Neoplasms	3,365	100.0%

The five leading cancer deaths accounted for more than half of all cancer deaths in males in Connecticut in 2015.
The ten most common causes of site-specific cancer death in Connecticut females are shown in Table 5.

The five leading cancer deaths accounted for more than 6 out of every 10 cancer deaths in females in Connecticut in 2015.

Table 5: The ten most common causes of cancer death in females in Connecticut in 2015.

Cancer Site	Count	Percent
Lung and Bronchus	792	24.0%
Female Breast	432	13.1%
Colon and Rectum	280	8.5%
Pancreas	257	7.8%
Ovary	170	5.1%
Leukemia	126	3.8%
Corpus and Uterus, NOS	116	3.5%
Non-Hodgkin Lymphoma	112	3.4%
Liver and Intrahepatic Bile Duct	99	3.0%
Brain and Other Nervous System	93	2.8%
Other Cancers	824	25.0%
All Malignant Neoplasms	3,301	100.0%

Mortality rates[2] for the leading causes of cancer death, by racial and ethnic group, are shown in Table 6. There is considerable variation in cancer mortality between racial/ethnic groups. Compared with non-Hispanic white men, non-Hispanic black men have significantly higher mortality rates of all malignant neoplasms, prostate cancer, colorectal cancer, liver cancer, myeloma, and stomach cancer, and significantly lower rates of brain, cancer, bladder cancer, and leukemia. Similarly, Hispanic men have significantly higher incidence rates of liver and stomach cancer and significantly lower rates of all malignant neoplasms, lung cancer, esophageal cancer, pancreatic cancer, and bladder cancer, when compared with non-Hispanic white men.

Compared with non-Hispanic white women, non-Hispanic black women have significantly higher

[2] The mortality rate is the number of cancer deaths in a given population per year and is expressed per 100,000 population at risk. Mortality rates are usually age-adjusted which takes into account differences in the age distributions in different populations or in a population over time.

mortality rates of uterine cancer, liver cancer, stomach cancer, and myeloma, and significantly lower mortality rates of lung cancer. Hispanic women have significantly higher rates of stomach cancer and lower mortality rates of all malignant neoplasms, lung cancer, breast cancer, brain cancer, and ovarian cancer when compared with non-Hispanic white women.

The reasons for these differences in rates are complex and vary for different cancer sites. Contributory factors include differences in the stage of diagnosis of the cancer, lifestyle factors (such as smoking) and access to health insurance and health care services.

Table 6: Age-adjusted mortality rates for the ten leading cases of cancer deaths in males and females in Connecticut, 2011-2015

	Total				Non-Hispanic White				Non-Hispanic Black					Hispanic				
	N	AAMR	95% LCL	95% UCL	N	AAMR	95% LCL	95% UCL	N	AAMR	95% LCL	95% UCL		N	AAMR	95% LCL	95% UCL	
FEMALE																		
All Malignant Neoplasms	16,571	130.7	128.7	132.8	14,416	133.8	131.6	136.2	1,276	139.6	131.9	147.6		666	89.1	82.0	96.5	-
Lung and Bronchus	4,098	32.9	31.8	33.9	3,743	35.4	34.2	36.6	228	24.6	21.5	28.1	-	99	14.6	11.7	17.9	-
Female Breast	2,288	18.3	17.6	19.1	1,963	18.9	18.0	19.8	202	20.8	18.0	23.9		91	10.3	8.2	12.8	-
Colon and Rectum	1,361	10.4	9.8	10.9	1,168	10.4	9.8	11.1	113	12.3	10.1	14.8		56	7.6	5.6	10.0	
Pancreas	1,256	9.8	9.2	10.4	1,080	9.8	9.2	10.5	100	11.4	9.2	13.9		58	8.5	6.3	11.0	
Ovary	860	6.9	6.5	7.4	753	7.2	6.7	7.8	59	6.6	5.0	8.5		37	4.5	3.1	6.3	-
Leukemia	628	4.8	4.4	5.2	550	4.8	4.4	5.3	36	4.2	2.9	5.8		37	4.7	3.2	6.7	
Non-Hodgkin Lymphoma	559	4.2	3.9	4.6	494	4.3	3.9	4.7	25	2.8	1.8	4.2		30	4.6	3.0	6.6	
Corpus and Uterus, NOS	548	4.4	4.0	4.8	428	4.0	3.6	4.4	83	9.0	7.1	11.2	+	29	3.9	2.6	5.7	
Liver and Intrahepatic Bile Duct	414	3.4	3.0	3.7	321	3.1	2.7	3.4	49	5.2	3.8	6.9	+	29	3.8	2.5	5.6	
Brain and Other Nervous System	400	3.3	3.0	3.7	359	3.7	3.3	4.1	23	2.6	1.6	3.9		15	1.8	0.9	3.0	-
MALE																		
All Malignant Neoplasms	16,853	178.4	175.7	181.2	14,605	180.6	177.6	183.6	1,232	205.9	193.8	218.6	+	772	135.1	124.6	146.3	-
Lung and Bronchus	4,176	43.9	42.5	45.3	3,648	44.6	43.2	46.1	305	51.1	45.2	57.6		162	30.4	25.4	35.9	-
Prostate	1,621	18.0	17.1	18.9	1,390	17.4	16.5	18.4	162	32.4	27.3	38.0	+	60	14.7	11.0	19.0	
Colon and Rectum	1,282	13.5	12.7	14.2	1,074	13.3	12.5	14.2	111	18.6	15.1	22.7	+	78	13.5	10.3	17.3	
Pancreas	1,168	12.1	11.4	12.9	1,018	12.4	11.6	13.2	90	14.2	11.2	17.6		44	6.9	4.8	9.6	-
Liver and Intrahepatic Bile Duct	889	8.9	8.3	9.5	663	7.9	7.3	8.6	98	14.0	11.2	17.2	+	95	14.1	11.1	17.6	+
Leukemia	807	8.8	8.2	9.5	714	9.1	8.5	9.8	38	6.0	4.1	8.4	-	42	6.9	4.6	9.7	
Urinary Bladder	786	8.6	8.0	9.3	739	9.3	8.6	10.0	27	4.5	2.9	6.6	-	15	2.5	1.3	4.3	-
Esophagus	691	7.0	6.5	7.5	622	7.4	6.8	8.0	36	5.9	4.0	8.3		24	4.4	2.7	6.7	-
Non-Hodgkin Lymphoma	655	7.1	6.6	7.7	579	7.2	6.6	7.8	31	5.4	3.5	7.7		34	4.7	3.1	6.9	
Brain and Other Nervous System	495	5.2	4.7	5.6	451	5.8	5.3	6.4	16	2.0	1.1	3.3	-	22	3.6	2.1	5.6	

* Rates are age-adjusted to the 2000 US standard population and are expressed per 100,000 persons. Rates not reported for cancer sites with fewer than 15 cases. LCL: 95%lower confidence limit; UCL: 95% upper confidence limit. + denotes the rate is significantly higher than the rate for non-Hispanic white males/females (95% significance level); - denotes the rate is significantly lower than the rate for non-Hispanic white males/females (95% significance level).

Potential Life-Years Lost

Mortality rates predominately reflect mortality patterns among the elderly, where death rates are highest. Alternative measures have been proposed to reflect the mortality experienced by younger age-groups. One important alternative measure that gives more emphasis to deaths occurring at younger ages is Potential Life-Years Lost (PLL). By giving more weight to deaths at younger ages, additional emphasis is given to premature deaths, where interventions that extend life expectancy will have the largest impact on a population. This report provides figures for PLL rates to age 75.

Table 7: Potential life-years lost (PLL) to age 75. Top ten cancer sites for Connecticut males.

Cancer Site		Years of PLL	Percent	** APC Trend, 2005-2015
Lung & Bronchus		4,628	20.8%	-4.1
Colon & Rectum		1,758	7.9%	.
Liver & IHB		1,713	7.7%	.
Pancreas		1,705	7.7%	-2.3
Brain & CNS		1,625	7.3%	.
Leukemia		1,125	5.1%	.
Esophagus		1,060	4.8%	.
Prostate		895	4.0%	.
Non-Hodgkin Lymphoma	*	823	3.7%	.
Kidney & Renal Pelvis	*	608	2.7%	.
All Cancers Combined		22,273	100.0%	-1.8

* This site is in top 10 for PLL <75, but not for total deaths.
** Annual Percent Change (APC) figures are displayed if statistically significant (p<.05).

Top-ranked cancer sites based on PLL vary somewhat from the rankings based on all cancer deaths. In particular, mortality due to cancers of the Brain and Nervous System rank higher when we focus on premature deaths (tables 7 and 8). For men, brain cancer is five ranks higher in the premature mortality tables, reflecting the younger age at incidence and death associated with this disease.

Among males, cancer of the kidney and non-Hodgkin lymphoma are ranked among the top ten premature deaths (table 7), but not in the all-ages death rankings. Among females, stomach cancer is ranked among the top ten premature deaths, but not in the all-ages death rankings.

Table 8: Potential life-years lost (PLL) to age 75. Top ten cancer sites for Connecticut females.

Cancer Site		Years of PLL	Percent	** APC Trend, 2005-2015
Breast		4,060	20.4%	-2.3
Lung & Bronchus		3,950	19.8%	-4.2
Colon & Rectum		1,638	8.2%	.
Ovary		1,260	6.3%	.
Pancreas		1,180	5.9%	.
Brain & CNS		995	5.0%	.
Corpus & Uterus, NOS		765	3.8%	.
Leukemia		663	3.3%	-6.1
Liver & IHB		568	2.8%	5.0
Stomach	*	413	2.1%	.
All Cancers Combined		19,913	100.0%	-2.3

* This site is in top 10 for PLL <75, but not for total deaths.
** Annual Percent Change (APC) figures are displayed if statistically significant (p<.05).

Between 2005 and 2015 premature mortality due to all cancers declined significantly for females (-2.3% per year), and for males (-1.8% per year). This represents a net decline over this 11-year period in PLL of 21% for females and 17% for males. However, progress was not uniform across all cancer sites. Among females, only 3 of 10 cancer

sites had significant declines over this 11-year period, and there was a significant increase observed in liver cancer (Table 8). Liver cancer is strongly associated with viral hepatitis B and C infection, thus appropriate health interventions targeted at high risk populations might reduce their risk of developing or dying from liver cancer. Among males, only 2 of 10 sites achieved statistically significant declines (Table 7).

Changes in Cancer Mortality Over Time

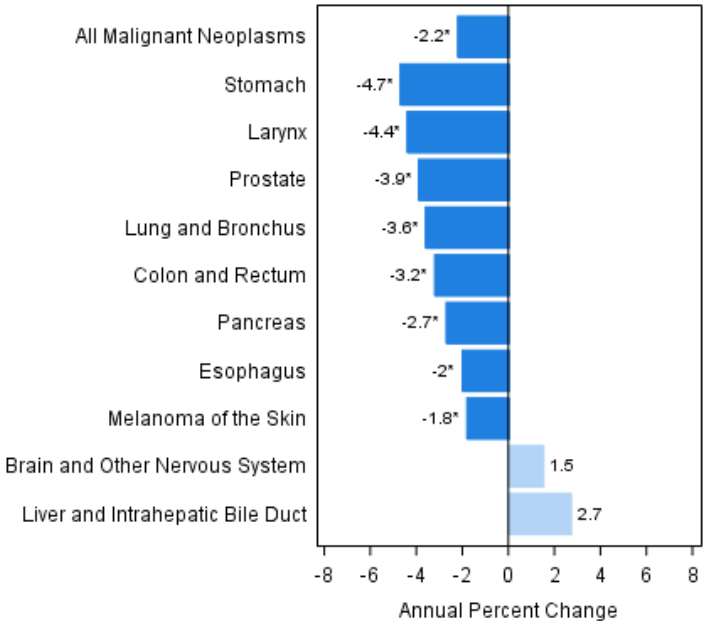
Cancer is the second leading cause of death in the nation and in Connecticut. It is estimated that one in four men and one in five women in the US will die from cancer. Advances in the early detection and treatment of cancer have led to declines in deaths from some cancers. However, deaths from other cancers continue to increase year on year. Monitoring cancer mortality rates over time allows us to determine where progress has been made and to identify areas where efforts to reduce death from cancer should be focused.

Figures 4 and 5 show the changes in the cancer mortality rates in men and women in Connecticut over the period 2006-2015. There are encouraging declines in mortality from a number of cancers in both males and females. Decreases in mortality from cancers of the (female) breast, colon and rectum and prostate are due in part to the early detection of these cancers through screening, as well as advances in the treatment of these cancers.

Changes in patterns of tobacco use have led to a significant decrease in esophageal and lung cancer mortality in males; a smaller decrease in lung cancer mortality is observed in females. Stomach cancer has decreased significantly in both males and females.

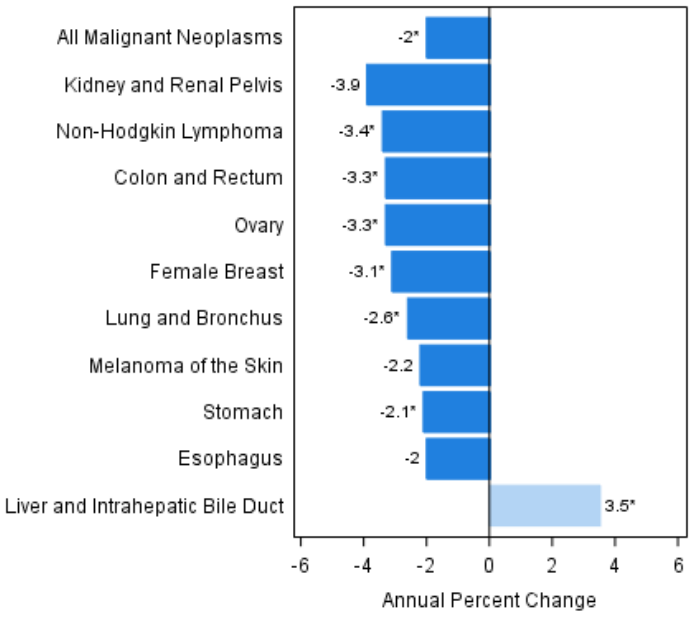
Cancers where the death rates have been increasing, albeit not significantly, include liver and bile duct for men and women, and brain cancer for men.

Figure 4: Average annual percentage change (APC) for mortality from selected cancers 2006-2015 in Connecticut males.



Annual percentage change (APC)
***Indicates that the APC is significantly different from zero (p<0.05)**

Figure 5: Average annual percentage change (APC) for mortality from selected cancers 2006-2015 in Connecticut females.



Annual percentage change (APC)
***Indicates that the APC is significantly different from zero (p<0.05)**

Reducing the Burden of Cancer

It is estimated that more than half of all cancers are preventable.[1] By making healthy lifestyle choices and getting recommended cancer screening tests, individuals can greatly reduce their risk of developing cancer.

Table 9 summarizes known modifiable cancer risk factors (a cancer risk factor is something that raises a person's chance of developing cancer).

Table 9. Modifiable Cancer Risk Factors. Adapted from a study by researchers at The American Cancer Society www.cancer.org

Cancer site	Tobacco	Obesity	Alcohol	Poor Diet*	Physical Inactivity	HPV Infection	UV Radiation
Lung	✓			✓			
Breast		✓	✓		✓		
Colorectal		✓	✓	✓	✓		
Bladder	✓						
Melanoma							✓
Uterus		✓			✓		
Oral Cavity			✓	✓			
Liver		✓	✓				
Esophagus	✓						
Larynx	✓			✓			
Cervix						✓	
Anus						✓	
Vagina						✓	
Penis						✓	

* Diet high in saturated fats and red meat and/or low in fruits, vegetables and whole grains.

[1] Proportion and Number of Cancer Cases and Deaths Attributable to Potentially Modifiable Risk Factors in the United States; Farhad Islami et al. CA Can J Clin DOI 10.3322/caac.21440

Cancer-Related Risk Behaviors in Connecticut Residents

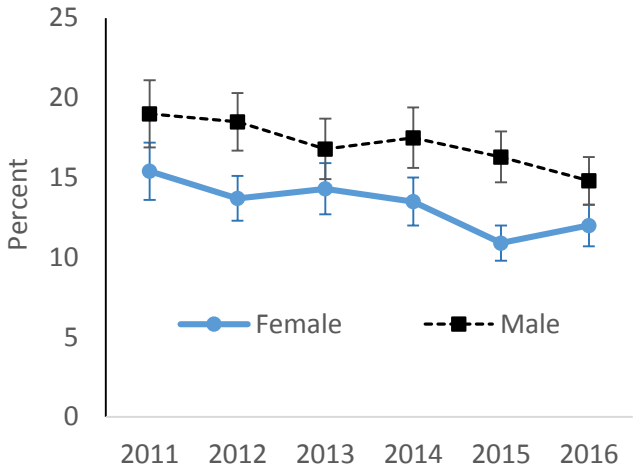
The Connecticut Behavioral Risk Factor Surveillance System (BRFSS) is an ongoing annual telephone survey that collects information on health-related risk behaviors and events, chronic disease conditions and use of preventive services such as cancer screening from a sample of Connecticut adults.

The following data are derived from the CT BRFSS.[2-3] In 2011, two methodological refinements were made to the BRFSS. The first was to expand the sample to include data received from cell phone users. This change was made to better reflect the population. The second change was to modify the statistical method to weight BRFSS survey data. The new approach simultaneously adjusts survey respondent data to known proportions of demographics such as age, race and ethnicity, and gender. These changes should be considered when comparing BRFSS data before and after 2011. More information about CT BRFSS is available at:
www.ct.gov/dph/brfss
For the latest CT BRFSS Summary Report, go to:
https://portal.ct.gov/-/media/Departments-and-Agencies/DPH/BRFSS/BRFSS2016CTReport.pdf

Smoking Prevalence

From 2011 through 2016, the prevalence of smoking among adults has decreased from 17% in 2011 to 13% in 2016.Smoking prevalence was highest in adults with a high school degree or less (21% in 2016), in adults with an income less than $35,000 (23% in 2016), and in adults ages 18-34 (15% in 2016) (data not shown).

Figure 6: Trend in prevalence of adults who currently smoke in Connecticut, 2011-2016.



Physical Activity

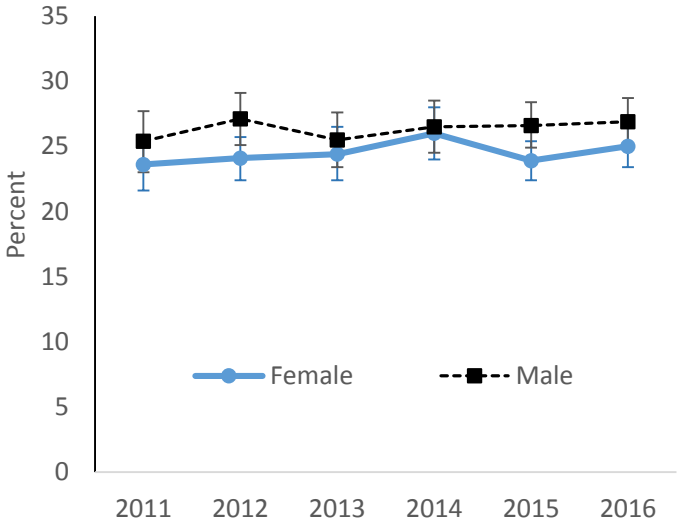
The Office of Disease Prevention and Health Promotion encourages adults to avoid inactivity, because any amount of physical activity has health benefits[4]. In 2016, 21% of Connecticut adults reported not participating in any leisure time physical activities. This rate was much higher among adults with a high school education or less (31%) compared to adults with more than a high school education (15%). No leisure-time physical activity was also related to income with the highest proportion of inactivity reported among adults earning an income less than $35,000 (34%).

[2] CT BRFSS data kindly provided by BRFSS Epidemiologist, Xi Zheng, MPH, MS and CT BRFSS Coordinator, Celeste Jorge, MPH
[3] https://www.cdc.gov/surveillancepractice/reports/brfss/brfss.html
[4] https://health.gov/paguidelines/guidelines/adults.aspx

Obesity

From 2011 through 2016, there was an increase in obesity among both male and female adults in Connecticut. The annual rate of increase was 0.6% for males and 0.4% for females. The rate of increase for males was significantly higher than that for females, suggesting that in future years the percent of obesity among males may significantly exceed that of females. In 2016, the percent obesity among males and females was 27% and 25%, respectively, affecting an estimated 360,000 men and 320,000 women in the state.

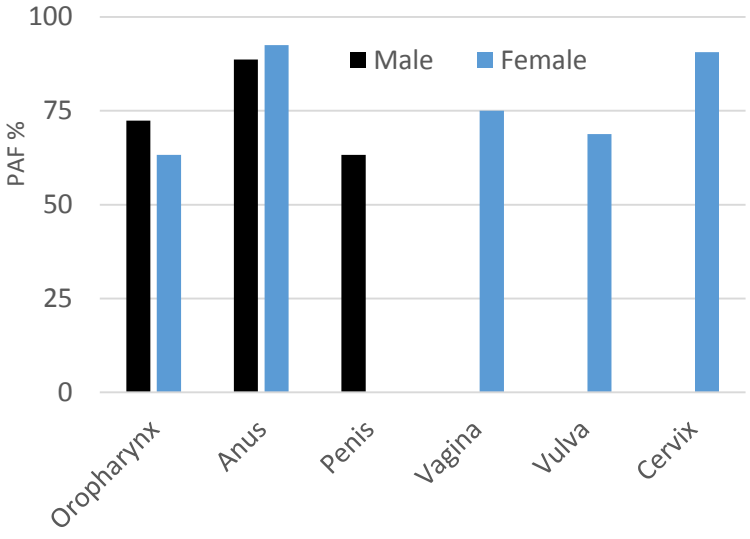
Figure 7: Percent of obese adults in Connecticut, 2011-2016.



HPV-Related Cancers

Human Papillomavirus (HPV) is a group of viruses that is extremely common among teens and adults. Most cases of HPV do not lead to cancer, but infections that do not go away may cause cancers of the oral cavity, oropharynx, anus, penis, vagina, vulva, and cervix. The HPV vaccine prevents these cancer-causing infections. In 2017, 64% of females and 53% of males ages 13-17 were up-to-date on receiving the HPV vaccine.[5] Population-attributable fraction (PAF) is the proportion of cases of a particular disease that can be attributed to a specific risk factor. The PAFs from a study by Saraiya et al.[6] were applied to cancer incidence data to determine the impact of modifiable risk factors (such as HPV) on cancer incidence. Between 2012-2016, 1,589 cancers among women and 974 cancers among men were attributable to HPV infection.

Figure 8: Proportion of cancers that could be avoided by preventing HPV infection in Connecticut, 2012-2016.



Cancer Screening

Cancer screening tests can help find cancer at an early or even pre-invasive stage, before symptoms appear. When abnormal tissue or cancer is found early, it may be easier to treat or cure. The U.S. Preventive Services Task Force (USPSTF) and American Cancer Society (ACS) provide recommendations for the screening of the following cancers: female breast; cervical, colorectal, lung, and prostate cancer. The current recommendations are summarized in Table 10.

The percent of women aged 18 and over who received a pap test in the past three years decreased between 2004 and 2010 and again between 2012 and 2016. The percent of women ages 50-74 who received a mammogram in the past two years has remained relatively stable across the years. In 2016, about 25% of adult women did not receive a pap test in the past three years, and 14% of women between 50 and 74 years old did not receive a mammography in the past two years.

Figure 9: Breast and cervical cancer screening in Connecticut, 2002-2016

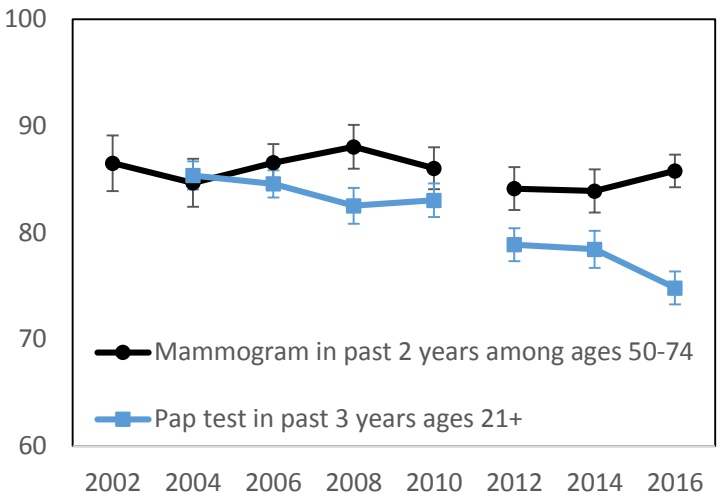
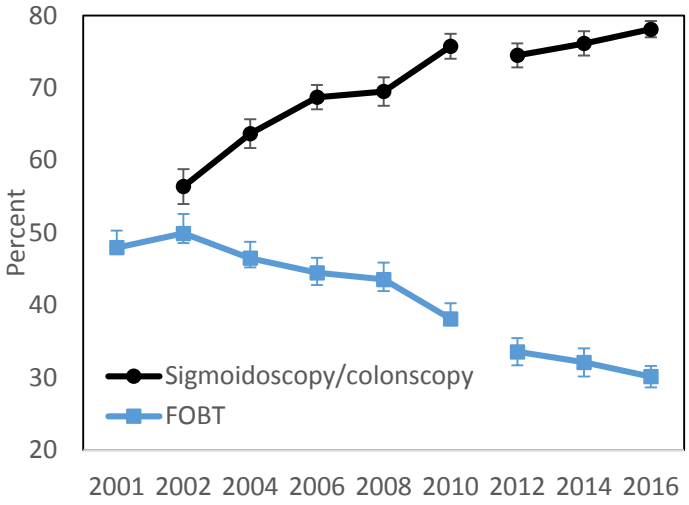


Table 10. American Cancer Society and US Preventive Services Task Force cancer screening guidelines in the US for breast, cervical, colorectal, lung and prostate cancers (as of September 2018).

Cancer Site	Organization	Screening Test	Population Targeted	Frequency
Breast	ACS (2015)	Mammography	Women ages 40 to 44 years Women ages 45 to 54 years Women ages 55 and older	Optional annual mammogram Annual Every other year
	USPSTF (2016)	Mammography	Women ages 40 to 49 years Women aged 50 to 74 years	Optional Every other year
Cervix	ACS (2012)	Pap test, HPV test	Women ages 21 to 29 years Women ages 30 to 65 years	Pap test every 3 years Pap test + HPV test every 5 years or Pap test every 3 years
	USPSTF (2018)	Pap test, HPV test	Women ages 21 to 29 years Women ages 30 to 65 years	Pap test every 3 years Pap test + HPV test every 5 years or Pap test every 3 years
Colorectal	ACS (2018)	Fecal Occult Blood Test (FOBT), fecal immunochemical test (FIT), Multitarget stool DNA test, Sigmoidoscopy, CT colonography, or colonoscopy	Men and women aged 45 years and older	FOBT: annual FIT: annual DNA: every 3 years Sigmoidoscopy: every 5 years CT colonography: every 5 years Colonoscopy: every 10 years
	USPSTF (2016)	FOBT, FIT, FIT-DNA, sigmoidoscopy, CT colonography, or colonoscopy	Men and women aged 50 to 75 years	FOBT: annual FIT: annual FIT-DNA: every 1 to 3 years Sigmoidoscopy: every 5 years Sigmoidoscopy+FIT: every 10 years + FIT every year CT colonography: every 5 years Colonoscopy: every 10 years
Lung*	ACS (2013)	The American Cancer Society does not recommend tests to screen for lung cancer in people who are at average risk of this disease. However, the ACS does have screening guidelines for individuals who are at high risk of lung cancer due to cigarette smoking. If you meet all of the following criteria then you might be a candidate for screening: 55 to 74 years of age; in fairly good health; have at least a 30 pack-year smoking history *and* are either still smoking or have quit smoking within the last 15 years.		
	USPSTF (2013)	Low-dose computed tomography	Men and women aged 55-80 years with a 30 pack-year smoking history, who are current smokers or who have quit within past 15 years. §	Annual
Prostate	ACS (2010)	The ACS recommends that men make an informed decision with their doctor about whether to be tested for prostate cancer. Research has not yet proven that the potential benefits of testing outweigh the harms of testing and treatment. The ACS believes that men should not be tested without learning about what we know and don't know about the risks and possible benefits of testing and treatment.		
	USPSTF (2018)	The U.S. Preventive Services Task Force recommends men ages 55 to 69 make an individual decision about prostate cancer screening with their clinician. The Task Force recommends against routine screening for men age 70 and older.		

ACS: American Cancer Society (www.cancer.org)
USPSTF: United States Preventive Services Task Force (www.uspreventiveservicestaskforce.org)
* The USPSTF has started the process of updating its recommendation on screening for lung cancer.
§ Screening should be discontinued once a person has not smoked for 15 years or develops a health problem that substantially limits life expectancy or the ability or willingness to have curative lung surgery.

Figure 10: Colorectal cancer screening behavior in Connecticut, 2001-2016

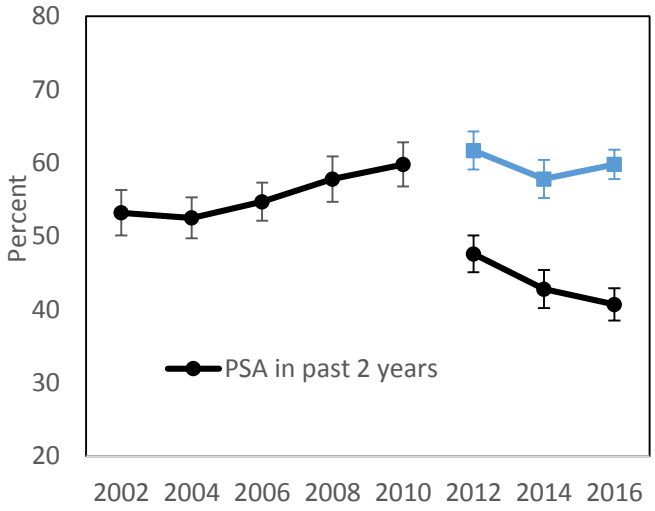


The percent of adults at least 50 years old in Connecticut who have ever received a sigmoidoscopy/colonoscopy increased steadily from a low of 64% in 2004 to 76% in 2010. Then increased again from 75% in 2012 to a high of 78% in 2016. Conversely, the percent in this age group who received a fecal occult blood test (FOBT) within the past two years decreased from 48% in 2001 to 38% in 2010. The percentage continued to decreased from 34% in 2012 to a low of 30% in 2016. 76% of adults ages 50-75 met the USPSTF guidelines for colorectal cancer screening in 2016 (refer to Table 10 for screening guidelines).

Prostate cancer screening by prostate specific antigen (PSA) testing remains highly controversial because of uncertainty over the benefits versus the risk of harm. Potential side-effects of diagnostic and therapeutic procedures include erectile dysfunction and urinary and bowel incontinence. The USPSTF changed recommendations for PSA screening in beginning in 2008, and is now recommending that men ages 55-69 make the decision for PSA with their clinician.

From 2002 to 2008, the percentage of men getting PSA testing increased from 53% to 60%. From 2012 to 2016, the percentage of mean getting PSA decreased from 48% to 41%, while the percentage discussing PSA with a doctor has remained right around 60%.

Figure 11: Prostate cancer screening behavior for men ages 40+ in Connecticut, 2002-2016



Recent Publications

The following list includes journal articles co-authored by CTR staff. A complete bibliography of studies utilizing CTR data can be found on the CTR web page: www.ct.gov/dph/TumorRegistry

1. Layne, T.M., Ferrucci, L.M., Jones, B.A., et at., Concordance of cancer registry and self-reported race, ethnicity, and cancer type: a report from the American Cancer Society's study of cancer survivors. Cancer Causes Control, 2019. 30(1): p. 21-29.
2. Laprise, C., Cahoon, E.K., Lynch, C.F., et al., *Risk of lip cancer after solid organ transplantation in the United States.* Am J Transplant, 2018.
3. Swede, H., Sarwar, A., Magge, A., et al., *Mortality risk from comorbidities independent of triple-negative breast cancer status: NCI-SEER-based cohort analysis.* Cancer Causes Control, 2016. **27**(5): p. 627-36.
4. Polednak, A.P., *Evidence for a stabilization of incidence rates for base of tongue and tonsil carcinoma in the U.S. white population.* Oral Oncol, 2016.
5. Petkov, V.I., Miller, D.P., Howlader, N., et al., *Breast-cancer-specific mortality in patients treated based on the 21-gene assay: a SEER population-based study.* NPJ Breast Cancer, 2016. **2**: p. 16017.
6. Karami, S., Yanik, E.L., Moore, L.E., et al., *Risk of Renal Cell Carcinoma Among Kidney Transplant Recipients in the United States.* Am J Transplant, 2016. **16**(12): p. 3479-3489.
7. Viola, K.V., Rezzadeh, K.S., Gonsalves, L., et al., *National utilization patterns of Mohs micrographic surgery for invasive melanoma and melanoma in situ.* J Am Acad Dermatol, 2015. **72**(6): p. 1060-5.
8. Suneja, G., Shiels, M.S., Angulo, R., et al., *Cancer treatment disparities in HIV-infected individuals in the United States.* J.Clin.Oncol., 2014. **32**(22): p. 2344-2350.
9. Polednak, A.P. and C. Phillips, *Cancers coded as tongue not otherwise specified: relevance to surveillance of human papillomavirus-related cancers.* J Registry Manag, 2014. **41**(4): p. 190-5.
10. Polednak, A.P. and C. Phillips, *Surveillance of the frequency and results of testing of incident oropharyngeal cancers for human papillomavirus: the potential role of population-based cancer registries.* J.Registry Manag., 2014. **41**(3): p. 113-119.
11. Polednak, A.P., *Inaccuracies in oral cavity-pharynx cancer coded as the underlying cause of death on U.S. death certificates, and trends in mortality rates (1999-2010).* Oral Oncol., 2014. **50**(8): p. 732-739.
12. Huang, H., Ma, X., Waagepetersen, R., et al., *A new estimation approach for combining epidemiological data from multiple sources.* J Am Stat Assoc, 2014. **109**(505): p. 11-23.
13. Clairwood, M., Ricketts, J., Grant-Kels, J., et al., *Melanoma in skin of color in Connecticut: an analysis of melanoma incidence and stage at diagnosis in non-Hispanic blacks, non-Hispanic whites, and Hispanics.* Int.J.Dermatol., 2014. **53**(4): p. 425-433.