

Cancer in Texas

— Texas Cancer Registry 2012 —



Texas Cancer Registry



A SPECIAL THANKS FOR THE DEDICATION AND HARD WORK OF CANCER REGISTRARS AND OTHERS RESPONSIBLE FOR DATA COLLECTION ACROSS TEXAS.

The Texas Department of State Health Services (DSHS) and Cancer Prevention and Research Institute of Texas (CPRIT) work collaboratively in support of the Texas Cancer Registry (TCR) and the fight against cancer.

RECOGNITION OF FUNDING SOURCES

Maintaining a statewide cancer registry that meets both National Program of Cancer Registries and Centers for Disease Control and Prevention (CDC) high quality data standards and North American Association of Central Cancer Registries (NAACCR) gold certification is accomplished through collaborative funding efforts.

In 2005, the Texas Legislature provided additional funding for the Texas Cancer Registry to achieve and maintain national high quality data standards and certification. With this new funding, the TCR attained both CDC high quality data standards and gold certification from NAACCR for the first time in 2005. These standards have been maintained through funding from the Texas Department of State Health Services, the Higher Education Coordinating Board, and now through the Cancer Prevention and Research Institute of Texas.

The TCR also acknowledges the CDC for its financial support under Cooperative Agreement 1U58DP003902-01. The contents of this report are solely the responsibility of the authors and do not necessarily represent the official views of the CDC.

Requested Citation:

Risser DR, Bowcock CL, Betts PD, Hakenewerth AM, Williams MA, Magid R, Garcia R. Cancer in Texas 2012. Austin, TX: Texas Cancer Registry, Texas Department of State Health Services; Cancer Prevention and Research Institute of Texas, 2012.

TABLE OF CONTENTS

About the Texas Cancer Registry	2
About the Cancer Prevention and Research Institute of Texas	3
Cancer in Texas	3
Expected New Cancer Cases and Deaths for Leading Cancer Sites, 2012	4
Estimated Number of Texans Living with Cancer	5
Trends in Texas Cancer Incidence and Mortality	7
Racial and Ethnic Variation in Cancer Rates	8
Cancer Survival	11
Cause-Specific Cancer Survival by Race and Ethnicity	13
Childhood and Adolescent Cancer in Texas	15
Use of TCR Data	19
CPRIT Funded Studies Using TCR Data	22
Comparative Effectiveness Research	22
Accessing Texas Cancer Data	23
Technical Notes	25
References	27

About the Texas Cancer Registry

The Texas Cancer Registry (TCR) at the Department of State Health Services is the primary source of cancer data in Texas and is one of the largest cancer registries in the nation. TCR data are one way in which local, state, and national public health officials, as well as other stakeholders, measure the Texas cancer burden in the fight against cancer. The TCR also plays a significant role in measuring the burden nationally.

TCR data are an integral part of public health, supporting many of the ten essential services of public health (<http://www.cdc.gov/nphsp/essentialServices.html>). The data can be used to determine those at highest risk of developing cancer, target communities for prevention and control interventions, identify and address cancer disparities, and evaluate whether prevention, screening, and treatment efforts are making a difference. TCR data also contribute significantly to clinical, epidemiologic, and health services research and investigations. TCR data also directly support activities related to the Cancer Prevention and Research Institute of Texas.

The TCR was legislatively mandated in 1979 and statewide data meeting national standards have been collected since 1995. Data are collected from over 500 hospitals, cancer treatment centers, ambulatory surgery centers, and pathology laboratories located throughout the state, as well as from national laboratories and other state registries. The TCR currently meets the National Program of Cancer Registries, Centers for Disease Control and Prevention (CDC) high quality data standards and is Gold Certified by the North American Association of Central Cancer Registries (NAACCR). In 2010, the TCR was one of ten state registries selected by the CDC as a specialized cancer registry for the Enhancing Cancer Registries for Comparative Effectiveness Research (CER) project.

The TCR receives approximately 250,000 reports of cancer annually. Included in these are more than 20,000 cancer reports for out-of-state residents who are seeking care in Texas. The TCR sends these reports to their residing state cancer registry, providing a significant contribution to the overall national cancer surveillance system.

The TCR collects information such as the types of cancers that occur, their locations within the body, the extent of cancer at the time of diagnosis (disease stage), the kinds of first course treatment that patients receive, length of survival, and patient characteristics. The ultimate goal and purpose of the TCR is to collect the highest quality cancer data that will contribute towards cancer prevention and control, improving diagnosis, treatment, survival, and quality of life for cancer patients.



Texas Cancer Registry

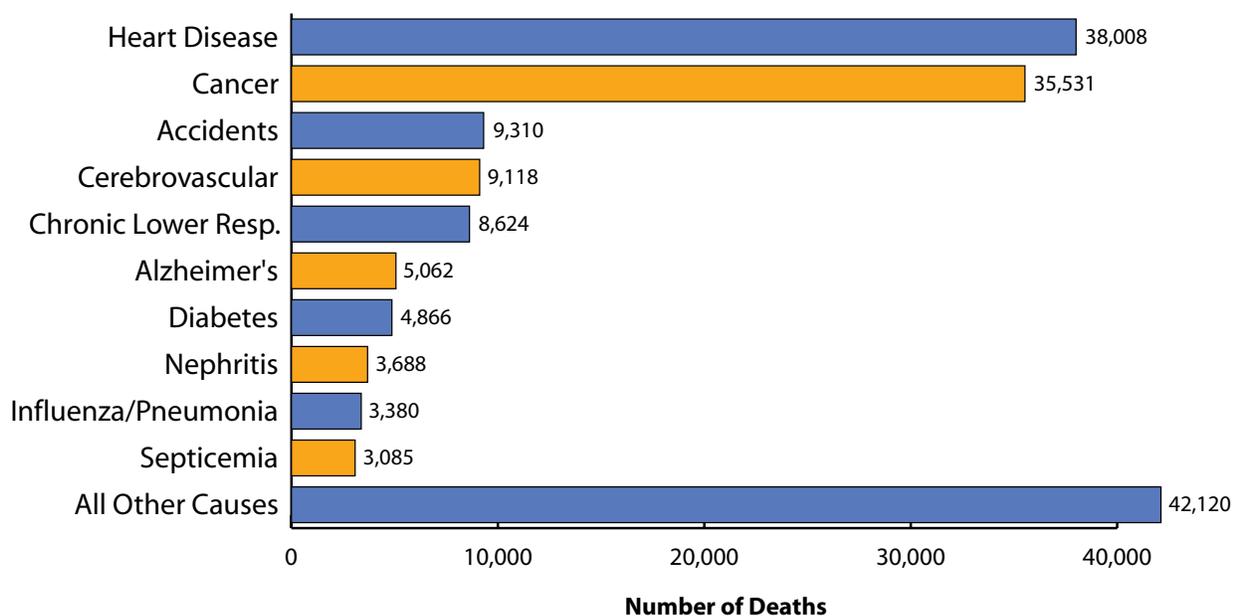
About the Cancer Prevention and Research Institute of Texas

Texas voters overwhelmingly approved a constitutional amendment in 2007 establishing the Cancer Prevention and Research Institute of Texas (CPRIT) and authorizing the state to issue \$3 billion in bonds to fund groundbreaking cancer research and prevention programs and services in Texas. CPRIT's goal is to expedite innovation and product development in cancer research and to enhance access to evidence-based prevention programs and services throughout the state. Under the guidance of its governing body, the Oversight Committee, CPRIT accepts applications and awards grants for a wide variety of cancer-related research and for the delivery of cancer prevention programs and services by public and private entities located in Texas. All CPRIT-funded research is conducted in-state by Texas-based scientists, and reflects CPRIT's mission to attract and expand the state's research capabilities and create high quality new jobs in Texas.

Cancer in Texas

Cancer is the second leading cause of death in Texas and the nation (Figure 1).¹ It is the leading cause of death for persons younger than 85 years and is expected to surpass heart disease as the overall leading cause of death within this decade. It is estimated that 1 in 2 men and 1 in 3 women will be diagnosed with cancer in his or her lifetime.² Cancer is also one of the most costly illnesses in the United States. In Texas alone, costs in 2011 were estimated to be \$28.1 billion.³

Figure 1. Leading Causes of Death in Texas Residents, 2009



Source: <http://www.dshs.state.tx.us/CHS/VSTAT/vs09/t16.shtm>.



Expected New Cancer Cases and Deaths for Leading Cancer Sites, 2012

In 2012, it is estimated that there will be 110,135 Texans newly diagnosed with cancer and 39,072 will die of the disease. More than 32,000 new cases will be for female breast cancer and male prostate cancer combined. It is expected that there will be almost 11,000 lung cancer deaths, which will account for more than a quarter of all cancer deaths (Tables 1 and 2).

Table 1. Expected Number of New Cancer Cases and Deaths in Texas Females, 2012

Type	Expected New Cases		Type	Expected Deaths	
	Number	%		Number	%
Breast	16,127	31	Lung	4,379	25
Lung	6,108	12	Breast	2,867	16
Colon & Rectum	4,765	9	Colon & Rectum	1,649	9
Corpus & Uterus, NOS	2,460	5	Pancreas	1,060	6
Non-Hodgkin's Lymphoma	1,979	4	Ovary	927	5
Thyroid	1,894	4	Leukemia	646	4
Melanoma	1,888	4	Non-Hodgkin's Lymphoma	599	3
Kidney & Renal Pelvis	1,601	3	Liver & Intrahepatic Bile Duct	561	3
Ovary	1,551	3	Corpus & Uterus, NOS	459	3
Leukemia	1,276	2	Brain	439	2
All Others	11,592	23	All Others	4,320	24
All Sites Combined	51,241	100	All Sites Combined	17,906	100

All sites combined includes all malignant cancers and in-situ bladder cancer. New cases were estimated by applying age-, sex-, and race/ethnic-specific incidence rates for Texas 2004–2008, to the Texas 2012 population. Melanoma, breast and prostate cancer expected cases were estimated by applying California 2004–2008 age-, sex-, and race/ethnic-specific incidence rates to the Texas 2012 population. California rates were used for these sites due to additional case-ascertainment methods used in California, and similar race and ethnic populations. Expected deaths were estimated by applying age-, sex-, and race/ethnic-specific mortality rates for Texas, 2007–2008, to the Texas 2012 population. Totals may not sum due to rounding. Source: Prepared by the Texas Cancer Registry, Cancer Epidemiology and Surveillance Branch, Texas Department of State Health Services, November 2011.

Table 2. Expected Number of New Cancer Cases and Deaths in Texas Males, 2012

Type	Expected New Cases		Type	Expected Deaths	
	Number	%		Number	%
Prostate	16,777	28	Lung	6,229	29.4
Lung	8,447	14	Prostate	1,779	8.4
Colon & Rectum	5,839	10	Colon & Rectum	2,072	9.8
Melanoma	2,797	5	Pancreas	1,226	5.8
Urinary Bladder	2,792	5	Liver & Intrahepatic Bile Duct	1,207	5.7
Kidney & Renal Pelvis	2,540	4	Leukemia	857	4.1
Non-Hodgkin's Lymphoma	2,379	4	Non-Hodgkin's Lymphoma	779	3.7
Oral Cavity & Pharynx	1,776	3	Kidney & Renal Pelvis	717	3.4
Leukemia	1,731	3	Esophagus	687	3.2
Liver & Intrahepatic Bile Duct	1,599	3	Urinary Bladder	578	2.7
All Others	12,216	21	All Others	5,033	23.8
All Sites Combined	58,893	100	All Sites Combined	21,165	100

All sites combined includes all malignant cancers and in-situ bladder cancer. New cases were estimated by applying age-, sex-, and race/ethnic-specific incidence rates for Texas 2004–2008, to the Texas 2012 population. Melanoma, breast and prostate cancer expected cases were estimated by applying California 2004–2008 age-, sex-, and race/ethnic-specific incidence rates to the Texas 2012 population. California rates were used for these sites due to additional case-ascertainment methods used in California, and similar race and ethnic populations. Expected deaths were estimated by applying age-, sex-, and race/ethnic-specific mortality rates for Texas, 2007–2008, to the Texas 2012 population. Totals may not sum due to rounding. Source: Prepared by the Texas Cancer Registry, Cancer Epidemiology and Surveillance Branch, Texas Department of State Health Services, November 2011.



Estimated Number of Texans Living with Cancer

With more people being diagnosed with cancer, improvements in treatment, and cancers being caught earlier, there are increasing numbers of cancer survivors. Additionally, the number of people living with cancer will continue to increase as the population grows and ages. Using methods from the National Cancer Institute, the TCR calculated limited-duration prevalence, which estimates the number of people living on a specified date (January 1, 2009) who had a cancer diagnosis in the past 10 years (January 1, 1999–December 31, 2008). This estimate is lower than calculating complete prevalence (anyone alive who was ever diagnosed with cancer), however, enough years of TCR data are not yet available to calculate complete prevalence. The cancer sites with the highest prevalence in Texas are prostate, breast, and colorectal cancers (Table 3).

Table 3. Estimated Number of Texans Living on January 1, 2009 with a Prior Diagnosis of Cancer in the Past 10 Years

Site	Total	Males	Females
All Sites Combined	476,481	240,094	236,387
Bladder	19,413	14,666	4,747
Brain	4,883	2,619	2,264
Breast	98,630	592	98,038
Cervix	6,686	0	6,686
Colon & Rectum	43,831	22,418	21,413
Esophagus	1,579	1,232	347
Eye & Orbit	1,165	622	543
Gallbladder	445	100	345
Hodgkin's Lymphoma	4,901	2,610	2,291
Kaposi's Sarcoma	1,110	1,053	57
Kidney & Renal Pelvis	14,245	8,581	5,664
Larynx	3,164	2,569	595
Leukemia	11,857	6,783	5,074
Acute Lymphocytic Leukemia	2,793	1,583	1,210
Liver & Intrahepatic Bile Duct	2,489	1,786	703
Lung & Bronchus	17,487	8,114	9,373
Melanoma	26,233	13,726	12,507
Mesothelioma	238	157	81
Myeloma	4,126	2,234	1,892
Non-Hodgkin's Lymphoma	20,758	10,923	9,835
Oral Cavity & Pharynx	9,855	6,700	3,155
Ovary	6,011	0	6,011
Pancreas	2,146	1,051	1,095
Prostate	110,610	110,610	0
Small Intestine	1,681	901	780
Stomach	3,767	2,167	1,600
Testis	5,848	5,848	0
Thyroid	17,443	3,713	13,730
Corpus & Uterus, NOS	18,106	0	18,106

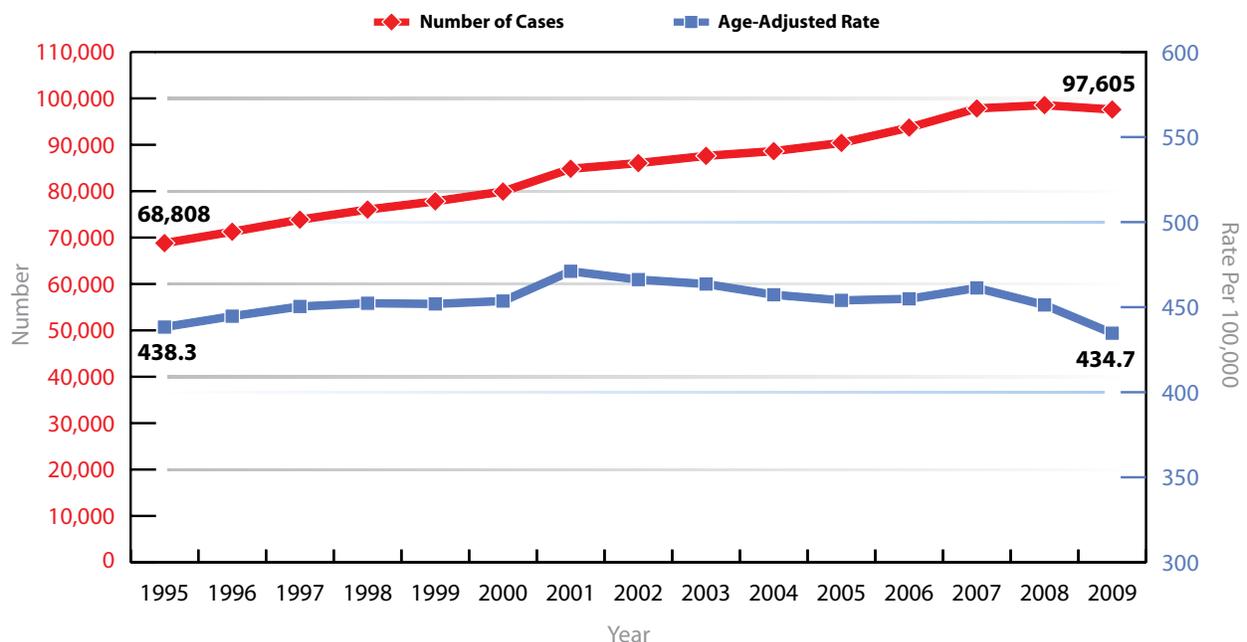
The estimates for Texas are derived from the counted prevalence in the National Cancer Institute (NCI) SEER program, also for January 1, 2009. The NCI counts are provided by age, sex and race/ethnicity (non-Hispanic whites, Hispanic whites, blacks, and all other races combined). These counts are given as a percentage and the percentages are applied to the corresponding Texas population groups to come up with the projected prevalence in Texas. This is done using software provided by the SEER program. For additional information about the software used to project Texas prevalence see: <http://srab.cancer.gov/projprev/>. For more information see: <http://srab.cancer.gov/prevalence/limited.html>. Please note that these are only estimates and are based on applying national prevalence counts to our Texas population.

Trends in Texas Cancer Incidence and Mortality

Cancer incidence refers to the occurrence of a new case of cancer (diagnosed for the first time), and cancer mortality to a death from cancer. Rates are calculated by dividing the number of new cancer cases or deaths during a specified time period (typically 1, 5, or 10 years) by the appropriate population at risk, such as county or state populations. Populations in different geographic areas can vary considerably in terms of age, so rates are adjusted for age according to an accepted standard. This makes it possible to compare rates for different geographic areas.

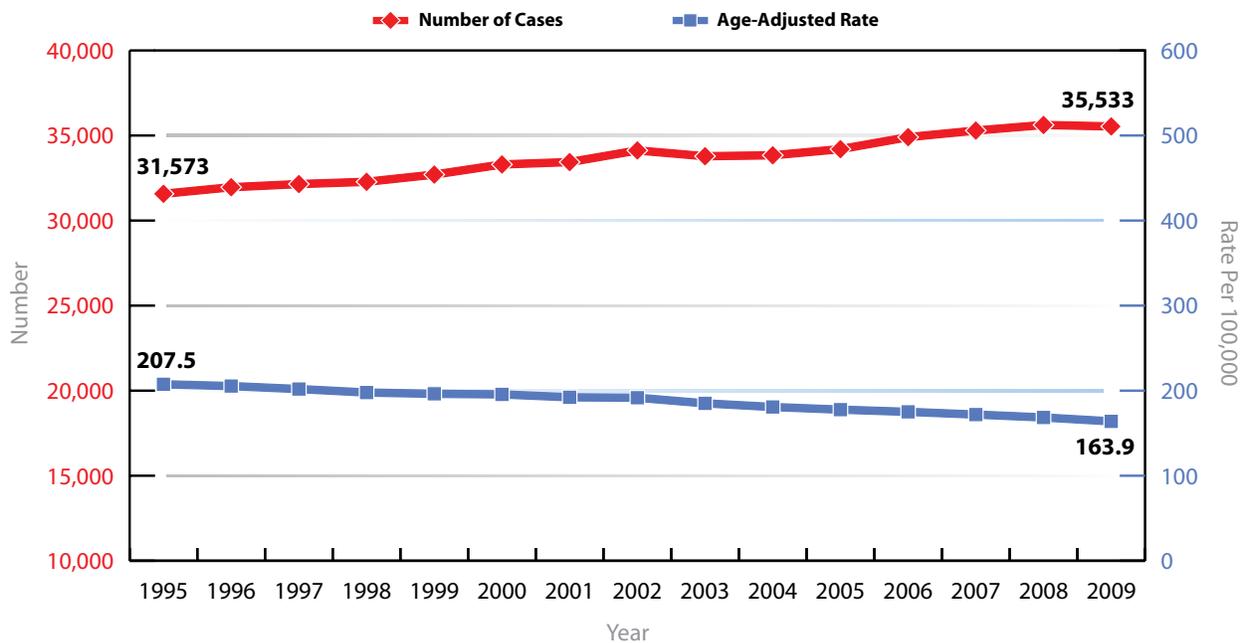
Figures 2 and 3 present recent trends in cancer incidence and mortality rates, and trends in the numbers of new cancer cases and deaths. While both cancer incidence and mortality rates have been declining in recent years, both the numbers of new cancer cases and deaths are increasing each year. This finding can be explained by the increasing size and aging of the Texas population. Although there are more people diagnosed with cancer in Texas (numerator), the proportion of new cases compared to the population (denominator) is decreasing.

Figure 2. Trends in the Total Number of New Cancer Cases and Incidence Rates in Texas, 1995–2009



Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups - Census P25-1130) standard.

Figure 3. Trends in the Total Number of Cancer Deaths and Mortality Rates in Texas, 1995–2009



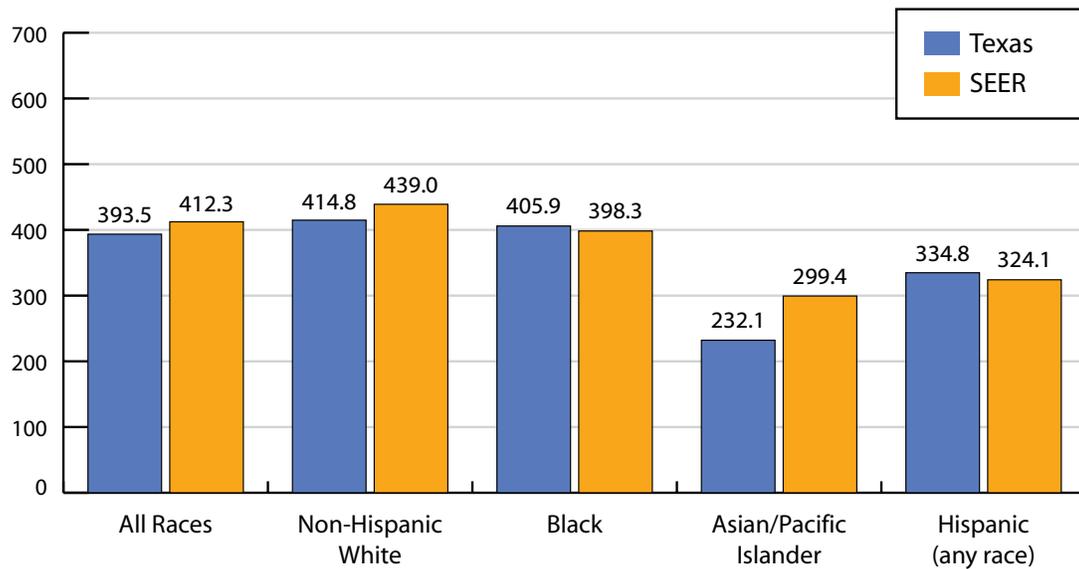
Rates are per 100,000 and age-adjusted to the 2000 US Std Population (19 age groups - Census P25–1130) standard.

Racial and Ethnic Variation in Cancer Rates

Cancer incidence and mortality rates also vary greatly by race and ethnicity. The differences vary by cancer type and can be a result of many factors, including differences in risk factors, access to care, and appropriate treatment. In Texas, the highest overall cancer incidence and mortality rates are found among blacks, followed by non-Hispanic whites. The lowest overall cancer incidence and mortality rates are found among Asian/Pacific Islanders. Incidence and mortality rates by race, ethnicity and sex are presented below, comparing Texas to the National Cancer Institute’s (NCI) Surveillance Epidemiology and End Results (SEER) program and the U.S., respectively (Figures 4–7).

The greatest disparities are found among males, where black males have an incidence rate 14% higher and a mortality rate 36% higher than non-Hispanic whites. Conversely, Hispanic males have an incidence rate that is only 76% as high, and Asian/Pacific Islander males a rate that is only 51% as high as in non-Hispanic whites.

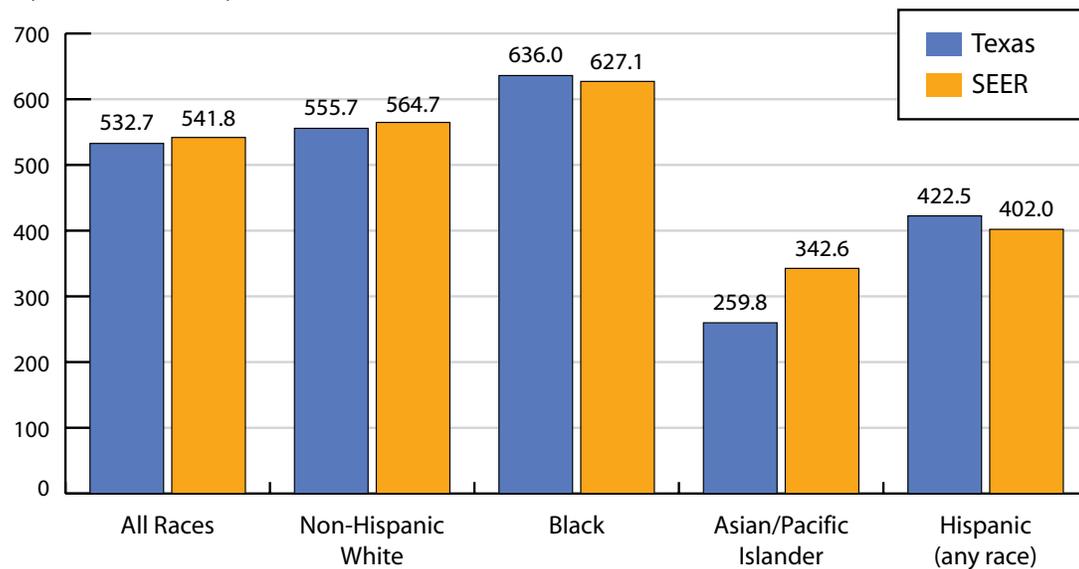
Figure 4. Age-Adjusted Cancer Incidence Rates in Females, Texas and 18 SEER* Registries, by Race/Ethnicity, 2005–2009



* SEER 18 Registries rates data derived from (<http://seer.cancer.gov/data/seerstat/nov2011/>) Filename: Incidence – SEER 18 Regs Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2011 Sub. Vintage 2009 Pops (2000-2009) <Katrina/Rita Population Adjustment>.

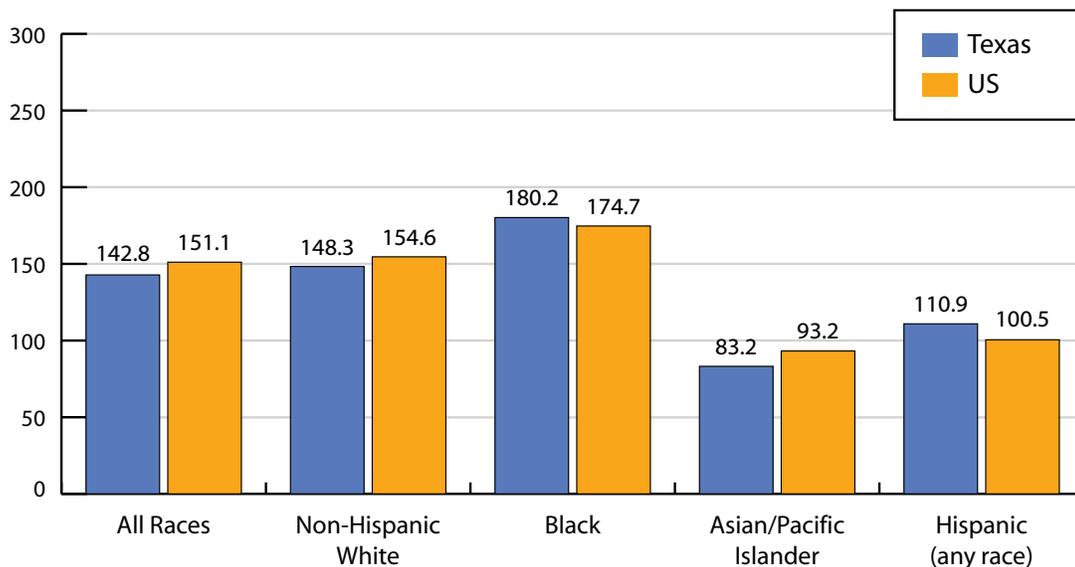
Overall cancer incidence rates in Texas for both men and women appear to be slightly lower than NCI’s SEER rates. However, differences exist by race and ethnicity. Non-Hispanic whites and Asian/Pacific Islanders in Texas have lower cancer incidence rates compared to SEER, while black males and Hispanics in Texas have higher rates than SEER (Figures 4–5). The patterns are similar for cancer mortality (Figures 6–7).

Figure 5. Age-Adjusted Cancer Incidence Rates in Males, Texas and 18 SEER* Registries, by Race/Ethnicity, 2005–2009



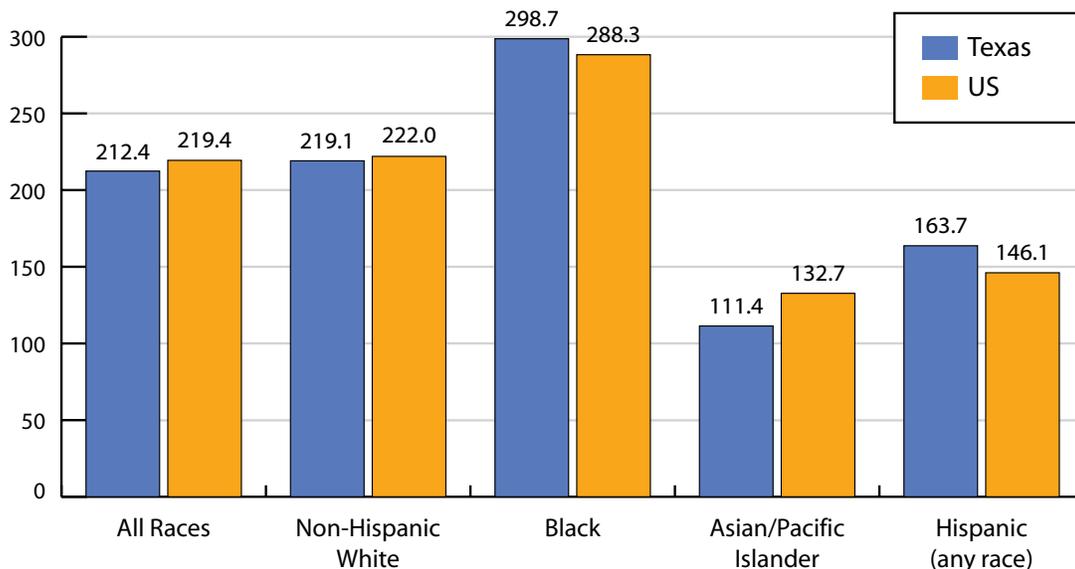
* SEER 18 Registries rates data derived from (<http://seer.cancer.gov/data/seerstat/nov2011/>) Filename: Incidence – SEER 18 Regs Research Data + Hurricane Katrina Impacted Louisiana Cases, Nov 2011 Sub. Vintage 2009 Pops (2000-2009) <Katrina/Rita Population Adjustment>.

Figure 6. Age-Adjusted Cancer Mortality Rates in Females, Texas and US by Race/Ethnicity, 2005–2009



U.S. rates data derived from (<http://seer.cancer.gov/data/seerstat/nov2011/>) Filename: Mortality – All COD, Aggregated with State, Total U.S. (1990-2009) <Katrina/Rita Population Adjustment>.

Figure 7. Age-Adjusted Cancer Mortality Rates in Males, Texas and US, by Race/Ethnicity, 2005–2009



U.S. rates data derived from (<http://seer.cancer.gov/data/seerstat/nov2011/>) Filename: Mortality – All COD, Aggregated with State, Total U.S. (1990-2009) <Katrina/Rita Population Adjustment>.

Cancer Survival

On page 6 we show the estimated cancer prevalence, or numbers of persons living with cancer, at a particular point in time. Cancer survival is presented as a rate or percentage of all the persons diagnosed with cancer during a particular time period who survive for at least a specific number of years after diagnosis, in this case 5 years. For different sites of cancer, Table 4 shows the 5-year survival. These survival rates range from 96.7% for prostate cancer to only 8.1% for pancreatic cancer.

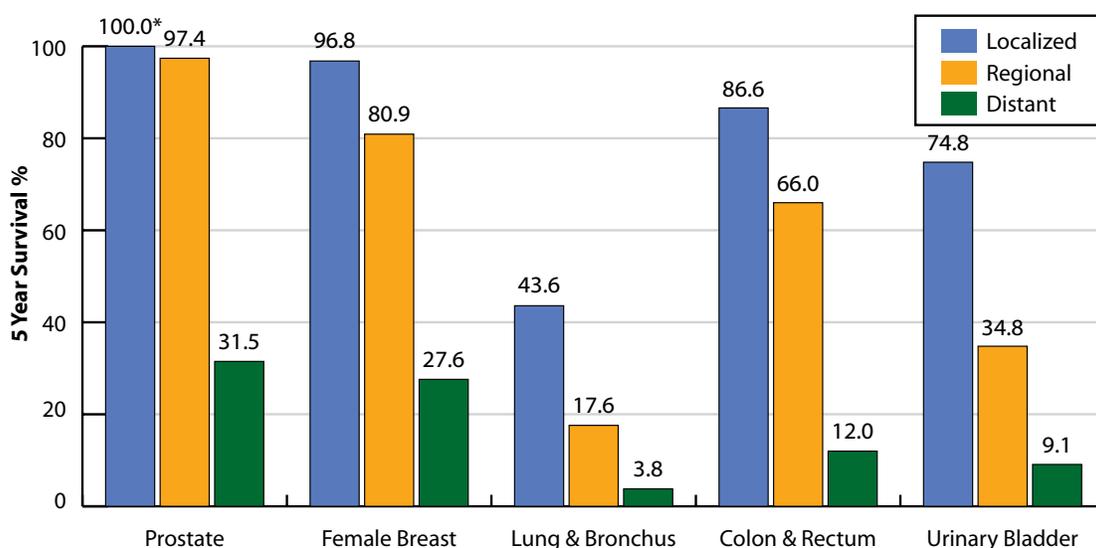
Table 4. Five-Year Relative Cancer Survival Rates in Texans, All Races, Diagnosed 1995–2009

Cancer Site	5-Year Survival
All Sites Combined	62.1%
Prostate	96.7%
Thyroid	96.2%
Testis	93.9%
Breast(Female only)	86.5%
Melanoma of the Skin	84.6%
Hodgkin Lymphoma	80.6%
Corpus & Uterus, NOS	80.4%
Urinary Bladder	75.0%
Cervix Uteri	69.0%
Kidney & Renal Pelvis	67.0%
Non-Hodgkin Lymphoma	63.4%
Colon & Rectum	62.1%
Larynx	60.1%
Oral Cavity & Pharynx	57.6%
Leukemia	54.7%
Ovary	46.0%
Myeloma	39.4%
Brain & Nervous System	39.0%
Stomach	24.9%
Esophagus	16.6%
Lung & Bronchus	15.4%
Liver & Intrahepatic Bile Duct	13.3%
Pancreas	8.1%

Actuarial method. No adjustment for heterogeneity. Expected Rates for Relative Survival are from U.S. 1970–2006 by individual year (White, Black Other [AI/PI All Races for Other Unspec 1991+ and Unknown]).Ederer II method used for cumulative expected.

Typically, the earlier a cancer is diagnosed, the greater the chance of long-term survival. Survival by stage at diagnosis is presented below, with stage categorized into localized, regional spread, and distant (metastatic) spread. Figure 8 demonstrates the importance of detecting cancer early. Except for lung and bladder cancer, the five-year survival rates for cancers diagnosed at the localized stage were close to 90% or higher. However, the survival rates for cancers diagnosed at late stage ranged from 4%–32%. Survival from lung cancer remains poor, and fewer than half of patients diagnosed with early stage lung cancer survive past five years.

Figure 8. Five-Year Cancer Survival for Selected Cancer Sites by Stage at Diagnosis (Age 20+), Texas, 1995–2009



Actuarial method. No adjustment for heterogeneity. Expected Rates for Relative Survival are from U.S. 1970, 1980, 1990, 2000 (White, Black, Other (AI/API) All Races for Other Unspec and Unknown). Cases diagnosed at autopsy only or by death certificate only were excluded from the analysis. Cases were of a first primary malignant cancer, and of known age, and of male or female sex.

*The relative cumulative survival is over 100 percent and has been adjusted. The relative cumulative survival increased from a prior interval and has been adjusted.

The distribution of selected cancer by stage at diagnosis is presented in Table 5. Most prostate and bladder cancers are diagnosed at the localized stage, in contrast to only about half of breast and one-third of colorectal tumors. Less than one-fifth of lung cancers are diagnosed at the localized stage.

Table 5. Distribution of Cancer Stage at Diagnosis for Selected Cancer Sites, Texas, 2005–2009

Cancer Site	Localized %	Regional %	Distant %	Unknown %
Prostate	71.8	8.7	3.7	15.7
Female Breast	46.4	25.5	5.0	6.0
Lung	17.9	21.7	45.9	14.4
Colon & Rectum	36.6	31.4	18.4	10.0
Bladder	80.6	6.6	3.8	9.1

Of all cancers diagnosed, malignant and in-situ.

Cause-Specific Cancer Survival by Race and Ethnicity

Table 4 presents *relative* cancer survival statistics. This type of survival statistic compares the survival of cancer patients to the survival of a similar group of persons without cancer. Although relative survival is a standard used by many organizations to track cancer survival, it is problematic for Texas due to the diverse population and the lack of appropriate life tables that show Hispanic survival. Therefore, in this section another method of cancer survival analysis (*cause-specific* cancer survival) is used that permits calculation of survival for specific race and ethnicity groups.

Cause-specific survival calculations consider only deaths from cancer, not deaths from unrelated causes. Therefore, cause-specific survival does not need to use standard life tables to compare cancer deaths with expected deaths from other causes. Cause-specific survival for major Texas race and ethnicity groups is shown in Table 6. Results tend to be similar to relative survival (Table 4, p.11) results, but are not identical. By comparing the relative survival results for all Texans (Table 4) and the cause-specific survival results (Table 6) for all races, it is possible to see the differences between these two different methods for calculating survival rates. For all sites combined, the differences are small (less than the 95% confidence intervals, not shown), and for many individual cancer sites the rates are also very similar. However, for a few sites, especially those with longer survival times, when it is more likely that the cancer patients may die from some other cause than cancer, there may be large differences between the relative survival and cause-specific survival percentages.

Table 6. Five-Year Cause-Specific Survival, for Cancers Diagnosed 2001–2008, and followed Through December, 2009, Both Sexes Combined, And by Race/Ethnicity and Primary Site, Texas

Site	Five-Year Cause-Specific Survival %				
	All Races	Non-Hispanic White	Black	Hispanic	Asian/Pacific Islander
All Sites Combined	63.0	63.3	56.1	63.1	64.1
Oral Cavity & Pharynx	61.1	63.4	45.6	57.2	68.1
Esophagus	17.2	17.9	11.2	16.9	26.7
Stomach	26.8	24.3	27.9	27.5	39.2
Colon & Rectum	61.2	62.2	54.0	60.6	66.5
Liver & Intrahepatic Bile Duct	15.2	15.9	12.8	14.0	22.3
Pancreas	7.8	7.1	5.4	10.2	15.4
Larynx	62.2	62.9	56.6	63.2	69.8
Lung & Bronchus	15.8	15.9	12.9	16.6	19.1
Melanoma	84.2	83.8	68.1	75.5	81.3
Breast (Female only)	85.1	86.8	74.7	83.6	90.8
Cervix Uteri	69.0	69.2	57.9	71.9	65.8
Corpus & Uterus, NOS	79.8	81.7	60.3	81.2	81.4
Ovary	43.0	40.5	35.2	51.3	52.1
Prostate	92.3	92.9	90.0	90.3	93.8
Testis	94.6	96.0	92.9	92.6	85.9
Urinary Bladder	74.5	75.3	59.6	73.0	78.2
Kidney & Renal Pelvis	70.3	69.8	70.1	70.8	71.1
Brain & Nervous System	40.7	35.6	48.6	50.0	57.8
Thyroid	95.7	96.2	95.3	94.5	97.0
Hodgkin's Lymphoma	83.2	83.8	78.7	82.9	89.2
Non-Hodgkin's Lymphoma	67.5	68.1	63.8	65.1	70.3
Myeloma	45.0	43.4	46.3	45.8	55.6
Leukemia	58.9	57.7	54.6	60.7	64.1

Incidence data for Hispanics and non-Hispanics are based on NHIA. Cause of death used SEER cause-specific death classification. Cases diagnosed at autopsy or death certificate only were excluded from the analysis. Cases were of a first primary malignant cancer, and of known age, and of male or female sex. Five-year cause-specific survival was calculated by actuarial method using diagnosis years 2001–2008, with follow-up through 2009.

For all sites combined, Texas blacks have a much lower cause-specific survival (56.1%) compared to non-Hispanic whites, Hispanics, and Asian/Pacific Islanders (63–64%). This discrepancy is especially pronounced for melanoma and tumors of the oral cavity and pharynx, larynx, esophagus, colon and rectum, breast, cervix, corpus and uterus, and bladder. In contrast, Asian/Pacific Islanders have better cause-specific cancer survival than other races and ethnic groups, a pattern that is especially evident for myeloma and leukemia, and tumors of the oral cavity and pharynx, larynx, esophagus, stomach, colon and rectum, liver and bile duct, pancreas, and brain and nervous system. Non-Hispanic whites have by far the worst survival from brain and nervous system tumors.

Numerous factors may influence cancer patient survival by race and ethnicity. Other factors affecting cancer survival include stage of disease at diagnosis, treatments received, residence (urban or rural), cancer site distribution in the population, cell type distribution for some cancer sites, age at diagnosis, and general health, among others. To the extent that these factors vary by race and ethnicity, they may provide at least part of the explanation for race/ethnicity differences in overall cancer survival.



Childhood and Adolescent Cancer in Texas

Each year approximately 1,200 Texas children are diagnosed with cancer and approximately 200 children die from the disease. Cancer is the leading cause of death by disease among U.S. children younger than 15 years.⁴ The types of childhood cancers diagnosed differ substantially by age and are often examined separately for children ages 0–14 years and adolescents ages 15–19 years.

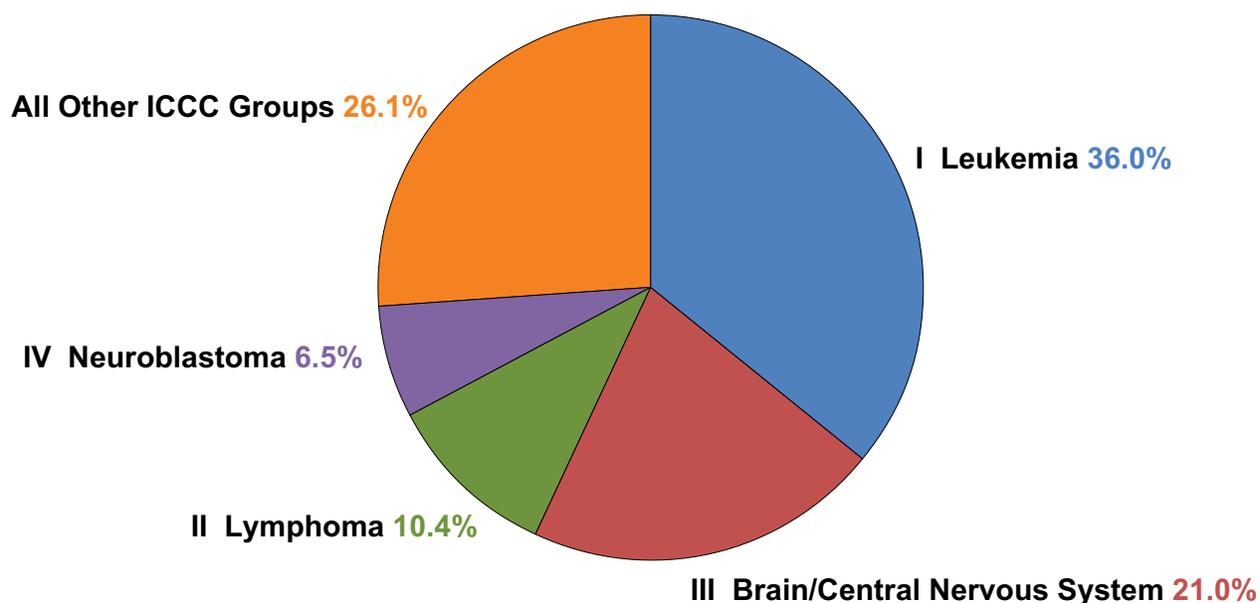
Childhood Cancer

Among Texas children (0–14 years), leukemia is the most commonly occurring cancer group (Figure 9), and comprises 36% of all childhood malignancies. Cancers of the central nervous system, involving the brain or spinal cord, are the second most commonly diagnosed, constituting 21% of all childhood cancers in Texas. The average number of cases per year and rates are presented for each International Classification of Childhood Cancer (ICCC) group in Table 7.

Adolescent Cancer

Among Texas adolescents (15–19 years) (Figure 10), the leading cancers are lymphomas, primarily Hodgkin's disease and non-Hodgkin's lymphoma, accounting for 19% of all cancers in this age group. The lymphomas are followed by leukemias (17%) and germ cell tumors, which are primarily gonadal (15%). The average number of cases per year and rates per million are presented for each ICCC group in Table 8.

Figure 9. Distribution of Cancer Types among Texas Children Aged 0–14 Years, 2005–2009*



* Roman numerals indicate category of cancer according to the International Classification of Childhood Cancer, 3rd edition (ICCC-3); <http://seer.cancer.gov/iccc/iccc3.html>.

Table 7. Average Number of Cases per Year and Average Annual Rates* of Childhood Cancer (0–14 Years), Texas, 2005–2009

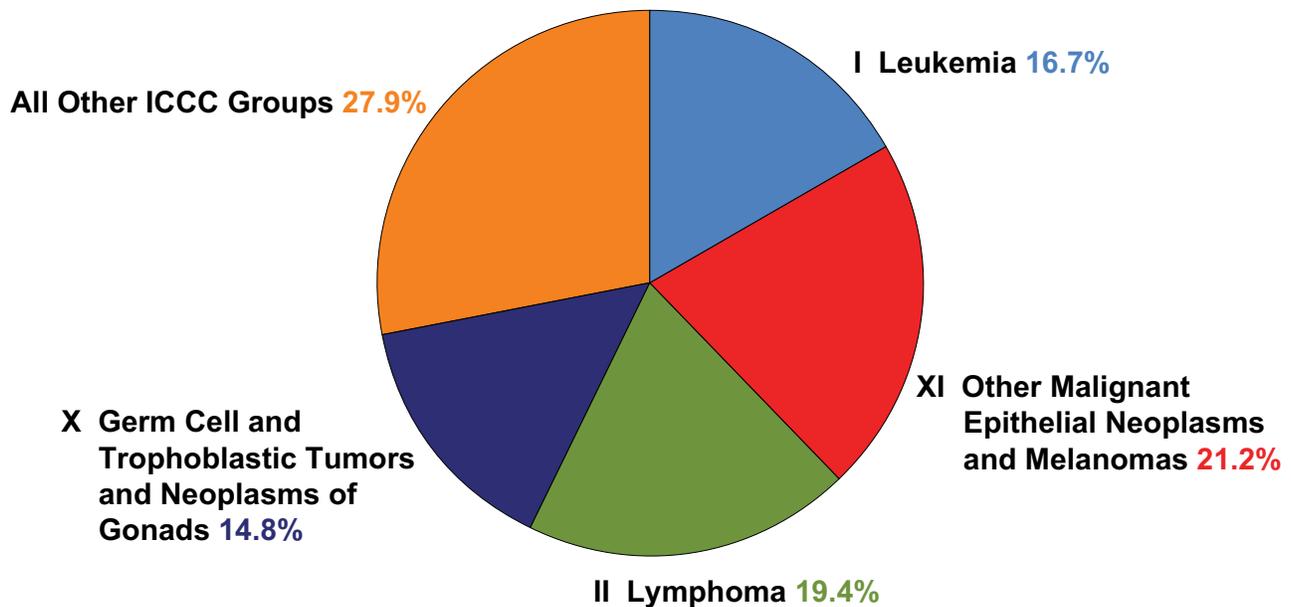
International Classification of Childhood Cancer (ICCC Group)	Average Number Cases per Year	Rate per 1,000,000
All ICCC Groups Combined	924	162.5
I Leukemias, Myeloproliferative & Myelodysplastic Diseases	333	57.9
II Lymphomas and Reticuloendothelial Neoplasms	96	17.6
III CNS and misc. Intracranial and Intraspinial Neoplasms	194	34.5
IV Neuroblastoma and Other Peripheral Nervous Cell Tumors	60	9.8
V Retinoblastoma	23	3.7
VI Renal Tumors	40	6.7
VII Hepatic Tumors	13	2.2
VIII Malignant Bone Tumors	38	7.2
IX Soft Tissue and Other Extraosseous Sarcomas	53	9.5
X Germ Cell & Trophoblastic Tumors & Neoplasms of Gonads	32	5.7
XI Other Malignant Epithelial Neoplasms and Melanomas	37	6.9
XII Other and Unspecified Malignant Neoplasms	5	0.9

* Because childhood cancer is a rare event, childhood cancer rates are usually given as rates per 1,000,000, rather than rates per 100,000, as are other cancer sites. Changing the base of the rate makes for more meaningful rates for comparison purposes.



Trends in childhood (age 0–14 years, Figure 11) and adolescent (age 15–19 years, Figure 12) cancer indicate that since 1995 the annual percent change in incidence rates has increased significantly (by 0.9% per year in children and 1.5% per year in adolescents). However, during this same period, mortality rates have been decreasing (–2.5% per year in children, statistically significant, and by –1.0% per year, not statistically significant, in adolescents). It is unclear why incidence rates have been increasing; however, advancements in treatment likely account for the observed decrease in mortality rates.⁴

Figure 10. Distribution of Cancer Sites Among Texas Adolescents Aged 15–19 Years, 2005–2009



* Roman numerals indicate category of cancer according to the International Classification of Childhood Cancer, 3rd edition (ICCC-3); <http://seer.cancer.gov/iccc/iccc3.html>.

Table 8. Average Number of Cases per Year and Average Annual Rates* of Adolescent Cancer (15–19 Years), Texas, 2005–2009

International Classification of Childhood Cancer (ICCC Group)	Average Number Cases per Year	Rate per 1,000,000
All ICCC Groups Combined	392	224.1
I Leukemias, Myeloproliferative & Myelodysplastic Diseases	65	37.4
II Lymphomas and Reticuloendothelial Neoplasms	76	43.4
III CNS and misc. Intracranial and Intraspinal Neoplasms	42	24.2
IV Neuroblastoma and Other Peripheral Nervous Cell Tumors	1	0.5
V Retinoblastoma	0	0.0
VI Renal Tumors	5	2.6
VII Hepatic Tumors	2	1.0
VIII Malignant Bone Tumors	26	14.9
IX Soft Tissue and Other Extrasosseous Sarcomas	30	16.9
X Germ Cell & Trophoblastic Tumors & Neoplasms of Gonads	58	33.3
XI Other Malignant Epithelial Neoplasms and Melanomas	83	47.4
XII Other and Unspecified Malignant Neoplasms	4	2.4

* Because childhood cancer is a rare event, childhood cancer rates are usually given as rates per 1,000,000, rather than rates per 100,000, as are other cancer sites. Changing the base of the rate makes for more meaningful rates for comparison purposes.

Figure 11. Trends in Childhood (Age 0-14) Cancer Using Three-Year Moving Average Incidence and Mortality Rates, Texas, 1995-2009

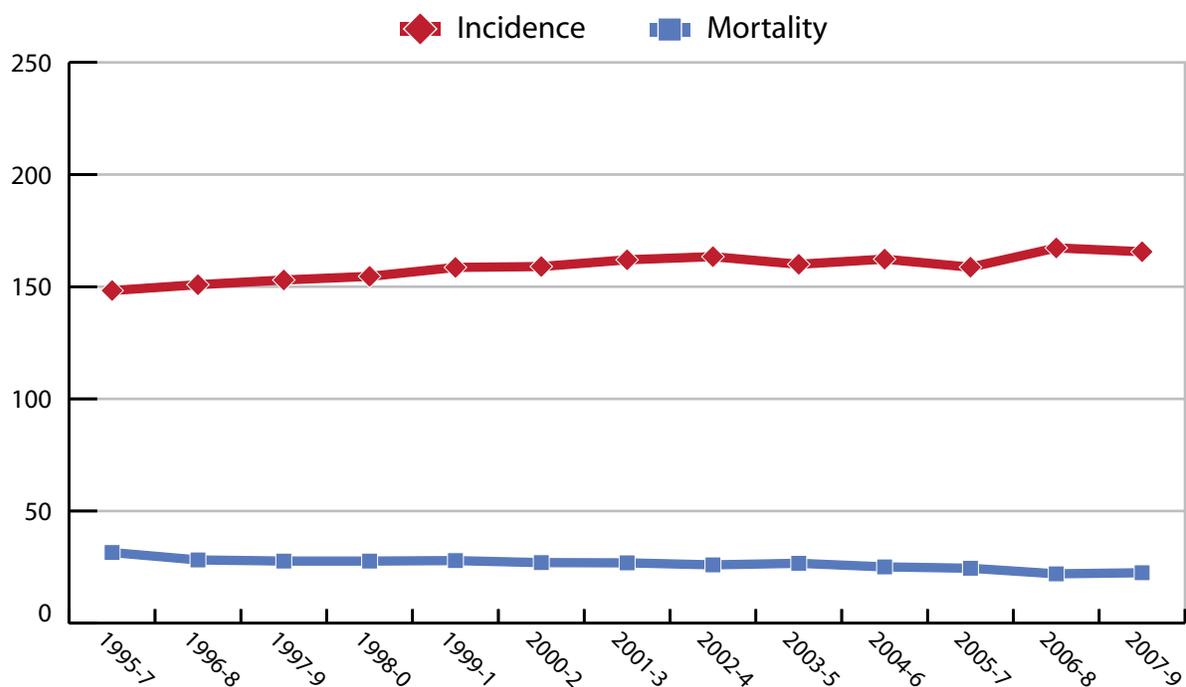
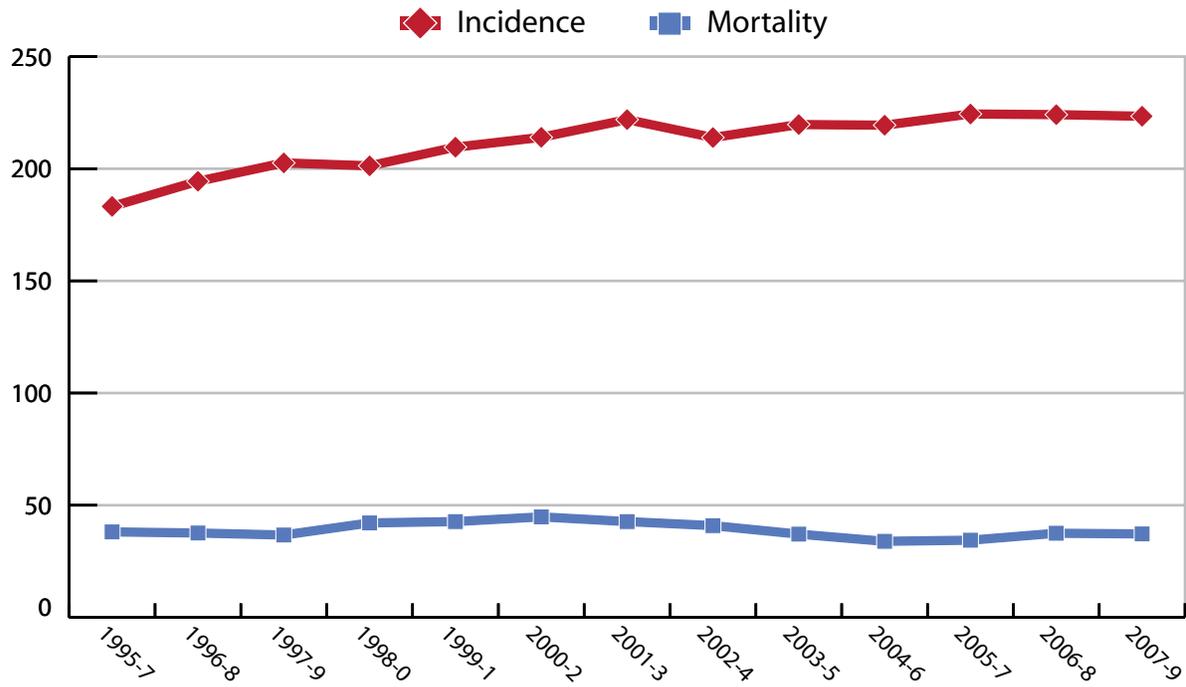


Figure 12. Trends in Adolescent (Age 15-19) Cancer Using Three-Year Moving Average Incidence and Mortality Rates, Texas, 1995-2009



*Rates are per 1,000,000 and age-adjusted to the 2000 US Standard population (19 age groups - Census P25-1130).

Use of TCR Data: A Sample of Studies and Projects

The TCR provided data to support numerous studies that impact cancer knowledge in Texas and the nation. As of October 2012, TCR data were supporting 42 active studies. In addition, there were 479 peer-reviewed papers published that include data from the TCR. The TCR also plays an important role in cancer research conducted in Texas by directly supporting studies and projects applied for and funded by CPRIT. The following are a sample of studies and publications. For a more complete list of studies and publications in which TCR data are used, please visit our website: <http://www.dshs.state.tx.us/tcr/>, and click on “How Texas Cancer Data Are Being Used”. For a complete listing of studies funded by CPRIT, please visit: <http://www.cprit.state.tx.us/funded-grants>.

Participation in National Studies

Trends in the Incidence of Cancer Among HIV-positive Adults in Texas, 1995-2007, Dr. Michael E. Scheurer, Baylor College of Medicine

Incidence of Breast and Other Cancers In Female Flight Attendants, Dr. Lynne Pinkerton, National Institute for Occupational Safety and Health, CDC

Cancer Incidence and Cancer Mortality in the World Trade Center Health Registry, Dr. James Cone, New York City Department of Health and Mental Hygiene

Black Women's Health Study: A Follow-Up Study, Dr. Lynne Rosenberg, Slone Epidemiology Center, Boston University

NIH-AARP Diet and Health Study, Dr. Yikyung Park, National Institutes of Health

Cancer Incidence in Solid Organ Transplant Recipients and End Stage Renal Cancer: The Transplant Cancer Match Study, Dr. Eric Engels, National Cancer Institute

Risk of Childhood Cancer Among Infants with Birth Defects, Dr. Sue Carozza, Oregon State University

Shifting the Focus: Addressing Breast Cancer Disparities at the Health Care Organizational Level, Marilyn Sonilal, University of Texas School of Public Health

Assisted Reproductive Technology and Risk of Cancer in Women, Dr. Barbara Luke, Michigan State University, and Dr. Logan Spector, University of Minnesota

Update of Incidence and Mortality Studies of Bladder Cancer Among Workers Exposed to O-Toluidine in a Chemical Manufacturing Plant, Dr. Tania Carreon-Valencia, National Institute for Occupational Safety and Health, CDC

Identifying Geographic and Socioeconomic Disparities in Access to Care for Pediatric Cancer Patients in Texas, Dr. Mary Austin, The University of Texas MD Anderson Cancer Center

Epidemiology of Ovarian Cancer in African American Women, Dr. Melissa Bondy, Baylor College of Medicine

Environmental Determinants of Hepatocellular Carcinoma in South Texas, Dr. Corey Sparks, University of Texas Health Science Center at San Antonio

Early Life Exposures to Air Toxins and the Risk of Early Childhood Leukemia, Dr. Elaine Symanski, University of Texas School of Public Health

Cancer and Exposure to Low Level Arsenic in Drinking Water, Dr. Billy Phillips and Dr. Gordon Gong, Texas Tech University Health Sciences Center

Forteo Patient Registry, Dr. Alicia Gilsenan, RTI Health Solutions

Selected Publications

- Bambhroliya AB, Burau KD, Sexton K. **Spatial analysis of county-level breast cancer mortality in Texas.** *J Environ Public Health*, 2012; Epub, Jan 31.
- Carozza SE, Langlois PH, Miller EA, Canfield M. **Are children with birth defects at higher risk of childhood cancers?** *Am. J. Epidemiol*, 2012 Epub, Apr 24.
- Gong G, Belasco E, Hargrave KA, Lyford C, Philips BU. **Determinants of delayed detection of cancers in Texas Counties in the United States of America.** *Int. J. Equity Health*, 2012;11:29 Epub, May 29.
- Goodman M, Naiman JS, Goodman D, LaKind JS. **Cancer clusters in the USA: what do the last 20 years of state and federal investigations tell us?** *Crit. Rev. Toxicol*, 2012 Epub, Apr 21.
- Kitahara CM, Platz EA, Park Y, Hollenbeck AR, Schatzkin A, de Gonzalez AB. **Body fat distribution, weight change during adulthood, and thyroid cancer risk in the NIH-AARP diet and health study.** *Int J Cancer*. 2012;130(6):1411–1419.
- Radin RG, Rosenberg L, Palmer JR, Cozier YC, Kumanyika SK, Wise LA. **Hypertension and risk of uterine leiomyomata in US black women.** *Hum Reprod*. 2012;27(5):1504–1509.
- Rajabi B, Corral JC, Hakin N, Mulla ZD. **Descriptive epidemiology of gastric adenocarcinoma in the State of Texas by ethnicity: Hispanic versus White non-Hispanic.** *J. Gastric Cancer*, 2012; Published on-line 18 January 2012.
- Ramirez AG, Weiss NS, Holden AE, Suarez L, Cooper SP, Munoz E, Naylor SL. **Incidence and risk factors for hepatocellular carcinoma in Texas Latinos: implications for prevention research.** *PLoS One*. 2012;7(4):e35573. Epub Apr 18.
- Shiels MS, Engels EA. **Increased risk of histologically defined cancer subtypes in human immunodeficiency virus-infected individuals: Clues for possible immunosuppression-related or infectious etiology.** *Cancer*, 2012; Epub, Feb 22.
- Simard EP, Pfeiffer RM, Engels EA. **Mortality due to cancer among people with AIDS: a novel approach using registry-linkage data and population attributable risk methods.** *AIDS*, 2012; Epub, Mar 31.
- Tian N, Goovaerts P, Zhan FB, Chow TE, Wilson JG. **Identifying risk factors for disparities in breast cancer mortality among African-American and Hispanic women.** *Women's Health Issues*, 2012.
- Wan N, Zhan FB, Lu Y, Tiefenbacher JP. **Access to healthcare and disparities in colorectal cancer survival in Texas.** *Health Place*, 2012 Mar;18(2):321–9.

Wise LA, Palmer JR, Cozier YC, Rosenberg L. **Hair relaxer use and risk of uterine leiomyomata in African American women.** *Am J Epidemiol.*, 2012;175(5):432–40.

CPRIT Funded Studies Using TCR Data

Breast Screening and Patient Navigation (BSPAN)

The BSPAN project used TCR data to help design an evidence-based patient outreach program. BSPAN's mission is to provide breast cancer screening and follow-up services to uninsured and underinsured women by providing community outreach and education, reducing both geographic and financial access barriers to mammography, and shepherding the women with abnormal mammograms through the steps leading to care.

Evaluation of TCR data indicated that Tarrant County (Fort Worth) and the five surrounding counties had the highest incidence of invasive breast cancer when compared with the rest of the state. It was also noted that access to mammography and subsequent screening rates were suboptimal. BSPAN UT-Southwestern/Moncrief Cancer Resources staff met with TCR epidemiologists and Texas Breast and Cervical Cancer Screening (BCCS) staff to discuss the best possible cancer registry data analysis and how to optimally coordinate with the BCCS program. With additional funding, BSPAN expanded the program to the six underserved north Texas counties, increasing access to breast cancer screening, diagnostic mammograms, and biopsies in the five-county area.

BSPAN has increased the numbers of breast cancers found at early, treatable stages. During the first year, 1,683 women were screened with 6.1 cancers found per 1,000 patients screened, exceeding the national average by 380%. This data-driven intervention project was also profiled by the CDC as a rural breast cancer screening success story. (For additional information, visit these links:

http://www.cdc.gov/chronicdisease/resources/publications/aag/pdf/2011/Cancer_2011_success_stories_508.pdf,

<http://www.utsouthwestern.edu/life-at/features/breast-cancer-cpritchtml>.)

Comparative Effectiveness Research

It is becoming more and more important to understand the relationship between health care treatment decisions, and the effectiveness of the resulting health outcomes. Research to answer the question, “Which treatment works best for which people and under what circumstances?” is called “comparative effectiveness research,” or CER.

In Texas, a multi-institutional cancer-related project, “Comparative Effectiveness Research on Cancer in Texas” (CERCIT), was funded by CPRIT. CERCIT is a collaborative effort bringing together cancer research experts from the University of Texas Medical Branch, MD Anderson Cancer Center, the University of Texas Health Science Center at Houston, Rice University, Baylor College of Medicine, and the Texas Cancer Registry of the Texas Department of State Health Services. This research will allow us to investigate cancer-related CER issues that have never before been evaluated.

CERCIT has four primary project categories and many sub-projects. One of the primary projects focuses on utilization of cancer screening with a unique perspective. Much research has been conducted to identify underutilization of cancer screening, but very little has been done to evaluate potential overutilization of screening. Overutilization of screening in some areas may use resources that might be better used in other areas where screening is underutilized.

This project will take advantage of Texas’ large size, rural and urban populations, and race/ethnic and economic diversity to systematically describe and evaluate cancer screening practices in Texas. Ultimately this will allow investigation of the benefits and harms associated with over- and underutilization of screening for certain cancers and help identify optimal screening practices for those cancers throughout the state.

Another valuable CERCIT project focuses on assessing the quality of cancer treatments in Texas. There is no single repository for complete cancer treatment data. The TCR collects some treatment information, but the data are not complete enough to evaluate overall cancer treatment patterns in Texas. This project links TCR data with Medicare and Medicaid claims datasets to provide the most complete picture of cancer treatment available. This will allow researchers to create a more accurate picture of patterns of care, identify potential gaps in the quality of cancer treatment, help identify areas where cancer patients are underserved, and help target resources to populations who would benefit the most. (For additional information visit this link: <http://www.txcercit.org/>.)

Accessing Texas Cancer Data

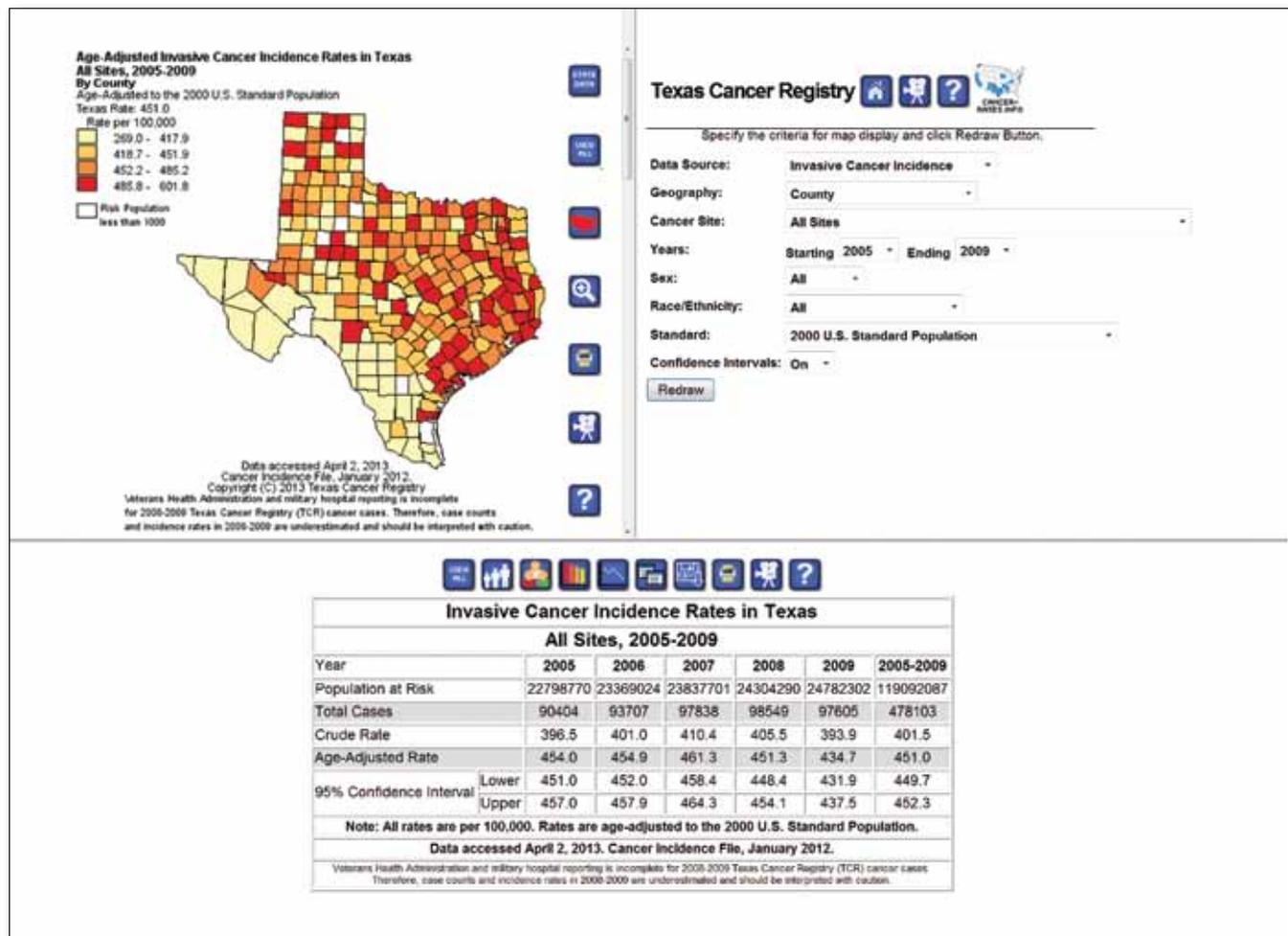
The Texas Cancer Registry has made significant efforts to make data available and accessible to anyone with an interest in Texas cancer data. TCR web pages provide cancer incidence, mortality, and survival data, fact sheets, and various reports on cancer in Texas. A web query tool is also available for individuals to quickly obtain cancer rates and counts for various levels of geography in Texas, such as county and metropolitan statistical areas (MSAs).

Texas Cancer Registry Statistical Data Web Page

<http://www.dshs.state.tx.us/tcr/data.shtm>

Texas Cancer Registry Web Query Tool

Texas cancer data may be queried using a Web Query Tool, available on the TCR website or accessed directly at <http://www.cancer-rates.info/tx/index.php>. Users can quickly obtain information about numbers of cases and incidence and mortality rates for the selected geographic region, cancer site, year, sex, and race-ethnicity.



Data Available for Research

TCR data are also used for various research purposes. Learn how to request a specialized data file or how to conduct a data linkage from the following web address: <http://www.dshs.state.tx.us/tcr/data-linkage.shtm>. Researchers may request the TCR's Limited-Use Dataset, which includes data on all cancers diagnosed in Texas residents with all identifying information removed. Information is available at: <http://www.dshs.state.tx.us/tcr/limited-use-data.shtm>. For questions or other data-related assistance, contact the TCR at: 512-305-8506 or within Texas 1-800-252-8059 (toll-free) or CancerData@dshs.state.tx.us.

Data Sources

The primary sources of case reporting in the Texas Cancer Registry are from Texas hospitals and cancer treatment centers. Additional sources include outpatient clinics, free-standing pathology labs, and other state central cancer registries when Texas residents are diagnosed or treated out of state. Cancer mortality data were extracted from electronic files provided by the DSHS, Center for Health Statistics, that contain demographic and cause of death information from Texas Vital Statistics death certificates.

Classification by Anatomic Site

Cancer incidence data are classified by primary anatomic site and histologic type, based on the International Classification of Diseases for Oncology (ICD-O-3), third edition.⁵ Site recode groups for classifying types of cancer were recoded using SeerPrep version 2.4.5 software, and these recodes are shown at: http://seer.cancer.gov/siterecode/icdo3_d01272003, obtained 08/07/2012. Cancer incidence data for children and adolescents (ages 0–19) are classified under a different system, the International Classification of Childhood Cancer (ICCC-3), that is categorized primarily by histology (cell type) rather than by anatomic site.⁶ This classification is also provided on the SEER website: http://seer.cancer.gov/iccc/iccc3_ext.html.

For cancer mortality, the TCR classifies anatomic site according to the SEER Cause of Death Recode (http://seer.cancer.gov/codrecode/1969+_d04162012/index.html). For statistical reporting of cancer mortality data, SEER has defined major site groups based on the ICD version 10.⁷ These site groups are defined consistently across time to facilitate reporting of long term trends, with earlier versions of ICD used for deaths prior to 1999. The use of these cancer site groupings follows national cancer standards, and allows Texas cancer data to be compared directly with national and other state data.

Classification by Race and Ethnicity

Race and ethnicity information for cancer cases is based primarily on information contained in the patient's medical record. This information may be supplied directly by the patient, may be determined by admissions staff or other medical personnel, and/or can be based on last name, race or ethnicity of parents, birthplace, and/or maiden name. The reporting of race or ethnicity may be influenced by the race and ethnic distribution of the local population, by local interpretation of data collection guidelines, and other factors. It is possible that some differences in race and ethnic-specific rates reflect biases of classification, rather than true differences in risk.

The race and ethnicity of each cancer patient is classified according to the categories defined in the North American Association of Central Cancer Registries (NAACCR) Standards for Cancer Registries Volume II: Data Standards and Data Dictionary.⁸ Classification of Hispanics for incidence data is based on the NAACCR Hispanic Identification Algorithm (NHIA). The race groups used in this report for generating incidence and mortality rates include the following categories: non-Hispanic white, black, Hispanic, Asian/Pacific Islander, and American Indian/Alaskan Native. The Hispanic designation can be of any race, but in 2005–2009, 97.1% of Hispanics in Texas diagnosed with cancer were of the white race. Unless persons of unknown race are coded as Hispanic (only 0.8% of Hispanics with cancer were of unknown race), they are not included in any of the race or ethnic categories, but are still included in the total for All Races. Therefore, the four categories provided in this report (non-Hispanic white, black, Hispanic, Asian/Pacific Islander) will not sum to the total for All Races. Mortality data are provided by these same categories, but the Hispanic designation is based on the death certificate's Hispanic origin question, which is answered by the informant. The informant may be next of kin, friend, funeral director, attending physician, medical examiner, justice of the peace, or other source. The above classification methods are consistent with methods used by other states and national organizations.

Age-adjusted Rates

Average annual cancer incidence and mortality rates were age-adjusted using the direct method, and 19 age groups up to age 85+. Age-adjustment enables the direct comparison of incidence or mortality rates by eliminating the effect of differences in the age-distributions between various comparison populations. Direct standardization weights the age-specific rates for a given sex, race, ethnicity, or geographic area by the age distribution of the standard population. The 2000 United States standard population was used as the standard for all calculations.

Trends in Age-adjusted Rates

Changes in cancer incidence and mortality over time can be shown by trend line graphs. For this report we examined trends in both cancer incidence and mortality (1995–2009). In Figure 11 these trends are shown using three-year moving averages of the rates. Moving averages are used because they have the advantage of increasing the stability of the rates (by using average annual rates) with a minimal loss of information, since the time periods are only incremented by single years. This not only increases stability, but also produces a smoother trend line. This is particularly useful for rates based on small numbers of cases, such as childhood cancer.

The APC (annual % change) is calculated by fitting a linear regression to the natural logarithm of the annual rates to form a trend line, using the calendar year as a predictor variable (formula: $\ln(\text{rate}) = m(\text{year}) + b$). From the slope of the regression line, m , APC is calculated as $\text{APC} = 100 * (e^m - 1)$. The APC values are given in this report as the % increase or decrease per year.

Expected Numbers of Cases and Deaths

Estimated cases are calculated by applying 2004–2008 Texas age-, sex-, and race/ethnic-specific cancer incidence rates to the corresponding 2012 Texas population, except for melanoma, breast and prostate cancers. California rates were used for these sites because of similarity between California and Texas populations and more complete California Cancer Registry case ascertainment. Estimated numbers of deaths were calculated by applying 2007–2008 Texas age-, sex-, and race/ethnic-specific mortality rates to the corresponding 2012 Texas population.

Survival Analysis

The Texas Cancer Registry completes follow-up on all incident cancer cases, allowing generation of cancer survival estimates in Texas. In this report two methods were used for adjusting cancer survival for competing causes of death. Relative Survival adjusts for other causes of death by dividing the Observed Survival by the Expected Survival, which itself is generated by using standard life tables for the U.S. population available in SEER*Stat software. Therefore, it is a measure of survival from cancer after discounting the other potential causes of death.

Cause-specific survival only counts the death if it was from the cancer site, by examining the cause of death on the death certificate. Deaths from other non-cancer causes are considered to be censored.



References

1. Siegel R, Naishadham D, Jemal A. Cancer Statistics, 2012. *CA Cancer J Clin* 2012; 62:10–29. Available: <http://onlinelibrary.wiley.com/doi/10.3322/caac.20138/full>, Accessed 10/29/2012.
2. American Cancer Society. *Cancer Facts & Figures 2012*. Atlanta: American Cancer Society; 2012. Available: <http://www.cancer.org/research/cancerfactsfigures/cancerfactsfigures/cancer-facts-figures-2012>, Accessed 10/29/2012.

3. The Perryman Group. An Economic Assessment of the Cost of Cancer and the Benefits of the Cancer Prevention and Research Institute of Texas and its Programs. 2011. Available: http://www.cprit.state.tx.us/images/uploads/cancer_cost_and_cprit_economic_impact_executive_summary_fy2011.pdf.
4. National Cancer Institute. A Snapshot of Pediatric Cancers. Available: <http://www.cancer.gov/researchandfunding/snapshots/pediatric>, Accessed 04/28/2013.
5. Fritz A, Percy C, Jack A, Shanmugaratnam K, Sobin L, Parkin D, Whelan S (eds). International Classification of Diseases for Oncology, Third Edition. Geneva: World Health Organization, 2000.
6. Surveillance, Epidemiology, and End Results, NCI. SEER Modification of Site/histology Recode Based on International Classification of Childhood Cancer, Third edition (ICCC-3) based on ICD-O-3. 2005 Available: http://seer.cancer.gov/iccc/iccc3_ext.html, Accessed 10/29/2012.
7. WHO. Manual of the International Statistical Classification of Disease, Injuries and Causes of Death. Tenth revision, ed. Vol. 1. Geneva: World Health Organization 1992.
8. Thornton M. Standards for Cancer Registries Volume II: Data Standards and Data Dictionary, Record Layout Version 12.1, 15th ed. Springfield, Ill.: North American Association of Central Cancer Registries. 2010.



Texas Cancer Registry



Publication # 10-12820
April 2013