Kronkosky Charitable Foundation

Research Brief

Cancer

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Cancer is a generic term that is used to describe over 100 different diseases. When the DNA of a cell becomes changed or damaged, mutations occur that affect normal cell growth resulting in uncontrollable cell division. Abnormal cell division oftentimes results in a mass of tissue called a tumor. When the tissue cells of the tumor remain in the same place where the cells originated and cell division simply enlarges the tumor, the condition is considered to be benign (not cancerous). Cancer occurs when the abnormally dividing cells migrate and invade other body cells. The condition is considered malignant because the migrating cells "take over" and the invaded cells die. Although tumors can be a classic symptom of cancer, not all tumors are cancerous and not all cancers form tumors (National Cancer Institute (NCI), 2015a). Cancers are generally categorized according to type:

- **Carcinoma** - cancer that begins in the skin or in tissues that line or cover internal organs
- **Sarcoma** - cancer that begins in bone, cartilage, fat, muscle, blood vessels, or other connective or supportive tissue
- **Leukemia** - cancer that starts in blood-forming tissue such as the bone marrow and causes large numbers of abnormal blood cells to be produced and enter the blood
- **Lymphoma and myeloma** - cancers that begin in the cells of the immune system
- **Melanoma** – cancer that begins in cells which develop into melanocytes, pigment in the skin
- **Central nervous system cancers** - cancers that begin in the tissues of the brain and spinal cord

(NCI, 2015a)

Leading Cancers in the U.S. and Texas

Among the various cancers, research has concluded that lung and bronchus, colon and rectum, breast (female) and prostate account for almost half of cancer diagnoses and deaths (American Cancer Society [ACS], 2019).

The most recent statistical information reported to the Texas Department of State Health Services (DSHS) regarding statewide mortality rates related to cancer covers the years from 2011-2015. Based on this data, DSHS projects a total of 44,713 fatalities due to cancer in Texas in 2018. DSHS believes that lung and bronchus cancer will continue to be the leading cause of mortality with an estimated 15,485 new cases and 11,092 deaths. Prostate and breast cancer are anticipated to have the highest incidence of new cases with approximately 13,936 and 17,566 new diagnoses respectively. DSHS predicts 3,143 women to pass away from breast cancer and 2,028 males from prostate cancer in 2018. However, the second highest number of expected deaths for the year will likely be caused by colon cancer; though only 7,978 people are estimated to be newly diagnosed with this form of cancer, 3,366 mortalities are predicted. Cancer of the pancreas appears to have the closest connection between new diagnoses and fatalities with 3,551 new cases predicted and 2,925 deaths expected for 2018 (DSHS, 2018a).

The following table lists the most recent five-year survival statistics for the state of Texas and the nation for cancers diagnosed 1995-2014, followed through December 2015. In almost all instances, U.S. survival rates are higher than those in Texas.

Five-Year Relative Survival		
	Texas %	**U.S. %**
All Sites	63.0	66.7
Breast (Female only)	86.8	89.7
Cervix uteri	68.7	70.2
Colon & Rectum	62.3	64.8
Corpus & Uterus, NOS	80.5	82.7
Kidney & Renal Pelvis	69.7	70.5
Leukemia	57.3	57.3
Liver and IH Bile Duct	15.6	16.0
Lung & Bronchus	16.4	16.9
Melanoma of the Skin	85.0	92.4
Myeloma	45.0	43.2
Non-Hodgkin Lymphoma	65.8	67.4
Oral Cavity & Pharynx	59.9	63.0
Ovary	47.4	45.9
Pancreas	9.9	6.9
Prostate	95.5	98.9
Stomach	27.1	28.0
Thyroid	97.0	97.4
Urinary Bladder	74.4	78.9
(DSHS, 2018b)		

Risk Factors

There is oftentimes no identifiable cause for cancer. Factors such as age ("80% of all cancers are diagnosed in people aged 55 and older" ACS, 2019, p.2), tobacco use, sunlight (UV rays), certain chemicals and other substances, ionizing radiation, some viruses and bacteria, hormones, family history and poor diet can all play a role. However, the existence of one or more of these factors does not guarantee a cancer diagnosis, but does heighten the risk of eventually developing cancer in the future (NCI, 2015b). While some cancers are strongly hereditary (colorectal, breast, and prostate) it is now thought that it is the interplay between common gene variations and environmental risk factors/lifestyle that lead to the genetic damage that results in cancer. In 2019, almost 19% of the estimated 740,000 newly diagnosed cancer cases will be caused by smoking. In addition, 18% of cancer cases that occur America are related to overweight or obesity, physical inactivity, and/or poor nutrition, and thus could also be prevented (ACS, 2019).

Some of the major risk factors that are strongly linked to an increased risk for specific cancers include:

- *Tobacco use* is linked to many cancers such as lung, kidney, bladder, oral cavity, esophageal, pancreatic, and stomach; it is the leading cause of preventable death in the nation. Tobacco smoke has more than 7,000 chemicals; 250 are known to cause harm, and 69 are known to cause cancer.
- *Infections* from certain viruses, bacteria, and parasites can disrupt normal cell growth, weaken the immune system, or cause chronic inflammation; increasing cancer probabilities.
  - Epstein-Barr virus is linked to lymphomas and cancers of the nose and throat
  - Hepatitis B and C viruses are linked to liver cancer
  - Human Immunodeficiency Virus (HIV) weakens the immune system, leading to increased risks of sarcoma, lymphomas, and cancers of the anus, cervix, liver, lung, and throat
  - Human papillomavirus (HPV) is linked to cancers of the penis, vagina, cervix, anus, and oropharynx
  - Heliobacter pylori is linked to gastric (stomach/esophageal) cancer and MALT lymphoma
- *Ionizing radiation* has enough energy to damage DNA ad cause cancer
- *Alcohol consumption* has been linked to increased risk of oral, esophageal, breast and liver cancers
- *Obesity* is linked to higher risk of postmenopausal breast cancer as well as colorectal, endometrial, esophageal, kidney and pancreatic cancers; Being physically active and maintaining a healthy weight may help reduce risks of some cancers.
- *Environmental* chemical exposure has been linked to lung cancer (air pollution, second hand smoke, and asbestos) and skin and bladder cancers (arsenic in drinking water)

(NCI, 2015b)

Prevention

Researchers estimate that up to two-thirds of all cancers can be prevented. The Mayo Clinic advocates some simple steps that everyone can take to prevent cancer:

- Eliminate tobacco use
- Eat healthy
- Stay active and maintain a healthy weight
- Protect yourself from the sun
- Get immunized (Hepatitis B and HPV)
- Avoid risky behaviors (HIV prevention)
- Get cancer screenings

(Mayo Clinic, 2018)

The first five goals of the Texas Cancer Plan are related to primary prevention and risk reduction of cancer through "promoting change in behavior, policy, environment, or other systems to prevent or reduce the risk of developing cancer" (Cancer Prevention & Research Institute of Texas [CPRIT], 2018, p.4). Those goals relate to the same lifestyle changes as listed above.

Treatment

There are a variety of treatment options available, depending on the type of cancer diagnosed. The basic treatments include:

- *Chemotherapy* – drug used to kill cancer cells, stop or slow the growth of cancer cells, or to kill cancer cells that have returned or spread to other parts of the body
- *Radiation therapy* – injures or destroys cells in the area being treated by damaging their genetic material, making it difficult for these cells to continue to grow and divide
- *Surgery* – in most cases, the surgeon removes the tumor and some tissue around it which may help prevent the tumor from growing back – nearby lymph nodes may also be removed

(NCI, 2017)

Treatment generally depends upon the spread of the cancer at the time of diagnosis. Localized cancers respond well to surgery and radiation, which are focused treatments aimed at removing and destroying cancer cells, respectively. Treatments are often used in conjunction with each other; for example, surgery performed prior to radiation in an effort to improve the effectiveness of radiation treatment or radiation used before surgery to shrink the size of a tumor and thereby reduce physical disfigurement (NCI, 2017).

Chemotherapy is given as a combination of drugs that work together to destroy cancer cells. The primary advantage of chemotherapy is that it treats the entire body, not a localized area. Since cancer cells can spread from the primary site through blood or lymph vessels to secondary sites, localized treatments may not be thorough enough to cure the cancer that is diagnosed. However, chemotherapy attacks both cancerous and normal cells (ACS, 2016).

Although chemo, radiation and surgery have been the traditional courses of treatment, newer treatment options such as targeted therapy (where drugs attack specific cancer cells), and immunotherapy (also called biological therapy, helps the immune system attack cancer cells), can be used to work with the chemo and radiation, or used as a primary source of treatment. Numerous other therapy options exist including: hormone therapy, stem cell transplant, and precision medicine (treatments based on a genetic understanding of their disease). Many more cancer treatments, such as gene therapy, are still in clinical trials and not yet available to everyone (Mayo Clinic, 2017; NCI, 2017).

Cost for Cancer Treatment

One of the biggest expenses associated with cancer is the treatment itself. "The Agency for Healthcare Research and Quality estimates that the direct medical costs (total of all health care expenditures) for cancer in the US in 2015 were $80.2 billion. Fifty-two percent of those costs were for hospital outpatient or office-based provider visits, and 38% were for inpatient hospital stays" (ACS, 2019, p.9). In Texas, the 2018 direct medical costs and costs for morbidity and mortality losses were $40.3 billion. Additionally, estimates for cancer cost to the Texas economy were $212.2 billion in reduced annual spending; $104.6 billion in output losses, and 1,064,595 jobs lost due to

morbidity and mortality. The Texas government spends more than $1.1 billion in health-related expenditure related to cancer treatments through the CHIP, Medicaid, Teacher Retirement and Employee Retirement systems (CPRIT, 2019, p.18).

The individual cost of cancer can be devastating to the patient and his/her family. A study conducted in 2017 interviewed 300 insured cancer patients. The researchers found that 16% "reported high or overwhelming financial distress". Interviewed patients, on average, pay 11% of their total household income towards cancer-related health costs. These costs have a negative impact on the quality of cancer care since patients have to make significant lifestyle changes and spend less on necessities: food, clothing, & prescriptions (Chino, et al., 2017).

Another factor making health care expensive is the cost of new cancer treatments. These new treatments typically drive up the cost of prescription drugs and health care becomes less accessible. Due to the disparity in the health care system, those who cannot afford to pay for their care end up with higher medical costs, poorer outcomes, and could possibly face premature death. These people are "2.5 times as likely to declare bankruptcy as healthy people" and are "80 percent more likely to die" (Moore, 2018).

Social and Emotional Impacts of Cancer

It is estimated that 70% of cancer survivors experience depression at some point in their treatment. Depression in a cancer patient can be difficult to diagnose because it mirrors many symptoms of cancer treatment, including weight loss, fatigue, insomnia, and inability to concentrate. It has also been found that symptoms of depression were associated with a shorter survival time (University of Texas MD Anderson Cancer Center, 2019).

In many cases the social aspect can be as daunting as the emotional. It is not uncommon for cancer survivors to experience amputations, disfigurement and loss of organs like the colon or bladder. How other people react to someone's illness is perhaps the biggest challenge faced by cancer survivors. Re-entering social and professional life can often be difficult. Many times, worries of infection, not having enough energy to get through a workday; and anxiety about not being able to think clearly because of "chemobrain" or memory loss can make the transition from patient to ordinary person stressful (University of Texas MD Anderson Cancer Center, 2019).

Survivorship

"Due to advances in early detection and treatment, today there are more cancer survivors, living longer after diagnosis, than ever before" (CPRIT, 2018, p.18). Although the diseases are treated, many are left impaired both physically and mentally. A recent study reported that cancer survivors had significantly overall lower health-related quality of life (HRQoL) than the general population. A standardized instrument found that the survivors' mean score was 69.0, while the general population scored 88.8. The need to identify and rehabilitate impairments and disabilities that result from cancer treatment is often unrecognized or ignored by medical providers (Medeiros, et al., 2015). Providing "survivorship programs and services such as patient navigation, treatment and care plans, culturally and linguistically appropriate outreach and education, and effective symptom management" (CPRIT, 2018, p.18) is a critical component of the Texas Care Plan.

The Future

The future for research and prevention continues to broaden both on a national and state level. The Cancer Genome Atlas (TCGA), a project of the National Institutes of Health (NIH), was created to "generate comprehensive, multi-dimensional maps of the key genomic changes in major types and subtypes of cancer." The Atlas aims utilize these maps and further develop "better strategies for diagnosing, treating, and preventing cancer" (NIH, 2019).

In 2007, the Texas legislature approved the establishment of the Cancer Prevention and Research Institute of Texas (CPRIT, 2018). Through August 2018, CPRIT has "invested $2.15 billion in 1,317 of the best ideas in cancer research, product development and prevention. These investments are building a vibrant life sciences and prevention infrastructure and have enhanced Texas' competitive edge in the global fight against cancer" (CPRIT, 2019, p.15).

Despite the decline of cancer incidence and mortality in recent years, it still remains a prevalent threat today. Researchers feel that with enough funding there is the possibility of a cure in the coming years. Until then, prevention, awareness, early detection, and effective treatment will be the only means of preventing or treating someone with cancer. In order "to successfully address the challenges of managing cost effectiveness and improved access to promising new treatments, partnerships between industry, governments, academic institution and patient advocacy groups will be critical" (Varian, p5).

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