The Impact of Cancer on Knox County, Tennessee Residents from 2010 to 2014

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Knox County Health Department

Every Person, A Healthy Person

Executive Summary

- The average, age-adjusted rate for new cases of cancer among Knox County, Tennessee residents between 2010 and 2014 was 464.9 per 100,000 pop. (approximately two thousand cases per year).
- Knox County males (534.7 per 100,000 pop.) were more likely to be diagnosed with cancer compared to Knox County females (416.4 per 100,000 pop.) between 2010 and 2014.
- In 2014, 7.4% of Knox County adults reported they had been diagnosed with a form of cancer other than skin cancer at some point in their lives (approximately 25,000 adults).
- Almost nine percent (8.6%) of Knox County adults reported they had been diagnosed with skin cancer during their lifetime (approximately 29,000 adults) in 2014.
- In 2014, 21.2% of Knox County adults reported they were currently smoking and 21.4% of Knox County adults reported low physical activity levels, both potential risk factors for cancer.
- Cancer screening rates within recent years tends to range from 60% to 85% depending on the test and the demographic group being evaluated.
- Exposures from radon, certain fibers such as asbestos, 'tars' and other by-products from the combustion of certain materials, and workplace exposures to certain metals and chemicals have all been linked to increase risk for certain cancers.

Purpose of this report

This report seeks to assess the effect that the many forms of cancer, also known as neoplasms or malignant neoplasms, have on Knox County, Tennessee residents. It is hoped that community organizations dedicated to reducing the burden of cancer on community residents will use this information as a source for targeting their future efforts and campaigns.

Cancer Defined

The Centers for Disease Control and Prevention (CDC) defines cancer as a disease in which "abnormal cells divide without control and can invade other tissues" (CDC, 2016, February 3). Cancer cells may form solid masses in the body called tumors or they may enter the blood stream where they can do different forms of damage. Some tumors may be benign, often growing slowly, and may not spread to other tissues. Benign tumors do not always present danger to the patient unless they occur in sensitive areas such as the brain, eyes or spinal cord. Unlike benign tumors, cells from malignant tumors can travel to other parts of the body and begin new tumors (National Cancer Institute, 2015, February 9). There are over 100 known forms of cancers (NIH, n.d.). Common treatments for cancer include surgery, radiation, hormone therapy and chemotherapy.

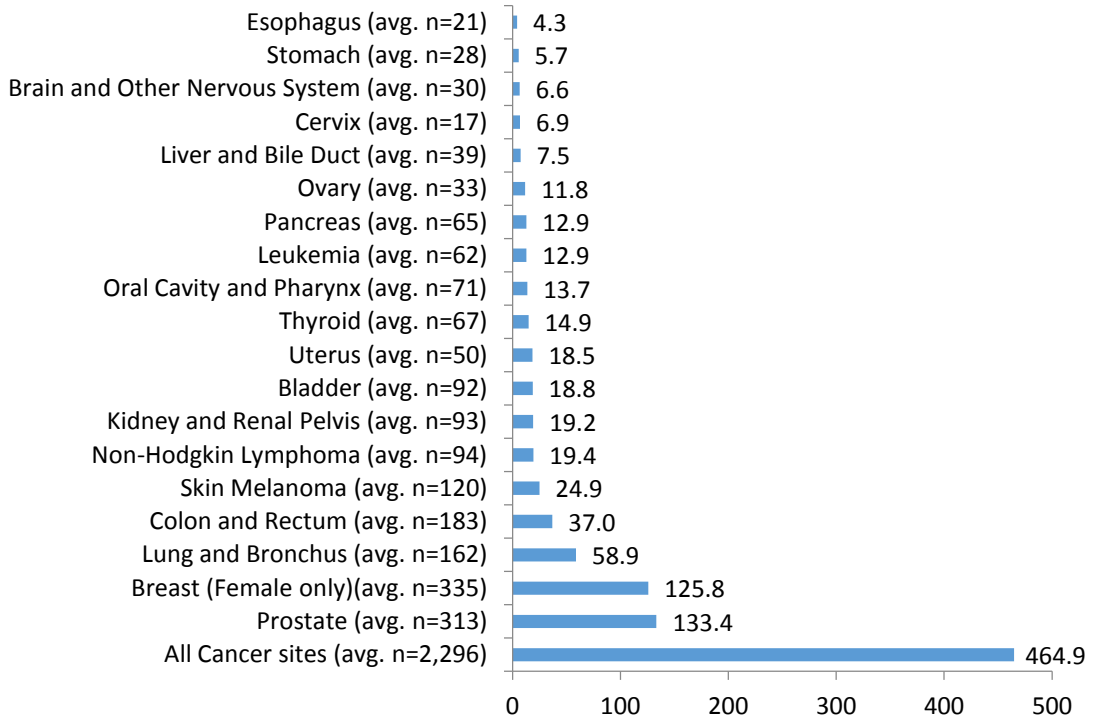
The causes of cancer are complex and vary with the type of cancer being discussed. It is believed that cancer may be caused by both internal variables such as genetic mutations, hormones and immunity conditions and external forces such as tobacco use, infectious disease, and exposures to cancer-causing agents in the environment such as radon gas, certain pesticides, heavy metals or vinyl chloride (Friis and Sellers, 2004).

New diagnoses of cancer in Knox County (incidence)

Estimates of the number of new cases of cancer each year in Knox County (incidence rate) are available from the State Cancer Profiles database hosted by the National Cancer Institute, a subsidiary of the CDC. Limited to invasive cancers only, the database uses a variety of sources to compute new cases of cancers. Between 2010 and 2014, Knox County had an average of 2,296 new cases of cancer per year (an age-adjusted average rate of 464.9 per 100,000 population) according to the National Cancer Institute **(Figure 1)**.

Figure 1 shows Knox County's average age-adjusted incidence (new cases) rates per 100,000 for cancer between 2010 and 2014 for Knox County residents.

Figure 1: Average age-adjusted incidence rates per 100,000 population for new cancer diagnoses among Knox County residents by cancer site: 2010-2014



Source: State Cancer Profiles Incidence Rates Table, National Cancer, Institute Website

Table 1 shows the top five types of new cancer diagnoses (incidence) in Knox County by the type of cancer in an average year between 2010 and 2014 by gender.

Table 1: Top five types of annual incidence rates for cancer per year (averaged during the years from 2010 to 2014) in Knox County by gender: Average rates per 100,000 pop.

	Males		Females
1	Prostate: 133.4	1	Breast: 125.8
2	Lung and Bronchus: 88.1	2	Lung and Bronchus: 58.9
3	Colon and Rectum: 42.6	3	Colon and Rectum: 32.8
4	Bladder: 33.5	4	Thyroid: 22.4
5	Skin Melanoma: 32.2	5	Skin Melanoma: 20.0

Source: State Cancer Profiles Incidence Rates Table, National Cancer, Institute Website

As seen in Table 2, Knox County males (overall cancer rate = 534.7 per 100,000) had an overall higher incident rate (reported new cases) for cancers compared to Knox County females (overall cancer rate = 416.4 per 100,000) in Knox County from 2010 to 2014. In addition, Knox County males tended to have higher incidence rates compared to females for the most frequent forms of cancer from 2010-2014 (Table 2).

Table 2. Top ten forms of non-gender specific cancers in which Knox County males had higher rates compared to Knox County females from 2010 to 2014: Average incidence rates per 100,0000 population

	Males **Incidence Rate per 100,000 pop. (CI)**	**Females** **Incidence Rate per 100,000 pop. (CI)**
All Cancer Sites	534.7 (520.8-548.9)	416.4 (405.3-427.8)
Lung and Bronchus	88.1 (82.4-94.1)	58.9 (54.8-63.1)
Colon and Rectum	42.6 (38.7-46.7)	32.8 (29.7-36.0)
Skin Melanoma	32.2 (28.8-35.9)	20.0 (17.5-22.7)
Bladder	33.5 (29.9-37.3)	8.3 (6.8-10.0)
Kidney & Renal Pelvis	25.1 (22.2-28.4)	14.4 (12.4-16.6)
Non-Hodgkin Lymphoma	22.7 (19.8-25.8)	16.8 (14.7-19.2)
Oral Cavity & Pharynx	21.2 (18.6-24.1)	7.3 (5.9-8.9)
Leukemia	16.5 (14.1-19.2)	10.1 (8.4-12.0)
Pancreas	14.8 (12.6-17.4)	11.5 (9.8-13.4)
Liver and Bile Duct	12.4 (10.4-14.6)	3.5 (2.4-4.7)

Source: State Cancer Profiles Incidence Rates Table, National Cancer, Institute Website

One exception to this trend was thyroid cancer. Knox County females (rate = 19.6 per 100,000 pop.) had a higher 2010-2014 incidence rate for thyroid cancer compared to Knox County males (7.2 per 100,000 pop.).

Table 3 shows top five 2010-2014 incidence rates for Knox County by race, limited to white (including Hispanic white) and African American (including Hispanic black) residents which together made up 94.3% of Knox County's population in 2010 (Tennessee HIT website). There were no significant differences for the overall cancer rate for whites, including Hispanic (rate = 468.2 per 100,000 pop.) and African Americans, including Hispanic (rate = 447.4 per 100,000) in Knox County from 2010 to 2014. One

exception to this was prostate cancer with the 2010-2014 average rate for African American (including Hispanic) men at 169.0 (CI: 140.7-201.2) and white (including Hispanic) men at 130.9 (CI: 124.0-138.1) as seen in Table 3.

Table 3: Top five types of annual incidence rates for cancer per year (averaged during the years from 2010 to 2014) in Knox County by race (white and black or African American populations): Rates per 100,000 pop

	White (including Hispanic)		African American (including Hispanic)
1	Prostate: 130.9	1	Prostate: 169.0*
2	Breast (Female): 124.5	2	Breast (Female): 141.6
3	Lung and Bronchus: 71.5	3	Colon and Rectum: 41.8
4	Non-Hodgkin Lymphoma: 19.6	4	Kidney and Renal Pelvis: 17.8
5	Kidney and Renal Pelvis: 19.5	5	Non-Hodgkin Lymphoma 16.3

*Significantly higher at $p < .05$ compared to the white estimate. All other estimates do not indicate a significant difference.

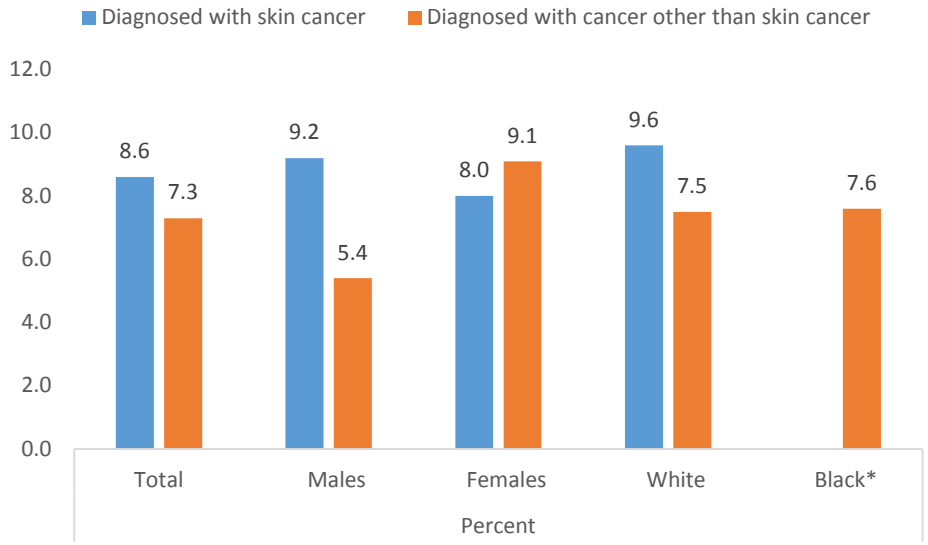
Source: State Cancer Profiles Incidence Rates Table, National Cancer, Institute Website

Cancer survivorship in Knox County

Administered approximately every 3 to 5 years among Knox County adults, the Knox County Behavioral Risk Factor Survey provides a convenient way to estimate the number of adults (18+ years) who have been diagnosed with cancer at some point in their lives. Seven percent (7.3%) of Knox County adults reported they had been diagnosed with cancer other than skin cancer at some point in their lives in 2014 **(Figure 2).** This translates to an estimated 25,000 Knox County adults that had been diagnosed with cancer other than skin cancer that have survived their cancer or are currently living with their cancer. As seen in Figure 3, at 9.1%, in Knox County, women were more likely to report this diagnosis compared to men (5.4%) while white (7.5%) and African American or black adults (7.6%) in Knox County did not show any significant differences in their response to this variable.

Almost nine percent (8.6%) of the sample or approximately 29,000 Knox County adults in 2014 reported they had been diagnosed with skin cancer at some point in their lives **(Figure 2).**

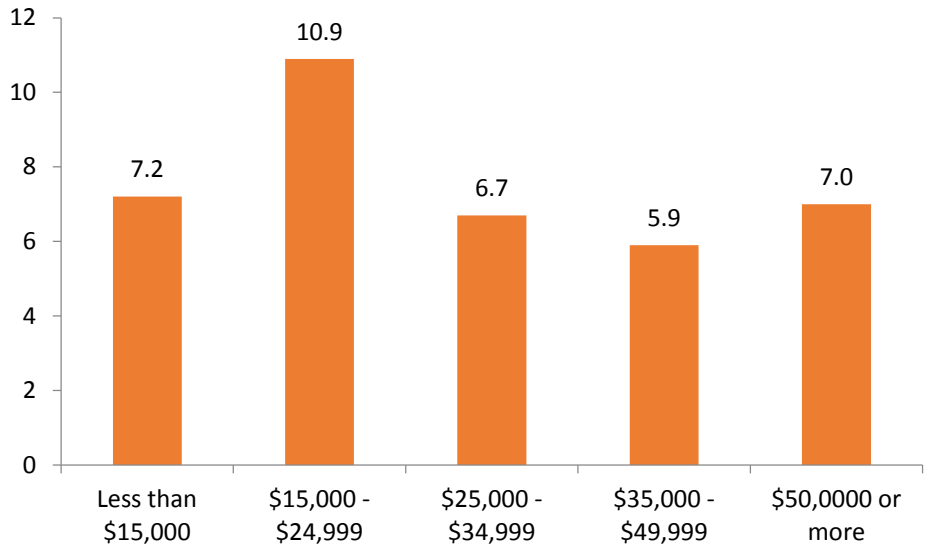
Figure 2: Percentage of Knox County adults (18+ years) reporting they had been diagnosed with (1) skin cancer and (2) other forms of cancer during their lifetimes in 2014



**Black or African American respondents reported too few cases of skin cancer to report a rate in 2014.*
Source: 2014 Knox County Behavior Risk Factor Survey

Cancer diagnoses, other than skin cancer cuts across all income levels **(Figure 3).**

Figure 3. Percentage of Knox County adults (18+ years) diagnosed with cancer other than skin cancer by income group, 2014



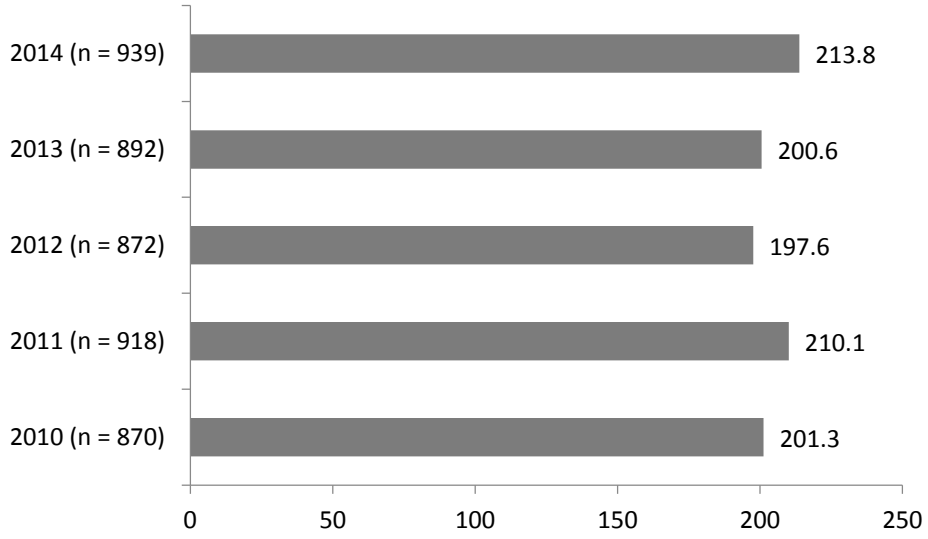
Source: 2014 Knox County Behavior Risk Factor Survey

Deaths in Knox County due to cancer

Cancer is the second leading cause of death in the United States behind heart disease and the number one cause of deaths among adults 45-64 years of age (CDC, 2016, February 25). The 2008-2012 age-adjusted mortality rate for all forms of cancer in the United States is estimated at 171.2 per 100,000 (ACS, 2016a). However, the CDC's '*Annual Report to the Nation on the Status of Cancer 1975-2012'* states that the overall death rates due to cancers has been dropping an average of 1.5% each year from 2003 to 2012 in the United States (CDC, 2016, March 9). This report suggests that efforts toward targeted behavior modifications such as (1) reducing tobacco use, (2) increasing exercise, and (3) avoiding sun exposure, along with (4) innovations in cancer screening tools, and (5) improved treatments were responsible for reducing the mortality (death) toll of cancer in the nation.

In 2014, there were 939 mortalities in Knox County with cancer listed as the primary cause of death (Health Information Tennessee, 2017, November 2). Cancer is also the second most frequent cause of death in Knox County with heart disease (all forms) remaining number one. Knox County's cancer mortality rates have remained static from 2010-2014 **(Figure 4).**

Figure 4. Cancer-related mortality rates per 100,000 pop. among Knox County residents, 2010-2014



Source: Tennessee Health Information Tennessee Website

Risk behaviors for cancer

Tobacco use, heavy alcohol use, excess body fat, excess sun exposure, and contracting certain diseases such as human papillomavirus (HPV), hepatitis B and hepatitis C are all believed to significantly increase one's risk for certain forms cancers. In addition, a family history of cancer diagnoses increases the risk for cancer in the individual (ACS, 2016).

Based on self-reported data from multiple years of the Knox County Behavioral Risk Factor Survey, an estimated one out of five Knox County adults (aged 18+) reported they are currently smoking, one out of five reported they have not exercised (outside of work) in the past 30 days, and one out of four are obese (based on their height and weight) as seen in Table 4. In addition, five percent of Knox County adults report heavy alcohol use (more than 2 drinks per day for men or more than 1 drink per day for women) and three percent report current smokeless tobacco product use **(Table 4).** These behaviors have remained fairly stable during each survey year. Reductions in these behaviors/conditions may help reduce the incidence levels (numbers of new cases) of cancer in Knox County.

Table 4. Behaviors associated with higher cancer risks reported by Knox County adults in 2014: Percentages

	2002	2005	2008	2011	2014
Current smoker	25.6	22.1	21.5	17.8	21.2
Current smokeless tobacco user	NA	NA	NA	3.9	3.4
Current heavy alcohol user*	5.8	6.3	4.7	4.2	5.0
No physical exercise outside of work in past 30 days	NA	27.8	23.7	21.1	21.4
Obese adults (30.0 BMI or greater)	21.1	24.4	28.3	27.6	28.6

*Heavy alcohol use is defined as more than two drinks per day for men and more than one drink for women

Sources: 2002, 2005, 2008, 2011, 2014 Knox County Behavioral Risk Factor Surveys

Certain cancer screenings such as colonoscopy, digital rectal exams, PSA tests, HPV tests, breast and testicle self-exams, mammograms, and pap tests have proven to be effective tools for making early diagnoses of some forms of cancers and maximizing the efficacy of treatment practices (ACS, 2016). Table 5 illustrates the percent of Knox County adults reporting they had these screenings within recent years.

Table 5: Cancer screening behaviors reported by Knox County adults in 2014: Percentages

	2005	2008	2011	2014
All adults (50+ years) -Colorectal exam	63.6	70.9	73.0	73.2
All adults-(50+ years) Home blood stool test in past 2 years	NA	34.5	28.6	19.2
Women 18+ Cervical cancer screen/Pap test in past 3 years	86.7	84.0	82.3	80.0
Women 50+ Clinical breast exam in past 12 months	74.0	68.8	67.2	71.1
Women 40+ Mammogram in past two years	84.4	82.3	77.1	76.7
Women 50+ Mammogram in past two years	84.8	84.0	82.4	80.2
Men 40+ PSA test in past two years	NA	60.7	58.7	50.4

Sources: 2005, 2008, 2011, 2014 Knox County Behavioral Risk Factor Surveys

Environmental cancer risks

In addition to the behaviors noted above that can increase cancer risk, exposures to certain natural or man-made chemicals can increase the risk for specific cancers:

- Radon and other sources of radiation

Radon is a naturally-occurring invisible, tasteless, odorless but radioactive gas formed in the earth when uranium breaks down into lighter elements (radioactive decay). Since it is a gas, it works its way to the surface of the earth through cracks and openings in rocks, and if a building is located where it reaches the surface, it may enter and collect in the building, exposing those inside. Radon exposure is the second-leading cause of lung cancer after tobacco use (Environmental Protection Agency, 2013), and buildings in Knox County are at elevated risk of having radon concentrations above those considered safe by the US EPA (Environmental Protection Agency, 2015) due to the type of bedrock in this area and the porous limestone above it. Testing for radon is inexpensive (or free: residents may request a kit from the Tennessee Department of Environment and Conservation) and buildings found to have elevated radon levels can be made safe by improving ventilation and sealing cracks below ground level. Any source of ionizing radiation, from medical x-rays to flying at high altitudes, can damage the DNA in our bodies and carries a small but real increase in cancer risk. While these exposures cannot be totally avoided in everyday life, it is good to be aware of them and minimize such exposures when possible.

- Fibers, fine particles, and dusts

For many years, the fibrous, fireproof mineral asbestos was widely used to reduce fire risks in the home and workplace. However, breathing in the fibers can increase the rates of lung cancer and mesothelioma, a cancer of the linings of the lungs and abdominal cavity. Asbestos exposures account for the largest percentage of occupational cancers, with the risk being compounded if the worker also smokes. While most uses of asbestos have been banned, almost everyone has been exposed to asbestos at some point in their life. Workers in construction, electricians and carpenters are most likely to be exposed to asbestos on the job today. Exposure to silica dust in mining or sandblasting, and exposure to wood dust in sanding or manufacturing furniture are two additional workplace exposures associated with increased cancer risks (National Institutes of Health, 2003).

- Products of Combustion

A number of chemicals that are produced as a result of burning are capable of causing cancer. The “tar” discussed in connection with tobacco use contains compounds called PAHs (polycyclic aromatic hydrocarbons) which are potent carcinogens. These compounds are also present in diesel exhaust and are present in foods that are smoked, barbecued or charcoal-broiled, roasted coffee and sausages. Studies show increased incidence of lung, skin, and urinary cancers in humans exposed to PAHs. Burning materials that contain chlorine (like electrical fires that burn plastic wiring insulation) can form dioxins, which are another group of cancer-causing compounds. Because they break down very slowly and are dispersed throughout the global environment, everyone has traces of dioxin in

their bodies. Changes in workplace practices from trash incineration to metal smelting (extraction from ore) and bleaching paper pulp have reduced workplace exposures compared to decades ago (National Institutes of Health, 2003).

- Workplace carcinogen exposures

A number of metals are associated with specific types of cancers for workers in a range of industries. These include arsenic, beryllium, cadmium, chromium, lead and nickel. While several industrial solvents are suspected of causing human cancer, only benzene has been proven to do so to date. Other workplace chemicals that are known carcinogens include vinyl chloride (used to make plastics, although the resulting plastic polymer is not carcinogenic) and benzidine, used in dying leather, paper and textiles, and associated with bladder cancer since the 1920s. Agricultural workers may be exposed to carcinogens ranging from aflatoxin, a natural carcinogen produced by fungi, to pesticides. Of the nearly 900 active ingredients in registered pesticides in the United States, about 20 have been found to be carcinogenic in animals, although not all have been tested (National Institutes of Health, 2003). Workers should review the safety data sheets for the chemicals they are exposed to on the job to check for proper safety precautions to avoid health risks on the job. In the healthcare industries, some immunosuppressive drugs given to transplant recipients are carcinogenic, and long-term use of some estrogens have been linked to cancer. Everyone should always discuss potential side effects of all medications with a doctor or pharmacist when using prescription drugs.

Implications for the Community

The findings in this report suggest that the incidence of cancer among Knox County residents may be reduced in a number of ways. Curbing risk behaviors such as smoking, excessive drinking, spending too much time in the sun without adequate protection, and reducing obesity levels may be key to bringing down the number of cancer diagnoses and mortalities from many types of cancers in Knox County.

While greater understanding and improved regulations have resulted in significant decreases in exposures to environmental carcinogens in recent decades, more work needs to be done to reduce the backlog of suspected carcinogens for which testing is incomplete. And since all exposures to carcinogens cannot be avoided – sunlight itself can cause skin cancer and airborne PAHs are present to some degree in the air everywhere, while some exposures, like x-rays and certain medications may be worth the risks due to other benefits resulting from the exposure – research into the biochemical mechanisms by which cancer occurs and can ultimately be controlled must continue as well.

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Questions on this report?

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