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Summary Report of
Texas Department of State Health Services Investigation of
Specific Cancer Occurrences
Within Zip Code 78839, Crystal City
Zavala County, Texas

Covering 1999–2008

Background

Concern about a possible excess of cancer diagnoses prompted the Texas Department of State Health Services (DSHS) to re-examine the occurrence of cancer in zip code 78839, Crystal City, Texas. Local citizens were concerned that past exposures to arsenic, toxaphene, and DDT from the Crystal City airport remediated site may be causing cancer. Previous cancer cluster investigations #09016 and #06057, which had shown a liver cancer excess in males, could now be updated.

To determine if selected cancers occurring in previous years were elevated, DSHS evaluated 1999–2008 incidence data for cancers of the bladder, pancreas, kidney and renal pelvis (area at the center of the kidney), prostate, liver and intrahepatic bile duct (within the liver), colon and rectum, lung and bronchus, and thyroid. Cluster analyses require complete statewide cancer data and the Texas Cancer Registry (TCR) is complete through 2008. Incidence data are the best indicator of the occurrence of cancer in an area because they more accurately show the number and types of cancer diagnosed each year than mortality data. Texas cancer incidence data currently meet national standards for timeliness and data quality. This report presents information on the investigation of specific cancer occurrences in Crystal City, the investigative methods used, results, recommendations, and general information on cancer risk factors.

Investigation Methodology

According to the National Cancer Institute (NCI), a cancer cluster is a greater than expected number of cancers among people who live or work in the same area and who develop or die from the same cancer within a short time of each other. A cancer cluster investigation is designed with the specific intention of addressing the question, "Is there more cancer in the area or population of concern than we would expect?" While these types of investigations can be used to investigate whether the amount of cancer in a community is more than expected, they cannot determine either the cause of the cancers or possible associations with any risk factors.

DSHS follows guidelines recommended by the federal Centers for Disease Control and Prevention (CDC) for investigating cancer clusters[1]. If DSHS finds more cancer than expected or if rare or unlikely cancers are found in unusual age groups, various factors are considered to determine whether further study could identify a likely cause. Very few cancer cluster investigations in the United States proceed to this stage.

To determine whether a statistically significant excess of cancer existed in the geographic areas of concern, the number of observed cases was compared to what would be "expected" based on the state cancer rates. Calculating the expected number(s) of cancer cases typically takes into consideration the race, sex, and ages of people who are diagnosed with cancer. This is important because a population's makeup of race, sex, and age all impact cancer rates. When trying to determine if there is more or less cancer in a community compared to the rest of the state, an investigation must ensure that differences in cancer rates are not simply due to differences in population demographics. Since a higher than expected number of cancer cases in a community may occur by chance alone, the role of chance is also considered in the statistical analysis.

The cluster analysis tables in this report present the number of observed cases for males and females; the number of "expected" cases; the standardized incidence ratio (SIR); and the corresponding 99% confidence interval. The SIR is simply the number of observed cases divided by the number of expected cases. When the SIR of a selected cancer is equal to 1.0, then the number of observed cases is equal to the expected number of cases, based on the incidence rates in the state. When the SIR for a particular cancer is less than 1.0, there are fewer cases of that type of cancer in the area than would have been expected. Conversely, an SIR greater than 1.0 indicates that there are more cases of a specific type of cancer in the area than would have been expected. As mentioned above, population estimates that are too low can result in an overestimate of the SIR and population estimates that are too high can result in an underestimate of the SIR.

Since an excess of cancer may occur by chance alone, the role of chance is considered in the statistical analysis. To determine whether an SIR greater than 1.0 or less than 1.0 is statistically significant, or outside the variation likely to be due to chance, confidence intervals are calculated. A 99% confidence interval is used for determining statistical significance and takes into account the likelihood that the result occurred by chance. Given that there is variability in the number of cancer cases that occur each year and some uncertainty in calculating the expected number of cases, the confidence interval provides a range in which the SIR is expected to fall 99% of the time. If the confidence interval for the SIR contains a range that includes 1.0, the result is not statistically significant and the observed number of cases is within a range that is considered no different than the expected number of cases. The confidence intervals are particularly important when trying to interpret small numbers of cases. When dealing with a small number of cases and a small population (for example, a zip code), the confidence interval will be wide. Wide confidence intervals reflect greater uncertainty in the results. Additionally, if only one or two cases are expected for a particular cancer, then the report of three or four observed cases will result in a very large SIR. A more extreme example would be the situation where the expected number of cases was less than 1.0; in such an instance one case can result in a very high SIR. As long as the 99% confidence interval contains 1.0, the SIR is still within the range one might expect and is, therefore, not statistically significant.

Investigation Results

The analysis of incidence data for zip code 78839, Crystal City, Texas, from January 1, 1999–December 31, 2008, found cancers of the prostate, lung, colon and rectum, bladder, kidney and renal pelvis, thyroid, liver and intraheaptic bile duct, and pancreas to be within expected ranges in both males and females. Analysis summaries are presented in Table 1.

Discussion

The TCR generally receives multiple reports of cancer from multiple sources for the same person. The TCR then needs to combine information from these reports into a single record. In the past two years, the TCR has made significant progress updating records that only had cancer reports from death certificates. Since the liver is a frequent site of cancer metastasis (where the tumor has spread from its primary location), the liver is often incorrectly recorded as the primary tumor location on death certificates. As a result of the progress the TCR has made in obtaining and combining additional cancer reports, many cases of liver cancer have been amended to the correct tumor location, which reduced the number of liver cancer cases in this report from previous years.

Like other studies, this cancer cluster investigation had limitations. The incidence data used in the cluster analysis did not include data for the most recent years. Also, cancer incidence data are based on residence at the time of diagnosis. It is possible that some residents who developed cancer no longer lived in the area at the time of diagnosis, so were not included in the analyses. However, it is also possible that people may have moved into the area and then developed cancer because of an exposure from a prior residential location or other factors. These cases are included in the investigation.

Recommendations

Based on the findings and the information discussed above, it is not recommended at this time to further examine the cancers in Crystal City, Texas. As new data or additional information become available, consideration will be given to updating or re-evaluating this investigation.

Information on Cancer and Cancer Risk Factors

Overall, the occurrence of cancer is common, with approximately two out of every five persons alive today predicted to develop some type of cancer in their lifetime.[2] In Texas, as in the United States, cancer is the leading cause of death for people under the age of 85.[3] Also, cancer is not one disease, but many different diseases. Different types of cancer are generally thought to have different causes. If a person develops cancer, it is probably not due to one factor but to a combination of factors such as heredity; diet, tobacco use, and other lifestyle factors; infectious agents; chemical exposures; and radiation exposures. Although cancer may impact individuals of all ages, it primarily is a disease of older persons with over one-half of cancer cases and two-thirds of cancer deaths occurring in persons 65 and older. Finally, it takes time for cancer to develop, between 10–40 years can go by between the exposure to a carcinogen and a diagnosis of cancer.[4]

Chances of a person developing cancer as a result of exposure to an environmental contaminant are slight. Most experts agree that exposure to pollution, occupational, and industrial hazards account for fewer than 10% of cancer cases.[5] The Harvard Center for Cancer Prevention estimates 5% of cancer deaths are due to occupational factors, 2% to environmental pollution and 2% to ionizing/ultraviolet radiation.[6] In contrast, NCI estimates that lifestyle factors such as tobacco use and diet cause 50 to 75 percent of cancer deaths.[7] Eating a healthy diet and refraining from tobacco are the best ways to prevent many kinds of cancer. It is estimated that one-third of all cancer deaths in this country could be prevented

by eliminating the use of tobacco products. Additionally, about 25 to 30 percent of the cases of several major cancers are thought to be associated with obesity and physical inactivity.[8]

Known Risk Factors for Cancers Examined in This Investigation

Below are brief summaries from the American Cancer Society and the National Cancer Institute about cancer risk factors for the specific cancers studied in this investigation.[9,10]

The occurrence of cancer may vary by race/ethnicity, gender, type of cancer, geographic location, population group, and a variety of other factors. Scientific studies have identified a number of factors for various cancers that may increase an individual's risk of developing a specific type of cancer. These factors are known as risk factors. Some risk factors individuals can do nothing about, but many are a matter of choice.

Prostate Cancer

Prostate cancer is the most common type of malignant cancer (other than skin) diagnosed in men, affecting an estimated one in five American men. Risk factors for prostate cancer include aging, a high fat diet, physical inactivity, and a family history of prostate cancer. African American men are at higher risk of acquiring prostate cancer and dying from it. Prostate cancer is most common in North America and northwestern Europe. It is less common in Asia, Africa, Central America, and South America.

Colon and Rectum Cancer

Researchers have identified several risk factors that increase a person's chance of developing colorectal cancer: family and personal history of colorectal cancer, hereditary conditions such as familial adenomatous polyposis, personal history of intestinal polyps and chronic inflammatory bowel disease, aging, a diet mostly from animal sources, physical inactivity, obesity, smoking, and heavy use of alcohol. People with diabetes have a 30%-40% increased chance of developing colon cancer. Recent research has found a genetic mutation leading to colorectal cancer in Jews of Eastern European descent (Ashkenazi Jews).

Lung and Bronchus Cancer

The greatest single risk factor for lung cancer is smoking. The American Cancer Society estimates that 87% of lung cancer is due to smoking. Several studies have shown that the lung cells of women have a genetic predisposition to develop cancer when they are exposed to tobacco smoke. Other risk factors include secondhand smoke, asbestos exposure, radon exposure, other carcinogenic agents in the workplace such as arsenic or vinyl chloride, marijuana smoking, recurring inflammation of the lungs, people with silicosis and berylliosis, personal and family history of lung cancer, and arsenic in drinking water. In some cities, air pollution may slightly increase the risk of lung cancer. This risk is far less than that caused by smoking.

Bladder Cancer

The greatest risk factor for bladder cancer is smoking. Men get bladder cancer at a rate four times that of women. Smokers are more than twice as likely to get bladder cancer as nonsmokers. Whites are two times more likely to develop bladder cancer than are African Americans. Other risk factors for bladder cancer include occupational exposure to aromatic amines such as benzidine and beta-napthylamine, aging, chronic bladder inflammation, personal history of urothelial carcinomas, birth defects involving the bladder and umbilicus, infection with a certain parasite, high doses of certain chemotherapy drugs, and arsenic in your drinking water.

Kidney and Renal Pelvis Cancer

Kidney cancer risk factors include smoking, obesity, a sedentary lifestyle, occupational exposure to heavy metals or organic solvents, advanced kidney disease, family history, high blood pressure, certain medications, and aging. Men and African Americans have higher rates of kidney cancer.

Pancreatic Cancer

Risk factors for cancer of the pancreas include smoking, long-standing diabetes, chronic pancreatitis, cirrhosis of the liver, being African American, genetic syndromes, aging, obesity, family history, occupational exposure, and stomach problems. A diet high in meats and fat may increase pancreatic cancer risk.

Liver and Intrahepatic Bile Duct Cancer

In contrast to many other types of cancer, the number of people who develop liver cancer and die from it is increasing. Men and Asian Americans have higher rates of liver cancer. The risk factors for liver cancer include viral hepatitis, cirrhosis, long-term exposure to aflatoxin, exposure to vinyl chloride and thorium dioxide, diabetes, obesity, anabolic steroids, arsenic in drinking water, bile duct disease, ulcerative colitis, liver fluke infection, and aging. Chemicals that are associated with bile duct cancer include dioxin, nitrosamines, and polychlorinated biphenyls (PCBs).

Thyroid Cancer

Risk factors for thyroid cancer include diets low in iodine, head and neck radiation, and certain hereditary conditions. Females have higher rates of thyroid cancer. Asians have an increased risk of developing thyroid cancer.

For additional information about cancer, visit the "Resources" link on the DSHS Website at: http://www.dshs.state.tx.us/tcr/

Questions or comments regarding this investigation may be directed to: Brenda Mokry, Epidemiology Studies & Initiatives at 800-252-8059 or brenda.mokry@dshs.state.tx.us.

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Table 1

Number of Observed and Expected Cancer Cases and Race Adjusted Standardized Incidence Ratios, Selected Cancers, Zip Code 78839, Crystal City, TX, 1999–2008

Males				
Site	**Observed**	**Expected**	**SIR**	**99% CI**
Prostate	39	39.5	1.0	0.6 – 1.5
Liver and Intrahepatic Bile Duct	8	6.2	1.3	0.4 – 3.0
Lung and Bronchus	16	18.7	0.9	0.4 – 1.6
Colon and Rectum	21	17.0	1.2	0.7 – 2.1
Bladder	4	6.2	0.7	0.1 – 2.0
Kidney and Renal Pelvis	8	7.6	1.1	0.3 – 2.4
Pancreas	2	3.9	0.5	0.0 – 2.4
Thyroid	1	1.4	0.7	0.0 – 5.4

Females				
Site	**Observed**	**Expected**	**SIR**	**99% CI**
Liver and Intrahepatic Bile Duct	7	3.3	2.2	0.6 – 5.3
Lung and Bronchus	10	12.5	0.8	0.3 – 1.7
Colon and Rectum	13	14.5	0.9	0.4 – 1.8
Bladder	2	2.1	0.9	0.1 – 4.4
Kidney and Renal Pelvis	6	5.9	1.0	0.3 – 2.7
Pancreas	1	4.2	0.2	0.0 – 1.8
Thyroid	2	5.3	0.4	0.0 – 1.8

Note: The SIR (standardized incidence ratio) is defined as the number of observed cases divided by the number of expected cases. The latter is based on sex- and age-specific cancer incidence rates for Texas during the period 1999–2008. The SIR has been rounded to the first decimal place.

*Significantly higher than expected at the $p < 0.01$ level.
**Significantly lower than expected at the $p < 0.01$ level.