Updated Summary Report

Occurrence of Cancer

In Zip Codes 75022 & 75028

Flower Mound, Denton County, Texas

Time Period: 2002–2011

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Prepared by the

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Executive Summary

In January of 2010, residents of Flower Mound, Texas were concerned that possible exposure to benzene or other contaminants related to natural gas well drilling and/or hydraulic fracturing in the Barnett Shale was causing cancer in the area. In March 2010, the Texas Department of State Health Services (DSHS) investigated cancer incidence in zip codes 75022 and 75028, and an update was provided in March 2011. A recent article in the Virginia Environmental Law Journal renewed public concern about cancer incidence in Flower Mound. Due to ongoing concerns by the community, DSHS repeated a cancer cluster investigation (CCI) in these zip codes using updated cancer and population information.

The Centers for Disease Control and Prevention (CDC) and Council for State and Territorial Epidemiologists (CSTE) define a cancer cluster as a greater than expected number of cancer cases that occurs within a group of people in a geographic area over a defined period of time. In accordance with their Guidelines, the primary purpose of this CCI is to determine whether the suspected cancer cluster is a statistically significant excess; it is not intended to be an epidemiologic study to assess the association between cancers and environmental causes or to determine whether an epidemiologic study is feasible. Because cancer is common, cases might appear to occur with alarming frequency within a community even when the number of cases is within the expected rate for the population.

In this CCI, standardized incidence ratios (SIRs) were calculated as the number of observed cases divided by the number of expected cases in the area of concern for a ten year time-period (January 1, 2002 – December 31, 2011). Both 95% and 99% confidence intervals (CIs) were calculated for each SIR.

The previous CCIs for Flower Mound examined incidence data for leukemia and brain/central nervous system (CNS) childhood cancers (0–19 years), as well as leukemias, non-Hodgkin's lymphomas, and breast cancers for all ages. Childhood liver cancers were added to this 2014 update at the request of a concerned citizen.

Female breast cancer was the only type of cancer considered in this report where the observed number of cases was higher than expected and the result was statistically significant; this result is consistent with previous findings.   Given the level of concern in the community, DSHS plans to continue to monitor cancer incidence in the Flower Mound area.

Background

In January of 2010, residents of Flower Mound, Texas were concerned that possible exposure to benzene or other contaminants related to natural gas well drilling and/or hydraulic fracturing in the Barnett Shale was causing cancer in the area. According to the Centers for Disease Control and Prevention (CDC) and Council for State and Territorial Epidemiologists (CSTE), determining causation requires clinical and laboratory studies. However, CCIs can assess the presence of a greater than expected number of cancer cases within a group of people in a geographic area over a defined time period.[1]

In March 2010, the Texas Department of State Health Services (DSHS) investigated cancer incidence in zip codes 75022 and 75028, and an update was provided in March 2011.[2,3] In 2010 and 2011, DSHS evaluated complete, statewide cancer incidence data for childhood (0–19 years) leukemia subtypes, leukemia subtypes for all ages, and non-Hodgkin's lymphoma for all ages based on community concerns. Breast cancer and childhood brain & central nervous system cancers were included in the analyses because of separate requests from concerned citizens. In both investigations, the observed number of female breast cancer cases was higher than expected in zip codes 75022 and 75028, and the result was statistically significant.

A recent article in the Virginia Environmental Law Journal renewed public concern about cancer incidence in Flower Mound.[4] In 2014, due to the ongoing concerns by the community, DSHS conducted another cancer cluster investigation (CCI) in these zip codes using updated cancer and population information.

Methods

This investigation evaluates incidence data from 2002-2011 for childhood leukemias, brain/central nervous system cancers, and liver cancers (0-19 years), all age leukemias, non-Hodgkin's lymphoma, and breast cancers. The approach to this investigation is consistent with the guidelines from CDC and the Council of State and Territorial Epidemiologists.[1] Childhood liver cancers were added to this 2014 update at the request of a concerned citizen. The latest completed data available for this study was 2011; therefore, the time period for analysis represents the latest full ten-year period currently available from the Texas Cancer Registry (TCR).

Data Source

Population-based cancer incidence data are considered to be the best available indicator of cancer occurrence, and data for Texas currently meet national standards for timeliness and data quality. Consequently, for this type of investigation, DSHS obtains cancer incidence data from the TCR, which tracks the numbers and types of new cancer cases diagnosed each year by age, race, sex, and place of residence (at time of diagnosis) within the State of Texas. 2000 and 2010 Decennial Census zip code population estimates were obtained from the American Fact Finder website at http://factfinder2.census.gov, which is administered by the U.S. Census Bureau, and then adjusted for estimated population changes in the two zip code areas to yield yearly zip code population estimates. Zip codes 75022 and 75028 were selected for analysis because they included the geographic areas of concern. Zip code level analysis is appropriate considering the

small population and number of cancer cases in the area of concern. Yearly state population estimates were obtained from the National Cancer Institute (NCI).

The TCR is responsible for the collection, maintenance, and dissemination of high quality population-based cancer data. Over 240,000 reports of cancer are received annually from more than 500 hospitals, cancer treatment centers, and ambulatory surgery centers located throughout the state, as well as pathology laboratories (located both in and outside of Texas), and other state cancer registries. The TCR collects information such as the types of cancers that occur and 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, the length of survival, and patient characteristics. The TCR also meets national CDC timeliness and "high quality" data standards, as well as North American Association of Central Cancer Registry certification standards.

Standardized Incidence Ratio (SIR)

The standardized incidence ratio (SIR) is calculated as the number of observed cases divided by the number of expected cases for each cancer site in the area of concern. In this report, the number of *observed* cases for each zip code was obtained from the TCR. The *expected* numbers of cancer cases were calculated by multiplying the age, sex, and race-specific cancer incidence rates of the reference population, Texas, by the number of people in the corresponding demographic groups in the zip codes of concern. An SIR equal or below 1.00 indicates the observed number of cases are not greater than expected. An SIR greater than 1.00 indicates that there are more cases of a specific type of cancer in the area than would be expected[1]. Because 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 also calculated.

Confidence Intervals (CIs)

A confidence interval is a measure of how precise the SIR value is. In this CCI, DSHS calculated both 95% and 99% confidence intervals (CIs) for each SIR using Fisher's exact method.[5] When both upper and lower ends of the CI are greater than 1.00, the observed number of cases is considered statistically significantly greater than expected.

Wide confidence intervals (which are common when dealing with small populations, rare types of cancer, and short periods of time) reflect a greater uncertainty in the results. Consequently, such values should be interpreted with caution.

In all cases, when results are described as significant or not significant, DSHS is referring only to statistical significance, with the understanding that all cases of cancer are significant to the individual, the family, and friends of the individuals who are affected.

Results

Analysis summaries are presented in Tables 1-6. The tables show resulting SIRs for each of the individual cancer types, the number of observed and expected cases, and the corresponding 95% and 99% CIs for each SIR. Statistically significant SIRs and 99% and/or 95% CIs are indicated with asterisks.

This analysis using data from January 1, 2002 to December 31, 2011 found that the observed number of female breast cancer cases was higher than expected in zip code 75022 (Table 1) and 75028 (Table 2), as well as in both zip codes combined (Table 3) and the results were statistically significant. The observed number of breast cancer cases in males, as well as leukemia and non-Hodgkin's lymphoma in both males and females, was not different than the expected number of cases (Tables 1-3).

The observed number of childhood leukemias, childhood brain/CNS cancers, and childhood liver cancers was not higher than expected in both males and females in zip code 75022 (Table 4), zip code 75028 (Table 5), and both zip codes combined (Table 6).

Discussion

Of the cancers examined in this report, breast cancer in females was the only cancer type for which the number of observed cases was higher than expected and the result was statistically significant, a result consistent with the previous DSHS investigations.

According to the CDC and CSTE, reasons why the observed number of cancer cases may be higher than expected in a particular area include better access to medical care or screening and changing cancer rates over time.[1,6] Additionally, these differences could be due to common lifestyle factors, environmental or occupational exposures, random chance, zip code boundary changes, or changes in diagnostic methods and case reporting.

Overall, cancer is quite common. Approximately half of all men and one third of all women will develop cancer in their lifetime.[7] In Texas, as in the rest of the United States, cancer is the second leading cause of death, accounting for 22.1% of all deaths with heart disease (the leading cause) accounting for 22.9%.[8]

Cancer is not a single disease, but many different diseases, and different types of cancer have different risk factors. A risk factor is anything that affects a person's chance of getting a disease. Cancers are often caused by a combination of risk factors.

According to the American Cancer Society, risk factors for breast cancer include gender, aging, genetic factors, family and personal history of breast cancer, race/ethnicity, dense breast tissue, certain benign breast conditions, lobular carcinoma in situ, menstrual periods, previous chest radiation, diethylstilbestrol (DES), and lifestyle factors, such as not having children or having children after the age of 30 years, use of oral contraceptives and hormone replacement therapy, drinking alcohol, being overweight or obese, and lack of regular physical activity.[9]

Relative to other risk factors, the chance of a person developing cancer as a result of exposure to an environmental contaminant is small. 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.[10] In comparison, the National Cancer Institute estimates that 50 to

75% of all cancer deaths are caused by lifestyle factors such as tobacco use and diet.[11] Eating a healthy diet and refraining from tobacco use 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 35% of cancers are thought to be associated with obesity and physical inactivity.[10]

Cancer Cluster Investigation Limitations

The primary purpose of this cancer cluster investigation is to identify a potential cancer cluster by determining whether the observed number of cases is statistically greater than expected. It is important to note it is not intended to determine the feasibility of conducting an epidemiologic study, or to carry out an epidemiologic study to assess the association between cancers and environmental causes.

A period of 10-40 years can elapse between the beginning of an exposure to a carcinogen and the development of a clinically diagnosable case of cancer (latency). Latency and change of residency add to the complexity of these investigations. When people move in and out of an area of interest, it becomes more difficult to tell whether living in the area is associated with an excess of cancers because residential history is not tracked.

The ability to obtain accurate population estimates for the population of interest at the zip code level also may be limited because population estimates by age, race, and sex at the zip code level are not available for all the years included in this report and zip code boundaries change over time. For this investigation, population data for each of the years included in the analysis were estimated from the 2000 and 2010 Decennial Census zip code population data. This method assumed that the population grew at a constant rate.

A sufficiently large population is also needed to ensure the results are stable. When the observed number of cases and/or the expected number of cases is small, this is generally an indication that the population is too small, the time period is too short, or the cancer site is too rare to calculate meaningful SIRs. Consequently, such values should be interpreted with caution.

When multiple types of cancers are evaluated in more than one zip code area, the validity of the statistical analyses is limited by multiple comparisons. For example, when using a 95% CI, there is a 5% chance of getting a statistically significant SIR due to random chance alone. The more SIRs calculated, the more significant associations are expected.

Recommendations

Given the level of concern in the community, DSHS plans to continue to monitor cancer incidence in the Flower Mound area.

Additional Information

For additional information about cancer clusters, visit the Centers for Disease Control and Prevention, "About Cancer Clusters," web page at http://www.cdc.gov/nceh/clusters/about.htm.

For additional information on cancer risk factors, visit the American Cancer Society, "What Causes Cancer?" web page at http://www.cancer.org/cancer/cancercauses/index.

Questions or comments regarding this investigation may be directed to Dr. Heidi Bojes at (512) 776-6704 or by e-mail at Heidi.Bojes@dshs.state.tx.us.

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Table 1. Standardized incidence ratios (SIRs) and confidence intervals (CIs) for all ages leukemia, non-Hodgkin's lymphoma, and breast cancer from 2002-2011 in zip code 75022 (Flower Mound, TX)

Males					
Cancer Site/Morphology	**Observed**	**Expected**	**SIR**	**95% CI**	**99% CI**
Acute Lymphocytic Leukemia	5	1.8	2.78	(0.90, 6.48)	(0.60, 7.86)
Chronic Lymphocytic Leukemia	3	3.8	0.79	(0.16, 2.31)	(0.09, 2.89)
Acute Myeloid Leukemia	2	2.7	0.77	(0.09, 2.78)	(0.04, 3.57)
Chronic Myeloid Leukemia	1	1.5	0.67	(0.02, 3.71)	(0.01, 4.95)
Aleukemic, Subleukemic and NOS	0	0.5	0.00	(0.00, 7.38)	(0.00, 10.60)
Non-Hodgkin Lymphoma	15	15.7	0.96	(0.54, 1.58)	(0.44, 1.79)
Breast	1	0.7	1.43	(0.04, 7.96)	(0.01, 10.61)
Females					
Acute Lymphocytic Leukemia	3	1.5	2.00	(0.41, 5.85)	(0.23, 7.32)
Chronic Lymphocytic Leukemia	2	2.2	0.91	(0.11, 3.28)	(0.05, 4.21)
Acute Myeloid Leukemia	5	2.2	2.27	(0.74, 5.30)	(0.49, 6.43)
Chronic Myeloid Leukemia	1	1.1	1.00	(0.03, 5.57)	(0.01, 7.43)
Aleukemic, Subleukemic and NOS	0	0.5	0.00	(0.00, 9.22)	(0.00, 13.25)
Non-Hodgkin Lymphoma	15	11.3	1.33	(0.74, 2.19)	(0.61, 2.49)
Breast	131	101	1.30*	(1.08, 1.53)	(1.02, 1.61)

Note: SIR: standardized incidence ratio, CI: confidence interval. SIR is calculated as the number of observed cases divided by the number of expected cases and CIs are calculated using Fisher's exact method.

*Indicates the observed number of cancer cases is statistically significantly greater than the expected number of cases.

Table 2. Standardized incidence ratios (SIRs) and confidence intervals (CIs) for all ages leukemia, non-Hodgkin's lymphoma, and breast cancer from 2002-2011 in zip code 75028 (Flower Mound, TX)

Males					
Cancer Site/Morphology	**Observed**	**Expected**	**SIR**	**95% CI**	**99% CI**
Acute Lymphocytic Leukemia	2	3.5	0.57	(0.07, 2.06)	(0.03, 2.65)
Chronic Lymphocytic Leukemia	5	6.8	0.74	(0.24, 1.72)	(0.16, 2.08)
Acute Myeloid Leukemia	4	5	0.80	(0.22, 2.05)	(0.13, 2.52)
Chronic Myeloid Leukemia	3	2.9	1.03	(0.21, 3.02)	(0.12, 3.79)
Aleukemic, Subleukemic and NOS	1	1	1.00	(0.03, 5.57)	(0.01, 7.43)
Non-Hodgkin Lymphoma	26	29.5	0.88	(0.58, 1.29)	(0.50, 1.43)
Breast	1	1.4	0.77	(0.23, 4.28)	(0.77, 5.72)
Females					
Acute Lymphocytic Leukemia	4	2.8	1.43	(0.39, 3.66)	(0.24, 4.50)
Chronic Lymphocytic Leukemia	4	4.3	0.93	(0.25, 2.38)	(0.16, 2.93)
Acute Myeloid Leukemia	7	4.5	1.56	(0.62, 3.20)	(0.45, 3.81)
Chronic Myeloid Leukemia	2	2.1	0.95	(0.11, 3.44)	(0.05, 4.41)
Aleukemic, Subleukemic and NOS	0	0.9	0.00	(0.00, 4.10)	(0.00, 5.89)
Non-Hodgkin Lymphoma	18	22.6	0.80	(0.47, 1.26)	(0.40, 1.42)
Breast	238	202.3	1.18*	(1.03, 1.33)	(0.99, 1.38)

Note: SIR: standardized incidence ratio, CI: confidence interval. SIR is calculated as the number of observed cases divided by the number of expected cases and CIs are calculated using Fisher's exact method.

*Indicates the observed number of cancer cases is statistically significantly greater than the expected number of cases.

Table 3. Standardized incidence ratios (SIRs) and confidence intervals (CIs) for all ages leukemia, non-Hodgkin's lymphoma, and breast cancer from 2002-2011 in zip codes 75022 and 75028 (Flower Mound, TX)

Males					
Cancer Site/Morphology	**Observed**	**Expected**	**SIR**	**95% CI**	**99% CI**
Acute Lymphocytic Leukemia	7	5.3	1.32	(0.53, 2.72)	(0.38, 3.23)
Chronic Lymphocytic Leukemia	8	10.5	0.76	(0.33, 1.50)	(0.24, 1.77)
Acute Myeloid Leukemia	6	7.6	0.79	(0.29, 1.72)	(0.20, 2.06)
Chronic Myeloid Leukemia	4	4.4	0.91	(0.25, 2.33)	(0.15, 2.86)
Aleukemic, Subleukemic and NOS	1	1.5	0.67	(0.02, 3.71)	(0.01, 4.95)
Non-Hodgkin Lymphoma	41	45.3	0.91	(0.65, 1.23)	(0.58, 1.34)
Breast	2	2.1	0.95	(0.11, 3.44)	(0.05, 4.41)
Females					
Acute Lymphocytic Leukemia	7	4.3	1.63	(0.65, 3.35)	(0.47, 3.98)
Chronic Lymphocytic Leukemia	6	6.5	0.92	(0.34, 2.01)	(0.24, 2.41)
Acute Myeloid Leukemia	12	6.7	1.79	(0.93, 3.13)	(0.74, 3.60)
Chronic Myeloid Leukemia	3	3.2	0.94	(0.19, 2.74)	(0.11, 3.43)
Aleukemic, Subleukemic and NOS	0	1.3	0.00	(0.00, 2.84)	(0.00, 4.08)
Non-Hodgkin Lymphoma	33	33.8	0.98	(0.67, 1.37)	(0.59, 1.51)
Breast	369	303.3	1.22*	(1.10, 1.34)	(1.06, 1.39)

Note: SIR: standardized incidence ratio, CI: confidence interval. SIR is calculated as the number of observed cases divided by the number of expected cases and CIs are calculated using Fisher's exact method.

*Indicates the observed number of cancer cases is statistically significantly greater than the expected number of cases.

Table 4. Standardized incidence ratios (SIRs) and confidence intervals (CIs) for childhood (0-19 years old) leukemia, brain/central nervous system cancers, and liver cancers from 2002-2011 in zip code 75022 (Flower Mound, TX)

Males 0-19 Years					
Cancer Site/Morphology	**Observed**	**Expected**	**SIR**	**95% CI**	**99% CI**
Lymphoid leukemias	4	1.3	3.08	(0.84, 7.88)	(0.52, 9.68)
Acute myeloid leukemias	0	0.3	0.00	(0.00, 12.30)	(0.00, 17.66)
Chronic myeloproliferative diseases	0	0.2	0.00	(0.00, 18.44)	(0.00, 26.49)
Myelodysplastic syndrome and other myeloproliferative	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Unspecified and other specified leukemias	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Ependymomas and choroid plexus tumor	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Astrocytomas	2	0.8	2.50	(0.30, 9.03)	(0.13, 11.59)
Intracranial and intraspinal embryonal tumors	0	0.3	0.00	(0.00, 12.30)	(0.00, 17.66)
Other gliomas	0	0.3	0.00	(0.00, 12.30)	(0.00, 17.66)
Other specified intracranial/intraspinal neoplasms	2	0.3	6.67	(0.80, 24.07)	(0.33, 30.90)
Unspecified intracranial and intraspinal neoplasms	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Hepatoblastoma	0	0	0	N/A	N/A
Hepatic carcinomas	0	0	0	N/A	N/A
Unspecified malignant hepatic tumors	0	0	0	N/A	N/A
Females 0-19 Years					
Lymphoid leukemias	3	1.1	2.73	(0.56, 7.97)	(0.31, 9.98)
Acute myeloid leukemias	1	0.3	3.33	(0.10, 18.57)	(0.03, 24.77)
Chronic myeloproliferative diseases	0	0.2	0.00	(0.00, 36.89)	(0.00, 52.98)
Myelodysplastic syndrome and other myeloproliferative	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Unspecified and other specified leukemias	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Ependymomas and choroid plexus tumor	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Astrocytomas	0	0.7	0.00	(0.00, 5.27)	(0.00, 7.57)
Intracranial and intraspinal embryonal tumors	0	0.2	0.00	(0.00, 36.89)	(0.00, 52.98)
Other gliomas	0	0.3	0.00	(0.00, 12.30)	(0.00, 17.66)
Other specified intracranial/intraspinal neoplasms	0	0.4	0.00	(0.00, 9.22)	(0.00, 13.25)
Unspecified intracranial and intraspinal neoplasms	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Hepatoblastoma	0	0	0	N/A	N/A
Hepatic carcinomas	0	0	0	N/A	N/A
Unspecified malignant hepatic tumors	0	0	0	N/A	N/A

Note: SIR: standardized incidence ratio, CI: confidence interval. SIR is calculated as the number of observed cases divided by the number of expected cases and CIs are calculated using Fisher's exact method.

*Indicates the observed number of cancer cases is statistically significantly greater than the expected number of cases.

Table 5. Standardized incidence ratios (SIRs) and confidence intervals (CIs) for childhood (0-19 years old) leukemia, brain/central nervous system cancers, and liver cancers from 2002-2011 in zip code 75028 (Flower Mound, TX)

Males 0-19 Years					
Cancer Site/Morphology	**Observed**	**Expected**	**SIR**	**95% CI**	**99% CI**
Lymphoid leukemias	1	2.6	0.38	(0.01, 2.14)	(0.00, 2.86)
Acute myeloid leukemias	2	0.6	3.33	(0.40, 12.03)	(0.17, 15.45)
Chronic myeloproliferative diseases	0	0.3	0.00	(0.00, 12.30)	(0.00, 17.66)
Myelodysplastic syndrome and other myeloproliferative	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Unspecified and other specified leukemias	0	0.2	0.00	(0.00, 18.44)	(0.00, 26.49)
Ependymomas and choroid plexus tumor	1	0.3	3.33	(0.10, 18.57)	(0.03, 24.77)
Astrocytomas	2	1.5	1.33	(0.16, 4.81)	(0.07, 6.18)
Intracranial and intraspinal embryonal tumors	1	0.6	1.67	(0.05, 9.28)	(0.02, 12.38)
Other gliomas	0	0.6	0.00	(0.00, 6.15)	(0.00, 8.83)
Other specified intracranial/intraspinal neoplasms	1	0.6	1.67	(0.05, 9.28)	(0.02, 12.38)
Unspecified intracranial and intraspinal neoplasms	0	0.3	0.00	(0.00, 12.30)	(0.00, 17.66)
Hepatoblastoma	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Hepatic carcinomas	0	0	0	N/A	N/A
Unspecified malignant hepatic tumors	0	0	0	N/A	N/A
Females 0-19 Years					
Lymphoid leukemias	4	2	2.00	(0.55, 5.12)	(0.34, 6.30)
Acute myeloid leukemias	0	0.5	0.00	(0.00, 7.38)	(0.00, 10.60)
Chronic myeloproliferative diseases	0	0.3	0.00	(0.00, 12.30)	(0.00, 17.66)
Myelodysplastic syndrome and other myeloproliferative	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Unspecified and other specified leukemias	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Ependymomas and choroid plexus tumor	0	0.2	0.00	(0.00, 18.44)	(0.00, 26.49)
Astrocytomas	1	1.3	0.77	(0.02, 4.28)	(0.01, 5.72)
Intracranial and intraspinal embryonal tumors	0	0.3	0.00	(0.00, 12.30)	(0.00, 17.66)
Other gliomas	1	0.5	2.00	(0.06, 11.14)	(0.02, 14.86)
Other specified intracranial/intraspinal neoplasms	2	0.7	2.86	(0.34, 10.31)	(0.14, 13.24)
Unspecified intracranial and intraspinal neoplasms	0	0.2	0.00	(0.00, 18.44)	(0.00, 26.49)
Hepatoblastoma	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Hepatic carcinomas	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Unspecified malignant hepatic tumors	0	0	0	N/A	N/A

Note: SIR: standardized incidence ratio, CI: confidence interval. SIR is calculated as the number of observed cases divided by the number of expected cases and CIs are calculated using Fisher's exact method.

*Indicates the observed number of cancer cases is significantly different than the expected number of cases.

Table 6. Standardized incidence ratios (SIRs) and confidence intervals (CIs) for childhood (0-19 years old) leukemia, brain/central nervous system cancers, and liver cancers from 2002-2011 in zip codes 75022 and 75028 (Flower Mound, TX)

Males 0-19 Years					
Cancer Site/Morphology	**Observed**	**Expected**	**SIR**	**95% CI**	**99% CI**
Lymphoid leukemias	5	3.9	1.32	(0.43, 3.07)	(0.28, 3.72)
Acute myeloid leukemias	2	0.9	2.22	(0.27, 8.02)	(0.11, 10.30)
Chronic myeloproliferative diseases	0	0.5	0.00	(0.00, 7.38)	(0.00, 10.60)
Myelodysplastic syndrome and other myeloproliferative	0	0.2	0.00	(0.00, 18.44)	(0.00, 26.49)
Unspecified and other specified leukemias	0	0.3	0.00	(0.00, 12.30)	(0.00, 17.66)
Ependymomas and choroid plexus tumor	1	0.4	2.50	(0.08, 13.93)	(0.03, 18.58)
Astrocytomas	4	2.2	1.82	(0.50, 4.65)	(0.30, 5.72)
Intracranial and intraspinal embryonal tumors	1	0.9	1.11	(0.03, 6.19)	(0.01, 8.26)
Other gliomas	0	0.9	0.00	(0.00, 4.10)	(0.00, 5.89)
Other specified intracranial/intraspinal neoplasms	3	0.9	3.33	(0.69, 9.74)	(0.38, 12.20)
Unspecified intracranial and intraspinal neoplasms	0	0.4	0.00	(0.00, 9.22)	(0.00, 13.25)
Hepatoblastoma	0	0.3	0.00	(0.00, 12.30)	(0.00, 17.66)
Hepatic carcinomas	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Unspecified malignant hepatic tumors	0	0	0	N/A	N/A
Females 0-19 Years					
Lymphoid leukemias	7	3.1	2.26	(0.91, 4.65)	(0.66, 5.53)
Acute myeloid leukemias	1	0.7	1.43	(0.04, 7.96)	(0.01, 10.61)
Chronic myeloproliferative diseases	0	0.4	0.00	(0.00, 9.22)	(0.00, 13.25)
Myelodysplastic syndrome and other myeloproliferative	0	0.2	0.00	(0.00, 18.44)	(0.00, 26.49)
Unspecified and other specified leukemias	0	0.2	0.00	(0.00, 18.44)	(0.00, 26.49)
Ependymomas and choroid plexus tumor	0	0.3	0.00	(0.00, 12.30)	(0.00, 17.66)
Astrocytomas	1	1.9	0.53	(0.02, 2.93)	(0.01, 3.91)
Intracranial and intraspinal embryonal tumors	0	0.4	0.00	(0.00, 9.22)	(0.00, 13.25)
Other gliomas	1	0.8	1.25	(0.04, 6.96)	(0.01, 9.29)
Other specified intracranial/intraspinal neoplasms	2	1.1	1.82	(0.22, 6.56)	(0.09, 8.43)
Unspecified intracranial and intraspinal neoplasms	0	0.4	0.00	(0.00, 9.22)	(0.00, 13.25)
Hepatoblastoma	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Hepatic carcinomas	0	0.1	0.00	(0.00, 36.89)	(0.00, 52.98)
Unspecified malignant hepatic tumors	0	0	0	N/A	N/A

Note: SIR: standardized incidence ratio, CI: confidence interval. SIR is calculated as the number of observed cases divided by the number of expected cases and CIs are calculated using Fisher's exact method.

*Indicates the observed number of cancer cases is significantly different than the expected number of cases.