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**Texas Department of State
Health Services**

**Assessment of the Occurrence of Cancer
Houston, Texas
2000-2016
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Prepared by the
Texas Department of State Health Services

Table of Contents

Executive Summary	1
Background	2
Methods	3
Data Sources	3
Statistical Analysis	4
Results	5
Discussion	5
Conclusion	6
Additional Information	7
Figure 1.	8
Table 1.	9
Table 2.	10
Appendix A	11

Executive Summary

At the request of the Houston Health Department (HHD), the Environmental Surveillance and Toxicology Branch (ESTB) and Texas Cancer Registry (TCR) of the Texas Department of State Health Services (DSHS) have examined the occurrence of cancer in the city of Houston, Texas consisting of ten census tracts.

DSHS followed the Centers for Disease Control and Prevention (CDC) and Council of State and Territorial Epidemiologists (CSTE) 2013 guidelines and agency protocol to investigate the occurrence of two types of adult (ages 20 years or older) cancers in a geographic area selected by HHD staff. In addition, DSHS investigated the occurrence of five types of adult cancers in each of these census tracts selected by HHD staff.

In accordance with these guidelines, the purpose of this assessment was to determine whether the observed number of cancer cases is statistically significantly greater than expected. It was not intended to determine the cause of the observed cancers or identify possible associations with any risk factors.

DSHS staff analyzed TCR data available for a 17-year period spanning from 2000 through 2016. United States Census data was used to estimate the population in the selected geographic area, which consisted of ten census tracts in Houston, Texas. To evaluate the occurrence of cancer in the area investigated, the number of observed cancer cases was compared to what would be expected for the area based on cancer rates in Texas. 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 the 17-year period (2000-2016). A 95 percent confidence interval (CI) was calculated for each SIR to determine statistical significance.

Observed numbers of several of the six cancer types analyzed were statistically significantly greater than expected, while others were within the range of what is expected based on cancer rates in Texas.

However, the limitations to the analysis must be taken into account when interpreting these results. The SIR estimates for some of the cancer types were based upon small numbers of cases observed over a long period of time (17 years). Reliability is also reduced for estimates based on small numbers, even if the SIRs results exceed 1.0. DSHS will continue to collaborate with HHD and will update this analysis upon request when new data become available.

Background

At the request of the Houston Health Department (HHD), the Environmental Surveillance and Toxicology Branch (ESTB) and Texas Cancer Registry (TCR) of the Texas Department of State Health Services (DSHS) examined the occurrence of cancer in an area within the city of Houston, Texas consisting of ten census tracts. Based on community concerns, HHD made this request following an assessment performed by DSHS in 2019 at the request of the Texas Commission on Environmental Quality¹. The results of that assessment are included in Appendix A.

The Centers for Disease Control and Prevention (CDC) and Council of 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 time². DSHS followed the CDC and CSTE 2013 Guidelines for Investigating Suspected Cancer Clusters and Responding to Community Concerns² and agency protocol³ to investigate the occurrence of cancer in this community.

The CDC and CSTE guidelines include four steps². The first step is to collect information about the community's concerns. The second step, reported here, is to determine whether the observed number of cancer cases is statistically significantly greater than expected. It is important to note that the data and statistical analysis conducted at this step cannot determine if cancers observed in the community are associated with environmental, lifestyle, or other risk factors.

The guidelines also provide additional steps that can be followed when appropriate. The third step is to evaluate the feasibility of performing an epidemiologic study to examine if exposure to a specific risk factor is associated with the suspected cancer cluster, and the fourth step is to conduct an epidemiologic study, if deemed feasible in step three. Many factors are considered in making the determination to progress to steps three or four. The CDC and CSTE guidelines state, "only a small fraction of cancer cluster inquiries might meet the statistical and etiological criteria to support a cluster investigation through all the steps outlined..."²

¹ Texas Department of State Health Services, Assessment of the Occurrence of Cancer, Houston, Texas, 2000-2016. August 13, 2019. Available from: <https://dshs.texas.gov/epitox/reports/Assessment-of-the-occurrence-of-cancer-Houston-2000-2016-Report.pdf>

² Centers for Disease Control and Prevention, *Investigating Suspected Cancer Clusters and Responding to Community Concerns*. MMWR, 2013. 62: p. 22.

³ Texas Department of State Health Services, *Protocol for Responding to Community Cancer Cluster Concerns*. Updated January 15, 2016. Available from: <http://www.dshs.texas.gov/epitox/CancerClusters/Protocol-for-Responding-to-Community-Cancer-Cluster-Concerns.pdf>.

Methods

Consistent with the CDC and CSTE guidelines, DSHS collaborated with HHD staff to select the geographic area, time frame, and cancers to be included in this analysis. The following adult (ages 20 years or older) cancer types were included in the analysis: esophagus, urinary bladder, larynx, lung and bronchus, other biliary, and liver.

HHD staff also requested DSHS analyze adult lip, acute myeloid leukemia, nose and nasal cavity, pleura, other non-epithelial skin, trachea, mediastinum, & other respiratory organs, and intrahepatic bile duct cancers. However, these cancer types had less than six cases in individual census tracts or in all census tracts analyzed together. If there were less than six cases of any cancer type, it was not included in the analysis per agency protocol.

Complete TCR cancer data are available for 1995 to 2016. DSHS evaluated 17 years of available cancer data. The geographic area investigated was selected by HHD to encompass the entire area of concern. The ten census tracts comprising the area investigated are shown in Figure 1.

This document outlines the results from step two of the CDC and CSTE guidelines, and only addresses the question, "Is there a statistically significant excess of cancer in the area of investigation?"

Data Sources

For each cancer type, the number of cases observed from 2000 through 2016 in the area included in the investigation was obtained from the TCR (Incidence – Texas, 1995-2016, SEER*Prep 2.5.3). The TCR is responsible for the collection, maintenance, and dissemination of high-quality Texas population-based cancer data, and meets national CDC timeliness and data quality standards, as well as North American Association of Central Cancer Registry certification standards. Adult (ages 20 years or older) cancers were defined according to Site Recode ICD-O-3/WHO 2008 Definitions⁴. Statewide cancer rates for the same time period were also obtained from the TCR.

Population estimates for 2000 through 2016 were calculated using linear interpolation based on population counts obtained from the United States Decennial Census⁵ for the years 2000 and 2010. This method, outlined by

⁴ National Cancer Institute, Surveillance, Epidemiology and End Results Program. Site Recode ICD-O-3/WHO 2008 Definition. Available online: http://seer.cancer.gov/siterecode/icdo3_dwhoeme/index.html

⁵ United States Census Bureau. *American FactFinder*. 2012; Available from: <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>.

the United States Census Bureau⁶, assumed population growth occurred in a linear manner.

Statistical Analysis

To determine if a statistically significant excess of cancer existed in the area investigated, the number of observed cancer cases was compared to what would be expected for the area based on cancer rates in Texas.

Characteristics such as race, sex, and age are closely related to cancer. To ensure that differences between the numbers of observed and expected cancer cases are not simply due to differences in these demographic characteristics, the expected numbers of cancer cases were calculated by multiplying the age-, sex-, and race-specific cancer incidence rates of Texas residents (reference population) by the number of people in the corresponding demographic groups in the area of investigation.

Standardized incidence ratios (SIRs) were calculated to determine if an excess of cancer exists in the area. The SIR is the number of observed cases compared to (divided by) the number of expected cases for each cancer type. A SIR greater than 1.00 indicates that the observed number of cases of a specific cancer type is higher than expected and a SIR less than 1.00 indicates that the observed number of cases of a specific cancer type is lower than expected.

Few, if any, communities will have exactly the same rate as the average state rate for a similar population; most will be higher or lower. Therefore, 95 percent confidence intervals (CI) were calculated for the SIRs to determine if the observed number of cases was statistically significantly different than expected. If a 95 percent CI (range) includes 1.00, no statistically significant excess (or reduction) of cancer is indicated. If a 95 percent CI does not contain 1.00, the SIR is outside the expected range and is statistically significant. When using a 95 percent CI, 5 percent of SIR values calculated is expected to be statistically significantly higher or lower than the state average due to random chance alone.

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.

⁶ US Census Bureau. *Methodology for the Intercensal Population and Housing Unit Estimates: 2000 to 2010*. 2012; Available from: http://www.census.gov/popest/methodology/2000-2010_Intercensal_Estimates_Methodology.pdf.

Results

Table 1 presents the number of observed cases, the number of expected cases, the SIRs, and the corresponding 95 percent CIs for each cancer type evaluated in the area with all census tracts analyzed together. The number of adult liver cancers in the area investigated was statistically significantly greater than expected based on cancer rates in Texas. The number of adult other biliary cancers was within the range of what is expected based on cancer rates in Texas.

SIRs and 95 percent CIs were also calculated for each census tract separately. Table 2 presents the number of observed cases, the number of expected cases, the SIRs, and the corresponding 95 percent CIs for each individual census tract. For each of these census tracts, only cancers in census tracts that had six or more cases are shown in Table 2.

- The number of adult esophagus cancers was statistically significantly greater than expected based on cancer rates in Texas in census tract 2110.
- The number of adult larynx cancers was statistically significantly greater than expected based on cancer rates in Texas in census tract 2111.
- The number of adult liver cancers was statistically significantly greater than expected based on cancer rates in Texas in census tract 2110, 2111, 2112, 2113, 2114, and 2116.
- The number of adult lung and bronchus cancers was statistically significantly greater than expected based on cancer rates in Texas in census tract 2113 and 2114.
- The number of adult urinary bladder cancers was within the range of what is expected based on cancer rates in Texas in the census tracts included.

Discussion

Consistent with the second step of the CDC and CSTE guidelines for investigating suspected cancer clusters, the primary purpose of this step (assessment) is to determine whether the observed number of cases is statistically significantly greater than expected². It is not intended to determine the cause of the observed cancers or identify possible associations with any risk factors.

The assessment step in a cancer cluster investigation has several inherent limitations, and results should be interpreted with these limitations in mind. Cancer is not a single disease, but rather many different diseases. Different types of cancers vary in etiologies (causes or origins) and may not share the

same predisposing factors. Cancers may be associated with a variety of factors such as genetics, lifestyle, and socioeconomic status. Because cancer is common, cases might appear to occur with alarming frequencies within a community even when the number of cases is within the expected rate for the population.

Additionally, cancer incidence data are based on residence at the time of diagnosis. As people move, it becomes more difficult to determine whether living in the area of investigation is associated with an excess of cancers, because residential history is not tracked. Latency (the time period elapsed between exposure and illness onset) adds to the complexity of this step in the investigation. For most adult cancers, a period of 10 to 40 years can elapse between the beginning of an exposure to a cancer-causing agent and the development of a clinically diagnosable case of cancer. It is possible that former residents who developed cancer no longer lived in the area at the time of diagnosis, and these cases would not be included in this assessment. It is also possible that new people have moved into the area and then were diagnosed with cancer; these cases are included in this assessment.

For this assessment, DSHS analyzed cancer types for both the ten census tracts together and for each of the census tracts separately, as requested by HHD. However, the results of the individual census tracts analyses should be interpreted with caution. The numbers of observed and expected cases for some of the cancer types were small. SIRs based on small numbers often yield wide confidence intervals, which reduces the reliability of SIR estimates.

Conclusion

Based on cancer rates in Texas, adult (ages 20 years or older) liver cancer was statistically significantly greater than expected in all ten census tracts analyzed together between 2000-2016. The observed number of adult other biliary cancer was within the range of what is expected. Additionally, based on cancer rates in Texas, adult (ages 20 years or older) esophagus, larynx, liver, and lung and bronchus cancers were statistically significantly greater than expected in certain census tracts. The observed number of adult urinary bladder cancers was within the range of what is expected in certain census tracts.

However, the limitations mentioned above must be taken into account when interpreting these results. The SIR estimates for some of the cancer types were based upon small numbers of cases observed over a long period of time (17 years). As mentioned above, reliability is reduced for estimates based on small numbers, even if the SIRs exceed 1.0. DSHS will continue to

collaborate with HHD and will update this analysis upon request when new data become available.

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 the Environmental Surveillance and Toxicology Branch, at 1-800-588-1248 (email: epitox@dshs.texas.gov).

Figure 1. Selected Census Tracts (2010) for Houston, Texas.

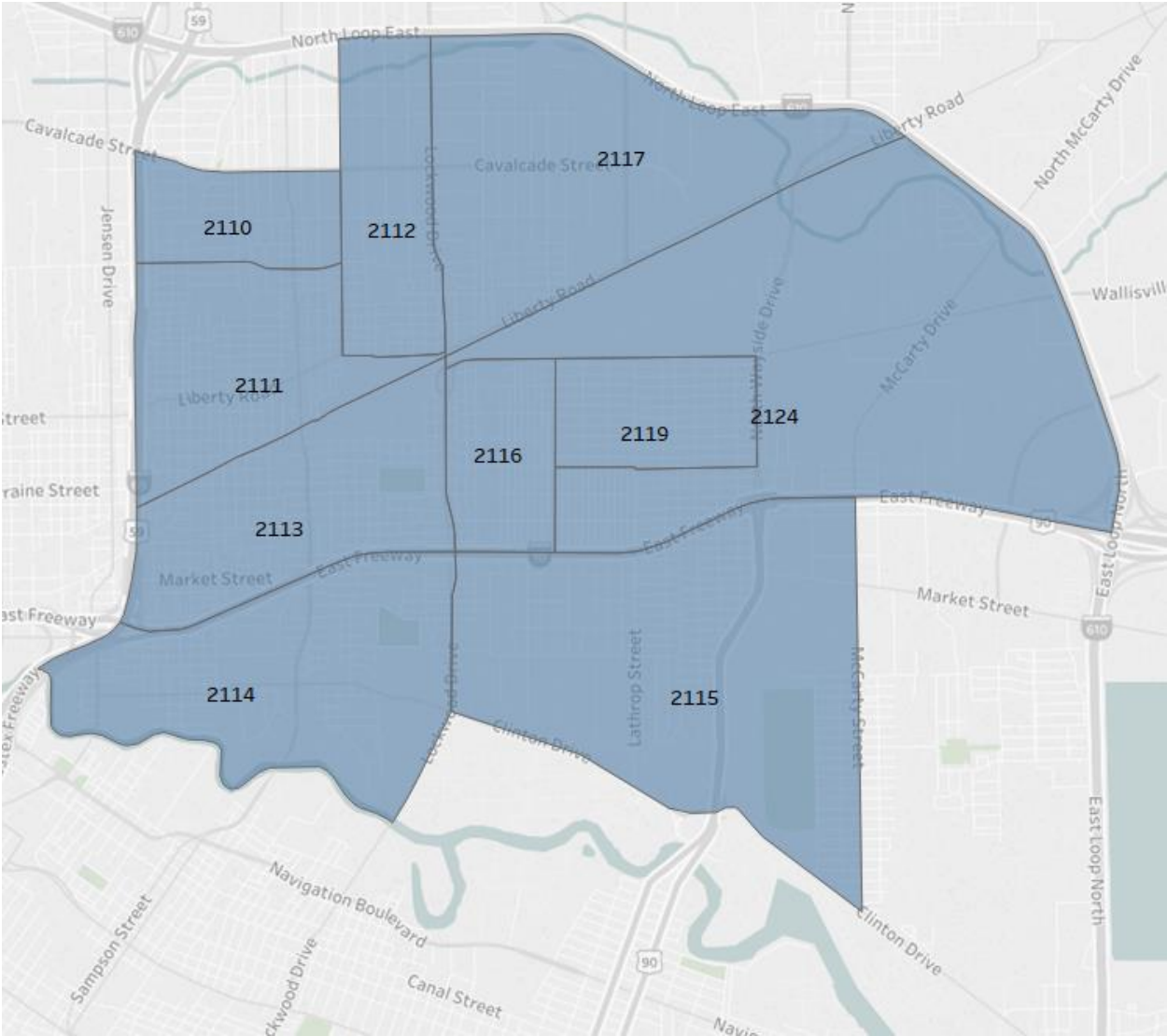


Table 1. Standardized Incidence Ratios (SIRs) and 95 percent Confidence Intervals (CIs) for Selected Adult (≥ 20 years) Cancers in Houston, Texas, 2000-2016.

Cancer Type	Observed	Expected	SIR	95% CI
Liver*	142	85.7	1.66	(1.40, 1.95)
Other Biliary	8	12.8	0.62	(0.27, 1.23)

*Indicates observed number of cancer cases is statistically significantly **higher** than expected

Table 2. Standardized Incidence Ratios (SIRs) and 95 percent Confidence Intervals (CIs) for Selected Adult (≥ 20 years) Cancers by census tract in Houston, Texas, 2000-2016.

Cancer Type	Census Tract	Observed	Expected	SIR	95% CI
Esophagus	2110*	7	1.8	3.80	(1.53, 7.82)
	2113	8	4.0	1.99	(0.86, 3.92)
	2117	6	3.2	1.90	(0.70, 4.14)
Larynx	2110	6	2.2	2.72	(1.00, 5.92)
	2111*	15	4.6	3.26	(1.82, 5.37)
	2113	8	4.9	1.64	(0.71, 3.23)
Liver	2115	6	2.8	2.15	(0.79, 4.67)
	2110*	11	4.9	2.25	(1.12, 4.03)
	2111*	26	12.2	2.14	(1.40, 3.13)
Lung and Bronchus†	2112*	14	6.9	2.04	(1.11, 3.42)
	2113*	21	11.4	1.85	(1.14, 2.82)
	2114*	14	5.2	2.68	(1.46, 4.49)
	2115	13	12.7	1.02	(0.54, 1.75)
	2116*	14	6.4	2.18	(1.19, 3.66)
	2117	7	9.1	0.77	(0.31, 1.59)
	2119	13	10.7	1.22	(0.65, 2.08)
	2124	9	6.8	1.32	(0.60, 2.50)
	2110	41	29.8	1.38	(0.99, 1.87)
	2111	72	58.6	1.23	(0.96, 1.55)
2112	45	35.8	1.26	(0.92, 1.68)	
2113*	89	63.2	1.41	(1.13, 1.73)	
2114*	57	26.5	2.16	(1.63, 2.79)	
2115	35	32.2	1.10	(0.76, 1.51)	
2116	28	19.7	1.42	(0.94, 2.05)	
2117	61	50.5	1.21	(0.92, 1.55)	
2119	24	25.0	0.96	(0.62, 1.43)	
2124	23	19.0	1.21	(0.77, 1.82)	
Urinary Bladder	2111	8	10.4	0.77	(0.33, 1.52)
	2112	8	6.0	1.33	(0.58, 2.63)
	2113	13	10.4	1.25	(0.67, 2.14)
	2116	7	4.7	1.51	(0.61, 3.10)
	2117	8	8.2	0.97	(0.42, 1.92)
2119	9	7.12	1.26	(0.58, 2.40)	

*Indicates observed number of cancer cases is statistically significantly **higher** than expected

†Due to data limitations, some cancer cases were not included in the tract-specific analyses.

Appendix A

Table 1. Standardized Incidence Ratios (SIRs) and 95 percent Confidence Intervals (CIs) for Selected Adult (≥ 20 years) Cancers in Houston, Texas, 2000-2016.¹

Cancer Type	Observed	Expected	SIR	95% CI
Acute Myeloid Leukemia	24	18.6	1.29	(0.83, 1.92)
Lung & Bronchus*	478	351.9	1.36	(1.24, 1.49)
Esophagus*	40	24.6	1.63	(1.16, 2.22)
Urinary Bladder	68	67.4	1.01	(0.78, 1.28)
Nose & Nasal Cavity	8	3.7	2.18	(0.94, 4.30)
Larynx*	53	27.9	1.90	(1.42, 2.48)

*Indicates observed number of cancer cases is statistically significantly **higher** than expected

Source: Texas Department of State Health Services, Assessment of the Occurrence of Cancer, Houston, Texas, 2000-2016. August 13, 2019. Available from: <https://dshs.texas.gov/epitox/reports/Assessment-of-the-occurrence-of-cancer-Houston-2000-2016-Report.pdf>