Agency for Toxic Substances and Disease Registry

Division of Health Studies

HEALTH CONSULTATION

HEALTH OUTCOME DATA EVALUATION

KELLY AIR FORCE BASE,

SAN ANTONIO, BEXAR COUNTY, TEXAS

May 2005

DEPARTMENT OF HEALTH & HUMAN SERVICES
Agency for Toxic Substances
and Disease Registry
Atlanta, Georgia 30333

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Prepared by

The Agency for Toxic Substances and Disease Registry

Division of Health Studies

Health Investigations Branch

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NOTE: The evaluation of health outcome data was originally included as Appendix G in the Kelly Air Force Base public health assessment document. Due to the volume and nature of the evaluation of health outcome data, it has been re-issued as a separate document. The wording of the health outcome data section has not been changed from the original text except in those instances where public comments were received and changes were incorporated. A list of the public comments received, as well as responses to those comments, can be found in the Kelly Air Force Base public health assessment.

For information regarding evaluation of environmental exposure at Kelly Air Force Base, the reader is referred to other ATSDR documents addressing this issue including the public health assessment, the current air emissions health consultation, the past air emissions health consultation, the on-base drinking water health consultation, and the East Kelly public health assessment**.** These documents will be placed at the local repositories for review or they can be requested by writing to

Chief, Program Evaluation, Records, and Information Services Branch (PERIS)

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I. HEALTH OUTCOME DATA

ATSDR selected health outcomes for evaluation based on community concerns and biological plausibility. During several site visits to Kelly Air Force Base in San Antonio, Texas, ATSDR staff members discussed health concerns with community residents. Many residents expressed concerns about elevated cancer rates and birth defects. Residents also expressed concerns about reports of lead found in soil samples taken from the neighborhood, and the effects that exposure to lead could have on their children. This health consultation addresses these concerns.

Health outcome data are evaluated if a completed exposure pathway exists for the chemical or chemicals suspected of causing the health outcome of concern. When a contaminant of concern has been identified as a carcinogen, specific types of cancers possibly related to the contaminant are usually selected for evaluation. At Kelly, we identified hexavalent chromium, and volatile organic compounds (VOCs) such as tetrachloroethylene and benzene in air, as a pathway of exposure. For cancer, the health outcomes we considered included cancer of the kidney, liver, lung, cervix, bladder, and leukemia. We also examined all reportable birth defects and low-birth weight babies. The majority of the health outcome data analyses focused on zip code areas 78211, 78228, and 78237. **Zip codes were used in the health outcome analyses because both the Texas Cancer Registry Division and the birth certificate data collect only zip code information. These three zip code areas (78211, 78228, and 78237) were originally analyzed because they were part of the original petition (areas north and southeast of Kelly) and because of their parallel relationship with Kelly.**

The evaluation of health outcome data helps to provide a general picture of the health of a community, and it could help to identify or confirm the presence of excess disease or illness in a community. That said, however, elevated rates of a particular disease might not necessarily be caused by hazardous substances in the environment. Other factors such as socioeconomic status, occupation, and lifestyle, can also influence disease development. In contrast, a contaminant can contribute to illness or disease without this effect reflected in the available health outcome data.

II. INTERPRETING HEALTH OUTCOME DATA

To determine whether an excess of a particular disease or health condition is present, ATSDR compares the observed number of cases in the population living in the area of concern to an "expected" number of cases determined from a standard population. For cancer, we examined the ratio of observed-to-expected number of cases (incidence) or deaths (mortality), and the information was further standardized to eliminate possible effects due to race, sex, and age. These ratios are referred to as the standardized incidence ratio (SIR) or standardized mortality ratio (SMR). The type of ratio used depends on the type of health data to which one refers. For birth defects and low-birth weight babies, we divided the number of observed cases by the number expected, producing an observed-to-expected ratio (O:E ratio).

An O:E ratio of 1.0 indicates that the number of cases observed in the population being evaluated is equal to the number of cases expected, based on the rate of disease in the comparison population. A ratio greater than 1.0 indicates that more cases occurred than expected; and a ratio less than 1.0 indicates that fewer cases occurred than expected. Accordingly, a ratio of 1.5 is interpreted as 50% more cases than expected; and a ratio of 0.9 indicates 10% fewer cases than would be expected.

Caution, however, should be exercised when interpreting these ratios. The interpretation of a ratio depends on both the value of the ratio and the numbers used to compute the ratio. Two ratios can have the same size but be interpreted differently. For example, a ratio of 1.5 based on 2 expected cases and 3 observed cases indicates a 50% excess in cancer, but the excess is actually only 1 case. Still, a ratio of 1.5 based on 200 expected cases and 300 observed cases represents the same 50% excess in cancer. But because the ratio is based on a greater number of cases, the estimate is less likely to be attributable to chance. Although the possibility is remote that 100 excess cases of cancer would occur by chance alone, a single excess case easily could be due to chance occurrence.

A certain amount of chance variation can be expected when looking at the occurrence of different health conditions in communities, and statisticians have developed methods to take this into account. One method is to calculate a 95% confidence interval (CI) for the O:E ratio. The 95% CI is the range of estimated ratio values that has a 95% probability of including the true ratio for the population. The confidence interval is a statistical measure of the precision of the risk estimate.

“Statistically significant” means there is less than a 5% chance that the observed difference is merely the result of random fluctuation in the number of observed cancer cases. For example, if the confidence interval does not include 1.0 and the interval is below 1.0, then the number of cases is significantly lower than expected. Similarly, if a confidence interval does not include 1.0 and the interval is above 1.0, then there is a significant excess in the number of cases. If the confidence interval includes 1.0, then the true ratio could be 1.0, and one cannot conclude with sufficient confidence that the observed number of cases reflects a real excess or deficit. As long as the 95% confidence interval contains 1.0, that indicates that the ratio is still within the range one might expect, based on the disease experience of the comparison population. Nevertheless, if either the upper or lower bound of the confidence interval is 1.0, it is considered of borderline statistical significance. This means that the ratio is close to being statistically significant, and that the number of cases was either higher or lower than expected.

In addition to the number of cases, the width of the confidence interval also reflects the precision of the ratio estimate. For example, a narrow confidence interval (e.g., 1.03–1.15) indicates that the population’s size was sufficiently large to generate a fairly precise estimate of the ratio. A wide interval (e.g., 0.85–4.50) indicates far less precision, and more uncertainty, in the calculated ratio.

III. CANCER DATA

All cancer data were provided by the Cancer Registry Division (CRD) of the Texas Department of Health. The CRD maintains cancer incidence and mortality data for the state of Texas. The data analyzed in this consultation was the most current data available at the time. Cancer incidence data are acquired under the Texas Cancer Incidence Reporting Act (Chapter 82, Health and Safety Code), which requires every general and special hospital, clinical laboratory, and cancer treatment center to report all cases of cancer to the CRD. Every person, whether inpatient or outpatient, whether diagnosed with or treated for cancer, must be reported to the CRD. Although the CRD is a passive registry that relies on other facilities to supply the information, it monitors the number of expected reports from each institution and contacts those facilities that fail to report. To ensure that reported data are complete and accurate, CRD staff members perform case-finding and other quality control checks at these other facilities. The CRD has determined that for Public Health Region 8, which includes San Antonio, cancer incidence reporting is 90%–95% complete for the years 1990–1994. Cancer mortality data is obtained by CRD from death certificate information maintained by the Bureau of Vital Statistics. The CRD conducted an analysis of both cancer incidence (1990–1994) and cancer mortality data (1991–1995) for three zip code areas around Kelly Air Force Base (78211, 78228, and 78237). **The three zip code areas (78211, 78228, and 78237) were originally analyzed because they were part of the original petition and because of their location to Kelly (areas north and southeast of Kelly).**

Initial Cancer Request

After receiving the petition to perform a public health assessment on neighborhoods north and southeast of Kelly Air Force Base, ATSDR requested that the CRD evaluate rates of cancers of the colon, pancreas, lung, prostate, breast, and leukemia in zip code areas 78211 and 78237. This information was used only to give a general idea of the rates of cancer in these communities. The results from this evaluation are presented in Appendix A.

Incidence Data

For the period 1990–1994, the CRD evaluated cancer incidence data for San Antonio zip code areas 78211, 78237, and 78228 for the following cancer sites: liver, lung, cervix, bladder, kidney, and leukemia. Data were initially evaluated using race-, sex-, and age-specific cancer incidence rates published by the California Cancer Registry. Statewide cancer incidence data for Texas were not available, and the California Cancer Registry had Hispanic cancer rates which could be used for comparison. During the course of the analyses, statewide cancer incidence data became available for Texas, and the analyses were updated to include the Texas comparison population. These results are presented in this section. The results from the initial analysis using California rates as the comparison population are included in Appendix B.

During the period 1990–1994, the number of cases observed for cancer of the liver, lung, bladder, kidney, and leukemia were close to the number expected among males and females in zip code

78211 (Table 1). The number of cases observed for cervical cancer among females was also close to the number expected in this area during this time period. In zip code 78228, the number of observed cases of bladder cancer and leukemia among males and females were close to the number expected, as were the number of cases observed for lung, cervical, and kidney cancer among females (Table 2). A significant excess of liver cancer among males was observed. A higher than expected number of kidney cancer cases, and a lower than expected number of lung cancer cases were observed among males in this zip code, which was of borderline statistical significance. In zip code 78237, the number of cases observed for lung, bladder and kidney cancer, as well as leukemia, was close to the number expected among males (Table 3). But a significant excess of liver cancer was observed among males in this zip code area, while among females, the number of cases observed for cancer of the liver, lung, and bladder were close to the number expected in this zip code area. A significant excess of leukemia among females was observed, as was a higher than expected number of kidney and cervical cancer cases, although these elevations were of borderline statistical significance.

Mortality Data

ATSDR compares mortality and incidence data for indications of reporting consistency. Using death certificate information, the CRD also evaluated cancer mortality for the same cancer sites for the three zip code areas of concern for the period 1991–1995 (Tables 4–6). During this period, a significant excess of liver cancer deaths was observed among males in zip codes 78228 and 78237. During the same period of time, a significant excess of liver cancer deaths was observed among females in zip codes 78211 and 78237. In zip code 78228, the number of lung cancer cases in males was significantly lower than expected. A higher than expected number of leukemia cases was observed among males in zip code 78237, although the elevation was of borderline statistical significance.

Additional Liver Cancer Analysis

Because of the increased occurrence of liver cancer in the initial three zip code areas, ATSDR requested that the CRD evaluate the incidence and mortality data for liver cancer in 10 additional zip code areas surrounding Kelly Air Force Base. This was done to determine any excess of liver cancer cases. Incidence data were initially evaluated using race-, sex-, and age-specific cancer incidence rates published by the California Cancer Registry — statewide cancer incidence data for Texas were not available at the time this analysis was conducted. Once statewide cancer incidence data for Texas became available, the analyses were conducted using these rates. The results from the analysis using California as the comparison population are included in Appendix B.

An additional five zip code areas were evaluated during the analysis of liver cancer rates in the area using Texas incidence data, but were not evaluated when conducting the analysis of liver cancer mortality. For the sake of consistency, Tables 7 and 8 include the results from the same zip code areas. The results from the five additional zip code areas are included in Appendix C.

The analysis of incidence data using Texas as the comparison population for the 10 additional zip code areas during the period 1990–1994 indicates a statistically significant excess of liver cancer among males in the 78201, 78205, and 78227 zip code areas (Table 7). A higher than expected number of liver cancer cases was observed among males in zip code 78207, although this excess was of borderline statistical significance. Among females in the study area during the same time period, no statistically significant excess of liver cancer was observed. However, a higher than expected number of liver cancer cases was observed among females in zip code 78207 and 78221, although these excesses were of borderline statistical significance.

The analysis of mortality data for this area during the period 1991–1995 also indicates a statistically significant excess of liver cancer among the males in the 78201, 78204, and 78207 zip code areas and females in the 78242 zip code (Table 8). A higher than expected number of liver cancer deaths in males was observed in zip code 78227 and in females in zip code areas 78207, 78221, and 78226, although the elevations were of borderline statistical significance.

Additional Cancer Analysis

To examine cancer incidence in other areas surrounding Kelly Air Force Base, ATSDR requested that the CRD evaluate incidence data for cancer of the liver, lung, cervix, bladder, kidney, and leukemia in the zip code areas 78201, 78204, 78205, 78207, 78221, 78224, 78225, 78226, 78227, and 78242 during the period 1990–1994. The results from these analyses are presented in Appendix D.

Discussion

Overall and when compared to Texas rates, liver cancer rates are elevated in many zip code areas surrounding Kelly Air Force Base. The reason for these elevations is, however, unknown. The data available to the Texas Cancer Registry regarding individuals who have been diagnosed with liver cancer are limited. Information is not available concerning known risk factors associated with liver cancer, or if individuals had occupations that exposed them to chemicals that are known liver carcinogens.

The analysis of liver cancer mortality found a significant excess among males and females in two zip code areas. Only one zip code area had a significant excess of liver cancer deaths for both males and females. While the number of liver cancer deaths was elevated, mortality can be affected by several factors, including socioeconomic status, access to medical care, and stage of disease at diagnosis. Additionally, the liver is a common site of metastasis (i.e., the spread of disease from one part of the body to another unrelated part) for tumors originating in other organs. Death certificates and hospital charts cannot always be relied on to distinguish accurately primary from secondary (metastatic) tumors, making the interpretation of these results difficult.

IV. GENERAL FACTS ABOUT CANCER

Almost everyone alive today will be affected by cancer — either personally, or because a friend or a family member contracts the disease. Approximately two out of every five persons will develop some type of cancer in their lifetime. Cancer is not one disease, but many different diseases; different types of cancer are generally thought to have different causes. In Texas, as in the United States as a whole, cancer is the second leading cause of death, exceeded only by heart disease. In 1996, 31,969 Texans died of cancer. Sixty-five percent of these deaths were in persons 65 years of age or older.

The incidence of cancer varies by race/ethnicity, sex, the type of cancer, geographic distribution, the population under study, and a variety of other factors. Scientific studies have identified a number of factors for various cancers which can increase an individual's risk of developing a specific type of cancer. Although some risk factors cannot be influenced by individual behavior, many can. General cancer risk factors include heredity, geographic area, diet, environmental causes, tobacco smoke, sexual practices, and alcohol consumption.

Liver Cancer [1]

The term "primary liver cancer" refers to any malignant tumor arising in the liver itself, not to a cancer that originates elsewhere and spreads, or metastasizes, to the liver. Hepatitis B infection is the most important risk factor in the occurrence of liver cancer worldwide. But for liver cancer to develop it is usually necessary for infection with hepatitis B to occur early in life; it rarely develops in individuals who become infected in adulthood. Males are at much greater risk (twofold to sevenfold higher) for developing liver cancer than females. Also, individuals with cirrhosis of the liver resulting from hepatitis B are at much higher risk of developing liver cancer than those with less severe liver disease. Cirrhosis refers to the consequences of chronic liver injury, that is, extensive scarring of the liver in which the scar tissue surrounds "nodules" of regenerating liver tissue. Some of the causes of cirrhosis are alcohol abuse, chronic hepatitis, prolonged obstruction to the outflow of the bile from the liver, and some viral forms of autoimmune liver disease. Recently, infection with the hepatitis C virus has been strongly linked with liver cancer.

Exposure to some chemicals and toxins can lead to liver cancer. Perhaps the best known and extensively studied is aflatoxin, a common mold found in poorly stored peanuts and other foods. It readily causes liver cancer in laboratory animals, and in humans it could potentiate the cancer-causing effects of hepatitis B infection.

Some forms of inherited metabolic diseases can predispose individuals to liver cancer. The most common of these is hemochromatosis or "iron overload," a disorder of iron metabolism that results in an excessive accumulation of iron in the body. If untreated, iron accumulation leads to cirrhosis and the development of liver cancer.

Other risk factors thought to be associated with liver cancer include alcohol intake, smoking, use of anabolic steroids, and the use of oral contraceptives.

Kidney Cancer [2]

Kidney cancer accounts for 2% of all new cancers each year in the United States. Studies have shown that cigarette smoking increases the risk of kidney cancer, as does high relative weight or obesity. Early studies noted the association of obesity and kidney cancer among women; however, more recent studies have also found an increased risk among overweight men. Some studies have found death from kidney cancer to be elevated among asbestos-exposed workers and among coke-oven workers in steel plants.

Leukemia [3,4]

Leukemia is cancer of the blood-forming cells. It occurs when immature or mature cells multiply in an uncontrolled manner in the bone marrow. The four types of leukemia include acute lymphocytic leukemia (ALL), acute myeloid leukemia (AML), chronic lymphocytic leukemia (CLL), and chronic myelogenous leukemia (CML). Each type can have a different etiology and a different prognosis.

In 1993, about 29,000 new cases of leukemia were diagnosed in the United States, representing about 2.4% of all new cancer cases in that year. Leukemia occurs slightly more often in whites than in blacks, and in males more often than females. The incidence of leukemia also varies by age. Leukemia accounts for nearly one-third of all children's cancers, but it actually affects far more adults than children. Acute lymphocytic leukemia occurs predominantly in young children and in adults age 65 and older; acute myeloid leukemia occurs in infants, adolescents, and older people, but is unusual in young children. Only 5% of childhood leukemia cases are chronic, and virtually all of these are chronic myeloid leukemia. Chronic lymphocytic leukemia almost never occurs in children and is rare before age 30; 60 years is the average age at diagnosis. Chronic myeloid leukemia is uncommon below the age of 20; half of all CML patients are over age 67.

Certain factors are known are known to increase the risk of developing the disease. Among these are exposure to radiation, heredity, congenital factors, chemicals (benzene), drugs (chloramphenicol, phenylbutazone), and viruses (human T-lymphotrophic virus type I or HTLV-I).

Cervical Cancer [5]

The two major risk factors for cancer of the cervix are sexual intercourse at an early age and multiple sex partners. More than 90% of all cervical cancer cases are due to a sexually transmitted human papillomavirus infection of the cervix.

In a number of studies, cigarette smoking has been found to increase the risk of cervical cancer, especially among long-term or high-intensity smokers. Choice of contraceptive method also appears to affect the risk of cervical cancer. There is increasing evidence that nutritional factors could play a role in cervical disease. Several studies suggest that low intake of either vitamin C or beta carotene might be associated with an elevated risk, although this has not always been found. Deficiency in folacin (one of the B complex vitamins) has also been proposed as a risk factor, especially among oral contraceptive users whose stores of this vitamin are depleted.

V. BIRTH OUTCOMES

Birth Defects Data

All data relating to birth defects were provided by the Texas Department of Health (TDH) Birth Defects Monitoring Division (TBDMD) and the TDH Bureau of Vital Statistics. Birth defects were identified by examining three types of vital record certificates: live birth certificates, fetal death certificates, and infant death certificates. Each type of vital record contains information on birth defects, and the fetal and infant death certificates also contain information on the cause(s) of death. The TBDMD began active surveillance for birth defects in San Antonio in January 1997.

Texas requires completion of birth certificates for all live births, and filing of those certificates with the state within 5 days of the birth. Birth defects are reported on birth certificates through the use of check boxes. The attending physician has the choice of 24 boxes. Twenty-two boxes list specific categories of birth defects; one check box is for "other" defects, and one check box for "none."

A fetal death certificate must be filed for any stillborn infant of 20 weeks or more gestation. Birth defects are also reported on fetal death certificates through the use of check boxes. The attending physician has the choice of the same 24 boxes.

Infant deaths are defined as the death of a baby less than 1 year of age. The same death certificate is used to record all deaths in Texas, regardless of the age at death. Death certificates list the International Classification of Disease 9th Revision (ICD-9) code for all causes of death — both the immediate cause and the underlying cause(s). The ICD-9 codes are a system of numerical codes for specific diseases and health conditions. Birth defects listed among the cause(s) of death are found coded by specific ICD-9 codes.

Case Definitions

For this health assessment, we defined a case as an infant or fetus who

1. was delivered between January 1, 1990, and December 31, 1995,
2. had a mother residing in zip code 78211, 79237, or 78228 at the time of the birth, and
3. had a birth defect indicated on a vital record (birth, death, or fetal death certificate).

Because of a change in the type of information required to be reported on birth certificates in 1989, 1990 is considered to be the first year for which reliable data on specific birth defects are available. The last year for which complete data are available is 1995.

To determine whether a possible "excess" of birth defects was present in the three zip codes of concern, ATSDR compared the number of "observed" cases for each category of birth defects to the number of cases we would have "expected" based on rates for specific birth defects for the entire state. As with the cancer information, we determined the observed-to-expected ratio (O:E) and calculated the 95% confidence interval for each birth defect category. We examined the number of birth defects for each type of vital record: birth, death, and fetal death certificates. The results are presented in the following sections, according to the type of vital record used for the analysis. Tables listing the specific number of cases and O:E ratios are found at the end of the report.

Birth Certificates

TDH compared the observed number of cases for each category of birth defect, as listed on the birth certificate check boxes, with the number that would have been expected and calculated the O:E ratio for each category of birth defects. The number of expected cases is based on the rate for specific birth defects for the entire state of Texas. The ratios were not adjusted for race or maternal age.

Tables 9–11 list information on birth defects recorded on birth certificate check boxes for each of the three zip codes of concern (78211, 78228, 78237) for the time period 1990–1995. The tables list the 22 specific birth defect categories and a nonspecific "other" category, the observed number of cases for each defect, the expected number, and the O:E ratio with the 95% confidence interval.

The only statistically significant findings from the birth certificate data are the category "other" defects in zip codes 78211 and 78237. The category "other" is a nonspecific category, basically a "catch-all" category for birth defects not attributed to one of the 22 categories of specific defects. The defects listed in the "other" category can include a wide variety of defects of different structural systems, some of which could be very serious or merely cosmetic, and whose cause(s) could be very diverse. A nonspecific category such as "other" is difficult to interpret because it is not possible to tell whether the elevated O:E ratios are due to a slight elevation in many different defects listed in the "other" category or if they are due to larger increases in one or two kinds of defects listed in the category.

Fetal Death Certificates

No statistically significant elevations of any O:E ratios appeared for conditions listed on fetal death certificates for any zip code. Tables 12–14 list the number of observed and expected cases for each birth defect category and the O:E ratios with 95% confidence intervals for the individual zip codes for the time period 1990–1995.

Infant Death Certificates

Death certificates for children less than 1 year old were also reviewed (Tables 15–17), and 17 specific categories of birth defects were evaluated for 1990–1995. No statistically significant elevations in the O:E ratios were seen for any of the defects in zip codes 78211 and 78228. The O:E ratios for three categories of heart and circulatory system-related defects were significantly elevated for zip code 78237. The elevated ratios were for the categories "bulbus cordis anomalies and anomalies of cardiac septal closure" (ICD–9 745), "other congenital anomalies of the heart" (ICD–9 746), and "other congenital anomalies of the circulatory system" (ICD–9 747). Several children had more than one heart or circulatory system defect listed on their death certificate (19 defects reported for 14 infants).

Discussion

The review of the 1990–1995 birth certificate and fetal death certificate data for zip codes 78211, 78228, and 78237 did not indicate an excess number of birth defects for any specific category of defect examined. The O:E ratios for the nonspecific "other" category on birth certificates were elevated for zip codes 78211 and 78237, but due to the nonspecific nature of the category, do not warrant additional analysis at this time. The infant death certificate data for zip code 78237, however, indicate an excess of reported cases for three categories of heart and circulatory system-related defects for 1990–1995.

Because of the increased occurrence of heart and circulatory-related defects in zip code 78237, additional analyses were performed to examine further the elevated O:E ratios for these categories. To determine if race/ethnicity might have accounted for or contributed to the elevated number of cases reported, the O:E ratios based on infant death certificate data for zip code 78237 were statistically adjusted for race and ethnicity (Table 18). Adjustment for race/ethnicity was performed because the race/ethnicity distribution of the San Antonio population differs from the population distribution of the state of Texas — our comparison population. During 1990–1995, 96.4% of all live births in San Antonio were Hispanic, while only 39.7% of all live births in the state of Texas were of Hispanic origin. When the comparison population does not reflect the race/ethnicity distribution of the study population (the San Antonio area) then the expected number of cases used for comparison could be overestimated or underestimated.

After adjusting for race/ethnicity, the O:E ratios for each of the three birth defect categories changed only slightly. The O:E ratios for "bulbus cordis anomalies and anomalies of cardiac septal closure" (ICD–9 745) and "other congenital anomalies of the heart" (ICD–9 746) remained significantly elevated for zip code 78327. The O:E ratio for "other congenital anomalies of the circulatory system" decreased slightly, and although it remained elevated, it is no longer statistically significant.

TDH also examined the information available on the birth and death certificates for the infants reported with these defects in zip code 78237. The age range of the mothers was 16–40 years with an average age of 24 (median age = 23). Nine of the 14 children (64%) were girls. As

previously noted, several children had multiple heart and circulatory system-related defects. One child had a diagnosed chromosomal defect.

TDH also calculated the O:E ratios for the three heart and circulatory system-related defects, adjusting for maternal age. Table 19 lists the observed and expected number of cases, the O:E ratio, and the 95% confidence interval for each birth defect. As would be expected from the California data, adjusting for mother's age increases the O:E ratios for each defect, and all O:E ratios remained statistically significant.

The cause(s) for the apparent excess of heart and circulatory system-related defects for zip code 78237 are not immediately evident. We know that for specific heart and circulatory system defects, several risk factors (i.e., factors that could increase the risk of a mother delivering a baby with a defective heart or circulatory system) have been identified. These risk factors include maternal diabetes, drinking alcohol, taking large amounts of vitamin A, and taking certain medications such as valproic acid or amphetamines. We do not have information which would allow us to evaluate the possible effect of these risk factors on the cases of heart and circulatory system defects for zip code 78237. We are recommending, however, continued monitoring of heart and circulatory system defects in zip code 78237, using vital statistic information and data from the Texas Birth Defects Monitoring Division as it becomes available.

VI. LOW-BIRTH WEIGHT

Information on low-birth weight is obtained from birth certificates from the Texas Department of Health's Bureau of Vital Statistics. A low-birth weight infant is defined as an infant who is born weighing less than 2,500 grams (5.5 pounds). For this health assessment, a case was defined as an infant weighing less than 2,500 grams (5.5 pounds) at birth that was born from 1990–1995 to a mother residing in one of the three zip code areas studied.

To determine whether an excess number of low-birth weight babies were born in the three zip codes in 1990–1995, the number of low-birth weight babies born in each zip code was compared with the number expected, using low-birth weight rates for the entire state of Texas for the same time period. For each zip code area, Table 20 lists the number of low-birth weight babies, the number expected, and the O:E ratio with 95% confidence intervals. Zip codes 78211 and 78228 did not have a significantly elevated number of low-birth weight babies reported. The O:E ratio for zip code 78237 was statistically significant.

Discussion

The review of the 1990–1995 low-birth weight data from infant birth certificates for zip codes 78211, 78228, and 78237 indicated an excess number of low-birth weight babies born in zip code area 78237. There are a number of risk factors which may increase a woman's chance of delivering a low-birth weight baby. Women who smoke, drink alcohol, have poor nutritional habits, or who

use illicit drugs have an increased risk for low-birth weight babies. Lack of access to early prenatal care has also been associated with an increased risk of delivering a low-birth weight baby. TDH did not have information available which would allow them to look at the role these risk factors might have played in the reported excess of low-birth weight babies for zip code 78237.

In short, a number of factors play an important role in the health of the mother and developing fetus and can affect birth weight. Some of these factors can be controlled by the mother, others cannot. Given, however, the community concerns and that the number of low-birth weight babies was elevated for zip code 78237 for 1990–1995, we recommend continued monitoring as additional data becomes available.

VII. LEAD STATISTICS SYSTEM

To address concerns regarding lead levels, we looked at information provided by the Texas Department of Health's Bureau of Women and Children on blood lead levels in children less than 5 years of age who were tested in 1993–1995 in three zip code areas: 78228, 78237, and 78211. This information is collected only for children who were tested under the Medicaid program. Blood lead levels are considered elevated if they are greater than or equal to 10 micrograms per deciliter (≥10 μg/dL). The U.S. Centers for Disease Control and Prevention (CDC) has defined blood lead levels of ≥10 μg/dL in children as warranting action or intervention. Tables 21–23 detail the results of blood lead tests in children for the three zip codes.

Zip Code Area 78211

In 1993, 574 blood lead tests were conducted on children less than 5 years of age to determine their blood lead levels. In 1994 and 1995, 285 and 296 children were tested in zip code 78211 (Table 21). The percentage of tests with elevated blood lead levels greater than 10 µg/dL was 10% in 1993, 4% in 1994, and 8% in 1995. Less than 2% of the test results reported were greater than 20 μg/dL each year.

Zip Code Area 78228

In 1993, 577 blood lead tests were conducted on children less than 5 years of age to determine their blood lead levels. In 1994 and 1995, 459 and 519 children were tested in zip code 78228 (Table 22). The percentage of tests with elevated blood lead levels greater 10 µg/dL was 5% in 1993, 3% in 1994, and 4% in 1995. Less than 2% of the test results reported were greater than 20 µg/dL each year.

Zip Code Area 78237

In 1993, 635 blood lead tests were conducted on children less than 5 years of age to determine their blood lead levels. In 1994 and 1995, 503 and 530 children were tested in zip code 78237 (Table 23). The percentage of tests with elevated blood lead levels greater 10 µg/dL was 7% in

1993, 4% in 1994, and 7% in 1995. Less than 1% of the test results reported each year were greater than 20 µg/dL.

Discussion

Between 1993 and 1995, cases of elevated blood lead levels were reported in 90% of the zip code areas in Bexar County. These data, however, are limited in that they only include children who were tested under the Medicaid program. They also do not provide information on the number of children who might have been tested more than once.

Statewide in 1994 and 1995, the percentage of children less than 5 years of age who had their first blood lead screening tests and were found to have elevated blood leads (≥10 µg/dL) was 6% in 1994 and 5.5% in 1995. The Centers for Disease Control, the Texas Department of Health, and many local health departments have established protocols for intervention with children with elevated blood lead levels. For children with elevated blood lead levels (≥10 μg/dL), medical care providers are asked to retest the child. If a child's second test shows an elevated blood level (≥10 μg/dL, but less than 20 μg/dL), it is recommended that the medical care provider talk with the parent about possible sources of lead exposure and that the child be retested in 3–4 months. If the child's second test shows a blood lead level ≥20 μg/dL, follow-up and counseling should be conducted by the medical care provider, and the Texas Department of Health or local health department will send a packet of information to the child's parents about lead poisoning. The packet, available in English and Spanish, explains what lead poisoning is, lists potential sources of lead in the home and environment, and recommends specific activities parents can do to limit exposure. In addition, the medical care provider can request that a public health nurse visit the home to talk with the parents. If necessary, an environmental investigator can also be asked to visit the residence to help identify specific sources of lead exposure. The investigator could also test various items such as paint, water, soil, and dishes for possible lead contamination. Children with elevated blood lead levels will be followed, including additional blood lead tests, until the blood lead level is below 10 μg/dL. The local, regional, and state health departments might all be involved in various aspects of the follow-up.

VIII. CONCLUSIONS

1. In zip code area 78211, an elevation of liver cancer deaths was observed among females.
2. In zip code area 78228, an elevation of liver and kidney cases was observed among males, as well as an elevation of liver cancer deaths among males.
3. In zip code area 78237, an elevation of liver cancer cases was observed among males and elevations of cancer of the cervix, kidney and leukemia was observed among females. Elevations of liver cancer and leukemia deaths were observed among males, as well as an elevation of liver cancer deaths among females.

4. Additional analysis of liver cancer rates in 10 other zip code areas indicated elevations of liver cancer among males in four of the zip code areas evaluated (78201, 78205, 78207, 78227) and among females in two of the zip code areas (78207, 78221). Elevations in liver cancer mortality were observed among males in four of the 10 zip code areas evaluated (78201, 78204, 78207, 78227) and among females in four of the 10 zip code areas evaluated (78207, 78221, 78226, 78242).
5. Analysis of birth defects found an excess of reported cases of heart and circulatory system–related defects for zip code area 78237.
6. Analysis found an elevated number of low-birth weight babies reported for zip code area 78237.

IX. RECOMMENDATIONS

- Include additional years of information to update such health outcomes as cancer, birth defects, and low-birth weight.
- Continue to monitor liver cancer incidence and mortality as more years of data become available.
- Continue monitoring heart and circulatory system defects using vital statistic information and data from the Texas Birth Defects Monitoring Division as it becomes available.
- Continue monitoring the number of low-birth weight babies reported as additional data becomes available.
- Determine whether data are available to address community concerns regarding lupus, hearing problems, asthma, allergies, hepatitis, and diabetes in the area.

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TABLES

Table 1. Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78211, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	11	6.3	1.7	0.9–3.1
Lung	27	30.4	0.9	0.6–1.3
Bladder	5	8.4	0.6	0.2–1.4
Kidney	6	7.7	0.8	0.3–1.7
Leukemia	6	6.2	1.0	0.4–2.1
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	6	3.0	2.0	0.7–4.4
Lung	11	14.7	0.7	0.4–1.3
Cervix	13	10.8	1.2	0.6–2.1
Bladder	4	3.1	1.3	0.4–3.3
Kidney	9	5.1	1.8	0.8–3.4
Leukemia	7	4.7	1.5	0.6–3.1

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

CI: confidence interval

Table 2. Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78228, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	23	10.8	**2.1***	1.4–3.2
Lung	64	84.5	**0.8**	0.6–1.0
Bladder	23	23.5	1.0	0.6–1.5
Kidney	26	16.4	**1.6**	1.0–2.3
Leukemia	17	13.9	1.2	0.7–2.0
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	8	5.6	1.4	0.6–2.8
Lung	44	51.4	0.9	0.6–1.1
Cervix	16	22.0	0.7	0.4–1.2
Bladder	9	9.5	0.9	0.4–1.8
Kidney	17	11.8	1.4	0.8–2.3
Leukemia	9	12.2	0.7	0.3–1.4

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

* Significantly higher (at the 5% level) than expected

Table 3. Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78237, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	20	8.2	**2.4***	1.5–3.8
Lung	40	39.2	1.0	0.7–1.4
Bladder	8	9.5	0.8	0.4–1.7
Kidney	10	9.4	1.1	0.5–2.0
Leukemia	10	7.6	1.3	0.6–2.4
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	5	4.3	1.2	0.4–2.7
Lung	16	20.5	0.8	0.4–1.3
Cervix	23	14.4	**1.6**	1.0–2.4
Bladder	6	4.5	1.3	0.5–2.9
Kidney	13	7.1	**1.8**	1.0–3.1
Leukemia	13	6.0	**2.2***	1.2–3.7

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

* Significantly higher (at the 5% level) than expected

Table 4. Number of Observed and Expected Cancer Deaths and Race Adjusted Standardized Mortality Ratios, Selected Sites, San Antonio, Texas, Zip Code 78211, 1991–1995

MALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	10	6.3	1.6	0.8–2.9
Lung	28	26.6	1.1	0.7–1.5
Bladder	2	1.8	1.1	0.1–4.0
Kidney	3	3.4	0.9	0.2–2.6
Leukemia	8	4.1	2.0	0.8–3.8
FEMALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	9	3.5	**2.6***	1.2–4.9
Lung	10	11.0	0.9	0.4–1.7
Cervix	6	3.3	1.8	0.7–4.0
Bladder	0	0.7	0.0	0.0–5.3
Kidney	3	2.0	1.5	0.3–4.4
Leukemia	2	3.0	0.7	0.1–2.4

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SMR (standardized mortality ratio) is the number of observed deaths divided by the number of expected deaths. The latter is based on race-, sex-, and age-specific cancer mortality rates for Texas during the period 1990-1995.

CI: confidence interval

* Significantly higher (at the 5% level) than expected

Table 5. Number of Observed and Expected Cancer Deaths and Race Adjusted Standardized Mortality Ratios, Selected Sites, San Antonio, Texas, Zip Code 78228, 1991–1995

MALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	21	11.4	**1.8***	1.1–2.8
Lung	52	72.5	**0.7**†	0.5–0.9
Bladder	3	4.8	0.6	0.1–1.8
Kidney	6	7.0	0.9	0.3–1.9
Leukemia	16	9.8	1.6	0.9–2.7
FEMALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	8	7.2	1.1	0.5–2.2
Lung	46	40.1	1.1	0.8–1.5
Cervix	2	6.7	0.3	0.0–1.1
Bladder	1	2.5	0.4	0.0–2.2
Kidney	3	4.8	0.6	0.1–1.8
Leukemia	3	8.3	0.4	0.1–1.1

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SMR (standardized mortality ratio) is the number of observed deaths divided by the number of expected deaths. The latter is based on race-, sex-, and age-specific cancer mortality rates for Texas during the period 1990-1995.

CI: confidence interval

* Significantly higher (at the 5% level) than expected

† Significantly lower (at the 5% level) than expected

Table 6. Number of Observed and Expected Cancer Deaths and Race Adjusted Standardized Mortality Ratios, Selected Sites, San Antonio, Texas, Zip Code 78237, 1991–1995

MALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	28	8.2	**3.4***	2.3–4.9
Lung	35	34.7	1.0	0.7–1.4
Bladder	2	2.1	1.0	0.1–3.4
Kidney	6	4.2	1.4	0.5–3.1
Leukemia	10	5.0	**2.0**	1.0–3.7
FEMALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	11	5.2	**2.1***	1.1–3.8
Lung	22	15.7	1.4	0.9–2.1
Cervix	7	4.7	1.5	0.6–3.1
Bladder	0	1.1	0.0	0.0–3.4
Kidney	4	2.9	1.4	0.4–3.5
Leukemia	7	4.2	1.7	0.7–3.4

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SMR (standardized mortality ratio) is the number of observed deaths divided by the number of expected deaths. The latter is based on race-, sex-, and age-specific cancer mortality rates for Texas during the period 1990-1995.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

* Significantly higher (at the 5% level) than expected

Table 7. Number of Observed and Expected Liver Cancer Cases and Race-Adjusted Standardized Incidence Ratios, San Antonio, Texas, 1990–1994

MALES				
Zip Code	**Observed**	**Expected**	**SIR**	**95% CI**
78201	16	7.9	**2.0***	1.3–3.3
78204	6	3.2	1.9	0.7–4.1
78205	3	0.4	**7.5***	1.5–21.9
78207	23	14.0	**1.6**	1.0–2.5
78221	7	5.3	1.3	0.5–2.7
78224	2	1.9	1.1	0.1–3.8
78225	6	3.7	1.6	0.6–3.5
78226	2	1.3	1.5	0.2–5.6
78227	11	4.4	**2.5***	1.2–4.5
78242	4	2.0	2.0	0.5–5.1

FEMALES				
Zip Code	**Observed**	**Expected**	**SIR**	**95% CI**
78201	8	5.5	1.5	0.6–2.9
78204	3	2.1	1.4	0.3–4.2
78205	0	0.3	0.0	0.0–12.3
78207	15	8.8	**1.7**	1.0–2.8
78221	7	2.8	**2.5**	1.0–5.2
78224	1	1.0	1.0	0.0–5.6
78225	3	1.9	1.6	0.3–4.6
78226	2	0.5	4.0	0.5–14.4
78227	4	2.1	1.9	0.5–4.9
78242	2	0.8	2.5	0.3–9.0

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

* Significantly higher (at the 5% level) than expected

Table 8. Number of Observed and Expected Liver Cancer Deaths and Race-Adjusted Standardized Mortality Ratios, San Antonio, Texas, 1991–1995

MALES				
Zip Code	**Observed**	**Expected**	**SMR**	**95% CI**
78201	18	8.4	**2.1***	1.3–3.4
78204	8	3.2	**2.5***	1.1–4.9
78205	2	0.5	4.0	0.5–14.4
78207	29	14.0	**2.1***	1.4–3.0
78221	9	5.5	1.6	0.7–3.1
78224	5	1.9	2.6	0.9–6.1
78225	6	3.8	1.6	0.6–3.4
78226	2	1.3	1.5	0.2–5.6
78227	10	4.9	**2.0**	1.0–3.8
78242	2	1.9	1.1	0.1–3.8

Note: The SMR (standardized mortality ratio) is the number of observed deaths divided by the

FEMALES				
Zip Code	**Observed**	**Expected**	**SMR**	**95% CI**
78201	10	7.1	1.4	0.7–2.6
78204	5	2.5	2.0	0.6–4.7
78205	0	0.4	0.0	0.0–9.2
78207	18	10.2	**1.8**	1.0–2.8
78221	8	3.6	**2.2**	1.0–4.4
78224	1	1.2	0.8	0.0–4.6
78225	2	2.3	0.9	0.1–3.1
78226	3	0.6	**5.0**	1.0–14.6
78227	4	2.7	1.5	0.4–3.8
78242	5	0.9	**5.6***	1.8–13.0

number of expected deaths. The latter is based on race-, sex-, and age-specific cancer mortality rates for Texas during 1990-1995.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

* Significantly higher (at the 5% level) than expected

Table 9. Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Birth Certificates, San Antonio, Texas, Zip Code 78211, 1991–1995

Congenital Anomaly	Observed Cases	Expected Cases[a]	O:E Ratio[b]	95% Confidence Interval
Anencephalus	3	1.24	2.41	0.49–7.06
Spina Bifida/Meningocele	1	1.24	0.81	0.02–4.49
Hydrocephalus	1	1.28	0.78	0.02–4.35
Microcephalus	1	0.40	2.51	0.06–13.93
Other Central Nervous System	0	0.69	--	--
Heart Malformations	4	4.38	0.91	0.25–2.34
Other Circulatory/Respiratory	1	2.81	0.36	0.01–1.98
Rectal Atresia/Stenosis	0	0.54	--	--
Tracheo-Esophageal Fistula	0	0.35	--	--
Omphalocele/Gastroschisis	1	1.34	0.75	0.19–4.16
Other Gastrointestinal Anomalies	0	0.88	--	--
Malformed Genitalia	3	3.80	0.79	0.16–2.31

Renal Agenesis	0	0.54	--	--
Other Urogenital Anomalies	3	2.80	1.07	0.22–3.13
Cleft Lip/Palate	3	3.22	0.93	0.19–2.72
Polydactyly/Syndactyly	1	3.43	0.29	0.01–1.62
Limb Reductions	2	0.66	3.04	0.37–10.94
Club Foot	3	2.42	1.24	0.26–3.62
Diaphragmatic Hernia	0	0.59	--	--
Other Musculoskeletal/Integument	3	5.44	0.55	0.11–1.61
Down Syndrome	2	1.76	1.14	0.14–4.10
Other Chromosomal Anomalies	0	0.72	--	--
Other	29	17.37	**1.67**[*]	1.12–2.40

[a] Based on rates for the entire state of Texas

[b] Observed number of cases divided by the expected number of cases)

[*] Significant at the 5% level

Table 10. Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Birth Certificates, San Antonio, Texas, Zip Code 78228, 1991–1995

Congenital Anomaly	Observed Cases	Expected Cases[a]	O:E Ratio[b]	95% Confidence Interval
Anencephalus	2	1.94	1.03	0.12–3.72
Spina Bifida/Meningocele	2	1.93	1.04	0.13–3.74
Hydrocephalus	1	2.00	0.50	0.01–2.79
Microcephalus	2	0.62	3.22	0.39–11.65
Other Central Nervous System	0	1.08	--	--
Heart Malformations	8	6.82	1.17	0.51–2.31
Other Circulatory/Respiratory	2	4.38	0.46	0.06–1.65
Rectal Atresia/Stenosis	0	0.84	--	--
Tracheo-Esophageal Fistula	0	0.54	--	--
Omphalocele/Gastroschisis	1	2.09	0.48	0.01–2.67
Other Gastrointestinal Anomalies	3	1.36	2.20	0.45–6.44
Malformed Genitalia	4	5.92	0.68	0.18–1.73

Renal Agenesis	1	0.84	1.19	0.03–6.63
Other Urogenital Anomalies	3	4.37	0.69	0.14–2.00
Cleft Lip/Palate	1	5.01	0.20	0.01–1.11
Polydactyly/Syndactyly	1	5.34	0.19	0.01–1.04
Limb Reductions	0	1.03	--	--
Club Foot	0	3.77	--	--
Diaphragmatic Hernias	0	0.92	--	--
Other Musculoskeletal/Integument	4	8.47	0.47	0.13–1.21
Down Syndrome	4	2.74	1.46	0.40–3.74
Other Chromosomal Anomalies	0	1.13	--	--
Other	22	27.07	0.81	0.51–1.23

[a] Based on rates for the entire state of Texas

[b] Observed to expected ratio (observed number of cases divided by the expected number of cases)

Table 11. Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Birth Certificates, San Antonio, Texas, Zip Code 78237, 1990–1995

Congenital Anomaly	Observed Cases	Expected Cases[a]	O:E Ratio[b]	95% Confidence Interval
Anencephalus	3	1.61	1.87	0.38–5.44
Spina Bifida/Meningocele	3	1.60	1.88	0.39–5.48
Hydrocephalus	2	1.66	1.21	0.15–4.35
Microcephalus	0	0.51	--	--
Other Central Nervous System	0	0.90	--	--
Heart Malformations	4	5.65	0.71	0.19–1.81
Other Circulatory/Respiratory	4	3.63	1.10	0.30–2.82
Rectal Atresia/Stenosis	2	0.70	2.86	0.36–10.31
Tracheo-Esophageal Fistula	1	0.45	2.22	0.06–12.38
Omphalocele/Gastroschisis	1	1.73	0.58	0.02–3.22
Other Gastrointestinal Anomalies	1	1.13	0.89	0.02–4.93
Malformed Genitalia	2	4.90	0.41	0.05–1.47

Renal Agenesis	0	0.69	--	--
Other Urogenital Anomalies	1	3.62	0.28	0.01–1.54
Cleft Lip/Palate	4	4.15	0.96	0.26–2.47
Polydactyly/Syndactyly	3	4.42	0.68	0.14–1.98
Limb Reductions	1	0.85	1.18	0.03–6.55
Club Foot	7	3.12	2.24	0.90–4.62
Diaphragmatic Hernias	0	0.77	--	--
Other Musculoskeletal/Integument	6	7.02	0.85	0.31–1.86
Down Syndrome	3	2.27	1.32	0.27–3.86
Other Chromosomal Anomalies	3	0.93	3.22	0.66–9.42
Other	33	22.42	**1.47***	1.01–2.06

[a] Based on rates for the entire state of Texas

[b] Observed to expected ratio (observed number of cases divided by the expected number of cases)

* Significant at the 5% level

Table 12. Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Fetal Death Certificates, San Antonio, Texas, Zip Code 78211, 1990–1995

Congenital Anomaly	Observed Cases	Expected Cases[a]	O:E Ratio[b]	95% Confidence Interval
Anencephalus	1	0.56	1.78	0.05–9.95
Spina Bifida/Meningocele	1	0.21	4.86	0.12–26.52
Hydrocephalus	0	0.32	--	--
Microcephalus	0	0.08	--	--
Other Central Nervous System	0	0.23	--	--
Heart Malformations	1	0.36	2.78	0.07–15.47
Other Circulatory/Respiratory	0	0.25	--	--
Rectal Atresia/Stenosis	0	0.08	--	--
Tracheo-Esophageal Fistula	0	0.02	--	--
Omphalocele/Gastroschisis	0	0.19	--	--
Other Gastrointestinal Anomalies	0	0.11	--	--
Malformed Genitalia	0	0.11	--	--

Renal Agenesis	0	0.14	--	--
Other Urogenital Anomalies	0	0.19	--	--
Cleft Lip/Palate	0	0.19	--	--
Polydactyly/Syndactyly	0	0.12	--	--
Limb Reductions	0	0.13	--	--
Club Foot	0	0.16	--	--
Diaphragmatic Hernias	0	0.05	--	--
Other Musculoskeletal/Integument	0	0.24	--	--
Down Syndrome	0	0.20	--	--
Other Chromosomal Anomalies	0	0.38	--	--
Other	1	1.29	0.78	0.02–4.32

[a] Based on rates for the entire state of Texas

[b] Observed to expected ratio (observed number of cases divided by the expected number of cases)

[c] Significant at the 5% level

Table 13. Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Fetal Death Certificates, San Antonio, Texas, Zip Code 78228, 1990–1995

Congenital Anomaly	Observed Cases	Expected Cases[a]	O:E Ratio[b]	95% Confidence Interval
Anencephalus	0	0.88	--	--
Spina Bifida/Meningocele	0	0.32	--	--
Hydrocephalus	0	0.50	--	--
Microcephalus	0	0.12	--	--
Other Central Nervous System	1	0.36	2.81	0.07–15.47
Heart Malformations	1	0.56	1.78	0.05–9.95
Other Circulatory/Respiratory	0	0.38	--	--
Rectal Atresia/Stenosis	0	0.13	--	--
Tracheo-Esophageal Fistula	0	0.04	--	--
Omphalocele/Gastroschisis	0	0.30	--	--
Other Gastrointestinal Anomalies	0	0.17	--	--
Malformed Genitalia	0	0.18	--	--

Renal Agenesis	0	0.22	--	--
Other Urogenital Anomalies	0	0.29	--	--
Cleft Lip/Palate	0	0.29	--	--
Polydactyly/Syndactyly	0	0.19	--	--
Limb Reductions	1	0.21	4.78	0.12–26.52
Club Foot	0	0.25	--	--
Diaphragmatic Hernias	0	0.08	--	--
Other Musculoskeletal/Integument	0	0.38	--	--
Down Syndrome	1	0.31	3.26	0.08–17.97
Other Chromosomal Anomalies	0	0.59	--	--
Other	0	2.01	--	--

[a] Based on rates for the entire state of Texas

[b] Observed to expected ratio (observed number of cases divided by the expected number of cases)

Table 14. Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Fetal Death Certificates, San Antonio, Texas, Zip Code 78237, 1990–1995

Congenital Anomaly	Observed Cases	Expected Cases[a]	O:E Ratio[b]	95% Confidence Interval
Anencephalus	0	0.73	—	--
Spina Bifida/Meningocele	1	0.27	3.76	0.09–20.63
Hydrocephalus	0	0.41	--	--
Microcephalus	0	0.10	--	--
Other Central Nervous System	1	0.30	3.39	0.09–19.2
Heart Malformations	0	0.47	--	--
Other Circulatory/Respiratory	0	0.32	--	--
Rectal Atresia/Stenosis	1	0.11	9.35	0.24–52.12
Tracheo-Esophageal Fistula	0	0.03	--	--
Omphalocele/Gastroschisis	0	0.25	--	--
Other Gastrointestinal Anomalies	0	0.14	--	--
Malformed Genitalia	0	0.15	--	--

Renal Agenesis	0	0.19	--	--
Other Urogenital Anomalies	0	0.24	--	--
Cleft Lip/Palate	0	0.24	--	--
Polydactyly/Syndactyly	0	0.16	--	--
Limb Reductions	0	0.17	--	--
Club Foot	0	0.21	--	--
Diaphragmatic Hernias	0	0.06	--	--
Other Musculoskeletal/Integument	0	0.31	--	--
Down Syndrome	0	0.25	--	--
Other Chromosomal Anomalies	1	0.49	2.05	0.05–11.4
Other	2	1.66	1.20	0.15–4.35

[a] Based on rates for the entire state of Texas

[b] Observed to expected ratio (observed number of cases divided by the expected number of cases)

Table 15. Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Infant Death Certificates, San Antonio, Texas, Zip Code 78211, 1990–1995

Congenital Anomaly	ICD9[a] Code	Observed Cases	Expected Cases[b]	O:E Ratio[c]	95%Confidence Interval
Anencephalus and similar anomalies	740	2.00	0.59	3.41	0.41–12.31
Spina bifida	741	--	0.15	--	--
Other congenital anomalies of nervous system	742	--	0.86	--	--
Bulbus cordis anomalies and anomalies of cardiac septal closure	745	1.00	1.05	0.96	0.02–5.30
Other congenital anomalies of heart	746	5.00	2.47	2.02	0.66–4.72
Other congenital anomalies of circulatory system	747	1.00	0.84	1.19	0.03–6.65
Congenital anomalies of respiratory system	748	4.00	2.08	1.92	0.52–4.92
Cleft palate and cleft lip	749	--	0.07	--	--
Other congenital anomalies of upper alimentary tract	750	1.00	0.09	11.76	0.30–65.53
Other congenital anomalies of digestive system	751	--	0.25	--	--
Congenital anomalies of urinary system	753	3.00	0.92	3.25	0.67–9.50

Certain congenital musculoskeletal deformities	754	--	0.04	--	--
Other congenital anomalies of limbs	755	--	0.08	--	--
Other congenital musculoskeletal anomalies	756	--	0.77	--	--
Congenital anomalies of the integument	757	--	0.05	--	--
Chromosomal anomalies	758	--	1.35	--	--
Other and unspecified congenital anomalies	759	--	0.69	--	--

[a] International Classification of Disease - 9th Edition

[b] Based on rates for the entire state of Texas

[c] Observed to expected ratio (observed number of cases divided by the expected number of cases)

Table 16. Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Infant Death Certificates, San Antonio, Texas, Zip Code 78228, 1990–1995

Congenital Anomaly	ICD9[a] Code	Observed Cases	Expected Cases[b]	O:E Ratio[c]	95%Confidence Interval
Anencephalus and similar anomalies	740	--	0.91	--	--
Spina bifida	741	--	0.24	--	--
Other congenital anomalies of nervous system	742	--	1.35	--	--
Bulbus cordis anomalies and anomalies of cardiac septal closure	745	1	1.63	0.61	0.02–3.42
Other congenital anomalies of heart	746	4	3.85	1.04	0.28–2.66
Other congenital anomalies of circulatory system	747	--	1.30	--	--
Congenital anomalies of respiratory system	748	1	3.24	0.31	0.01–1.7
Cleft palate and cleft lip	749	--	0.11	--	--
Other congenital anomalies of upper alimentary tract	750	1	0.13	7.55	0.19–42.0
Other congenital anomalies of digestive system	751	--	0.39	--	--
Congenital anomalies of urinary system	753	1	1.44	0.70	0.02–3.8

Certain congenital musculoskeletal deformities	754	--	0.06	--	--
Other congenital anomalies of limbs	755	1	0.12	8.19	0.21–45.62
Other congenital musculoskeletal anomalies	756	1	1.20	0.83	0.02–4.6
Congenital anomalies of the integument	757	--	0.07	--	--
Chromosomal anomalies	758	2	2.11	0.95	0.12–3.43
Other and unspecified congenital anomalies	759	--	1.08	--	--

[a] International Classification of Disease - 9th Edition

[b] Based on rates for the entire state of Texas

[c] Observed to expected ratio (observed number of cases divided by the expected number of cases)

Table 17. Comparison of Observed Cases to Expected Based on Congenital Anomalies as Listed on Infant Death Certificates, San Antonio, Texas, 78237, 1990–1995

Congenital Anomaly	ICD9[a] Code	Observed Cases	Expected Cases[b]	O:E Ratio[c]	95%Confidence Interval
Anencephalus and similar anomalies	740	2	0.76	2.64	0.32–9.54
Spina bifida	741	--	0.20	--	--
Other congenital anomalies of nervous system	742	--	1.12	--	--
Bulbus cordis anomalies and anomalies of cardiac septal closure	745	6	1.35	**4.45***	1.63–9.68
Other congenital anomalies of heart	746	9	3.19	**2.82***	1.29–5.36
Other congenital anomalies of circulatory system	747	4	1.08	**3.70***	1.01–9.48
Congenital anomalies of respiratory system	748	3	2.68	1.12	0.23–3.26
Cleft palate and cleft lip	749	--	0.09	--	--
Other congenital anomalies of upper alimentary tract	750	--	0.11	--	--
Other congenital anomalies of digestive system	751	1	0.32	3.12	0.08–17.37
Congenital anomalies of urinary system	753	2	1.19	1.68	0.20–6.07

Certain congenital musculoskeletal deformities	754	--	0.05	--	--
Other congenital anomalies of limbs	755	1	0.10	9.89	0.25–55.09
Other congenital musculoskeletal anomalies	756	2	0.99	2.01	0.24–7.27
Congenital anomalies of the integument	757	--	0.06	--	--
Chromosomal anomalies	758	2	1.75	1.15	0.14–4.14
Other and unspecified congenital anomalies	759	--	0.90	--	--

[a] International Classification of Disease - 9th Edition

[b] Based on rates for the entire state of Texas

[c] Observed to expected ratio (observed number of cases divided by the expected number of cases)

[*] Significant at the 5% level

Table 18. Comparison of Observed Cases to Expected Adjusted for Selected Congenital Anomalies as Listed on Infant Death Certificates, San Antonio, Texas, Zip Code 78237, 1990–1995

Congenital Anomaly	ICD9[a] Code	Observed Cases	Expected Cases[b]	O:E Ratio[c]	95%Confidence Interval
Bulbus cordis anomalies and anomalies of cardiac septal closure	745	6	1.33	**4.52**[*]	1.66–9.83
Other congenital anomalies of heart	746	9	3.03	**2.98**[*]	1.36–5.65
Other congenital anomalies of circulatory system	747	4	1.09	**3.67**	1.00–9.38

[a] International Classification of Disease - 9th Edition

[b] Based on rates for the entire state of Texas

[c] Observed to expected ratio (observed number of cases divided by the expected number of cases)

Bold type indicates an excess of borderline statistical significance

[*] Significant at the 5% level

Table 19. Comparison of Observed Cases to Expected Adjusted for Maternal Age for Selected Congenital Anomalies as Listed on Infant Death Certificates, San Antonio, Texas, Zip Code 78237, 1990–1995

Congenital Anomaly	ICD9[a] Code	Observed Cases	Expected Cases[b]	O:E Ratio[c]	95%Confidence Interval
Bulbus cordis anomalies and anomalies of cardiac septal closure	745	6	0.64	**9.32***	3.40–21.2
Other congenital anomalies of heart	746	9	2.34	**3.84***	1.76–7.30
Other congenital anomalies of circulatory system	747	4	0.51	**7.82***	2.13–20.0

[a] International Classification of Disease - 9th Edition

[b] Based on rates for the entire state of Texas

[c] Observed to expected ratio (observed number of cases divided by the expected number of cases)

* Significant at the 5% level

Table 20. Comparison of Observed to Expected Cases of Low-birth Weight as Listed on Infant Birth Certificates, Zip Codes 78211, 78228, and 78237, San Antonio, Texas, 1990–1995

Zip Code	Observed Cases	Expected Cases[a]	O:E Ratio[b]	95%Confidence Interval
78211	323	303.12	1.07	0.95–1.19
78228	461	472.32	0.98	0.89–1.07
78237	462	391.21	**1.18**[*]	1.08–1.30

[a] Based on rates for the entire state of Texas

[b] Observed to expected ratio (observed number of cases divided by the expected number of cases)

[*] Significant at the 5% level

Table 21. Blood Lead Levels of Children 0-72 Months of Age in San Antonio, Texas, Zip Code 78211

	Total Tests	Pb <10µg/dL	Pb ≥ 10µg/dL	Pb ≥ 20µg/dL	Pb ≥ 30µg/dL
1993	574	517 (90%)	51 (9%)	1 (< 1%)	0 (0%)
1994	285	275 (96%)	10 (3%)	2 (< 1%)	2 (< 1%)
1995	296	271 (92%)	19 (7%)	1 (< 1%)	0 (0%)

Table 22. Blood Lead Levels of Children 0-72 Months of Age in San Antonio, Texas, Zip Code 78228

	Total Tests	Pb <10µg/dL	Pb ≥ 10µg/dL	Pb ≥ 20µg/dL	Pb ≥ 30µg/dL
1993	577	546 (95%)	28 (4%)	5 (< 1%)	2 (0%)
1994	459	446 (97%)	13 (3%)	0 (0)	0 (0%)
1995	519	495 (96%)	13 (3%)	2 (< 1%)	0 (0%)

Table 23. Blood Lead Levels of Children 0-72 Months of Age in San Antonio, Texas, Zip Code 78237

	Total Tests	Pb <10µg/dL	Pb ≥ 10µg/dL	Pb ≥ 20µg/dL	Pb ≥ 30µg/dL
1993	635	589 (93%)	38 (6%)	1 (< 1%)	0 (0%)
1994	503	485 (96%)	18 (4%)	2 (< 1%)	2 (< 1%)
1995	530	494 (93%)	24 (6%)	1 (< 1%)	0 (0%)

APPENDIX A

Initial Cancer Request

After receiving the petition to conduct a public health assessment on neighborhoods north and southeast of Kelly Air Force Base, ATSDR requested that the Cancer Registry Division (CRD) of the Texas Department of Health evaluate cancer rates in zip code areas 78211 and 78237. Specifically, incidence (cases) and mortality (deaths) data were evaluated for cancers of the colon, pancreas, lung, prostate, breast, and leukemia for the periods 1985–1992 and 1990–1994 respectively.

In evaluating the cancer incidence data (Tables A–1 and A–2), the number of cancer cases among both males and female residents was either lower than or within the range expected, with the exception of pancreatic cancer, which was elevated among males in zip code area 78211. Evaluation of the mortality data (Tables A–3 and A–4) in these two zip codes found the number of cancer deaths among both male and female residents to be either lower than or within the range expected, with the exception of colon cancer and leukemia, elevated among males in zip code area 78237.

Table A–1 Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78211, 1985–1992

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Colon	24	38.9	**0.6†**	0.4–0.9
Pancreas	17	8.7	**2.0***	1.1–3.1
Lung	48	47.1	1.0	0.8–1.4
Prostate	67	91.2	**0.7†**	0.6–0.9
Leukemia	15	10.9	1.4	0.8–2.3
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Colon	18	31.9	**0.6†**	0.3–0.9
Pancreas	10	9.1	1.1	0.5–2.0
Lung	15	28.5	**0.5†**	0.3–0.9
Breast	88	87.7	1.0	0.8–1.2
Leukemia	8	8.0	1.0	0.4–2.0

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for California for the period 1988-1992. The SIR has been rounded to the first decimal place.

CI: confidence interval

* Significantly higher (at the 5% level) than expected

† Significantly lower (at the 5% level) than expected

Table A–2 Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78237, 1985–1992

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Colon	42	47.8	0.9	0.6–1.2
Pancreas	15	11.2	1.3	0.8–2.2
Lung	60	60.5	1.0	0.8–1.3
Prostate	80	117.4	**0.7**†	0.5–0.8
Leukemia	13	13.3	1.0	0.5–1.7
FEMALE				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Colon	26	47.1	**0.6**†	0.4–0.8
Pancreas	14	13.9	1.0	0.6–1.7
Lung	22	41.1	**0.5**†	0.3–0.8
Breast	105	119.0	0.9	0.7–1.1
Leukemia	13	11.0	1.2	0.6–2.0

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for California for the period 1988-1992. The SIR has been rounded to the first decimal place.

CI: confidence interval

* Significantly higher (at the 5% level) than expected

† Significantly lower (at the 5% level) than expected

Table A–3 Number of Observed and Expected Cancer Deaths and Race-Adjusted Standardized Mortality Ratios, Selected Sites, San Antonio, Texas, Zip Code 78211, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Colon	11	7.5	1.5	0.7–2.6
Pancreas	5	5.7	0.9	0.3–2.0
Lung	32	26.7	1.2	0.8–1.7
Prostate	12	10.8	1.1	0.6–1.9
Leukemia	8	4.1	1.9	0.8–3.8
FEMALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Colon	7	5.8	1.2	0.5–2.5
Pancreas	7	5.1	1.4	0.6–2.9
Lung	12	10.9	1.1	0.6–1.9
Breast	11	13.3	0.8	0.4–1.5
Leukemia	2	3.1	0.6	0.1–2.3

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SMR (standardized mortality ratio) is the number of observed deaths divided by the number of expected deaths. The latter is based on race-, sex-, and age-specific cancer mortality rates for Texas, 1990-1994. The SMR has been rounded to the first decimal place.

CI: confidence interval

Table A–4 Number of Observed and Expected Cancer Deaths and Race-Adjusted Standardized Mortality Ratios, Selected Sites, San Antonio, Texas, Zip Code 78237, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Colon	18	9.6	**1.9***	1.1–3.0
Pancreas	7	7.4	0.9	0.4–1.9
Lung	37	34.8	1.1	0.7–1.5
Prostate	18	14.3	1.3	0.7–2.0
Leukemia	14	5.0	**2.8***	1.5–4.7
FEMALES				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Colon	11	8.8	1.3	0.6–2.2
Pancreas	9	7.7	1.2	0.5–2.2
Lung	16	15.6	1.0	0.6–1.7
Breast	27	18.7	1.4	1.0–2.1
Leukemia	7	4.3	1.6	0.7–3.3

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SMR (standardized mortality ratio) is the number of observed deaths divided by the number of expected deaths. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas, 1990-1994. The SMR has been rounded to the first decimal place.

CI: confidence interval

* Significantly higher (at the 5% level) than expected

APPENDIX B

California Incidence Rates

California was initially chosen as the comparison population due to the availability of cancer incidence rates for the Hispanic population in that state. The number of expected cases presented in Tables B1–B3, therefore, was based on race-, sex-, and age-specific cancer incidence rates published by the California Cancer Registry. The initial zip codes of concern were 78211, 78228, and 78237.

During the period 1990–1994, the number of cases observed for cancer of the lung, bladder, kidney, or leukemia was close to the number expected among males and females in zip code 78211 (Table B–1). However, a significant excess of liver cancer was observed among the male residents and a significant excess of cervical cancer was observed among females. A higher than expected number of liver cancer cases was observed among females, although it was of borderline statistical significance. In zip code area 78228, the number of cases of lung, bladder, and leukemia cancer observed among males and females was close to the expected number (Table B–2). A significant excess of liver cancer among males was observed as was a significant excess of kidney cancer among males. The number of liver and kidney cancer cases was higher than expected among females, although the excesses were of borderline statistical significance. No excess of cervical cancer was observed among females. The number of cases observed for lung, bladder, and kidney cancer, as well as leukemia, was close to the number expected among males in zip code 78237 (Table B–3). The number of cases observed of liver and bladder cancer among females in this zip code was also close to the number expected. There was, however, a significant excess of liver cancer observed among the male residents, and a significant excess of cervical and kidney cancer in females. A higher than expected number of leukemia cases and a lower than expected number of lung cancer cases were observed among females although these excesses were of borderline statistical significance.

Additional Liver Cancer Analysis

Liver cancer incidence data was also examined for 15 additional zip codes in the Kelly AFB area.

The analysis of incidence data using California as the comparison population during the period 1990–1994 indicates a statistically significant excess of liver cancer among males in the 78201, 78204, 78205, 78207, and 78227 zip code areas (Table B–4). A higher than expected number of liver cancer cases was observed among males in zip code 78225, although this excess was of borderline statistical significance. Among females in the study area during the same time period, a statistically significant excess of liver cancer was observed in zip code areas 78207, 78212, and 78221.

Discussion

The initial analysis of liver cancer incidence using California rates for comparison found a significant excess of cases among males in all three of the initial zip code areas of concern with a corresponding elevation (although not statistically significant) among females in two zip code areas also. The additional liver cancer analysis using California rates for comparison found a

significant excess of cases among males in five of the fifteen zip code areas evaluated and among females in three of the zip code areas.

One of the limitations in using California data for the comparison population is that historically liver cancer rates in Texas have been consistently higher than those in California. This difference in background rates in the Texas and California populations is reflected in the standardized incidence ratios calculated for the zip code areas of concern. Using the California rates as a comparison results in an artificially lower expected number of cases for the San Antonio population and subsequently a higher standardized incidence ratio than if the Texas rates were used. The magnitude of the standardized incidence ratios for both males and females, however, is substantially reduced when using Texas as the comparison population.

Table B–1 Number of Observed and Expected New Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78211, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	10	3.6	**2.8***	1.3–5.1
Lung	27	28.6	0.9	0.6–1.4
Bladder	5	7.3	0.7	0.2–1.6
Kidney	6	7.0	0.9	0.3–1.9
Leukemia	6	6.8	0.9	0.3–1.9
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	5	1.6	**3.1**	1.0–7.3
Lung	11	18.0	0.6	0.3–1.1
Cervix	13	5.6	**2.3***	1.2–4.0
Bladder	4	2.6	1.5	0.4–3.9
Kidney	9	4.4	2.0	0.9–3.9
Leukemia	7	5.1	1.4	0.6–2.8

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for California during the period 1989-1993.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

* Significantly higher (at the 5% level) than expected

Table B–2 Number of Observed and Expected New Cancer Cases and Race Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78228, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	23	6.8	**3.4***	2.1–5.1
Lung	64	75.6	0.8	0.7–1.1
Bladder	23	20.4	1.1	0.7–1.7
Kidney	26	15.1	**1.7***	1.1–2.5
Leukemia	16	15.2	1.1	0.6–1.7
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	8	3.3	**2.4**	1.0–4.8
Lung	44	58.4	0.8	0.5–1.0
Cervix	16	12.2	1.3	0.7–2.1
Bladder	9	8.2	1.1	0.5–2.1
Kidney	17	10.2	**1.7**	1.0–2.7
Leukemia	9	12.8	0.7	0.3–1.3

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for California during the period 1989–1993.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

* Significantly higher (at the 5% level) than expected

Table B–3 Number of Observed and Expected New Cancer Cases and Race Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78237, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	20	4.7	**4.3***	2.6–6.6
Lung	40	36.9	1.1	0.8–1.5
Bladder	8	8.4	1.0	0.4–1.9
Kidney	10	8.6	1.2	0.6–2.1
Leukemia	9	8.3	1.1	0.5–2.1
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	5	2.4	2.1	0.7–4.9
Lung	16	25.8	**0.6**	0.4–1.0
Cervix	23	7.4	**3.1***	2.0–4.7
Bladder	6	3.8	1.6	0.6–3.4
Kidney	13	6.2	**2.1***	1.1–3.6
Leukemia	13	7.0	**1.9**	1.0–3.2

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is as the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for California during the period 1989-1993.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

* Significantly higher (at the 5% level) than expected

Table B–4 Number of Observed and Expected Liver Cancer Cases and Race-Adjusted Standardized Incidence Ratios, San Antonio, Texas, 1990–1994

MALES				
Zip Code	**Observed**	**Expected**	**SIR**	**95% CI**
78201	16	4.8	**3.3***	1.9–5.4
78204	6	1.7	**3.5***	1.3–7.7
78205	3	0.3	**10.0***	2.1–29.2
78207	23	7.6	**3.0***	1.9–4.5
78212	6	3.7	1.6	0.6–3.5
78221	7	3.4	2.1	0.8–4.2
78224	2	1.1	1.8	0.2–6.6
78225	6	2.1	**2.8**	1.0–6.2
78226	2	0.8	2.5	0.3–9.0
78227	11	3.1	**3.5***	1.8–6.3
78229	3	1.9	1.6	0.3–4.6
78238	0	1.5	0.0	0.0–2.5

78242	4	1.4	2.9	0.8–7.3
78245	2	1.3	1.5	0.2–5.6
78252	0	0.1	0.0	0.0–36.9

Table B–4 Number of Observed and Expected Liver Cancer Cases and Race-Adjusted Standardized Incidence Ratios, San Antonio, Texas, 1990–1994 (continued)

FEMALES				
Zip Code	**Observed**	**Expected**	**SIR**	**95% CI**
78201	7	3.0	2.3	0.9–4.8
78204	3	1.0	3.0	0.6–8.8
78205	0	0.2	0.0	0.0–18.0
78207	15	4.3	**3.5***	2.0–5.8
78212	8	2.2	**3.6***	1.6–7.2
78221	7	1.6	**4.4***	1.8–9.0
78224	1	0.6	1.7	0.0–9.3
78225	3	1.0	3.0	0.6–8.8
78226	2	0.3	6.7	0.8–24.1
78227	4	1.4	2.9	0.8–7.3
78229	0	1.0	0.0	0.0–3.7
78238	0	0.7	0.0	0.0–5.3

78242	2	0.6	3.3	0.4–12.0
78245	1	0.5	2.0	0.1–11.1
78252	0	0.0	0.0	——

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for California during the period 1989-1993.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

* Significantly higher (at the 5% level) than expected

APPENDIX C

Additional Liver Cancer Mortality Analysis

When conducting the additional liver analysis, five zip code areas were evaluated in the mortality analysis was not included in the liver cancer incidence analysis. For the sake of consistency, the results from the same zip code areas were presented in the Health Outcome Data section. The results from the additional zip code areas are presented in Table C-1.

Discussion

The additional analysis of liver cancer mortality in five zip code areas did not find a significant excess of cases among males or females in any of the zip code areas.

Table C-1. Number of Observed and Expected Liver Cancer Deaths and Race-Adjusted Standardized Mortality Ratios, San Antonio, Texas, 1991–1995

MALES				
Zip Code	**Observed**	**Expected**	**SMR**	**95% CI**
78212	11	6.8	1.6	0.8–2.9
78229	6	3.4	1.8	0.6–3.8
78238	0	2.3	0.0	0.0–1.6
78245	2	1.9	1.1	0.1–3.8
78252	0	0.1	0.0	0.0–36.9

FEMALES				
Zip Code	**Observed**	**Expected**	**SMR**	**95% CI**
78212	6	5.4	1.1	0.4–2.4
78229	1	2.1	0.5	0.0–2.7
78238	0	1.5	0.0	0.0–2.5
78245	1	0.9	1.1	0.0–6.2
78252	0	0.1	0.0	0.0–36.9

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SMR (standardized mortality ratio) is the number of observed deaths divided by the number of expected deaths. The latter is based on race-, sex-, and age-specific cancer mortality rates for Texas during the period 1990-1995.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

* Significantly higher (at the 5% level) than expected

APPENDIX D

Additional Cancer Analysis

To examine cancer incidence in other areas surrounding Kelly Air Force Base, ATSDR requested that the CRD evaluate incidence data for cancer of the liver, lung, cervix, bladder, kidney, and leukemia in the zip code areas 78201, 78204, 78205, 78207, 78221, 78224, 78225, 78226, 78227, and 78242, during the period 1990–1994 (Tables D1–D10).

In zip code area 78201, the number of cases observed for cancer of the lung, bladder, kidney, and leukemia was close to the number expected among males and females (Table D–1). However, a significant excess of liver cancer was observed among the male residents in this zip code area. In zip code area 78204 (Table D–2), 78224 (Table D–6), and 78225 (Table D–7) the number of cases observed for cancer of the lung, bladder, kidney, and leukemia was close to the number expected among males and females. The number of cases of cancer of the cervix was also close to the number expected for females in these three zip code areas for the time period 1990–1994.

In zip code area 78205 (Table D–3), a significant excess of liver cancer was observed among males during this time period and in zip code 78207 (Table D–4) a higher than expected number of liver cancer cases was observed among males and females, although the excesses were of borderline statistical significance. In zip code area 78221 (Table D–5), a significant excess of lung and kidney cancer was observed among males, as well as a significant excess of kidney cancer among females. A higher than expected number of liver cancer cases was observed among females in this zip code area, although the excess was of borderline statistical significance.

A significant excess of leukemia was observed among males in zip code area 78226 (Table D–8) during this time period. In zip code area 78227 (Table D–9), a significant excess of liver cancer, bladder cancer, and leukemia were observed among males, and a significant excess of lung cancer was observed among females. A higher than expected number of bladder cancer cases was also observed among females in this zip code area, although the excess was of borderline statistical significance. In zip code area 78242 (Table D–10), a significant excess of lung and kidney cancer was observed about males during this time period.

Table D–1. Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78201, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	16	7.9	**2.0***	1.3–3.3
Lung	74	63.5	1.2	0.9–1.5
Bladder	18	18.2	1.0	0.6–1.6
Kidney	16	12.1	1.3	0.8–2.1
Leukemia	17	10.8	1.6	0.9–2.5
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	8	5.5	1.5	0.6–2.9
Lung	40	46.7	0.9	0.6–1.2
Cervix	16	17.6	0.9	0.5–1.5
Bladder	6	9.4	0.6	0.2–1.4
Kidney	15	10.2	1.5	0.8–2.4
Leukemia	9	10.7	0.8	0.4–1.6

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

CI: confidence interval

* Significantly higher (at the 5% level) than expected

Table D–2. Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78204, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	6	3.2	1.9	0.7–4.1
Lung	19	16.0	1.2	0.7–1.9
Bladder	2	4.5	0.4	0.1–1.6
Kidney	5	3.8	1.3	0.4–3.1
Leukemia	2	2.8	0.7	0.1–2.6
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	3	2.1	1.4	0.3–4.2
Lung	12	9.3	1.3	0.7–2.3
Cervix	3	5.2	0.6	0.1–1.7
Bladder	0	2.2	0.0	0.0–1.7
Kidney	3	2.9	1.0	0.2–3.0
Leukemia	2	2.2	0.9	0.1–3.3

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

CI: confidence interval

Table D–3. Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78205, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	3	0.4	**7.5***	1.5–21.9
Lung	7	4.8	1.5	0.6–3.0
Bladder	1	1.4	0.7	0.0–4.0
Kidney	2	0.8	2.5	0.3–9.0
Leukemia	0	0.7	0.0	0.0–5.3
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	0	0.3	0.0	0.0–12.3
Lung	3	3.4	0.9	0.2–2.6
Cervix	1	0.7	1.4	0.0–8.0
Bladder	0	0.7	0.0	0.0–5.3
Kidney	0	0.6	0.0	0.0–6.1
Leukemia	0	0.6	0.0	0.0–6.1

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

* Significantly higher (at the 5% level) than expected

Table D–4. Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78207, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	23	14.0	**1.6**	1.0–2.5
Lung	69	65.0	1.1	0.8–1.3
Bladder	12	17.1	0.7	0.4–1.2
Kidney	19	15.6	1.2	0.7–1.9
Leukemia	10	12.7	0.8	0.4–1.4
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	15	8.8	**1.7**	1.0–2.8
Lung	32	35.6	0.9	0.6–1.3
Cervix	24	23.2	1.0	0.7–1.5
Bladder	4	8.5	0.5	0.1–1.2
Kidney	16	11.8	1.4	0.8–2.2
Leukemia	9	9.6	0.9	0.4–1.8

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

Table D–5. Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78221, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	7	5.3	1.3	0.5–2.7
Lung	66	43.8	**1.5***	1.2–1.9
Bladder	11	11.9	0.9	0.5–1.7
Kidney	16	8.7	**1.8***	1.1–3.0
Leukemia	7	7.7	0.9	0.4–1.9
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	7	2.8	**2.5**	1.0–5.2
Lung	24	27.6	0.9	0.6–1.3
Cervix	12	12.3	1.0	0.5–1.7
Bladder	9	4.7	1.9	0.9–3.6
Kidney	17	6.1	**2.8***	1.6–4.5
Leukemia	7	6.3	1.1	0.4–2.9

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

* Significantly higher (at the 5% level) than expected

Table D–6. Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78224, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	2	1.9	1.1	0.1–3.8
Lung	14	10.6	1.3	0.7–2.2
Bladder	2	2.9	0.7	0.1–2.5
Kidney	2	2.6	0.8	0.1–2.8
Leukemia	2	2.5	0.8	0.1–2.9
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	1	1.0	1.0	0.0–5.6
Lung	7	6.3	1.1	0.4–2.3
Cervix	3	4.8	0.6	0.1–1.8
Bladder	1	1.2	0.8	0.0–4.6
Kidney	2	1.9	1.1	0.1–3.8
Leukemia	0	2.2	0.0	0.0–1.7

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

CI: confidence interval

Table D–7. Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78225, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	6	3.7	1.6	0.6–3.5
Lung	19	19.7	1.0	0.6–1.5
Bladder	3	5.6	0.5	0.1–1.6
Kidney	3	4.5	0.7	0.1–1.9
Leukemia	3	2.0	1.5	0.3–4.4
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	3	1.9	1.6	0.3–4.6
Lung	10	10.7	0.9	0.4–1.7
Cervix	11	6.0	1.8	0.9–3.3
Bladder	3	2.3	1.3	0.3–3.8
Kidney	7	3.3	2.1	0.9–4.4
Leukemia	3	2.8	1.1	0.2–3.1

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

CI: confidence interval

Table D–8. Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78226, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	2	1.3	1.5	0.2–5.6
Lung	9	6.4	1.4	0.6–2.7
Bladder	0	1.6	0.0	0.0–2.3
Kidney	4	1.6	2.5	0.7–6.4
Leukemia	5	1.3	**3.8***	1.2–9.0
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	2	0.5	4.0	0.5–14.4
Lung	4	3.0	1.3	0.4–3.4
Cervix	2	2.5	0.8	0.1–2.9
Bladder	0	0.5	0.0	0.0–7.4
Kidney	1	1.0	1.0	0.0–5.6
Leukemia	3	1.0	3.0	0.6–8.8

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

* Significantly higher (at the 5% level) than expected

Table D–9. Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78227, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	11	4.4	**2.5***	1.2–4.5
Lung	61	51.5	1.2	0.9–1.5
Bladder	23	12.7	**1.8***	1.1–2.7
Kidney	15	8.9	1.7	0.9–2.8
Leukemia	18	8.7	**2.1***	1.2–3.3
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	4	2.1	1.9	0.5–4.9
Lung	50	30.7	**1.6***	1.2–2.1
Cervix	8	13.6	0.6	0.3–1.2
Bladder	10	4.6	**2.2**	1.0–4.0
Kidney	11	5.9	1.9	0.9–3.3
Leukemia	10	7.1	1.4	0.7–2.6

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

* Significantly higher (at the 5% level) than expected

Table D–10. Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78242, 1990–1994

MALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	4	2.0	2.0	0.5–5.1
Lung	38	19.6	**1.9***	1.4–2.7
Bladder	10	4.6	**2.2**	1.0–4.0
Kidney	9	3.8	**2.4***	1.1–4.5
Leukemia	7	4.1	1.7	0.7–3.5
FEMALES				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	2	0.8	2.5	0.3–9.0
Lung	11	10.4	1.1	0.5–1.9
Cervix	11	6.6	1.7	0.8–3.0
Bladder	3	1.4	2.1	0.4–6.3
Kidney	3	2.3	1.3	0.3–3.8
Leukemia	3	3.2	0.9	0.2–2.7

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas for the period 1992. The SIR has been rounded to the first decimal place.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

* Significantly higher (at the 5% level) than expected

APPENDIX E

Health Outcome Data Addendum

In August 1999, the Agency for Toxic Substances and Disease Registry (ATSDR) released Phase 1 of the public health assessment for Kelly Air Force Base. In this document, several types of health outcomes were evaluated, including several types of cancer, birth defects, and low-birth weight. ATSDR made the following recommendations.

- Include additional years of information to update such health outcomes as cancer, birth defects, and low-birth weight.
- Continue to monitor liver cancer incidence and mortality as more years of data become available.
- Continue monitoring heart and circulatory system defects using vital statistic information and data from the Texas Birth Defects Monitoring Division as it becomes available.
- Continue monitoring the number of low-birth weight babies reported as additional data becomes available.
- Determine whether data are available to address community concerns regarding lupus, hearing problems, asthma, allergies, hepatitis, and diabetes in the area.

This addendum will address part of the first recommendation by using additional years of information to update the cancer rates in the area. The Texas Department of Health will continue to monitor rates of liver cancer, birth defects, and low-birth weight babies, which addresses the first four recommendations. ATSDR will continue to attempt to locate data related to the fifth recommendation. To date, however, very limited, if any, information has been found. No data has been found regarding hearing loss. To determine whether an individual had decreased hearing ability, it would be necessary to test hearing function — something that is beyond the scope of a public health assessment. As additional documents are completed by ATSDR regarding base drinking water, East Kelly, and current and past air emissions on the base, additional health outcome data could be evaluated.

Cancer Data

In Phase 1, the Texas Department of Health Cancer Registry Division conducted an investigation of the occurrence of cases of cancer in selected zip code areas of San Antonio, Texas. The Cancer Registry Division evaluated the incidence and mortality data for cancer of the liver, lung, bladder, kidney, cervix, and leukemia in zip codes 78211, 78228, and 78237 for the periods of 1990–1994 (for incidence) and 1991–1995 (for mortality). The current analyses extend the previous study periods to include data for 1990–1996 (incidence) and 1990–1997 (mortality).

Texas Cancer Incidence Rates

The analysis of incidence data showed several statistically significant excesses in the San Antonio areas of zip codes 78211, 78228, and 78237 during the period 1990–1996 (Tables E1–E3).

Among male residents, the rate of liver cancer was significantly higher than expected in the 78228 and 78237 zip codes. The number of males with lung cancer in zip code 78228 was significantly lower than expected.

Among female residents, the number of kidney cancer cases was significantly higher in the 78211 zip code. A statistically significant excess of cervical cancer cases was observed in the 78237 zip code. A higher than expected number of females with kidney cancer was observed in zip code 78237, and a lower than expected number of females with lung cancer was observed in zip code area 78228, although these results were not statistically significant.

Texas Cancer Mortality Rates

The analysis of mortality data showed several statistically significant elevations for selected cancer sites in zip code areas 78211, 78228, and 78237 during 1990–1997 (Tables E4–E6). Among the male residents, the number of liver cancer deaths was significantly higher than expected in all three zip code areas. A significantly lower than expected number of deaths due to lung cancer in males was observed in zip code 78228. A higher than expected number of leukemia deaths for males was observed in zip code area 78237, although these results were not statistically significant.

Among female residents, the number of deaths from liver cancer was significantly higher than expected in the 78211 and 78237 zip code areas, and a significantly lower number of deaths from cervical cancer was observed in zip code area 78228. A higher than expected number of cervical cancer deaths was observed in zip code 78211, although this result was not statistically significant.

Discussion

Using the additional years of information available, the analysis of cancer incidence data continued to show statistically significant elevations in several cancer sites. The differences from the initial analysis include a statistically significant excess of cases of kidney cancer in females in zip code area 78211; no excess of cases of kidney cancer in males in zip code 78228; a lower than expected number of cases of lung cancer in females in zip code 78228; and no excess cases of leukemia in females in zip code 78237. The analysis of cancer mortality data using additional years of information continued to show statistically significant excess in several cancer sites and also showed a few differences from the initial analysis. These differences include a significant excess of cases of liver cancer in males and an excess of cases of cervical cancer in females in zip code area 78211 and a significant decrease of cases of cervical cancer in females in zip code area 78228.

The reasons for the elevations of rates of cancer in these zip code areas are not known. The data available to the Texas Cancer Registry regarding individuals who have been diagnosed with cancer are limited and does not include information about known risk factors for specific types of cancer. In regard to liver cancer, it should be noted that elevated rates of liver cancer are generally high throughout Texas compared to the nation. Increased rates have been observed nationally as well.

Additional Analysis of Leukemia Data

In Phase 1, leukemia incidence was elevated in females in zip code area 78237, and leukemia mortality was elevated in males in the same zip code area. Using additional years of information, the analysis showed a continuation of the elevated rates of leukemia mortality in males in zip code area 78237.

Leukemias are generally classified as lymphocytic or myelocytic, depending upon the cell type, and into acute or chronic, depending upon the degree of aggressiveness and rate of progression. Thus there are four basic types of leukemia: acute lymphocytic (ALL), chronic lymphocytic (CLL), acute myeloid (AML), and chronic myelogenous (CML). Further analysis was conducted examining the different types of leukemia in the three zip code areas to determine if there were elevations in specific types of leukemia or in specific age groups. Although data were requested from the Cancer Registry Division by cell type, age, and sex, due to reasons of confidentiality they are presented by cell type only.

Leukemia Incidence Data

From 1990–1996, a total of 84 cases of leukemia were reported in zip code areas 78211, 78227, and 78237 (Table E–7). The cases occurred with similar frequency in males and females (52% and 48% respectively). Of the 84 cases, nearly one-quarter (n=23; 27%) could not be classified into one of the four basic types of leukemia and were listed as "other." Of the 61 that were classified by cell type, approximately one-quarter (n=17; 28%) were ALL; one-fifth were CLL (n=12; 20%); one-third were AML (n=20; 33%); and one-fifth were CML (n=12; 20%).

Thirteen of the total number of leukemia cases occurred in children less than 19 years of age. Of these, two cases could be classified and were listed as "other." When examined by cell type, the majority of the childhood leukemia cases that were classified were ALL (n=8; 73%). Two cases of AML (18%) and one case of CML (9%) were reported in children, while no cases of CLL were reported. Among children, the expected distribution for the different subtypes of leukemia is 20% AML, 5% CML, and 75% ALL. Even with the small number of leukemia cases that occurred in children less than 19 years of age, the distribution of leukemia types was consistent with what is expected in this age group based on national data [1].

In adults, 71 cases of leukemia cases were reported. Of these, nearly one-third could not be classified (n=21; 30%). Of the 50 cases that were classified, nearly one-fifth were ALL (n=9; 18%), nearly one-quarter were CLL (n=12; 24%), more than one-third were AML (n=18; 36%), and more than one-fifth were CML (n=11; 22%). In adults, the expected rates are 54% AML, 15% CML, 6% ALL, and 25% CLL. When we compare the observed incidence rates in adults from the three zip code areas, we found a higher than expected proportion of ALL and CML types and a lower than expected proportion of AML cell type. In adults, however, it is difficult to draw conclusions from the subtypes of leukemia observed due to the large number of "other" types of leukemia reported which represents a significant proportion (30% or 21/71) of the reported adult leukemias.

Leukemia Mortality Data

From 1990–1997, a total of 70 deaths from leukemia were reported for zip code areas 78211, 78227, and 78237 (Table E–8). Approximately two-thirds were in males (n=44; 63%), and one-third were in females (n=26; 37%). Of the 70 deaths, more than one-third (n=27; 39%) could not be classified as one of the four basic types of leukemia and were listed as "other." Of the 43 that were classified by cell type, approximately one-fifth (n=9; 21%) were ALL, less than one-fifth were CLL (n=6; 14%), one-third were AML (n=14; 33%), and one-third were CML (n=14; 33%).

Seven of the reported deaths from leukemia occurred in children less than 19 years of age. Of these, three were unclassified and listed as "other." When examined by cell type, the majority were classified as ALL (n=3; 75%); one was classified as CML (n=1; 25%). No cases of CLL or AML were reported. Because of the small number of deaths reported from leukemia, it is not possible to draw conclusions from the subtypes of leukemia observed in children less than 19 years of age.

In adults, a total of 63 deaths from leukemia were reported. Of these, more than one-third were unclassified and listed as "other" (n=24; 38%). Of the 39 that were classified, less than one-fifth (n=6; 15%) were ALL; less than one-fifth were CLL (n=6; 15%); more than one-third were AML (n=14; 36%); and one-third were CML (n=13; 33%). In adults, the expected rates are 54% AML, 15% CML, 6% ALL, and 25% CLL. When we compare the observed mortality rates in adults from the three zip code areas, we found higher rates of CML and ALL and lower rates of AML and CLL. In adults, however, there were a large number of "other" types of leukemia reported. This represents a significant proportion of the adult leukemias reported and makes it difficult to draw conclusions from the subtypes of leukemia observed in adults.

Discussion

This purpose of this analysis was to examine the different types of leukemia reported in three zip code areas in San Antonio to determine possible elevations in specific types of leukemia or in specific age groups. If a leukemia case could not be classified into one of the four subtypes, it was classified as "other." Unfortunately, the fact that the "other" category represents a significant proportion of the leukemias reported makes it impossible to draw any conclusions from this information.

According to data from the National Cancer Institute, ALL is the most common type of childhood leukemia, while AML is the most common type of adult leukemia [1]. CLL and CML are more common among adults. Rates for all types of leukemia are higher among males than among females, and, with the exception of CML, rates are higher among whites than blacks [2].

We do not know the cause of the cases of leukemia in these areas. The risk factors for leukemia are varied and include diet, heredity, radiation, smoking, treatment with chemotherapeutic agents, and viral infections. Occupational exposures to chemicals are also suspected of influencing the development of leukemia.

Conclusions

1. In zip code area 78211, an elevation of kidney cancer cases was observed among females. Elevations of liver cancer deaths among males and females were also observed, as well as cervical cancer deaths among females.
2. In zip code 78228, elevations of liver cancer cases and liver cancer deaths were observed among males.
3. In zip code 78237, an elevation of liver cancer cases was observed among males and elevations of cancer of the cervix and kidney cancer was observed among females. Elevation of liver cancer deaths were observed among males and females, as well as an elevation of leukemia deaths among males.
4. The distribution of the different subtypes of leukemia that occurred in children less than 19 years of age was consistent with what is expected in this age group based on national data.
5. No conclusions can be made from the distribution of the different subtypes of leukemia in adults due to the large number of "other" types of leukemia reported.

Recommendations

1. The Texas Department of Health (TDH) will continue to monitor liver cancer incidence and mortality as more years of data become available. Since the completion of this document, the TDH has completed some additional analyses on more recent data. Their report is included in this document and can be found in Appendix G.
2. ATSDR will continue to work with researchers from the Texas Department of Health, Baylor School of Medicine, and Texas A&M to try and address the higher rates of liver cancer in Texas.

References

US National Institutes of Health. Leukemia. Report No. 94–329. Bethesda, MD: National Cancer Institute, 1993.

US National Institutes of Health. Cancer Rates and Risks. 4th Edition, Report. No. 96–691. Bethesda, MD: National Cancer Institute, 1996.

Table E–1. Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78211, 1990–1996

Males				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	15	9.3	1.6	0.9–2.7
Lung	39	43.2	0.9	0.6–1.2
Bladder	8	11.3	0.7	0.3–1.4
Kidney	9	11.7	0.8	0.4–1.5
Leukemia	10	8.8	1.1	0.5–2.1

Females				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	7	4.6	1.5	0.6–3.1
Lung	13	20.7	0.6	0.3–1.1
Cervix	19	15.6	1.2	0.7–1.9
Bladder	4	3.8	1.1	0.3–2.7
Kidney	15	7.8	**1.9***	1.1–3.2
Leukemia	10	6.9	1.4	0.7–2.7

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The latter is based on race-, sex-, and age-specific cancer incidence rates for Texas during the years 1992 and 1995 combined. The SIR has been rounded to the first decimal place.

CI: confidence interval

* Significantly higher (at the 5% level) than expected

Table E–2. Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78228, 1990–1996

Males				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Lung	91	120.2	0.8†	0.6–0.9
Bladder	29	32.4	0.9	0.6–1.3
Kidney	31	24.5	1.3	0.9–1.8
Leukemia	23	19.9	1.2	0.7–1.7

Females				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	10	8.8	1.1	0.5–2.1
Lung	60	73.9	0.8	0.6–1.0
Cervix	24	31.1	0.8	0.5–1.1
Bladder	10	12.2	0.8	0.4–1.5
Kidney	21	17.8	1.2	0.7–1.8
Leukemia	15	17.5	0.9	0.5–1.4

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The later is based on race-, sex-, and age-specific cancer incidence rates for Texas for the years 1992 and 1995 combined. The SIR has been rounded to the first decimal place.

CI: confidence interval

Bold type indicates an excess of borderline statistical significance

* Significantly higher (at the 5% level) than expected

† Significantly lower (at the 5% level) than expected

Table E–3. Number of Observed and Expected Cancer Cases and Race-Adjusted Standardized Incidence Ratios, Selected Sites, San Antonio, Texas, Zip Code 78237, 1990–1996

Males				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	32	12.1	**2.6***	1.8–3.7
Lung	60	56.0	1.1	0.8–1.4
Bladder	10	13.4	0.7	0.4–1.4
Kidney	18	14.3	1.3	0.7–2.0
Leukemia	12	11.0	1.1	0.6–1.9

Females				
Site	**Observed**	**Expected**	**SIR**	**95% CI**
Liver	11	6.8	1.6	0.8–2.9
Lung	26	29.4	0.9	0.6–1.3
Cervix	33	21.4	**1.5***	1.1–2.2
Bladder	9	5.5	1.6	0.7–3.1
Kidney	18	11.2	1.6	1.0–2.5
Leukemia	14	9.2	1.5	0.8–2.6

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SIR (standardized incidence ratio) is the number of observed cases divided by the number of expected cases. The later is based on race-, sex-, and age-specific cancer incidence rates for Texas for the years 1992 and 1995 combined. The SIR has been rounded to the first decimal place.

CI: confidence interval

* Significantly higher (at the 5% level) than expected

Bold type indicates an excess of borderline statistical significance

Table E–4. Number of Observed and Expected Cancer Deaths and Race-Adjusted Standardized Mortality Ratios, Selected Sites, San Antonio, Texas, Zip Code 78211, 1990–1997

Males				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	18	9.5	**1.9***	1.1–3.0
Lung	45	41.8	1.1	0.8–1.4
Bladder	5	2.8	1.8	0.6–4.2
Kidney	6	5.3	1.1	0.4–2.5
Leukemia	10	6.7	1.5	0.7–2.7

Females				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	12	4.7	**2.6***	1.3–4.5
Lung	18	17.7	1.0	0.6–1.6
Cervix	11	5.4	2.0	1.0–3.6
Bladder	2	1.2	1.7	0.2–6.0
Kidney	5	3.4	1.5	0.5–3.4
Leukemia	6	4.8	1.3	0.5–2.7

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SMR (standardized mortality ratio) is the number of observed deaths divided by the number of expected deaths. The later is based on race-, sex-, and age-specific cancer incidence rates for Texas during the period 1992–1997. The SMR has been rounded to the first decimal place.

CI: confidence interval

* Significantly higher (at the 5% level) than expected

Bold type indicates an excess of borderline statistical significance

Table E–5. Number of Observed and Expected Cancer Deaths and Race-Adjusted Standardized Mortality Ratios, Selected Sites, San Antonio, Texas, Zip Code 78228, 1990–1997

Males				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	37	16.9	**2.2***	1.5–3.0
Lung	86	116.2	0.7†	0.6–0.9
Bladder	8	7.7	1.0	0.4–2.0
Kidney	8	11.3	0.7	0.3–1.4
Leukemia	19	16.1	1.2	0.7–1.8

Females				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	14	9.6	1.5	0.8–2.4
Lung	61	66.6	0.9	0.7–1.2
Cervix	3	10.8	0.3†	0.1–0.8
Bladder	1	4.1	0.2	0.0–1.4
Kidney	7	7.9	0.9	0.4–1.8
Leukemia	11	13.4	0.8	0.4–1.5

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SMR (standardized mortality ratio) is the number of observed deaths divided by the number of expected deaths. The later is based on race-, sex-, and age-specific cancer incidence rates for Texas during the period 1992–1997. The SMR has been rounded to the first decimal place.

CI: confidence interval

* Significantly higher (at the 5% level) than expected

† Significantly lower (at the 5% level) than expected

Table E–6. Number of Observed and Expected Cancer Deaths and Race-Adjusted Standardized Mortality Ratios, Selected Sites, San Antonio, Texas, Zip Code 78237, 1990–1997

Males				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	47	12.4	**3.8***	2.8–5.0
Lung	63	54.7	1.2	0.9–1.5
Bladder	2	3.3	0.6	0.1–2.2
Kidney	8	6.7	1.2	0.5–2.4
Leukemia	15	8.2	1.8	1.0–3.0

Females				
Site	**Observed**	**Expected**	**SMR**	**95% CI**
Liver	20	7.0	**2.9***	1.7–4.4
Lung	30	25.5	1.2	0.8–1.7
Cervix	12	7.8	1.5	0.8–2.7
Bladder	2	1.9	1.1	0.1–3.8
Kidney	8	4.9	1.6	0.7–3.2
Leukemia	9	6.7	1.3	0.6–2.6

Data provided by the Cancer Registry Division of the Texas Department of Health.

Note: The SMR (standardized mortality ratio) is the number of observed deaths divided by the number of expected deaths. The later is based on race-, sex-, and age-specific cancer incidence rates for Texas during the period 1992–1997. The SMR has been rounded to the first decimal place.

CI: confidence interval

* Significantly higher (at the 5% level) than expected

Bold type indicates an excess of borderline statistical significance

Table E–7. Distribution of Leukemia Cases in Zip Code Areas 78211, 78228, and 78237 by Cell Type, San Antonio, Texas, 1990–1996

Zip Code	Leukemia Cell Type					
	ALL	CLL	AML	CML	Other	Total
78211	7	1	4	2	6	20
78228	6	9	10	4	9	38
78237	4	2	6	6	8	26
Total	17	12	20	12	23	84

Data provided by the Cancer Registry Division of the Texas Department of Health.

ALL: acute lymphocytic leukemia

CLL: chronic lymphocytic leukemia

AML: acute myeloid leukemia

CML: chronic myelogenous leukemia

Table E–8. Distribution of Leukemia Deaths in Zip Code Areas 78211, 78228, and 78237 by Cell Type, San Antonio, Texas, 1990–1997

Zip Code	Leukemia Cell Type					
	ALL	CLL	AML	CML	Other	Total
78211	2	2	4	4	4	16
78228	3	3	5	5	14	30
78237	4	1	5	5	9	24
Total	9	6	14	14	27	70

Data provided by the Cancer Registry Division of the Texas Department of Health.

ALL: acute lymphocytic leukemia

CLL: chronic lymphocytic leukemia

AML: acute myeloid leukemia

CML: chronic myelogenous leukemia

APPENDIX F

Figure 1. Kelly Air Force Base and Surrounding Zip Code Map