

Health Consultation

**Community Health Concerns along the San
Jacinto River, Houston Ship Channel, and Upper
Galveston Bay
Harris County, Texas**

March 2015



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Summary

Introduction	Since 1990, the Texas Department of State Health Services (DSHS) has had a fish consumption advisory in place for the San Jacinto River (SJR), Houston Ship Channel (HSC) and its contiguous waters, and the Upper Galveston Bay (UGB) due to identified contamination along these water bodies. As a result of heightened community awareness, DSHS has received multiple requests to conduct an in-depth epidemiological health study to determine if identified contamination in the SJR, HSC, and UGB could be contributing to their health problems.
Conclusions	The Texas Department of State Health Services (DSHS) and the Agency for Toxic Substances and Disease Registry (ATSDR) reached two conclusions in this health consultation:
Conclusion 1	DSHS concluded that at this time an in-depth epidemiologic study of health outcomes is not recommended.
Basis for Conclusion	Past analysis of available environmental data collected in the SJR area have not identified a specific problem that would validate conducting a community wide health study.
Conclusion 2	DSHS concluded that residents should continue to follow the fish consumption advisories issued for the SJR, HSC and its contiguous waters, and the UGB.
Basis for Conclusion	DSHS fish advisories found that fish and blue crab harvested from the SJR, HSC, UGB, and all adjoining waters continue to contain levels of polychlorinated dibenzofurans (PCDFs) and polychlorinated dibenzo- <i>p</i> -dioxins (PCDDs) at concentrations that could pose a risk to human health [1].
Next Steps	<ul style="list-style-type: none">• DSHS will remain involved in the community by conducting outreach campaigns, distributing educational materials, and gathering and addressing community health concerns.• The final version of this document will be made available to community members, city officials, and the U.S. Environmental Protection Agency (EPA) as well as other interested parties.• The final version of the cancer cluster investigation will be made available to community members, city officials, and the EPA as well as other interested parties.• DSHS will continue to work with EPA and the Texas Commission on Environmental Quality (TCEQ) in addressing community health concerns.
For More Information	If you have concerns about your health, it is recommended you contact your health care provider. You may also call Texas Department of State Health Services at (800) 588-1248 and ask to speak to Tina Walker with the Health Assessment program.

Background and Statement of Issues

In 1990, the Texas Department of State Health Services (DSHS) (formerly the Texas Department of Health), Seafood and Aquatic Life Group (SALG), conducted its first detailed study of fish from the Houston Ship Channel (HSC) and Upper Galveston Bay (UGB). The study confirmed that catfish species and blue crabs collected from these water bodies were contaminated with polychlorinated dibenzofurans (PCDFs; *furans*) and polychlorinated dibenzo-*p*-dioxins (PCDDs, *dioxins*) at concentrations that could pose a risk to human health [1]. As a result, DSHS issued a fish consumption advisory (ADV-3) for UGB to the north of a line connecting Red Bluff Point to Houston Point (by way of the Five Mile Cut marker), which included the HSC and the San Jacinto River (SJR). The advisory recommended that adults should limit consumption of any species of catfish and blue crabs to one meal per month¹. In addition, women of childbearing age and children less than 12 years of age should not consume any species of catfish and blue crabs. In 2013, ADV-49 was issued to include the HSC north of State Highway (SH) 146 including all of the SJR below the Lake Houston Dam. Due to elevated levels of dioxins, organochlorine pesticides, and polychlorinated biphenyls (PCBs), the advisory recommended that adults should limit consumption of all species of fish and blue crab to one meal per month. Women of childbearing age and children less than 12 years of age should not consume any species of fish and blue crabs. A map of the current fish advisory area is included in Appendix A.

As a result of these advisories and heightened community awareness of contamination along the HSC, SJR, and the UGB, numerous requests have been received by DSHS to conduct an epidemiological health study in these areas. A full list of the acronyms and abbreviations used in this report is included in Appendix B.

Discussion

Although warning signs with information about the fish consumption advisories have been placed throughout the river system, people continue to harvest fish and crabs from this area. Between October 2005 and January 2014, DSHS conducted eight educational outreach campaigns along the HSC, SJR, and UGB. Outreach activities were conducted in the following areas: DeZavalla Acres, Lakeview Homes; Lakeside Park Estates; Channelview Acres; Lynchburg; Lakeview Heights; Oakland Estates; Burnet Shores; River Terrace Park; San Jacinto Monument State Park; Baytown Nature Center; Eddie V. Gray Wetlands Center; local marinas, public boat ramps, and recreational vehicle (RV) parks located below the Lake Houston Dam to south of the I-10 bridge. A map of outreach locations is included in Appendix C.

These campaigns included speaking with people found fishing and/or swimming in and along the SJR from the Lake Houston Dam down to the UGB and along the HSC. These efforts were designed to educate the community on the risks associated with consuming fish and blue crab from the current advisory area. Information was distributed to individuals allowing them to make informed decisions regarding their continued consumption of fish and crabs harvested from these areas.

Through these outreach activities, public meetings, and information received from other partnering agencies, DSHS has heard numerous concerns regarding the perceived higher incidences of health problems among people living along the SJR.

¹ A meal is eight ounces of fish

Health Study

DSHS has been asked on numerous occasions to do a health study in the SJR area to identify and address community health concerns. There are a variety of reasons why community members may be interested in having a health study conducted. Some may hope to learn more about risks associated with exposure to environmental contamination, while others may want to know if a perceived disease cluster is real, and, if so, what may have caused the cluster. Although a health study can help identify if there is an excess of a particular health outcome in a community when compared to the county or state as a whole, it cannot confirm a link between exposure to contaminants and the development of a specific disease [2].

Past analysis of available environmental data collected in the SJR area have not identified a specific problem that would validate conducting a community wide health study at this time. We know that exposures to contaminated fish are likely to have occurred in the past, and the contaminants identified in the HSC, SJR, and UGB have a long latency period (the time between exposure and the appearance of related health outcomes). However, a health study in this area would not determine whether people were exposed to the contaminants of concern; if individuals have been exposed to increased levels of contaminants; how long individuals were exposed; and whether the exposure is consistent with the health effects people are experiencing.

To further address community concerns, DSHS has recently completed two birth defects investigations and is currently conducting a cancer investigation for the SJR area.

Birth Defects Investigation

In response to continued community concerns, the DSHS Texas Birth Defects Registry conducted two birth defects investigations. The initial investigation, which was released February 2015, compared occurrences of birth defects among deliveries to residents of the SJR area with occurrences in the state of Texas as a whole. However, during a meeting with the San Jacinto Community Awareness Committee on February 25, 2015, a concern was voiced regarding why the occurrence of birth defects appeared to be lower in the SJR area when compared to the state. In response to this concern the Texas Birth Defects Registry re-evaluated the data and compared the results to DSHS Public Health Region 6, which includes 13 counties in the Houston/Galveston area.

A birth defects cluster is described as too many babies born with the same birth defect for a defined period of time and in a specific area. Birth defects investigations look at the occurrence of clusters to determine if an increase in birth defects has occurred and, if so, whether there is an exposure that may be linked to this increase. It is important to note that these types of investigations are done to determine if an increase in birth defects has occurred in a particular area and, if so, whether a link can be made between the defects and an environmental exposure. They cannot answer parents' questions about why their child was born with a birth defect. Copies of the reports are included as Appendix D and Appendix E.

Cancer Investigation

In response to continued community concerns, the DSHS Environmental and Injury Epidemiology and Toxicology Unit (EIET) and Texas Cancer Registry (TCR) are currently examining the occurrence of cancer in east Harris County, Texas. Cancer data is available from 1995 to 2012. This data will be analyzed for each cancer type according to community concerns.

It should be noted that cluster investigations cannot determine the likely cause of any of the cancers observed in an area. Likewise, they cannot be used to determine what common risk factors, specific contaminants, or exposure sources (if any) may have contributed to the observed cancer cases in an area of concern. The investigation will determine whether the observed number of cancer cases for this area is statistically significantly greater than expected for Texas.

Conclusions

1. The Department of State Health Services (DSHS) concluded that due to the lack of an identified specific problem that would validate conducting a community wide health study, an in-depth epidemiologic study of health outcomes is not recommended at this time.
2. DSHS concluded that residents should continue to follow the fish consumption advisories from the Houston Ship Channel (HSC), San Jacinto River (SJR), Upper Galveston Bay (UGB), and all adjoining waters to reduce the risks of consuming contaminated species of fish and blue crab.

Recommendations

1. Residents should speak with their healthcare provider about their health concerns.
2. Residents should follow the DSHS Seafood and Aquatic Life Group (SALG) meal consumption recommendations to prevent increased exposure to contaminants from these areas. For additional information about consuming fish harvested in Texas water bodies, contact the DSHS SALG at 512-834-6757 or visit <http://www.dshs.state.tx.us/seafood/>. Women who are pregnant or plan to become pregnant should not consume any species of fish or blue crabs from the HSC, SJR, UGB, and all adjoining waters. Children under the age of 12 years should not consume any species fish or blue crabs from the HSC, SJR, UGB, and all adjoining waters.

Public Health Action Plan

1. DSHS will remain involved in the community by conducting outreach campaigns, distributing educational materials, and gathering and addressing community health concerns.
2. The final version of the cancer cluster investigation will be made available to community members, city officials, the U.S. Environmental Protection Agency (EPA), and other interested parties.
3. The final version of this health consultation will be made available to community members, city officials, EPA, and other interested parties.
4. DSHS will continue to work with partnering agencies to educate community members about the risks associated with consuming fish and blue crabs from the Houston Ship Channel, San Jacinto River, and Upper Galveston Bay.

Authors and Technical Advisors

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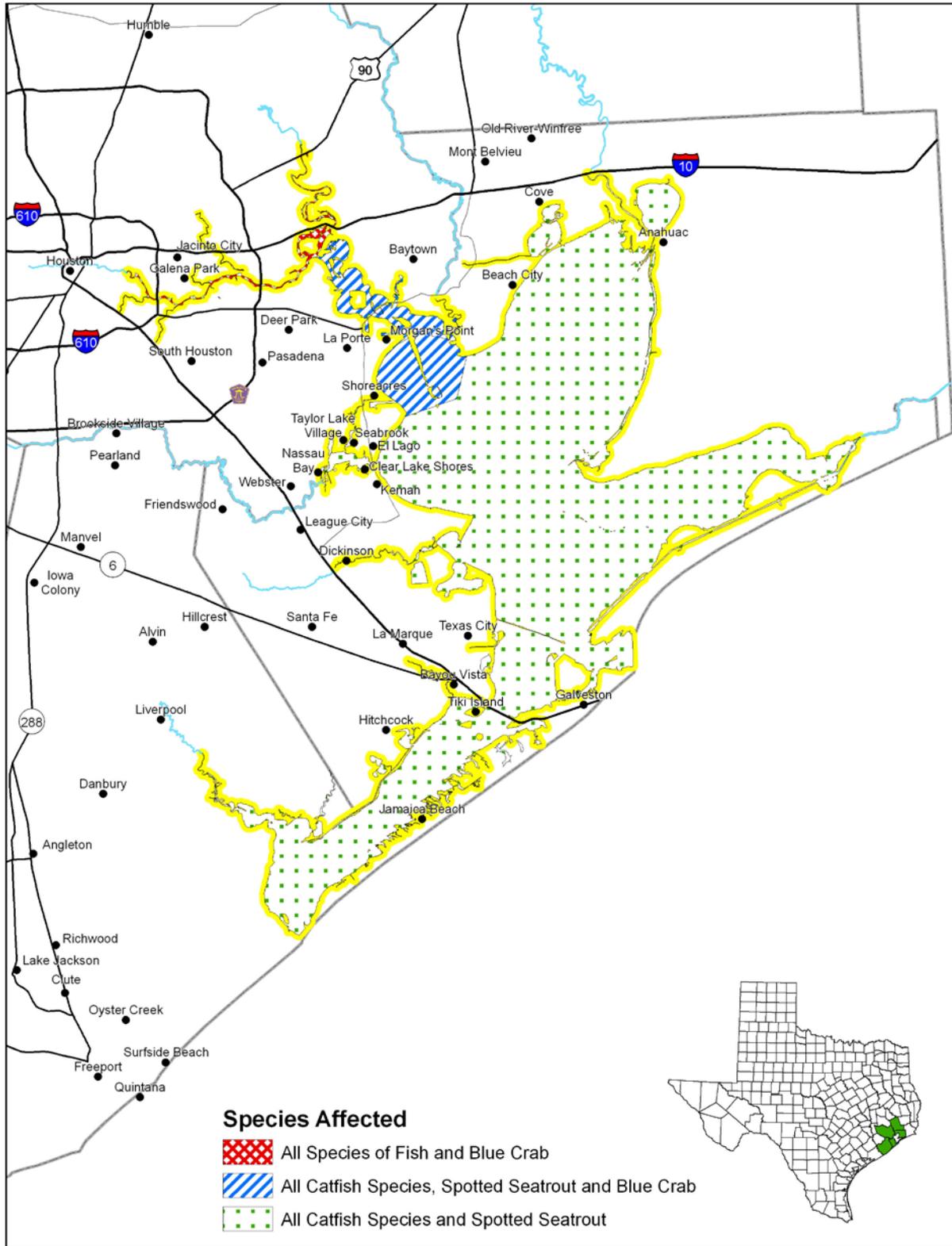
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References

1. Texas Department of State Health Services, Characterization of Potential Adverse Health Effects Associated with Consuming Fish from the San Jacinto River – Houston Ship Channel, Risk Characterization, Harris County, Texas. 2013.
2. California Department of Public Health, Environmental Health Investigations Branch.
<http://communityhealthstudies.org/content/welcome.html>

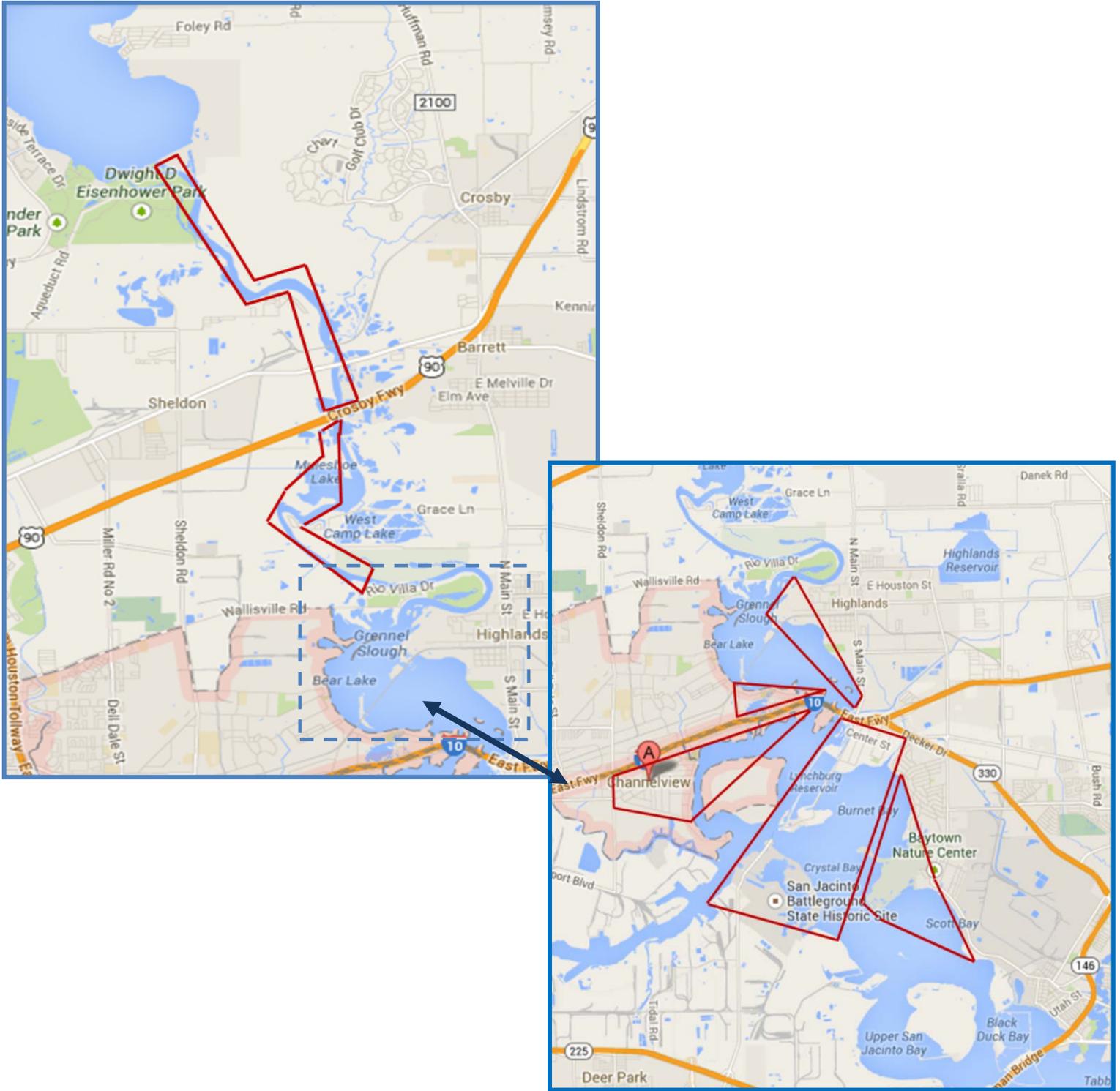
Appendix A – Map of Fish Consumption Advisory



Appendix B – Acronyms and Abbreviations

ATSDR	Agency for Toxic Substances and Disease Registry
DSHS	Texas Department of State Health Services
EIET	Environmental and Injury Epidemiology and Toxicology Unit
EPA	U.S. Environmental Protection Agency
HSC	Houston Ship Channel
PCBs	Polychlorinated biphenyls
PCDDs	Polychlorinated dibenzodioxins
PCDFs	Polychlorinated dibenzofurans
RV	Recreational vehicle
SALG	Seafood and Aquatic Life Group
SH	State highway
SJR	San Jacinto River
TCEQ	Texas Commission on Environmental Quality
TCR	Texas Cancer Registry
UGB	Upper Galveston Bay

Appendix C – Map of Areas Covered by DSHS Outreach Activities



Appendix D – Occurrence of Birth Defects in the San Jacinto River Waste Pit Area Compared to the State of Texas

OCCURRENCE OF BIRTH DEFECTS IN THE SAN JACINTO RIVER WASTE PIT AREA COMPARED TO THE STATE OF TEXAS

February 5, 2015

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OBJECTIVE

Compare occurrence of birth defects among deliveries to residents of the designated San Jacinto River Waste Pit (SJRWP) area with their occurrence in the state of Texas, both crude and adjusted for maternal age, maternal race/ethnicity, and sex of infant.

WHAT WE DID (METHODS)

Data Sources

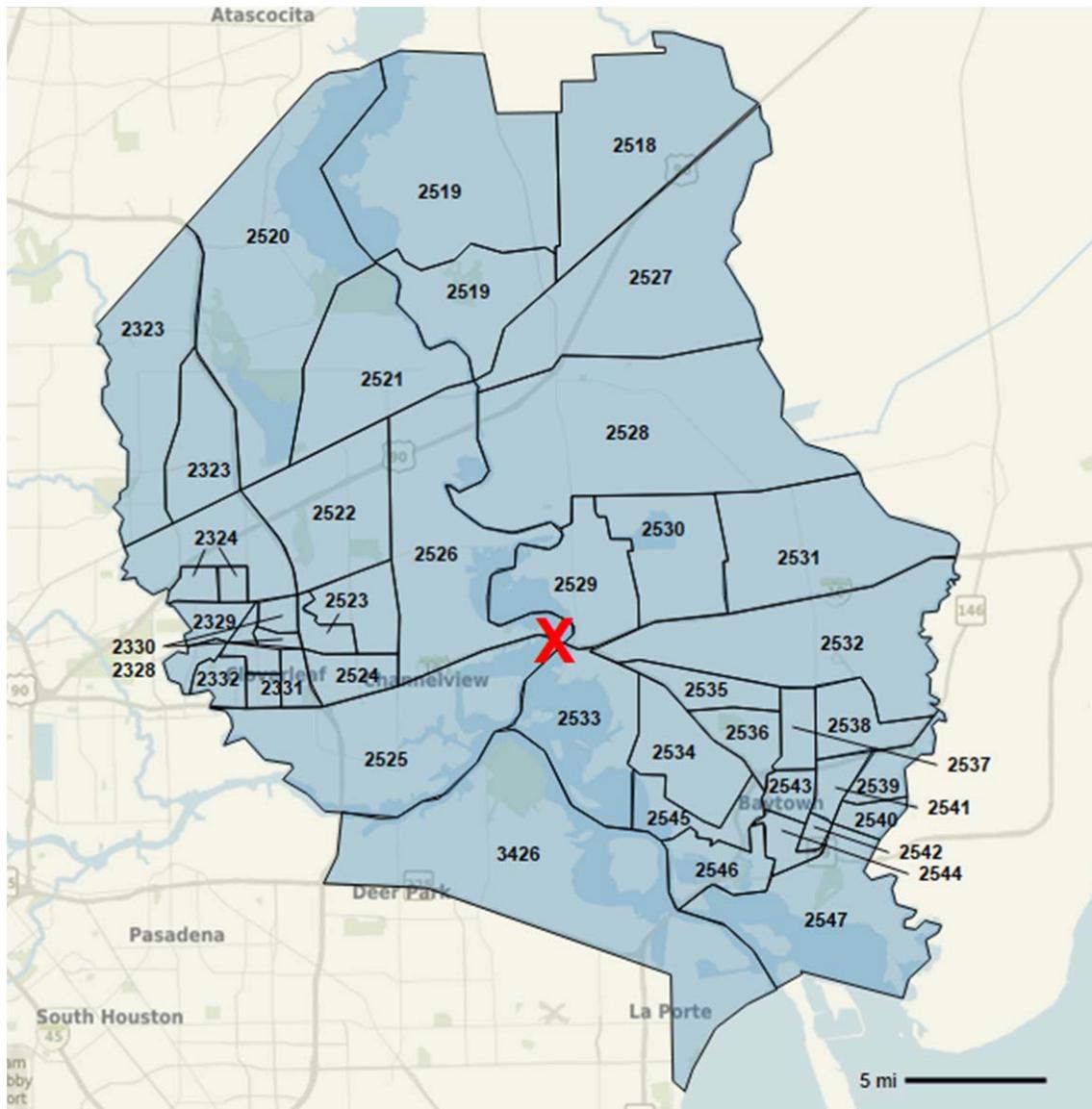
We analyzed data on children and pregnancies affected by birth defects from the Texas Birth Defects Registry (TBDR). This is an active surveillance system, which means staff regularly visit health care facilities to examine medical records instead of relying on facilities to report cases. We looked at data from 1999 (the first year the Registry was statewide) to 2011 (the most recent year of complete cleaned data).

We examined all categories of birth defects with at least five cases among deliveries to residents of the SJRWP area; this approach acknowledged that we do not know what causes most birth defects, and was a balance between trying to be comprehensive but limiting to at least five cases in order to have statistical precision. The result was 100 categories of birth defects, including one category for infants and fetuses with one or more birth defects of any kind.

Data on live births were also taken from 1999-2011, and were originally provided by the Center for Health Statistics.

From consultation with the community, the SJRWP area was defined as the area within the census tracts pictured in Figure 1. Whether a mother lived inside this area was based on her residence at the time of delivery. Because of how the area was defined, we only included records for which the mother's residence at delivery had been successfully assigned to a census tract (90.3% of TBDR data and 92.4% of birth data).

Figure 1. Census tracts (2000) selected for the San Jacinto River Waste Pits Superfund site birth defects investigation for the years 1999-2011.



Some census tracts were subdivided in the 2010 census; these subdivision boundaries are shown. X Indicates waste pits site.

Data Analysis

For each of the 100 categories of birth defects examined, occurrence in the SJRWP area was compared with occurrence in the entire state of Texas using Poisson regression. This approach is commonly used for rare events such as birth defects. The result is called a birth prevalence ratio, which is equivalent to comparing the birth prevalence (the number of cases per

no difference, the ratio is 1.00. If a birth defect occurs more frequently among births in the SJRWP area than in Texas overall, the ratio is higher than 1.00; if less frequently, the ratio is less than 1.00.

We also calculated the 95% confidence interval (CI) for each birth prevalence ratio. The 95% CI gives the range within which we would expect the true underlying ratio (which we can only estimate from the data) to fall 95% of the time. If the 95% CI does not include 1.00, then we conclude that the birth prevalence ratio is “statistically significantly” different from 1.00; in other words, the occurrence of that birth defect in the SJRWP area differs from Texas more than we would expect due to chance alone.

Birth prevalence ratios were calculated both crude (unadjusted) and adjusted for three characteristics that might differ in the two areas and that might explain a difference in birth defect occurrence: mother’s age, mother’s race/ethnicity, and sex of infant.

WHAT WE FOUND (RESULTS)

During 1999-2011, there were 53,899 live births to residents of the SJRWP area, which was 1.17% of the total live births to Texas residents for which census tract was known (4,591,616). Among deliveries to residents of the SJRWP area, there were 1,826 infants and fetuses with one or more birth defects, giving a birth prevalence of 338.8 cases per 10,000 live births. The whole state had 192,181 infants or fetuses with one or more birth defects, yielding a birth prevalence of 418.5 cases per 10,000 live births.

Dividing 338.8 by 418.5 resulted in a birth prevalence ratio of 0.81 (95% CI 0.77-0.85). This means that birth defects occurred less frequently among births to residents of the SJRWP area than in Texas overall; the birth prevalence of infants and fetuses with one or more birth defects in the SJRWP area was 81% of the birth prevalence for Texas as a whole, but the percentage could have ranged from 77% to 85%. Because the ratio (0.81) was less than 1.00 and the 95% CI did not include 1.00, the occurrence of birth defects in the SJRWP area was lower than in Texas, to a statistically significant extent.

After adjusting for mother’s age, mother’s race/ethnicity, and sex of infant, the birth prevalence ratio for infants and fetuses with one or more birth defects was 0.82 (95% CI 0.74-0.90), still significantly lower in the SJRWP area than in Texas.

After adjustment, there were two categories of birth defects that occurred more frequently among births in the SJRWP area than in Texas as a whole (Table 1).

Table 1. Birth defects with statistically significantly higher occurrence in the SJRWP area than in the state of Texas, 1999-2011, adjusted for maternal age, maternal race/ethnicity, and sex of infant.

BIRTH DEFECT	NUMBER ADJUSTED BIRTH PREVALENCE		
	OF CASES*	RATIO	95% CONF INTERVAL
Unspecified anomalies of heart	34	1.61	1.16 - 2.17
Other hamartoses, not elsewhere classified	6	2.09	1.06 - 3.63

* Total number in the SJRWP area, before adjustment.

There were 36 categories of birth defects with statistically significantly lower occurrence in the SJRWP area (Table 2).

Table 2. Birth defects with statistically significantly lower occurrence in the SJRWP area than in the state of Texas, 1999-2011, adjusted for maternal age, maternal race/ethnicity, and sex of infant.

BIRTH DEFECT	NUMBER ADJUSTED BIRTH PREVALENCE		
	OF CASES*	RATIO	95% CONF INTERVAL
Hemangioma, of unspecified site	33	0.56	0.38 - 0.79
Abnormalities of jaw size - micro/macrogathia	46	0.67	0.47 - 0.94
Congenital hydrocephalus	24	0.64	0.42 - 0.92
Other specified anomalies of brain	42	0.57	0.37 - 0.82
Coloboma, other anomalies of anterior segments	6	0.41	0.17 - 0.80
Cong anom of eyelids, lacrimal system, and orbit	23	0.64	0.38 - 0.98
Anomalies of ear causing impairment of hearing	8	0.43	0.20 - 0.77
Other specified anomalies of ear	54	0.42	0.29 - 0.57
Other specified anomalies of face and neck	17	0.57	0.34 - 0.90
Ventricular septal defect	237	0.80	0.68 - 0.94
Ostium secundum type atrial septal defect	437	0.78	0.67 - 0.89
Patent ductus arteriosus (PDA)	204	0.71	0.58 - 0.85
Anomalies of pulmonary artery	81	0.66	0.50 - 0.86
Anomalies of great veins	18	0.59	0.35 - 0.91
Other anomalies of peripheral vascular system	6	0.43	0.19 - 0.81
Other specified anomalies of mouth and pharynx	16	0.55	0.32 - 0.87
Atresia and stenosis of small intestine	7	0.40	0.16 - 0.82
Anomalies of intestinal fixation	9	0.49	0.26 - 0.83
Anom of cervix, vagina, ext female genitalia	25	0.52	0.37 - 0.69
Other specified anomalies of male genital organs	61	0.77	0.61 - 0.95
Other specified anomalies of bladder and urethra	7	0.52	0.23 - 0.98
Certain anomalies of skull, face, and jaw	81	0.38	0.28 - 0.49
Varus (inward) deformities of feet	33	0.65	0.46 - 0.88
Valgus (outward) deformities of feet	10	0.37	0.20 - 0.62
Other specified cong musculoskeletal deformities	24	0.48	0.28 - 0.76
Other anom of upper limb, inc shoulder girdle	16	0.50	0.29 - 0.79
Other anom of lower limb, inc pelvic girdle	39	0.44	0.29 - 0.62
Other specified anomalies of unspecified limb	18	0.58	0.38 - 0.83
Anomalies of skull and face bones	86	0.69	0.52 - 0.89
Anomalies of spine	15	0.51	0.30 - 0.80
Other anomalies of ribs and sternum	8	0.35	0.16 - 0.67
Other spec anom of muscle, tendon, conn tissue	27	0.39	0.25 - 0.57
Other specified anomalies of skin	12	0.25	0.14 - 0.41
Specified anomalies of nails	9	0.50	0.22 - 0.97
Down syndrome	44	0.68	0.49 - 0.92
Infants and fetuses with one or more birth defects	1826	0.82	0.74 - 0.90

* Total number in the SJRWP area, before adjustment.

Birth defects not shown in Tables 1 or 2 were not statistically significantly different in the SJRWP area than in Texas. More detailed results can be found in the appendices.

CONCLUSIONS

One hundred categories of birth defects had at least five cases delivered to mothers residing in the SJRWP area, and their occurrence in that area was compared with their occurrence in the state of Texas.

The occurrence of infants and fetuses with one or more birth defects was lower in the SJRWP area than in Texas as a whole, to a statistically significant extent.

Two birth defect categories were significantly higher in the area. One of these categories, “unspecified anomalies of heart” is a heterogeneous collection of unspecified heart defects. “Other hamartoses, not elsewhere classified” include congenital syndromes and conditions, the primary feature of which is hamartomata (disorganized benign masses of the cells and tissue normally found at the site of growth). This birth defect category is also a heterogeneous collection of conditions. Because both of these categories are heterogeneous collections of conditions, it would not be productive to investigate them further.

Thirty-five specific categories of birth defects (other than the category “infants and fetuses with one or more birth defects”) were significantly lower in the area, as compared to Texas as a whole.

ACKNOWLEDGEMENTS

Thanks to Mary Ethen, MPH, for help in designing the analysis and reviewing the report.

Appendix 1. Occurrence of birth defects in the San Jacinto River Waste Pit (SJRWP) area compared to the state of Texas, 1999-2011: Crude birth prevalence ratios with 95% confidence limits.

defect	cases ¹	prevratio ²	LCL ³	UCL ³ sig ⁴
228.0 Hemangioma, of unspecified site	33	0.54	0.38	0.75 Low
228.1 Cystic hygroma, lymphangioma any site	5	0.56	0.20	1.21
426.7 Congenital Wolfe-Parkinson-White syndrome	5	1.93	0.69	4.20
524.0 Abnormalities of jaw size - micro/macrognothia	46	0.67	0.49	0.88 Low
550.9 Inguinal hernia with no obstruction, no gangrene	23	0.99	0.64	1.46
740.0 Anencephalus	5	0.59	0.21	1.27
741 Spina bifida	26	1.40	0.92	2.01
742.1 Microcephalus	48	0.88	0.66	1.16
742.2 Reduction deformities of brain	29	0.74	0.50	1.04
742.3 Congenital hydrocephalus	24	0.65	0.42	0.95 Low
742.4 Other specified anomalies of brain	42	0.55	0.40	0.74 Low
742.5 Other specified anomalies of spinal cord	12	0.98	0.52	1.65
743.1 Microphthalmos	10	0.69	0.34	1.21
743.3 Congenital cataract and lens anomalies	9	0.85	0.41	1.53
743.4 Coloboma, other anomalies of anterior segments	6	0.42	0.17	0.84 Low
743.5 Cong anom of posterior segment	6	0.58	0.23	1.18
743.6 Cong anom of eyelids, lacrimal system, and orbit	23	0.62	0.40	0.91 Low
744.0 Anomalies of ear causing impairment of hearing	8	0.42	0.19	0.78 Low
744.2 Other specified anomalies of ear	54	0.41	0.31	0.53 Low
744.8 Other specified anomalies of face and neck	17	0.56	0.33	0.87 Low
744.9 Unspecified anomalies of face and neck	35	0.71	0.50	0.97 Low
745.1 Transposition of great vessels	26	0.97	0.64	1.39
745.2 Tetralogy of Fallot	16	0.84	0.49	1.33
745.4 Ventricular septal defect	237	0.80	0.70	0.91 Low
745.5 Ostium secundum type atrial septal defect	437	0.77	0.70	0.85 Low
745.6 Endocardial cushion defects	21	0.94	0.59	1.41
746.0 Anomalies of pulmonary valve	50	0.85	0.64	1.11
746.1 Tricuspid atresia and stenosis	14	0.84	0.47	1.36
746.2 Ebsteins anomaly	5	1.34	0.48	2.90
746.3 Congenital stenosis of aortic valve	9	0.71	0.34	1.28
746.4 Congenital insufficiency of aortic valve	13	0.72	0.40	1.19
746.5 Congenital mitral stenosis	25	1.27	0.83	1.84
746.7 Hypoplastic left heart syndrome	12	1.08	0.58	1.83
746.8 Other specified anomalies of the heart	157	0.99	0.84	1.16
746.9 Unspecified anomalies of heart	34	1.58	1.10	2.18 High
747.0 Patent ductus arteriosus (PDA)	204	0.71	0.62	0.81 Low
747.1 Coarctation of aorta	25	0.96	0.63	1.39
747.2 Other anomalies of aorta	49	0.77	0.57	1.01
747.3 Anomalies of pulmonary artery	81	0.68	0.55	0.85 Low
747.4 Anomalies of great veins	18	0.59	0.36	0.91 Low
747.6 Other anomalies of peripheral vascular system	6	0.43	0.17	0.87 Low
748.0 Choanal atresia	7	1.09	0.47	2.11
748.3 Other anomalies of larynx, trachea, and bronchus	11	0.90	0.47	1.55
748.4 Congenital cystic lung	5	1.16	0.42	2.52
748.5 Agenesis or aplasia of lung	14	0.78	0.44	1.27
749.0 Cleft palate alone	30	0.96	0.66	1.35
749.1 Cleft lip alone with/without cleft palate	51	0.92	0.69	1.20
750.1 Other anomalies of tongue	16	0.85	0.49	1.33
750.2 Other specified anomalies of mouth and pharynx	16	0.56	0.33	0.88 Low
750.3 T-E fistula, esophageal atresia and stenosis	6	0.54	0.21	1.09
750.5 Congenital hypertrophic pyloric stenosis	121	1.24	1.03	1.47 High
751.1 Atresia and stenosis of small intestine	7	0.41	0.17	0.79 Low
751.2 Atr/sten of lg intestine, rectum and anal canal	28	1.02	0.69	1.45
751.4 Anomalies of intestinal fixation	9	0.49	0.23	0.88 Low

751.5	Other anomalies of intestine	18	0.80	0.49	1.24
751.6	Anomalies of gallbladder, bile ducts, and liver	7	0.86	0.37	1.67
752.0	Anomalies of ovaries	7	1.06	0.46	2.07
752.4	Anom of cervix, vagina, ext female genitalia	25	0.55	0.36	0.80 Low
752.5	Undescended testicle	104	1.02	0.83	1.23
752.6	Hypospadias and epispadias	187	0.99	0.85	1.14
752.8	Other specified anomalies of male genital organs	61	0.73	0.56	0.93 Low
753.0	Renal agenesis and dysgenesis	28	0.94	0.63	1.34
753.1	Cystic kidney disease	30	0.91	0.62	1.28
753.2	Obstructive defects of renal pelvis and ureter	211	1.00	0.87	1.14
753.3	Other specified anomalies of kidney	22	0.66	0.42	0.97 Low
753.4	Other specified anomalies of ureter	32	0.64	0.45	0.90 Low
753.6	Atresia and stenosis of urethra and bladder neck	5	0.62	0.22	1.34
753.8	Other specified anomalies of bladder and urethra	7	0.51	0.22	0.99 Low
754.0	Certain anomalies of skull, face, and jaw	81	0.36	0.29	0.44 Low
754.3	Congenital dislocation of hip	19	0.78	0.48	1.19
754.4	Congenital genu recurvatum, bowing of leg bones	10	0.81	0.41	1.43
754.5	Varus (inward) deformities of feet	33	0.67	0.46	0.92 Low
754.6	Valgus (outward) deformities of feet	10	0.37	0.18	0.65 Low
754.7	Other deformities of feet	84	1.09	0.87	1.34
754.8	Other specified cong musculoskeletal deformities	24	0.47	0.31	0.69 Low
755.0	Polydactyly	121	1.17	0.97	1.39
755.1	Syndactyly	38	0.91	0.65	1.23
755.2	Reduction defects of upper limb	16	0.75	0.44	1.19
755.3	Reduction defects of lower limb	5	0.51	0.18	1.10
755.5	Other anom of upper limb, inc shoulder girdle	16	0.49	0.29	0.77 Low
755.6	Other anom of lower limb, inc pelvic girdle	39	0.43	0.31	0.57 Low
755.8	Other specified anomalies of unspecified limb	18	0.60	0.36	0.93 Low
756.0	Anomalies of skull and face bones	86	0.68	0.55	0.84 Low
756.1	Anomalies of spine	15	0.51	0.29	0.81 Low
756.3	Other anomalies of ribs and sternum	8	0.36	0.16	0.66 Low
756.6	Anomalies of diaphragm	15	0.83	0.48	1.32
756.7C	Omphalocele	10	1.05	0.52	1.85
756.7I	Gastroschisis	30	1.15	0.78	1.61
756.8	Other spec anom of muscle, tendon, conn tissue	27	0.36	0.24	0.51 Low
757.3	Other specified anomalies of skin	12	0.26	0.14	0.43 Low
757.5	Specified anomalies of nails	9	0.49	0.24	0.89 Low
758.0	Down syndrome	44	0.64	0.47	0.85 Low
758.2	Edwards syndrome	7	0.69	0.30	1.34
758.3	Autosomal deletion syndromes	14	1.04	0.59	1.70
758.5	Other conditions due to autosomal anomalies	15	1.14	0.66	1.83
759.0	Anomalies of spleen	6	0.88	0.35	1.79
759.3	Situs inversus	9	1.22	0.58	2.20
759.6	Other hamartoses, not elsewhere classified	6	2.02	0.80	4.14
759.8	Other specified anomalies and syndromes	15	0.67	0.39	1.08
888.8	Any monitored congenital anomaly ⁵	1826	0.81	0.77	0.85 Low

Appendix 1 footnotes:

1. Cases: Number of infants and fetuses with the specified birth defect in the SJRWP area
2. Prevalence: Crude (unadjusted) birth prevalence ratio (birth prevalence in the SJRWP area divided by birth prevalence for Texas)
3. LCL = Lower 95% confidence limit for the crude birth prevalence ratio; UCL = Upper 95% confidence limit for the crude birth prevalence ratio. The interval from the LCL to the UCL is the 95% confidence interval for the crude birth prevalence ratio.
4. Sig: Low = Crude birth prevalence is statistically significantly lower in the SJRWP area than in Texas as a whole; High = Crude birth prevalence is statistically significantly higher in the SJRWP area than in Texas as a whole.
5. Infants and fetuses with one or more birth defects

Appendix 2. Occurrence of birth defects in the San Jacinto River Waste Pit (SJRWP) area compared to the state of Texas, 1999-2011: Birth prevalence ratios adjusted for maternal age, maternal race/ethnicity, and sex of infant, with 95% confidence limits

defect	prevratio ¹	LCL ²	UCL ²	sig ³
228.0 Hemangioma, of unspecified site	0.56	0.38	0.79	Low
228.1 Cystic hygroma, lymphangioma any site	0.57	0.23	1.14	
426.7 Congenital Wolfe-Parkinson-White syndrome	2.03	0.83	4.07	
524.0 Abnormalities of jaw size - micro/macrogathia	0.67	0.47	0.94	Low
550.9 Inguinal hernia with no obstruction, no gangrene	0.98	0.61	1.49	
740.0 Anencephalus	0.57	0.12	1.61	
741 Spina bifida	1.38	0.94	1.94	
742.1 Microcephalus	0.85	0.59	1.18	
742.2 Reduction deformities of brain	0.73	0.49	1.04	
742.3 Congenital hydrocephalus	0.64	0.42	0.92	Low
742.4 Other specified anomalies of brain	0.57	0.37	0.82	Low
742.5 Other specified anomalies of spinal cord	0.99	0.54	1.63	
743.1 Microphthalmos	0.70	0.37	1.20	
743.3 Congenital cataract and lens anomalies	0.84	0.42	1.50	
743.4 Coloboma, other anomalies of anterior segments	0.41	0.17	0.80	Low
743.5 Cong anom of posterior segment	0.58	0.26	1.10	
743.6 Cong anom of eyelids, lacrimal system, and orbit	0.64	0.38	0.98	Low
744.0 Anomalies of ear causing impairment of hearing	0.43	0.20	0.77	Low
744.2 Other specified anomalies of ear	0.42	0.29	0.57	Low
744.8 Other specified anomalies of face and neck	0.57	0.34	0.90	Low
744.9 Unspecified anomalies of face and neck	0.72	0.48	1.04	
745.1 Transposition of great vessels	0.98	0.64	1.44	
745.2 Tetralogy of Fallot	0.86	0.44	1.48	
745.4 Ventricular septal defect	0.80	0.68	0.94	Low
745.5 Ostium secundum type atrial septal defect	0.78	0.67	0.89	Low
745.6 Endocardial cushion defects	0.98	0.62	1.48	
746.0 Anomalies of pulmonary valve	0.83	0.58	1.15	
746.1 Tricuspid atresia and stenosis	0.84	0.38	1.59	
746.2 Ebsteins anomaly	1.37	0.54	2.83	
746.3 Congenital stenosis of aortic valve	0.65	0.27	1.27	
746.4 Congenital insufficiency of aortic valve	0.71	0.43	1.10	
746.5 Congenital mitral stenosis	1.29	0.85	1.86	
746.7 Hypoplastic left heart syndrome	1.09	0.66	1.68	
746.8 Other specified anomalies of the heart	0.99	0.79	1.22	
746.9 Unspecified anomalies of heart	1.61	1.16	2.17	High
747.0 Patent ductus arteriosus (PDA)	0.71	0.58	0.85	Low
747.1 Coarctation of aorta	0.98	0.67	1.38	
747.2 Other anomalies of aorta	0.78	0.53	1.09	
747.3 Anomalies of pulmonary artery	0.66	0.50	0.86	Low
747.4 Anomalies of great veins	0.59	0.35	0.91	Low
747.6 Other anomalies of peripheral vascular system	0.43	0.19	0.81	Low
748.0 Choanal atresia	1.11	0.52	2.05	
748.3 Other anomalies of larynx, trachea, and bronchus	0.91	0.48	1.53	
748.4 Congenital cystic lung	1.17	0.49	2.32	
748.5 Agenesis or aplasia of lung	0.77	0.41	1.32	
749.0 Cleft palate alone	0.99	0.65	1.45	
749.1 Cleft lip alone with/without cleft palate	0.93	0.65	1.29	
750.1 Other anomalies of tongue	0.86	0.47	1.44	
750.2 Other specified anomalies of mouth and pharynx	0.55	0.32	0.87	Low
750.3 T-E fistula, esophageal atresia and stenosis	0.56	0.23	1.12	
750.5 Congenital hypertrophic pyloric stenosis	1.23	0.98	1.51	
751.1 Atresia and stenosis of small intestine	0.40	0.16	0.82	Low
751.2 Atr/sten of lg intestine, rectum and anal canal	1.04	0.73	1.44	
751.4 Anomalies of intestinal fixation	0.49	0.26	0.83	Low
751.5 Other anomalies of intestine	0.77	0.45	1.21	
751.6 Anomalies of gallbladder, bile ducts, and liver	0.86	0.40	1.59	
752.0 Anomalies of ovaries	1.09	0.50	2.01	
752.4 Anom of cervix, vagina, ext female genitalia	0.52	0.37	0.69	Low
752.5 Undescended testicle	1.01	0.81	1.24	
752.6 Hypospadias and epispadias	1.04	0.92	1.17	
752.8 Other specified anomalies of male genital organs	0.77	0.61	0.95	Low
753.0 Renal agenesis and dysgenesis	0.94	0.64	1.34	
753.1 Cystic kidney disease	0.91	0.57	1.36	

defect	prevalence ¹	LCL ²	UCL ²	sig ³
753.2 Obstructive defects of renal pelvis and ureter	1.01	0.87	1.18	
753.3 Other specified anomalies of kidney	0.66	0.36	1.09	
753.4 Other specified anomalies of ureter	0.68	0.43	1.01	
753.6 Atresia and stenosis of urethra and bladder neck	0.64	0.26	1.31	
753.8 Other specified anomalies of bladder and urethra	0.52	0.23	0.98	Low
754.0 Certain anomalies of skull, face, and jaw	0.38	0.28	0.49	Low
754.3 Congenital dislocation of hip	0.82	0.49	1.26	
754.4 Congenital genu recurvatum, bowing of leg bones	0.76	0.31	1.52	
754.5 Varus (inward) deformities of feet	0.65	0.46	0.88	Low
754.6 Valgus (outward) deformities of feet	0.37	0.20	0.62	Low
754.7 Other deformities of feet	1.09	0.86	1.36	
754.8 Other specified cong musculoskeletal deformities	0.48	0.28	0.76	Low
755.0 Polydactyly	1.08	0.84	1.35	
755.1 Syndactyly	0.90	0.54	1.39	
755.2 Reduction defects of upper limb	0.71	0.40	1.15	
755.3 Reduction defects of lower limb	0.51	0.12	1.34	
755.5 Other anom of upper limb, inc shoulder girdle	0.50	0.29	0.79	Low
755.6 Other anom of lower limb, inc pelvic girdle	0.44	0.29	0.62	Low
755.8 Other specified anomalies of unspecified limb	0.58	0.38	0.83	Low
756.0 Anomalies of skull and face bones	0.69	0.52	0.89	Low
756.1 Anomalies of spine	0.51	0.30	0.80	Low
756.3 Other anomalies of ribs and sternum	0.35	0.16	0.67	Low
756.6 Anomalies of diaphragm	0.82	0.41	1.46	
756.7C Omphalocele	1.08	0.57	1.82	
756.71 Gastroschisis	1.07	0.79	1.42	
756.8 Other spec anom of muscle, tendon, conn tissue	0.39	0.25	0.57	Low
757.3 Other specified anomalies of skin	0.25	0.14	0.41	Low
757.5 Specified anomalies of nails	0.50	0.22	0.97	Low
758.0 Down syndrome	0.68	0.49	0.92	Low
758.2 Edwards syndrome	0.73	0.34	1.35	
758.3 Autosomal deletion syndromes	1.05	0.64	1.62	
758.5 Other conditions due to autosomal anomalies	1.18	0.71	1.84	
759.0 Anomalies of spleen	0.87	0.36	1.70	
759.3 Situs inversus	1.18	0.57	2.11	
759.6 Other hamartoses, not elsewhere classified	2.09	1.06	3.63	High
759.8 Other specified anomalies and syndromes	0.70	0.38	1.15	
888.8 Any monitored congenital anomaly ⁴	0.82	0.74	0.90	Low

Appendix 2 footnotes:

1. Prevalence: Adjusted birth prevalence ratio (birth prevalence in the SJRWP area divided by birth prevalence for Texas, adjusted for maternal age, maternal race/ethnicity, and sex of infant)
2. LCL = Lower 95% confidence limit for the adjusted birth prevalence ratio; UCL = Upper 95% confidence limit for the adjusted birth prevalence ratio. The interval from the LCL to the UCL is the 95% confidence interval for the adjusted birth prevalence ratio.
3. Sig: Low = Adjusted birth prevalence is statistically significantly lower in the SJRWP area than in Texas as a whole; High = Adjusted birth prevalence is statistically significantly higher in the SJRWP area than in Texas as a whole.
4. Infants and fetuses with one or more birth defects

Appendix E – Occurrence of Birth Defects in the San Jacinto River Waste Pits Area Compared to Public Health Region 6, 1999-2011

Report 2: OCCURRENCE OF BIRTH DEFECTS IN THE SAN JACINTO RIVER WASTE PITS AREA COMPARED TO PUBLIC HEALTH REGION 6, 1999-2011

March 20, 2015

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BACKGROUND

The original report “Occurrence of Birth Defects in the San Jacinto River Waste Pits Area Compared to the State of Texas” (dated February 5, 2015) was discussed in a conference call with the Community Awareness Committee on February 25, 2015. During that call, a question came up regarding why the occurrence (birth prevalence) of so many birth defects was lower in the San Jacinto River Waste Pits area than the state. The answer was that the Public Health Region of Texas containing the study area (Region 6) has historically had lower levels of birth defect occurrence recorded in the Texas Birth Defects Registry, possibly due in part to under ascertainment. A re-analysis of the data was offered, to compare occurrence in the study area with Region 6. That re-analysis comprises this report.

OBJECTIVE

Compare occurrence of birth defects among deliveries to residents of the designated San Jacinto River Waste Pits (SJRWP) area with their occurrence in Public Health Region 6, both crude and adjusted for maternal age, maternal race/ethnicity, and sex of infant.

WHAT WE DID (METHODS)

(Note: The Methods are identical to the first report, except that here we compare with Region 6 instead of the whole State.)

Data Sources

We analyzed data on children and pregnancies affected by birth defects from the Texas Birth Defects Registry (TBDR). This is an active surveillance system, which means staff

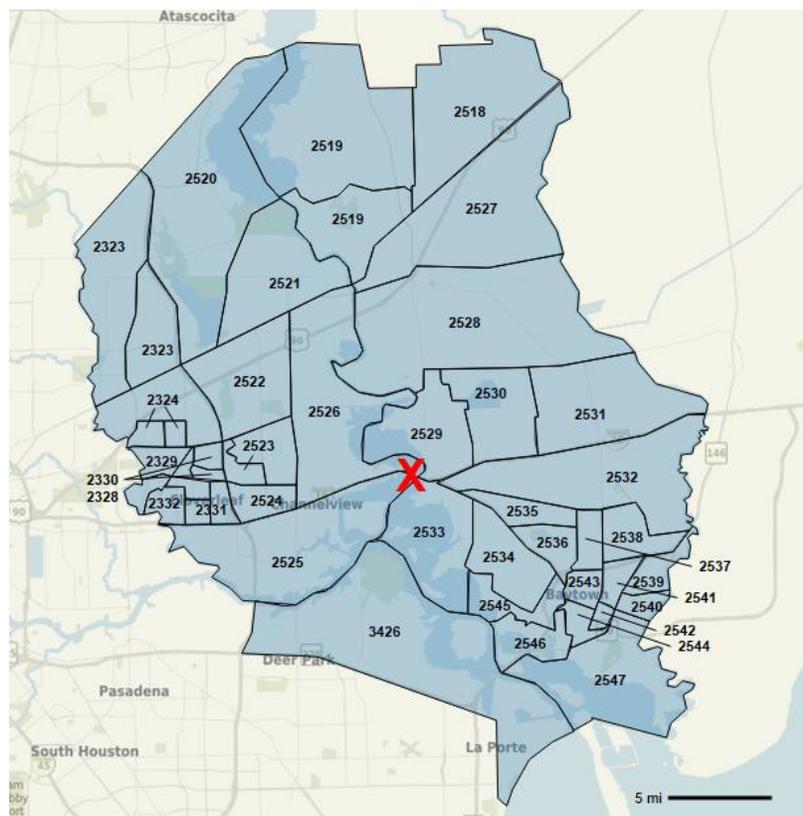
regularly visit health care facilities to examine medical records instead of relying on facilities to report cases. We looked at data from 1999 (the first year the Registry was statewide) to 2011 (the most recent year of complete cleaned data).

We examined all categories of birth defects with at least five cases among deliveries to residents of the SJRWP area; this approach acknowledged that we do not know what causes most birth defects, and was a balance between trying to be comprehensive but limiting to at least five cases in order to have statistical precision. The result was 100 categories of birth defects, including one category for infants and fetuses with one or more birth defects of any kind.

Data on live births were also taken from 1999-2011, and were originally provided by the Center for Health Statistics.

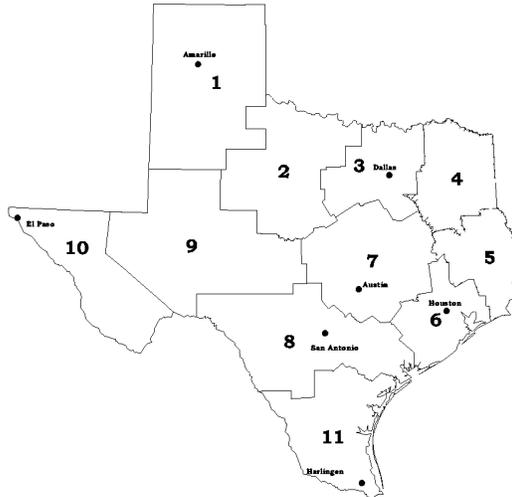
From consultation with the community, the SJRWP area was defined as the area within the census tracts pictured in Figure 1. Whether a mother lived inside this area was based on her residence at the time of delivery. Because of how the area was defined, we only included records for which the mother's residence at delivery had been successfully assigned to a census tract and could have Region assigned.

Figure 1. Census tracts (2000) selected for the San Jacinto River Waste Pits Superfund site birth defects investigation for the years 1999-2011.



The SJRWP study area was compared with Public Health Region 6. That region (Figure 2) consists of the following 13 counties in the Houston/Galveston area: Austin, Brazoria, Chambers, Colorado, Fort Bend, Galveston, Harris, Liberty, Matagorda, Montgomery, Walker, Waller, and Wharton counties.

Figure 2. Public Health Regions of Texas.



Data Analysis

For each of the 100 categories of birth defects examined, occurrence in the SJRWP area was compared with occurrence in Region 6 using Poisson regression. This approach is commonly used for rare events such as birth defects. The result is called a birth prevalence ratio, which is equivalent to comparing the birth prevalence (the number of cases per 10,000 live births) in the SJRWP area with the birth prevalence in Region 6. If there is no difference, the ratio is 1.00. If a birth defect occurs more frequently among births in the SJRWP area than in Region 6, the ratio is higher than 1.00; if less frequently, the ratio is less than 1.00.

We also calculated the 95% confidence interval (CI) for each birth prevalence ratio. The 95% CI gives the range within which we would expect the true underlying ratio (which we can only estimate from the data) to fall 95% of the time. If the 95% CI does not include 1.00, then we conclude that the birth prevalence ratio is “statistically significantly” different from 1.00; in other words, the occurrence of that birth defect in the SJRWP area differs from Region 6 more than we would expect due to chance alone.

Birth prevalence ratios were calculated both crude (unadjusted) and adjusted for three characteristics that might differ in the two areas and that might explain a difference in birth defect occurrence: mother’s age, mother’s race/ethnicity, and sex of infant.

WHAT WE FOUND (RESULTS)

During 1999-2011, there were 53,896 live births to residents of the SJRWP area, which was 4.6% of the 1,160,433 births to residents of Public Health Region 6 for which census tract was known. The crude (unadjusted) birth prevalence ratio for any monitored congenital anomaly was 1.00 (95% CI 0.95-1.04). This means that birth defects occurred at the same rate among births to residents of the SJRWP area as among births to residents of Region 6; the birth prevalence of infants and fetuses with one or more birth defects in the SJRWP area was 100% of the birth prevalence for Region 6, but the true underlying percentage (which we can only estimate) could have ranged from 95% to 104%.

After adjusting for mother’s age, mother’s race/ethnicity, and sex of infant, the birth prevalence ratio for infants and fetuses with one or more birth defects was 1.02 (95% CI 0.96-1.08), still the same in the SJRWP area as in Region 6.

After adjustment, there were three categories of birth defects that occurred more frequently among births in the SJRWP area than in Region 6 (Table 1).

Table 1. Birth defects with statistically significantly higher occurrence in the SJRWP area than in Region 6, 1999-2011, adjusted for maternal age, maternal race/ethnicity, and sex of infant.

BIRTH DEFECT	NUMBER	ADJUSTED BIRTH	PREVALENCE
	OF CASES*	RATIO	95% CONF INTERVAL
Congenital Wolfe-Parkinson-White syndrome	5	3.40	2.33 - 6.95
Spina bifida	26	1.58	1.02 - 2.33
Congenital hypertrophic pyloric stenosis	121	1.27	1.06 - 1.51

* Total number in the SJRWP area, before adjustment.

There were three categories of birth defects with statistically significantly lower occurrence in the SJRWP area than in Region 6 (Table 2).

Table 2. Birth defects with statistically significantly lower occurrence in the SJRWP area than in Region 6, 1999-2011, adjusted for maternal age, maternal race/ethnicity, and sex of infant.

BIRTH DEFECT	NUMBER	ADJUSTED BIRTH	PREVALENCE
	OF CASES*	RATIO	95% CONF INTERVAL
Other specified anomalies of the ear	54	0.72	0.54 - 0.94
Valgus (outward) deformities of the feet	10	0.53	0.31 - 0.83
Other specified anomalies of the skin	12	0.57	0.33 - 0.90

* Total number in the SJRWP area, before adjustment.

Birth defects not shown in Tables 1 or 2 were not statistically significantly different in the SJRWP area than in Region 6. More detailed results can be found in the appendices.

CONSLUSIONS

One hundred categories of birth defects had at least five cases delivered to mothers residing in the SJRWP area, and their occurrence in that area was compared with their occurrence in Public Health Region 6, the Houston/Galveston area.

The occurrence of infants and fetuses with one or more birth defects was the same in the SJRWP area as in Region 6.

Three birth defects were significantly higher in the study area. Congenital Wolfe-Parkinson-White syndrome (WPW) is a condition in which there is an extra electrical pathway of the heart. This can lead to periods of rapid heart rate (tachycardia); WPW syndrome is one of the most common causes of fast heart rate problems in infants and children. Males have this syndrome more frequently than females, some cases may be inherited, and some cases occur together with other birth defects of the heart. Spina bifida is a neural tube defect (NTD). Neural tube defects are higher in Hispanics than in other race/ethnic groups, in female infants, and in offspring of mothers who have not consumed sufficient folic acid, who had a prior NTD, who are diabetic or obese, or who take medication for epilepsy. Evidence for increased risk from occupational or environmental exposures is less consistent. Congenital hypertrophic pyloric stenosis is much higher among male infants than female, and in offspring of mothers who are young. It is lower among Blacks. Reports of associations with maternal use of medications are inconsistent.

Three categories of birth defects were significantly lower in the area as compared to Region 6.

With one hundred comparisons, we would expect roughly 5%, or 5 defects to be statistically significantly higher or lower in the SJRWP area than Public Health Region 6 by chance alone. We found 6 defects, which was close to what we would have expected. Furthermore, the three birth defects that were higher in the SJRWP area are not embryologically related, nor do they share many risk factors in common. Thus it seems unlikely that the same exposure could have caused their apparent increased occurrence there. Because of these considerations, it is my opinion that additional investigation related to birth defects in the SJRWP area is not warranted at this time.

ACKNOWLEDGEMENTS

Thanks to Mary Ethen, MPH, for help in designing the analysis and reviewing the report.

Appendix 1. Occurrence of birth defects in the San Jacinto River Waste Pits (SJRWP) area compared to Public Health Region 6, 1999-2011: Crude birth prevalence ratios with 95% confidence limits.

defect	cases ¹	prevalence ratio ²	LCL ³	UCL ³	sig ⁴
228.0 Hemangioma, of unspecified site	33	1.04	0.72	1.46	
228.1 Cystic hygroma, lymphangioma any site	5	0.81	0.29	1.78	
426.7 Congenital Wolfe-Parkinson-White syndrome	5	3.17	1.09	7.39	High
524.0 Abnormalities of jaw size - micro/macrogathia	46	0.93	0.68	1.23	
550.9 Inguinal hernia with no obstruction, no gangrene	23	1.19	0.76	1.77	
740.0 Anencephalus	5	0.77	0.27	1.69	
741 Spina bifida	26	1.67	1.09	2.44	High
742.1 Microcephalus	48	1.25	0.92	1.65	
742.2 Reduction deformities of brain	29	1.12	0.75	1.60	
742.3 Congenital hydrocephalus	24	0.79	0.51	1.16	
742.4 Other specified anomalies of brain	42	0.99	0.72	1.33	
742.5 Other specified anomalies of spinal cord	12	1.47	0.77	2.52	
743.1 Microphthalmos	10	0.92	0.45	1.63	
743.3 Congenital cataract and lens anomalies	9	1.08	0.51	1.99	
743.4 Coloboma, other anomalies of anterior segments	6	0.68	0.27	1.41	
743.5 Cong anom of posterior segment	6	0.78	0.31	1.61	
743.6 Cong anom of eyelids, lacrimal system, and orbit	23	1.13	0.72	1.68	
744.0 Anomalies of ear causing impairment of hearing	8	1.18	0.53	2.25	
744.2 Other specified anomalies of ear	54	0.71	0.54	0.92	Low
744.8 Other specified anomalies of face and neck	17	0.91	0.54	1.43	
744.9 Unspecified anomalies of face and neck	35	0.97	0.68	1.34	
745.1 Transposition of great vessels	26	1.03	0.68	1.49	
745.2 Tetralogy of Fallot	16	0.95	0.55	1.52	
745.4 Ventricular septal defect	237	0.92	0.81	1.05	
745.5 Ostium secundum type atrial septal defect	437	1.00	0.91	1.10	
745.6 Endocardial cushion defects	21	1.05	0.66	1.59	
746.0 Anomalies of pulmonary valve	50	1.16	0.86	1.53	
746.1 Tricuspid atresia and stenosis	14	0.78	0.44	1.28	
746.2 Ebsteins anomaly	5	1.56	0.55	3.49	
746.3 Congenital stenosis of aortic valve	9	0.87	0.41	1.59	
746.4 Congenital insufficiency of aortic valve	13	0.88	0.48	1.46	
746.5 Congenital mitral stenosis	25	1.22	0.79	1.78	
746.7 Hypoplastic left heart syndrome	12	1.20	0.63	2.04	
746.8 Other specified anomalies of the heart	157	1.08	0.92	1.27	
746.9 Unspecified anomalies of heart	34	1.31	0.91	1.82	
747.0 Patent ductus arteriosus (PDA)	204	0.94	0.81	1.08	
747.1 Coarctation of aorta	25	1.07	0.70	1.56	
747.2 Other anomalies of aorta	49	0.91	0.68	1.20	
747.3 Anomalies of pulmonary artery	81	1.05	0.83	1.30	
747.4 Anomalies of great veins	18	0.78	0.47	1.21	
747.6 Other anomalies of peripheral vascular system	6	0.90	0.35	1.86	
748.0 Choanal atresia	7	1.33	0.56	2.65	
748.3 Other anomalies of larynx, trachea, and bronchus	11	1.18	0.61	2.07	
748.4 Congenital cystic lung	5	1.06	0.37	2.33	
748.5 Agenesis or aplasia of lung	14	0.88	0.49	1.45	
749.0 Cleft palate alone	30	1.08	0.73	1.53	
749.1 Cleft lip alone with/without cleft palate	51	1.13	0.85	1.49	
750.1 Other anomalies of tongue	16	1.20	0.70	1.93	
750.2 Other specified anomalies of mouth and pharynx	16	1.00	0.58	1.60	

defect	cases ¹	prevalence ²	LCL ³	UCL ³ sig ⁴
750.3 T-E fistula, esophageal atresia and stenosis	6	0.65	0.26	1.34
750.5 Congenital hypertrophic pyloric stenosis	121	1.35	1.12	1.62 High
751.1 Atresia and stenosis of small intestine	7	0.55	0.23	1.07
751.2 Atresia/stenosis of large intestine, rectum and anal canal	28	1.00	0.67	1.43
751.4 Anomalies of intestinal fixation	9	0.77	0.36	1.40
751.5 Other anomalies of intestine	18	1.22	0.73	1.91
751.6 Anomalies of gallbladder, bile ducts, and liver	7	1.12	0.47	2.21
752.0 Anomalies of ovaries	7	1.41	0.59	2.81
752.4 Anomaly of cervix, vagina, external female genitalia	25	0.96	0.63	1.40
752.5 Undescended testicle	104	1.08	0.88	1.31
752.6 Hypospadias and epispadias	187	1.04	0.90	1.20
752.8 Other specified anomalies of male genital organs	61	1.02	0.78	1.31
753.0 Renal agenesis and dysgenesis	28	1.15	0.77	1.65
753.1 Cystic kidney disease	30	0.89	0.60	1.26
753.2 Obstructive defects of renal pelvis and ureter	211	1.04	0.90	1.19
753.3 Other specified anomalies of kidney	22	0.86	0.54	1.28
753.4 Other specified anomalies of ureter	32	0.84	0.57	1.17
753.6 Atresia and stenosis of urethra and bladder neck	5	0.79	0.28	1.74
753.8 Other specified anomalies of bladder and urethra	7	0.86	0.36	1.69
754.0 Certain anomalies of skull, face, and jaw	81	0.83	0.66	1.03
754.3 Congenital dislocation of hip	19	0.95	0.58	1.46
754.4 Congenital genu recurvatum, bowing of leg bones	10	1.13	0.56	2.03
754.5 Varus (inward) deformities of feet	33	1.08	0.75	1.51
754.6 Valgus (outward) deformities of feet	10	0.56	0.28	0.99 Low
754.7 Other deformities of feet	84	1.11	0.88	1.37
754.8 Other specified congenital musculoskeletal deformities	24	0.90	0.58	1.32
755.0 Polydactyly	121	0.97	0.80	1.16
755.1 Syndactyly	38	1.10	0.78	1.49
755.2 Reduction defects of upper limb	16	1.02	0.59	1.63
755.3 Reduction defects of lower limb	5	0.78	0.28	1.71
755.5 Other anomaly of upper limb, including shoulder girdle	16	0.76	0.44	1.21
755.6 Other anomaly of lower limb, including pelvic girdle	39	0.74	0.53	1.00 Low
755.8 Other specified anomalies of unspecified limb	18	0.93	0.56	1.45
756.0 Anomalies of skull and face bones	86	1.00	0.80	1.24
756.1 Anomalies of spine	15	0.82	0.47	1.32
756.3 Other anomalies of ribs and sternum	8	0.68	0.31	1.28
756.6 Anomalies of diaphragm	15	1.02	0.58	1.64
756.70 Omphalocele	10	1.18	0.58	2.11
756.71 Gastroschisis	30	1.45	0.98	2.06
756.8 Other specified anomaly of muscle, tendon, connective tissue	27	0.80	0.53	1.14
757.3 Other specified anomalies of skin	12	0.58	0.31	0.98 Low
757.5 Specified anomalies of nails	9	0.95	0.45	1.73
758.0 Down syndrome	44	0.74	0.54	0.99 Low
758.2 Edwards syndrome	7	0.84	0.36	1.65
758.3 Autosomal deletion syndromes	14	1.17	0.65	1.92
758.5 Other conditions due to autosomal anomalies	15	1.21	0.69	1.95
759.0 Anomalies of spleen	6	1.44	0.56	3.01
759.3 Situs inversus	9	1.46	0.69	2.70
759.6 Other hamartomas, not elsewhere classified	6	1.48	0.58	3.12

Appendix 1 (continued). Occurrence of birth defects in the San Jacinto River Waste Pits (SJRWP) area compared to Public Health Region 6, 1999-2011: Crude birth prevalence ratios with 95% confidence limits.

defect	cases ¹	prevalence ratio ²	LCL ³	UCL ³	sig ⁴
759.8 Other specified anomalies and syndromes	15	0.88	0.50	1.42	
888.8 Any monitored congenital anomaly ⁵	1826	1.00	0.95	1.04	

Appendix 1 footnotes:

1. Cases: Number of infants and fetuses with the specified birth defect in the SJRWP area
2. Prevalence ratio: Crude (unadjusted) birth prevalence ratio (birth prevalence in the SJRWP area divided by birth prevalence for Region 6)
3. LCL = Lower 95% confidence limit for the crude birth prevalence ratio; UCL = Upper 95% confidence limit for the crude birth prevalence ratio. The interval from the LCL to the UCL is the 95% confidence interval for the crude birth prevalence ratio.
4. Sig: Low = Crude birth prevalence is statistically significantly lower in the SJRWP area than in Region 6; High = Crude birth prevalence is statistically significantly higher in the SJRWP area than in Region 6.
5. Infants and fetuses with one or more birth defects

Appendix 2. Occurrence of birth defects in the San Jacinto River Waste Pits (SJRWP) area compared to Public Health Region 6, 1999-2011: Birth prevalence ratios adjusted for maternal age, maternal race/ethnicity, and sex of infant, with 95% confidence limits.

defect	cases ¹	prevratio ²	LCL ³	UCL ³	sig ⁴
228.0 Hemangioma, of unspecified site	1.06	0.72	1.50		
228.1 Cystic hygroma, lymphangioma any site	0.81	0.36	1.54		
426.7 Congenital Wolfe-Parkinson-White syndrome	3.40	2.33	6.95	High	
524.0 Abnormalities of jaw size - micro/macrogathia	0.93	0.70	1.21		
550.9 Inguinal hernia with no obstruction, no gangrene	1.22	0.76	1.85		
740.0 Anencephalus	0.72	0.21	1.78		
741 Spina bifida	1.58	1.02	2.33	High	
742.1 Microcephalus	1.20	0.91	1.56		
742.2 Reduction deformities of brain	1.11	0.80	1.50		
742.3 Congenital hydrocephalus	0.78	0.52	1.12		
742.4 Other specified anomalies of brain	1.03	0.69	1.47		
742.5 Other specified anomalies of spinal cord	1.44	0.89	2.20		
743.1 Microphthalmos	0.96	0.50	1.66		
743.3 Congenital cataract and lens anomalies	1.07	0.60	1.77		
743.4 Coloboma, other anomalies of anterior segments	0.68	0.31	1.27		
743.5 Cong anom of posterior segment	0.79	0.40	1.39		
743.6 Cong anom of eyelids, lacrimal system, and orbit	1.15	0.72	1.75		
744.0 Anomalies of ear causing impairment of hearing	1.16	0.59	2.05		
744.2 Other specified anomalies of ear	0.72	0.54	0.94	Low	
744.8 Other specified anomalies of face and neck	0.95	0.55	1.51		
744.9 Unspecified anomalies of face and neck	0.99	0.70	1.35		
745.1 Transposition of great vessels	1.05	0.69	1.53		
745.2 Tetralogy of Fallot	1.01	0.57	1.64		
745.4 Ventricular septal defect	0.94	0.80	1.09		
745.5 Ostium secundum type atrial septal defect	1.04	0.93	1.16		
745.6 Endocardial cushion defects	1.13	0.70	1.71		
746.0 Anomalies of pulmonary valve	1.18	0.84	1.60		
746.1 Tricuspid atresia and stenosis	0.83	0.39	1.52		
746.2 Ebsteins anomaly	1.61	0.65	3.30		
746.3 Congenital stenosis of aortic valve	0.84	0.38	1.59		
746.4 Congenital insufficiency of aortic valve	0.90	0.54	1.40		
746.5 Congenital mitral stenosis	1.25	0.83	1.81		
746.7 Hypoplastic left heart syndrome	1.19	0.74	1.83		
746.8 Other specified anomalies of the heart	1.14	0.97	1.34		
746.9 Unspecified anomalies of heart	1.35	0.91	1.92		
747.0 Patent ductus arteriosus (PDA)	0.97	0.81	1.14		
747.1 Coarctation of aorta	1.09	0.76	1.50		
747.2 Other anomalies of aorta	0.95	0.66	1.32		
747.3 Anomalies of pulmonary artery	1.06	0.83	1.34		
747.4 Anomalies of great veins	0.79	0.46	1.26		
747.6 Other anomalies of peripheral vascular system	0.94	0.43	1.76		
748.0 Choanal atresia	1.37	0.69	2.44		
748.3 Other anomalies of larynx, trachea, and bronchus	1.24	0.73	1.95		
748.4 Congenital cystic lung	1.06	0.44	2.12		
748.5 Agenesis or aplasia of lung	0.89	0.49	1.46		
749.0 Cleft palate alone	1.12	0.75	1.60		
749.1 Cleft lip alone with/without cleft palate	1.13	0.80	1.54		
750.1 Other anomalies of tongue	1.22	0.68	2.03		

Appendix 2 (continues). Occurrence of birth defects in the San Jacinto River Waste Pits (SJRWP) area compared to Public Health Region 6, 1999-2011: Birth prevalence ratios adjusted for maternal age, maternal race/ethnicity, and sex of infant, with 95% confidence limits.

defect	cases ¹	prevratio ²	LCL ³	UCL ³	sig ⁴
750.2 Other specified anomalies of mouth and pharynx	1.00	0.58	1.61		
750.3 T-E fistula, esophageal atresia and stenosis	0.67	0.29	1.30		
750.5 Congenital hypertrophic pyloric stenosis	1.27	1.06	1.51	High	
751.1 Atresia and stenosis of small intestine	0.56	0.23	1.10		
751.2 Atr/sten of lg intestine, rectum and anal canal	1.03	0.70	1.45		
751.4 Anomalies of intestinal fixation	0.79	0.40	1.38		
751.5 Other anomalies of intestine	1.22	0.74	1.90		
751.6 Anomalies of gallbladder, bile ducts, and liver	1.20	0.58	2.19		
752.0 Anomalies of ovaries	1.48	0.72	2.68		
752.4 Anom of cervix, vagina, ext female genitalia	0.91	0.66	1.22		
752.5 Undescended testicle	1.09	0.92	1.27		
752.6 Hypospadias and epispadias	1.11	0.99	1.25		
752.8 Other specified anomalies of male genital organs	1.10	0.91	1.31		
753.0 Renal agenesis and dysgenesis	1.15	0.74	1.68		
753.1 Cystic kidney disease	0.89	0.57	1.32		
753.2 Obstructive defects of renal pelvis and ureter	1.05	0.91	1.21		
753.3 Other specified anomalies of kidney	0.87	0.48	1.45		
753.4 Other specified anomalies of ureter	0.87	0.57	1.26		
753.6 Atresia and stenosis of urethra and bladder neck	0.83	0.30	1.81		
753.8 Other specified anomalies of bladder and urethra	0.87	0.46	1.48		
754.0 Certain anomalies of skull, face, and jaw	0.91	0.70	1.17		
754.3 Congenital dislocation of hip	0.95	0.56	1.51		
754.4 Congenital genu recurvatum, bowing of leg bones	1.13	0.51	2.17		
754.5 Varus (inward) deformities of feet	1.04	0.74	1.41		
754.6 Valgus (outward) deformities of feet	0.53	0.31	0.83	Low	
754.7 Other deformities of feet	1.11	0.90	1.36		
754.8 Other specified cong musculoskeletal deformities	0.90	0.55	1.39		
755.0 Polydactyly	1.00	0.79	1.24		
755.1 Syndactyly	1.11	0.70	1.67		
755.2 Reduction defects of upper limb	0.93	0.55	1.48		
755.3 Reduction defects of lower limb	0.75	0.09	2.78		
755.5 Other anom of upper limb, inc shoulder girdle	0.78	0.46	1.21		
755.6 Other anom of lower limb, inc pelvic girdle	0.75	0.50	1.08		
755.8 Other specified anomalies of unspecified limb	0.88	0.56	1.30		
756.0 Anomalies of skull and face bones	1.03	0.80	1.31		
756.1 Anomalies of spine	0.81	0.49	1.24		
756.3 Other anomalies of ribs and sternum	0.67	0.29	1.28		
756.6 Anomalies of diaphragm	1.03	0.55	1.74		
756.70 Omphalocele	1.23	0.62	2.16		
756.71 Gastroschisis	1.18	0.87	1.57		
756.8 Other spec anom of muscle, tendon, conn tissue	0.93	0.61	1.35		
757.3 Other specified anomalies of skin	0.57	0.33	0.90	Low	
757.5 Specified anomalies of nails	0.97	0.43	1.86		
758.0 Down syndrome	0.81	0.59	1.07		
758.2 Edwards syndrome	0.94	0.42	1.79		
758.3 Autosomal deletion syndromes	1.20	0.76	1.80		
758.5 Other conditions due to autosomal anomalies	1.27	0.75	2.02		
759.0 Anomalies of spleen	1.46	0.55	3.13		

759.3	Situs inversus	1.46	0.91	2.21
759.6	Other hamartoses, not elsewhere classified	1.64	0.70	3.26
759.8	Other specified anomalies and syndromes	0.88	0.51	1.40
888.8	Any monitored congenital anomaly ⁵	1.02	0.96	1.08

Appendix 2 footnotes:

1. **Prevratio:** Adjusted birth prevalence ratio (birth prevalence in the SJRWP area divided by birth prevalence for Region 6, adjusted for maternal age, maternal race/ethnicity, and sex of infant)
2. **LCL =** Lower 95% confidence limit for the adjusted birth prevalence ratio; **UCL =** Upper 95% confidence limit for the adjusted birth prevalence ratio. The interval from the LCL to the UCL is the 95% confidence interval for the adjusted birth prevalence ratio.
3. **Sig:** Low = Adjusted birth prevalence is statistically significantly lower in the SJRWP area than in Region 6; High = Adjusted birth prevalence is statistically significantly higher in the SJRWP area than in Region 6.
4. **Infants and fetuses with one or more birth defects**