# Methods

**Indicator**

S1. Birth Defects in Texas, 1999-2007.

**Summary**

Since 1994, the Texas Birth Defects Epidemiology and Surveillance Branch has maintained the Texas Birth Defects Registry, a population-based birth defects surveillance system. The Texas Birth Defects Registry began monitoring the Houston/Galveston and South Texas areas in 1995 and gradually expanded so that beginning with births in 1999, it covered the entire state. Since 1999, the registry has monitored all births in Texas (approximately 380,000 each year) and has identified cases of birth defects using multiple sources of information. Indicator S1 uses Texas Birth Defects Registry data to calculate the rates of different types of birth defects in Texas by the structural category and three-year period. Table S1a gives the rates of different types of birth defects in Texas by the structural category and mother's race/ethnicity, for the period 2005-2007.

**Data Summary**

| Indicator | S1. Birth defects in Texas, 1999-2007. | | |
|---|---|---|---|
| Time Period | 1999-2007 | | |
| Data | Texas Birth Defects Registry | | |
| Years (1999-2007) | 1999-2001 | 2002-2004 | 2005-2007 |
| Live births | 1,077,574 | 1,131,184 | 1,192,367 |
| Missing or unknown race/ethnicity (%) | 1,728 (0.2%) | 1,963 (0.2%) | 1,120 (0.1%) |

**Overview of Data Files**

Summary data were compiled by the Texas Department of State Health Services. These data gave the numbers of cases, total numbers of live births, and rates of birth defects per 10,000 live births for each combination of structural category, mother's race/ethnicity (All, White non-Hispanic, Black non-Hispanic, Hispanic, and "Other non-Hispanic"), and time period. The number of cases includes birth defects occurring in a fetal death or pregnancy termination as well as birth defects occurring in live births. Birth defects identified in the first twelve months after the birth are included.

**Calculation of Indicator**

For each structural category and three-year period, the rate of birth defects was calculated as the number of birth defects divided by the total number of live births:

Rate of birth defects per 10,000 live births =
Number of birth defects in structural category and time period / Number of live births in time period $\times$ 10000

## Questions and Comments

Questions regarding these methods, and suggestions to improve the description of the methods, are welcome. Please use the "Contact Us" link at the bottom of any page in the America's Children and the Environment website.

## Statistical Comparisons

Statistical analyses of the rates of birth defects in Texas were used to determine whether the differences between rates for different race/ethnicity groups were statistically significant. Using a Poisson regression model adjusted for dispersion, the number of cases for each race/ethnicity group was assumed to have a Poisson distribution with a mean equal to the number of live births of that demographic subgroup multiplied by the rate, and a variance equal to the mean multiplied by a dispersion parameter. The logarithm of the rate was assumed to be the sum of explanatory terms for the mother's race/ethnicity. Using this model, the difference in the percentage between different race/ethnicity groups is statistically significant if the difference between the corresponding sums of explanatory terms is statistically significantly different from zero. The p-values for each comparison between the rates of particular types of birth defects in Texas from 2005 to 2007 for different race/ethnicity groups are shown in Table 1. A p-value at or below 0.05 implies that the difference is statistically significant at the 5% significance level. No adjustment is made for multiple comparisons.

For these statistical analyses we used five race/ethnicity groups: White non-Hispanic; Black non-Hispanic; Hispanic; "Other non-Hispanic" and; Unknown. Data on race/ethnicity of the mother was missing or unknown for a small percentage of births (0.1-0.2%). The numbers and cases in this category were calculated by subtracting the totals for the other four race/ethnicity groups from the totals for all births. Statistical comparisons between the first four race/ethnicity groups and Unknown race/ethnicity are not shown.

Comparisons of the trends in the rates of birth defects in Texas from 1999 to 2007 are shown in Table 2. For each comparison, we present unadjusted and adjusted analyses. The unadjusted analyses directly compare the rates for different three-year periods. For the unadjusted comparisons, the only explanatory variables in the Poisson regression model are the intercept and a term for the middle year of the three-year period considered as a continuous variable. The adjusted analyses add race/ethnicity terms to the statistical model and compare the rates between different three-year periods after accounting for any differences in the race/ethnicity distributions between the three-year periods. For example, if births to White non-Hispanic mothers tend to have much higher probabilities of a birth defect in a given structural category, compared with Black non-Hispanics, and if the number of births to White non-Hispanic mothers is increasing much more rapidly than the number of births to Black non-Hispanic mothers, then the unadjusted trend would be significant but the adjusted trend (taking into account race/ethnicity) would not be significant.

For more details on these statistical analyses, see the description of the similar methods used for the National Cancer Institute, Surveillance, Epidemiology, and End Results (SEER) Program childhood cancer incidence indicator in the memorandum by Cohen (2011).[1]

Table 1. Statistical significance tests comparing the rates of birth defects in Texas between pairs of race/ethnicity groups for the years 2005 to 2007.

| Structural Category | First race/ethnicity group | Second race/ethnicity group | P-VALUE |
|---|---|---|---|
| Musculoskeletal | White non-Hispanic | Black non-Hispanic | 0.039 |
| Musculoskeletal | White non-Hispanic | Hispanic | < 0.001 |
| Musculoskeletal | White non-Hispanic | Other non-Hispanic | < 0.001 |
| Musculoskeletal | Black non-Hispanic | Hispanic | 0.780 |
| Musculoskeletal | Black non-Hispanic | Other non-Hispanic | 0.002 |
| Musculoskeletal | Hispanic | Other non-Hispanic | 0.001 |
| Cardiac and Circulatory | White non-Hispanic | Black non-Hispanic | 0.369 |
| Cardiac and Circulatory | White non-Hispanic | Hispanic | < 0.001 |
| Cardiac and Circulatory | White non-Hispanic | Other non-Hispanic | < 0.001 |
| Cardiac and Circulatory | Black non-Hispanic | Hispanic | < 0.001 |
| Cardiac and Circulatory | Black non-Hispanic | Other non-Hispanic | < 0.001 |
| Cardiac and Circulatory | Hispanic | Other non-Hispanic | < 0.001 |
| Genitourinary | White non-Hispanic | Black non-Hispanic | < 0.001 |
| Genitourinary | White non-Hispanic | Hispanic | < 0.001 |
| Genitourinary | White non-Hispanic | Other non-Hispanic | 0.028 |
| Genitourinary | Black non-Hispanic | Hispanic | 0.084 |
| Genitourinary | Black non-Hispanic | Other non-Hispanic | 0.371 |
| Genitourinary | Hispanic | Other non-Hispanic | 0.034 |
| Eye and Ear | White non-Hispanic | Black non-Hispanic | < 0.001 |
| Eye and Ear | White non-Hispanic | Hispanic | < 0.001 |
| Eye and Ear | White non-Hispanic | Other non-Hispanic | 0.033 |
| Eye and Ear | Black non-Hispanic | Hispanic | < 0.001 |
| Eye and Ear | Black non-Hispanic | Other non-Hispanic | 0.243 |
| Eye and Ear | Hispanic | Other non-Hispanic | < 0.001 |
| Gastrointestinal | White non-Hispanic | Black non-Hispanic | < 0.001 |
| Gastrointestinal | White non-Hispanic | Hispanic | 0.988 |
| Gastrointestinal | White non-Hispanic | Other non-Hispanic | < 0.001 |
| Gastrointestinal | Black non-Hispanic | Hispanic | < 0.001 |
| Gastrointestinal | Black non-Hispanic | Other non-Hispanic | 0.061 |
| Gastrointestinal | Hispanic | Other non-Hispanic | < 0.001 |
| Central Nervous System | White non-Hispanic | Black non-Hispanic | 0.373 |
| Central Nervous System | White non-Hispanic | Hispanic | 0.074 |
| Central Nervous System | White non-Hispanic | Other non-Hispanic | 0.046 |
| Central Nervous System | Black non-Hispanic | Hispanic | 0.033 |
| Central Nervous System | Black non-Hispanic | Other non-Hispanic | 0.019 |

[1] Cohen, J. 2011. *Selected statistical methods for testing for trends and comparing years or demographic groups in other ACE health-based indicators.* Memorandum submitted to Dan Axelrad, EPA, 3 October, 2011.

| Structural Category | First race/ethnicity group | Second race/ethnicity group | P-VALUE |
|---|---|---|---|
| Central Nervous System | Hispanic | Other non-Hispanic | 0.200 |
| Respiratory | White non-Hispanic | Black non-Hispanic | 0.873 |
| Respiratory | White non-Hispanic | Hispanic | < 0.001 |
| Respiratory | White non-Hispanic | Other non-Hispanic | 0.245 |
| Respiratory | Black non-Hispanic | Hispanic | 0.005 |
| Respiratory | Black non-Hispanic | Other non-Hispanic | 0.250 |
| Respiratory | Hispanic | Other non-Hispanic | 0.002 |
| Chromosomal | White non-Hispanic | Black non-Hispanic | 0.015 |
| Chromosomal | White non-Hispanic | Hispanic | 0.074 |
| Chromosomal | White non-Hispanic | Other non-Hispanic | 0.017 |
| Chromosomal | Black non-Hispanic | Hispanic | < 0.001 |
| Chromosomal | Black non-Hispanic | Other non-Hispanic | 0.457 |
| Chromosomal | Hispanic | Other non-Hispanic | 0.002 |
| Oral Cleft | White non-Hispanic | Black non-Hispanic | < 0.001 |
| Oral Cleft | White non-Hispanic | Hispanic | 0.499 |
| Oral Cleft | White non-Hispanic | Other non-Hispanic | 0.244 |
| Oral Cleft | Black non-Hispanic | Hispanic | < 0.001 |
| Oral Cleft | Black non-Hispanic | Other non-Hispanic | 0.015 |
| Oral Cleft | Hispanic | Other non-Hispanic | 0.368 |

Table 2. Statistical significance tests for the trends of birth defects in Texas, from 1999-2007.

| | | | | P-Values | |
|---|---|---|---|---|---|
| Structural Category | From | To | Against | Unadjusted | Adjusted for race/ethnicity |
| Musculoskeletal | 1999 | 2007 | year | < 0.001 | < 0.001 |
| Cardiac and Circulatory | 1999 | 2007 | year | < 0.001 | < 0.001 |
| Genitourinary | 1999 | 2007 | year | 0.003 | < 0.001 |
| Eye and Ear | 1999 | 2007 | year | < 0.001 | < 0.001 |
| Gastrointestinal | 1999 | 2007 | year | 0.156 | 0.008 |
| Central Nervous System | 1999 | 2007 | year | < 0.001 | < 0.001 |
| Respiratory | 1999 | 2007 | year | 0.303 | 0.174 |
| Chromosomal | 1999 | 2007 | year | 0.628 | 0.615 |
| Oral Cleft | 1999 | 2007 | year | 0.948 | 0.889 |