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Tennessee Birth Defects 2004-2008

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Executive Summary

This is a statewide population-based report produced by the Tennessee Birth Defects Registry (TBDR). It details the birth prevalence of 45 major birth defects for Tennessee infants born in the years 2004 through 2008. The report contains sections detailing the overall statewide birth defects counts and rates for each of the 45 birth defect diagnoses tracked by the TBDR. Additional statewide counts and rates are presented broken down by infant sex, race/ethnicity, and perinatal region. Other tabled risk factors are maternal age, education, smoking, and diabetes (types I and II).

Overall, 14,301 infants were born with a birth defect, resulting in an overall case rate of 342.3 per 10,000 live births or 3.4 percent for the five-year period 2004 through 2008. However, 2,984 newborns (21.3%) were affected by multiple birth defects with 1,017 having 3 or more birth defects. This resulted in an overall birth defects rate of 451.6 per 10,000 live births or 4.5% for the five-year period.

Birth defects were the leading cause of infant mortality in Tennessee in 2008, accounting for 146 infant deaths, which was 21.3% of all infant deaths that year.¹ In addition to infant deaths and the obvious pain and disability associated with birth defects, birth defects are expensive. The direct estimated lifetime cost of the 182 cases of the neural tube defect, spina bifida, documented in this report is \$101,920,000 in 2003 dollars.² If all potential child-bearing women were to take a daily multivitamin with 400 micrograms of folic acid, the majority of these cases would likely not have occurred.^{3,4} Likewise for many of the 57 anencephaly cases (i.e., babies born with little or no brain) that are documented in this report and are among the 146 infants that died in 2008.

Birth defects rates and case rates have both increased each of the five years 2004 to 2008 with birth defects rates of 388.6 and 520.4 per 10,000 live births in 2004 and 2008, respectively and case rates of 298.7 and 380.0 per 10,000 live births. The reason for the increase from 2004 to 2008 remains unexplained. It may represent a true increase in birth defects rates related to familial, maternal or environmental risk factors, or

improved birth defects surveillance. Or it may represent changes in clinical practice and the coding of birth defects diagnoses in hospitals. It could also be a combination of all these factors.

Birth defects were more common among whites, males and babies born to mothers aged 35 and older, but this is not the case for all birth defects. Birth defect rates vary by perinatal region with the highest rates in the Northeast and East perinatal regions and lower rates in the Southeast, Middle and West regions. The TBDR is working to evaluate factors that may affect regional differences as well as the racial/ethnic and gender differences in birth defects rates.

Birth defects were also more common among mothers who smoke cigarettes and who have only a high school or lesser education. Of the potential risk factors evaluated in this report, maternal diabetes (type I or type II) was the most potent. Mothers with type I or type II diabetes were 2.6 times more likely to have a baby born with a birth defect than a non-diabetic mother. Controlling maternal blood sugar levels before and during pregnancy is both achievable and essential to preventing diabetes-related birth defects in Tennessee.

Birth Defects Overview

Birth defects occur in the first three months of pregnancy with most originating in the first six weeks and can affect almost any part of the body. Nationally nearly one out of every 33 babies is born with a birth defect. Some defects are obvious at birth while others may not be apparent until adulthood. Some defects can result in life-long debilitating illnesses or death, whereas surgery and medical interventions may correct others but not without cost. Hospital costs alone for birth defects totaled \$2.6 billion in the United States in 2004, with birth defect admissions being on average more than twice as costly as other admissions (Russo and Elixhauser, 2007).⁵

Unfortunately, the underlying causes of individual birth defects are largely unknown; nearly 70% of birth defects have no known cause. This leaves many questions about the causes and patterns of birth defects unanswered. Information obtained through monitoring diseases and the surveillance of birth defects can assist with the task of addressing these questions. The primary use of data collected by TBDR is to observe patterns and detect changes in the patterns of leading birth defects. This data provides the basis for research studies into the causes of birth defects and to help develop and evaluate birth defects prevention programs. In 2008 birth defects were the leading cause of infant mortality in Tennessee, accounting for more than one in five infant deaths and causing 146 infants to die during the first year of life.¹

Tennessee Birth Defects Registry

The Tennessee Birth Defects Registry (TBDR) was established in law (TCA 68-5-506) by the Tennessee State Legislature in June 2000. The TBDR was established with the mission of: 1) providing annual information on birth defects prevalence and trends; 2) to provide information on the possible association of environmental hazards and other potential causes of birth defects; 3) to evaluate current birth defects prevention initiatives, providing guidance and strategies for improving those initiatives; and 4) to provide families of children with birth defects information on public services available to children with birth defects. Initially, the TBDR was a pilot program conducting birth

defects surveillance in Northeast Tennessee. Since 2003 the program has expanded to provide population-based birth defects surveillance for the entire state of Tennessee. The TBDR was established in order to 1) provide information on birth defect prevalence and trends; 2) to provide information on possible association of environmental hazards, behavioral risk factors and other potential causes of birth defects; 3) to evaluate current birth defects prevention initiatives, providing guidance and strategies for improving those initiatives; and 4) to provide families of children with birth defects information on public services available to children with birth defects.

Birth Defect Definition

This report details the birth prevalence of 45 major birth defects for Tennessee infants who were born to resident mothers during the period 2004 through 2008. The tracking of these birth defects is recommended by the Centers of Disease Control and Prevention (CDC) and the National Birth Defects Prevention Network (NBDPN). These birth defects are classified as major birth defects because they require medical or surgical treatment, have serious adverse effects on health and development, or have a significant cosmetic impact. Additionally, the 45 birth defects can be organized within eight diagnostic categories plus fetal alcohol syndrome:

Central Nervous System

Eye and Ear

Cardiovascular

Orofacial

Gastrointestinal

Genitourinary

Musculoskeletal

Chromosomal

Birth defect counts include: 1) live-born infants diagnosed with a birth defect during the first year of life; and 2) diagnosed fetal-death cases that were at least 500 grams in weight or in the absence of weight at least 22 weeks gestation. Effective July 1, 2010 the Department of Health's fetal death definition was changed to include cases of at

least 350 grams or 20 weeks completed gestation. But the fetal death cases included in this report were not covered by the new definition. The denominators for calculating birth defects rates include only live births and are reported per 10,000 live births.

Data Sources

The primary data sources in compiling this report are the Hospital Discharge Data System (HDDS) and the Birth, Death, and Fetal Death Statistical Data Systems, which are compiled, processed and stored by the Office of Vital Records and the Division of Health Statistics in the Office of Policy, Planning, and Assessment (PPA). The Tennessee Birth Defects Registry (TBDR), which is responsible for production of this report, is housed in the Research Division of PPA. The HDDS contains admission-level records for all patients treated in Tennessee licensed hospitals and their outpatient treatment and rehabilitation centers. The TBDR uses these records to track the 45 major birth defects. Infants' HDDS records containing diagnostic codes corresponding to the tracked birth defects are extracted, compiled and linked with their birth certificate records. The linkages provide validity checks and add information such as maternal risk factors, demographics and street-level geography that are not available in the HDDS. Together these data systems provide statewide population-based birth defects surveillance for Tennessee.

Data Limitations

The use of administrative data systems such as these for birth defects surveillance has limitations. The diagnostic codes used in the HDDS can contain minor variants of birth defects that should not be coded as major birth defects. Thus the coding system, The International Classification of Diseases Revision 9 Clinical Modification (ICD-9-CM), prevents distinguishing these differences for certain birth defects. As noted in previous reports, this has the effect of elevating rates for some of the more common birth defects, such as atrial septal defects, other heart defects and hypospadias, a common genitourinary defect. Less systematically, there are simple coding errors that result in non-cases being miscoded as having a birth defect. There is also evidence that there may be increased use of diagnostic codes to support the "off-label" use of surgical and

diagnostic procedures. This practice has the effect of artificially elevating counts of some birth defects diagnoses. For example, following up on a possible hospital-based pyloric stenosis cluster, reviews of affected infants' medical records by TBDR staff showed that the majority did not have pyloric stenosis, but instead were diagnosed with gastroesophageal reflux disease, which is not classified as a birth defect. Their gastric reflux was treated with a procedure called pyloromyotomy, which is used to treat infants with pyloric stenosis, and the diagnosis code for pyloric stenosis was subsequently added to their hospital discharge records.

Had the apparent cluster not triggered a review of individual records, all of these cases would have been recorded in the birth defects data system as having pyloric stenosis. The best way to eliminate this problem is to actively review all potential birth defects-related medical records at all Tennessee hospitals. However, TBDR did not have the capacity to perform this resource intensive review in recent years. Though not entirely eliminating the problem, the upcoming adoption of the International Classification of Diseases Revision 10 Clinical Modification (ICD-10-CM) in 2013 will likely diminish some of the coding-specificity problems encountered in the ICD-9-CM. However only active medical record reviews can differentiate improperly coded birth defects. Thus, the active review of medical records remains the gold standard for birth defects surveillance. Beginning in January 2012 the TBDR will renew efforts to review the medical records of Tennessee resident infants with birth defects diagnoses. These activities will be conducted by two public health nurse consultants specifically trained in the coding of birth defects.

Data Tables

Individual birth defect counts and rates are presented in tabular form for the state overall and broken down by infant sex, race/ethnicity and the five perinatal regions, which are served by Tennessee's five designated Perinatal Center Hospitals (Tables 1-4). Additional tables provide breakdowns by potential birth defect risk factors: maternal age, education, smoking, and type I and type II diabetes (Tables 5-8). Finally, birth

defects diagnostic category counts and rates for each of Tennessee's 95 counties are presented in Table 9.

All of the tables provide 95 percent confidence intervals for each of the rates. A 95 percent confidence interval is the interval that contains the true prevalence, which can only be estimated, 95 percent of the time. Narrower confidence intervals support greater certainty regarding an estimated rate, whereas wider confidence intervals support less certainty. In this report, confidence intervals for 100 cases or less are exact Poisson. Otherwise confidence intervals are based on the normal approximation. The width of a confidence interval is primarily dependent upon the number of birth defects (exact Poisson) or the size of the population used to compute the rate (normal approximation). Thus, confidence intervals become increasingly wider progressing through tables for the entire population to smaller subgroups and from more common to rarer birth defects. Accordingly, these rate estimates should be interpreted with caution. This is especially true of the county-level birth defects rates presented in Table 10. Confidence intervals are effective for determining the likely range for birth defects rate estimates that are affected by random error. Confidence intervals are less effective for determining the likely range of birth defects rate estimates affected by systematic error, such as limitations in disease classification coding systems and nonstandard coding practices in hospitals.

Birth defects may occur alone or in conjunction with other birth defects. Therefore, birth defects counts and rates are presented in two ways: 1) the number of birth defect diagnoses (i.e., birth defects rate); and 2) the number of patients, or cases, affected by birth defects (i.e., case rate). For example, when an infant or case has multiple birth defect diagnoses, we count and report each diagnosis separately. The totals for each of the eight birth defects categories, however, represent the number of cases (or patients) with one or more diagnoses in that category. Since it is also possible for a case to have diagnoses in multiple categories, the category totals cannot be added to obtain the total number of Tennessee cases, as this would overestimate the cases (i.e., affected infants). More specifically, of the 14,301 infants diagnosed with a birth defect between

2004 and 2008, 2,984 (20.87%) had more than one birth defect and while each represents a single case within a category, some are counted as cases in more than one diagnostic category and others may have multiple diagnoses within a category.

Risk Factors and Prevention

All of the tables except for the overall state and county tables (Tables 1 and 9) also include statistical significance indicators, showing whether differences in individual birth defects rates were related to or affected by the tabled risk factor. The potential differences were assessed using Poisson regression. Tables 2 through 8 present breakdowns by infant sex, race/ethnicity, region, maternal age, smoking, education and diabetes, respectively. All of these factors were related to some birth defects rates and to some birth defects more than others. Whereas infant sex, maternal age, smoking, and diabetes may affect birth defect rates more or less directly, maternal education is an indicator of educational achievement and socioeconomic status that may affect birth defect rates indirectly. Maternal education is also related to age in that as a group mothers with only a high school education or less tend to be younger, whereas mothers with a graduate degree tend to be older. Thus the finding in Table 6 (maternal education) that mothers with a graduate degree are at greatest risk of having a Down syndrome baby and that mothers with high school education or less are at lowest risk. Also, many birth defects are affected by more than one risk factor. Thus when evaluating these results, it may be informative to consider possible interactions among risk factors, looking at the results for individual birth defects across the different tables.

For example, gastroschisis is a musculoskeletal birth defect in which a newborn's intestines protrude through a rupture in the abdominal wall usually to the right side of the umbilical cord. Though sometimes treated with surgery immediately following birth, gastroschisis often requires a stay in the neonatal intensive care unit, where the newborn is ventilated and the intestines are sheathed in silastic sheeting and slowly lowered into the abdominal cavity over several days. Gastroschisis prevalence has been increasing in recent decades and is more prevalent in births to younger mothers. A number of studies have also shown relationships with recreational and therapeutic

drug use, especially vasodilators such as cocaine, amphetamines and ecstasy.^{6,7} Reviewing the tables shows that gastroschisis was not related to the basic demographics of infant sex (Table 2), race/ethnicity (Table 3) or perinatal region (Table 4), whereas, it was associated with maternal age (Table 5), maternal education (Table 6) and maternal smoking. Gastroschisis was most prevalent among mothers less than 20 years of age and of the 220 cases only 1 involved a mother 35 years and older. Gastroschisis was most prevalent among mothers without a high school diploma and least prevalent among mothers with a graduate degree. Gastroschisis was most prevalent among heavy smokers and least prevalent among mothers who did not smoke.

Looking at infant sex (Table 2) there was a very strong effect sex on pyloric stenosis rates with males affected at a rate more than four times higher than females. This finding is also consistent with findings in the birth defects literature.^{8,9} Overall male infants were nearly twice (1.8) as likely to be affected by birth defects as female infants. Maternal age (Table 5) also showed a strong association with some birth defects, especially Down syndrome, cardiovascular defects and orofacial clefts being more prevalent in older mothers and pyloric stenosis more prevalent in younger mothers. Each of the tables provides some insights into the correlates of birth defects in Tennessee.

Of the potential risk factors evaluated in this report, maternal diabetes (type I or type II) (Table 6) was the most potent. Overall, others with type I or type II diabetes were 2.6 times more likely to have a baby born with a birth defect than a non-diabetic mother. Controlling maternal blood sugar levels before and during pregnancy is both achievable and essential to preventing diabetes-related birth defects in Tennessee. In order to reduce the risk of birth defects diabetic women and obese women, who are at risk for becoming diabetic, should work with their health care provider to control their blood sugar before and during their pregnancies. The CDC recommends that a diabetic woman who wants to become pregnant should: 1) Plan her pregnancy; 2) See her doctor to assess the effects of her diabetes; 3) Eat healthy foods from a meal plan

made for her as a person with diabetes; 4) Exercise regularly; 5) Monitor blood sugar often; 6) Take her medications on time; 7) Control and treat low blood sugar and high blood sugar quickly; and 8) Follow-up regularly with her health care provider.^{10,11}

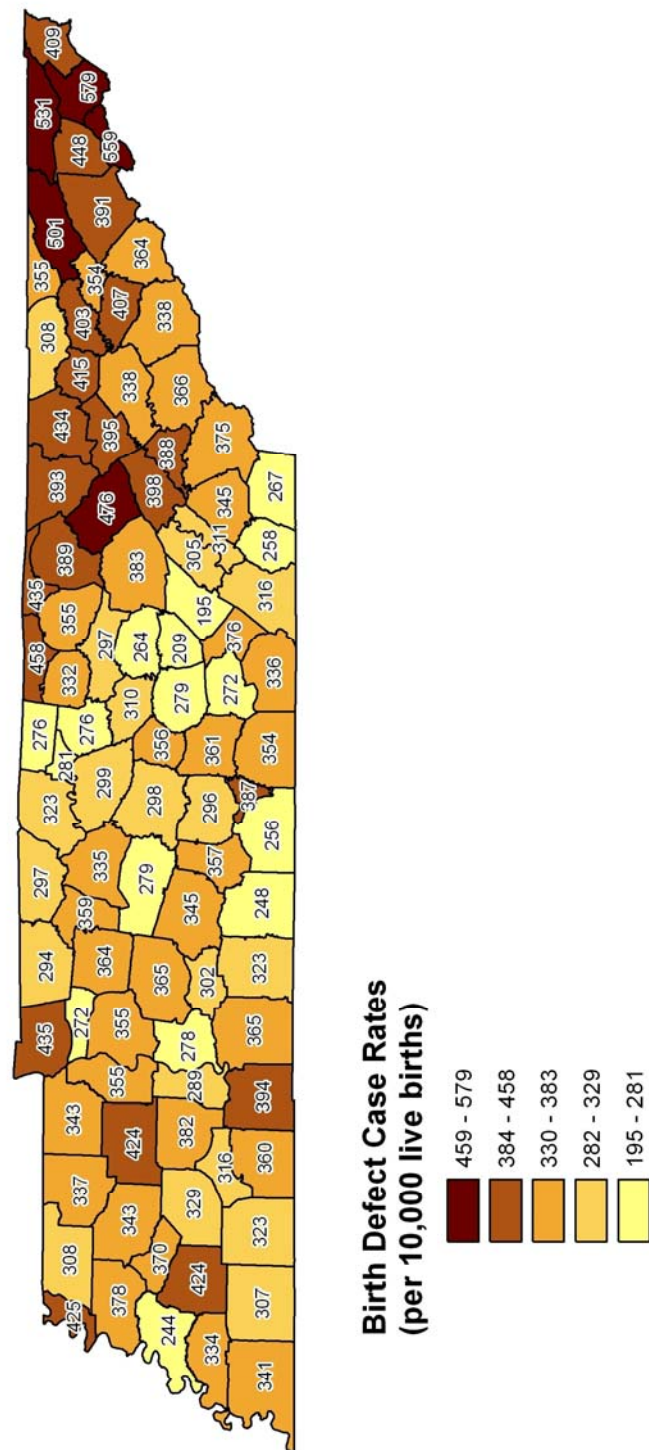
Gestational diabetes, which is a type of diabetes that develops during pregnancy, is generally not associated with elevated risk for birth defects. That is because gestational diabetes develops later in pregnancy than the critical period for the development of most birth defects, which is the first six weeks of pregnancy. Given this six week critical period, it is suggested that all women who could become pregnant should take a daily multivitamin containing 400 micrograms of folic acid. Doing so protects against neural tube defects such as spina bifida and anencephalus and waiting until one knows they are pregnant may be too late to benefit from folic acid.

Birth Defects Figures

Figures 1 and 2 are maps, showing the five Tennessee Perinatal Regions and the overall county-level birth defects rates for each of Tennessee's 95 counties, respectively. Tables 1 through 10 show the five-year (2004-2008) birth defect counts, rates and confidence intervals for the state overall and by infant sex, race/ethnicity, perinatal region, maternal age, maternal smoking and county of residence, maternal education and diabetes respectively. Definitions for each of the birth defects and a number of birth defects related terms are provided in the glossary at the end of the report. Figures 3 through 11 are graphs that show three-year backward moving averages for the overall birth defects and eight diagnostic category rates for the years 2001 through 2008. The moving average for the 2002 is based on the years 2000, 2001 and 2002. Using the moving average in data presentations tends to smooth the data, diminishing random fluctuation, making the underlying trend more apparent.

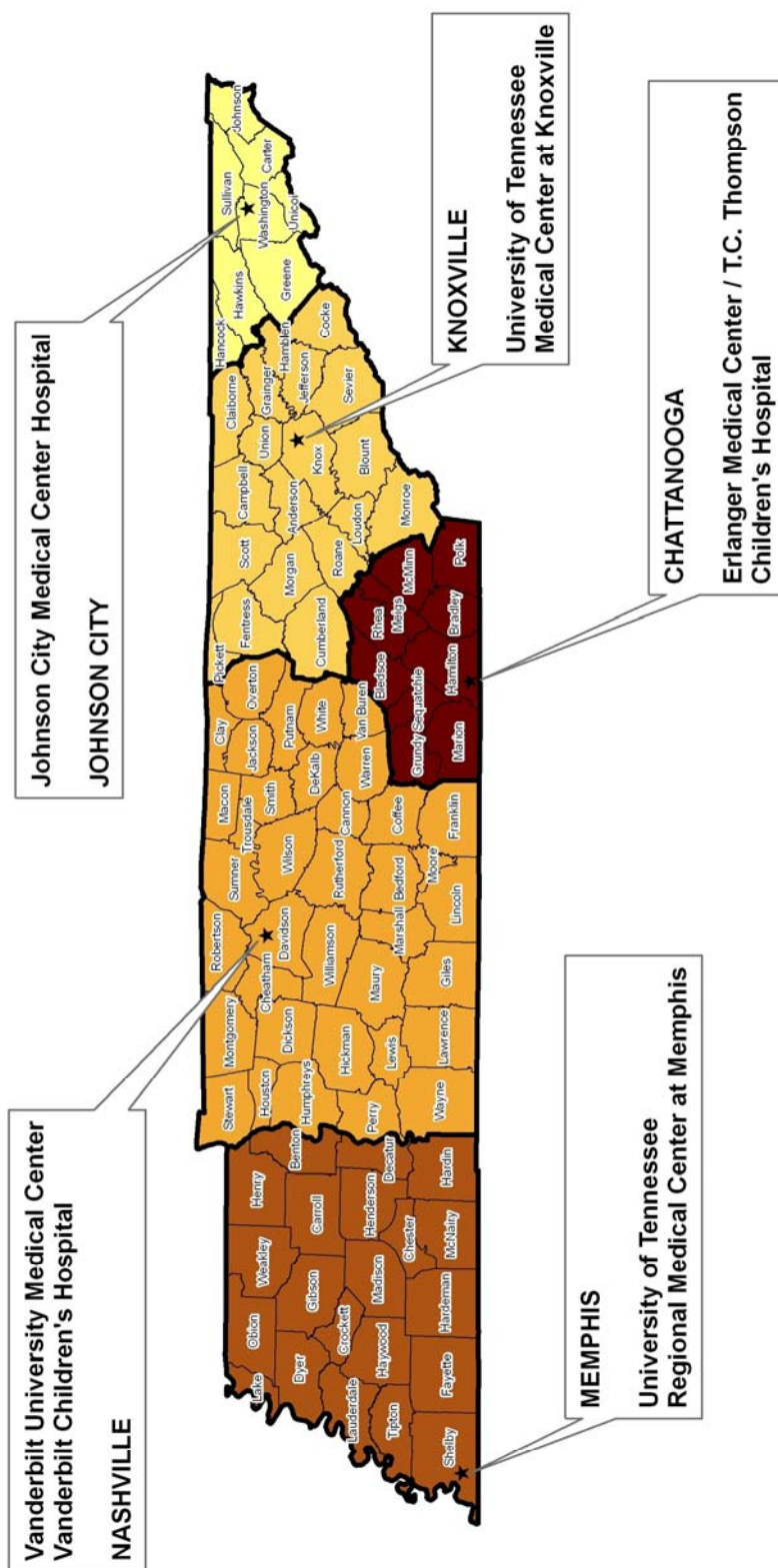
Seven of the nine charts showed generally increasing trend. It was apparent in the overall rates (Figure 3), central nervous system rates (Figure 4), cardiovascular rates (Figure 6), gastrointestinal rates (Figure 8), genitourinary rates (Figure 9), musculoskeletal rates (Figure 10) and chromosomal rates (Figure 11). Of the seven

increasing trends, five of the categories the overall, central nervous, cardiovascular, and gastrointestinal showed a flattening or slight downward trend for 2008, which was the final year. One can hope that this is an indication of a future trend, but whether or not it represents a trend is indeterminable at this time. Of the two charts not showing the trend the eye and ear birth defect rates (Chart 5) represent very small numbers and the rates are relatively unstable. The orofacial birth defects are also somewhat small in number, but these rates are not atypical for the orofacial defects and appear to represent a relatively flat and stable trend.



Source: Tennessee Birth Defects Registry 2004-2008

Figure 1. Tennessee County-Level Birth Defects Rates 2004-2008.



Source: Tennessee Birth Defects Registry

Figure 2. Tennessee Perinatal Regions and Perinatal Center Hospitals.

Table 1. Overall Tennessee Birth Defects Rates by Organ System 2004-2008				
Birth Defect	Count ¹	Rate ²	LL ³	UL ⁴
Central Nervous System				
Anencephalus	57	1.4	1.0	1.8
Spina Bifida	182	4.4	3.8	5.0
Hydrocephalus	303	7.3	6.5	8.1
Encephalocele	53	1.3	1.0	1.7
Microcephalus	414	9.9	9.0	10.9
Total Central Nervous System Cases	972	23.3	21.8	24.8
Eye and Ear				
Aniridia	6	0.1	0.1	0.3
Anophthalmia/Microphthalmia	38	0.9	0.6	1.3
Congenital Cataract	108	2.6	2.1	3.1
Anotia/Microtia	26	0.6	0.4	0.9
Total Eye and Ear Cases	171	4.1	3.5	4.8
Cardiovascular				
Common Truncus	40	1.0	0.7	1.3
Transposition of Great Arteries	260	6.2	5.5	7.0
Tetralogy of Fallot	236	5.6	5.0	6.4
Ventricular Septal Defect	1,818	43.5	41.5	45.6
Atrial Septal Defect	3,287	78.7	76.0	81.4
Endocardial Cushion Defect	162	3.9	3.3	4.5
Pulmonary Valve Atresia & Stenosis	449	10.7	9.8	11.8
Tricuspid Valve Atresia & Stenosis	45	1.1	0.8	1.4
Ebsteins Anomaly	33	0.8	0.5	1.1
Aortic Valve Stenosis	80	1.9	1.5	2.4
Hypoplastic Left Heart Syndrome	145	3.5	2.9	4.1
Patent Ductus Arteriosus	2,366	56.6	54.4	59.0
Coarctation of Aorta	263	6.3	5.6	7.1
Total Cardiovascular Cases	6,421	153.7	150.0	157.5
Orofacial				
Cleft Palate w/o Cleft Lip	306	7.3	6.5	8.2
Cleft Lip w/ & w/o Cleft Palate	468	11.2	10.2	12.3
Choanal Atresia	82	2.0	1.6	2.4
Total Orofacial Cases	850	20.3	19.0	21.8
Gastrointestinal				
Esophageal Atresia/Tracheoesophageal Fistula	96	2.3	1.9	2.8
Rectal & Large Intestinal Atresia/Stenosis	228	5.5	4.8	6.2
Pyloric Stenosis	1,869	44.7	42.7	46.8
Hirschsprungs Disease (congenital megacolon)	121	2.9	2.4	3.5
Biliary Atresia	38	0.9	0.6	1.3
Total Gastrointestinal Cases	2,334	55.9	53.6	58.2

Table 1. Overall Tennessee Birth Defects Rates by Organ System 2004-2008				
Birth Defect	Count ¹	Rate ²	LL ³	UL ⁴
Genitourinary				
Bladder Exstrophy	21	0.5	0.3	0.8
Hypospadias	2,213	53.0	50.8	55.2
Epispadias	43	1.0	0.7	1.4
Obstructive Genitourinary Defect	1,099	26.3	24.8	27.9
Renal Agenesis/Hypoplasia	197	4.7	4.1	5.4
Total Genitourinary Cases	3,505	83.9	81.2	86.7
Musculoskeletal				
Reduction Deformity (upper limbs)	85	2.0	1.6	2.5
Reduction Deformity (lower limbs)	75	1.8	1.4	2.3
Gastroschisis	220	5.3	4.6	6.0
Omphalocele	126	3.0	2.5	3.6
Diaphragmatic Hernia	143	3.4	2.9	4.0
Congenital Hip Dislocation	293	7.0	6.2	7.9
Total Musculoskeletal Cases	908	21.7	20.3	23.2
Chromosomal				
Trisomy 13	33	0.8	0.5	1.1
Down Syndrome	592	14.2	13.1	15.4
Trisomy 18	63	1.5	1.2	1.9
Total Chromosomal Cases	683	16.3	15.2	17.6
Fetal Alcohol Syndrome	87	2.1	1.7	2.6
Total Cases	14,301	342.3	336.8	348.0
Total Live Births	417,741			

Source: Tennessee Birth Defects Registry 2004-2008

¹Counts include cases resulting from live births and fetal deaths. ²Per 10,000 live births. ³ 95% confidence interval lower limit. ⁴95 percent confidence interval upper limit. Confidence intervals for 100 or less cases are exact Poisson; otherwise confidence intervals are based on the normal approximation.

Diagnostic data were derived from the Tennessee Hospital Discharge Data System (2004-2009), the Tennessee Death Statistical System (2004-2009) and the Tennessee Fetal Death Statistical System (2004-2008).

Total live births were derived from the Tennessee Birth Statistical system (2004-2008).

Figure 3. Tennessee Overall Birth Defects Rates 2001-2008

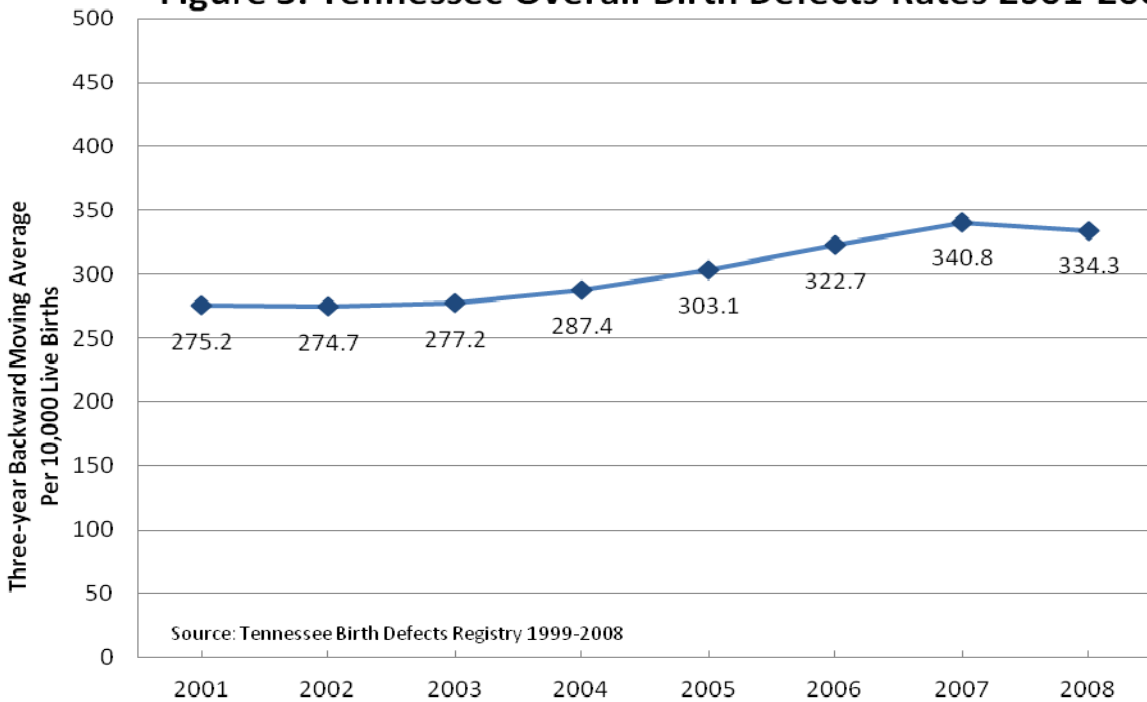


Figure 4. Tennessee Central Nervous System Birth Defects Rates 2001-2008

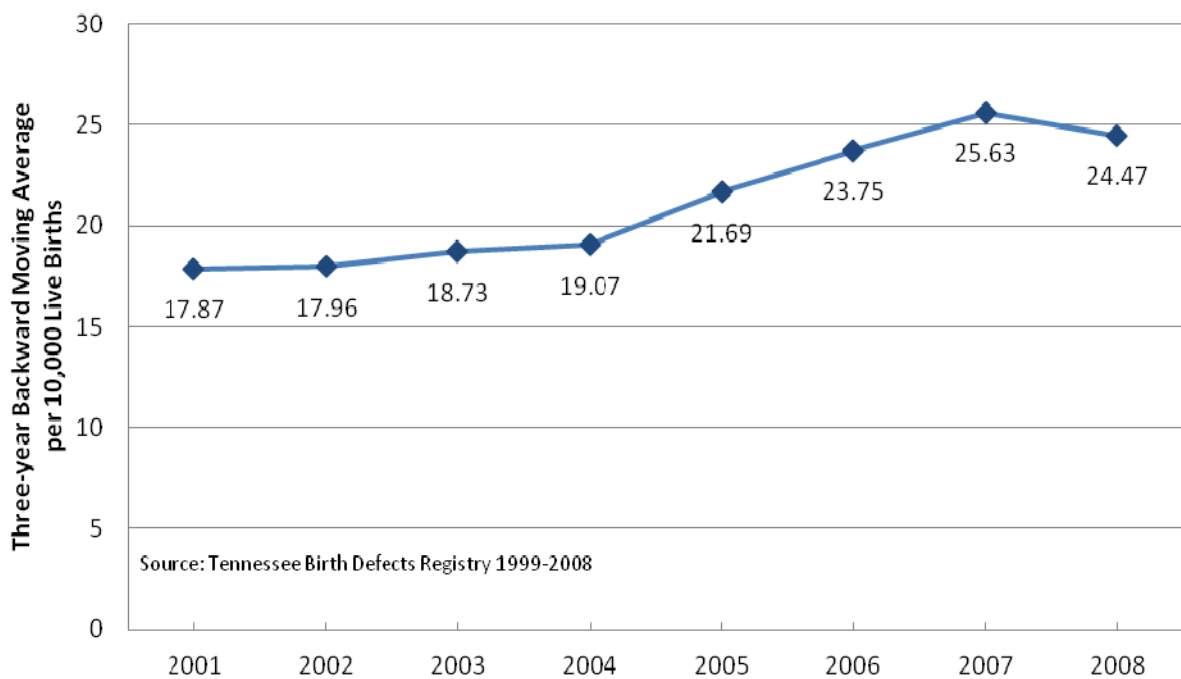


Figure 5. Tennessee Eye and Ear Birth Defects Rates 2001-2008

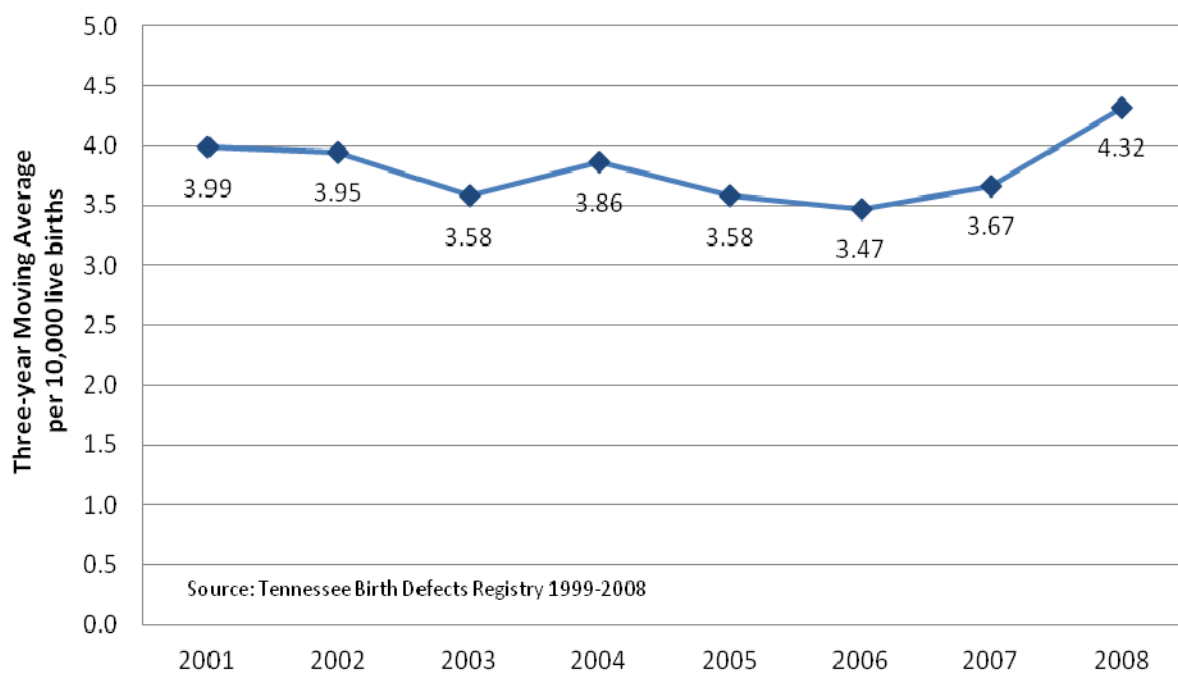


Figure 6. Tennessee Cardiovascular Birth Defects Rates 2001-2008

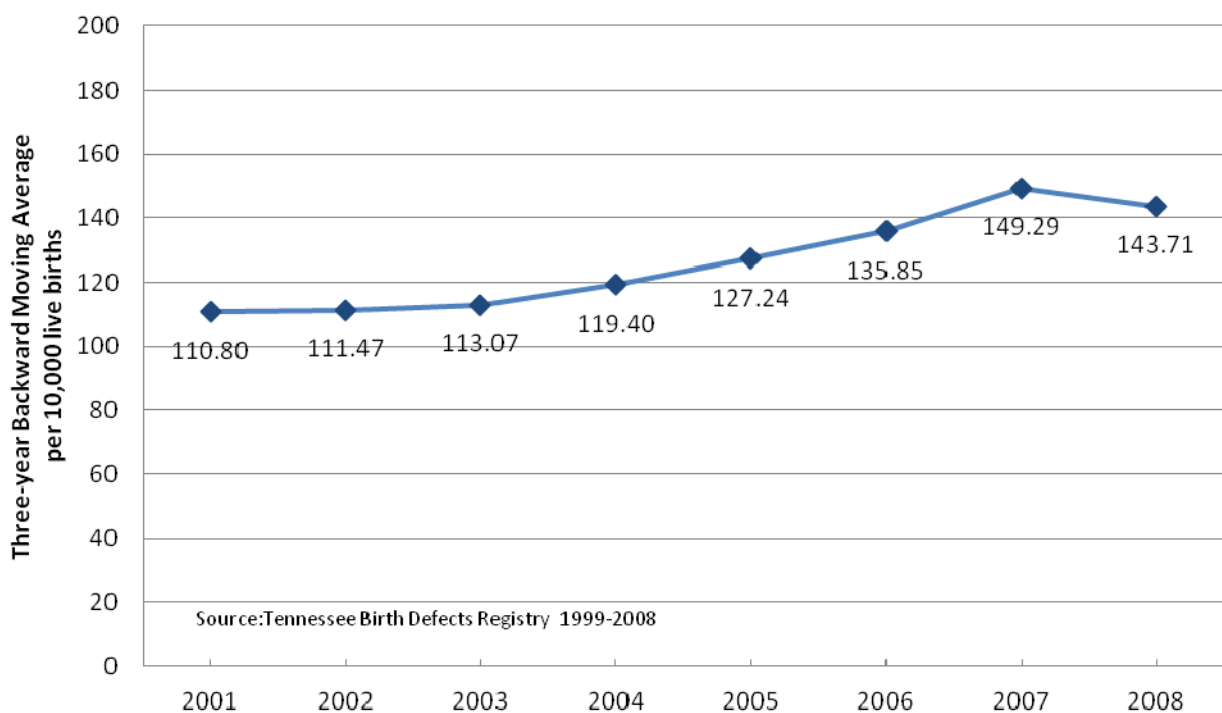


Figure 7. Tennessee Orofacial Birth Defects Rates 2001-2008

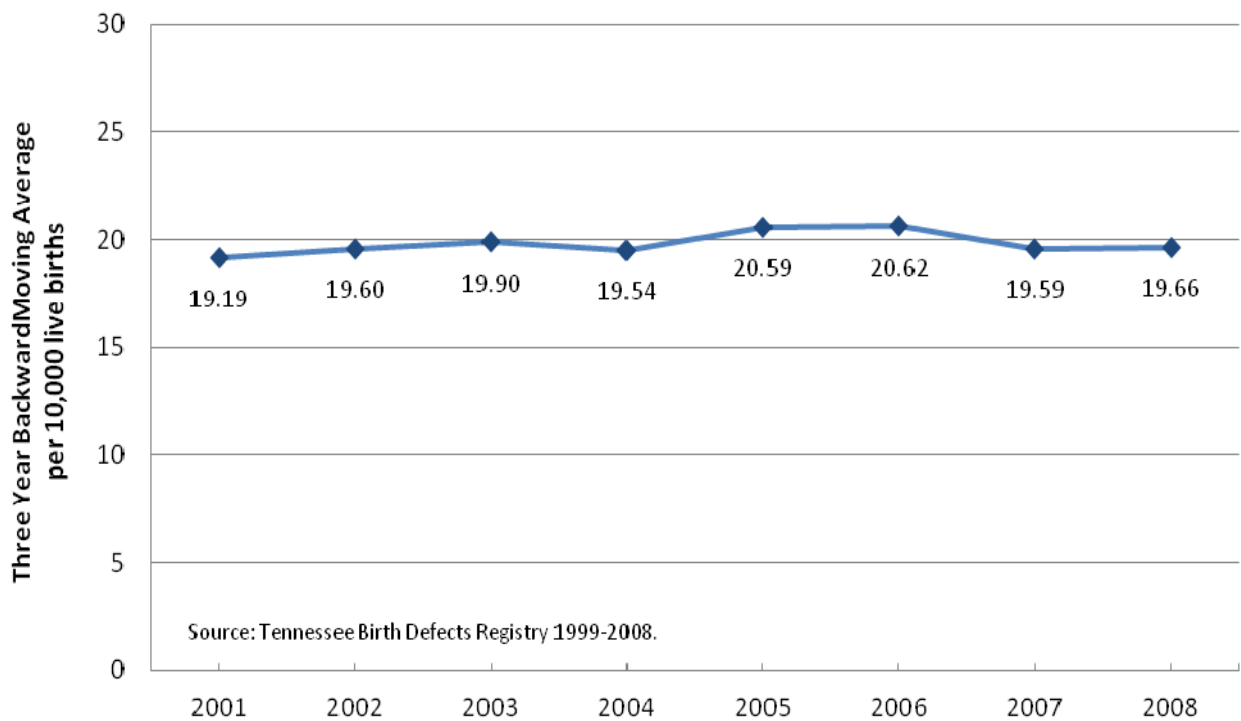


Figure 8. Tennessee Gastrointestinal Birth Defects Rates 2001-2008

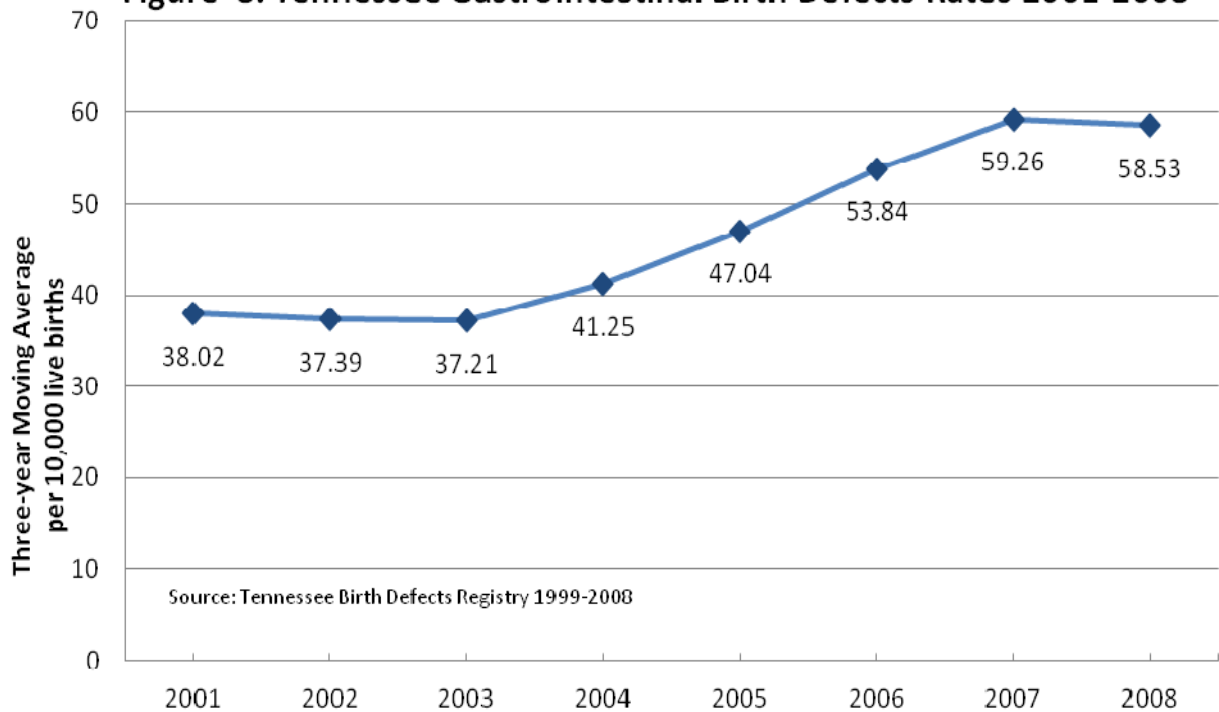


Figure 9. Genitourinary Birth Defects Rates 2001-2008

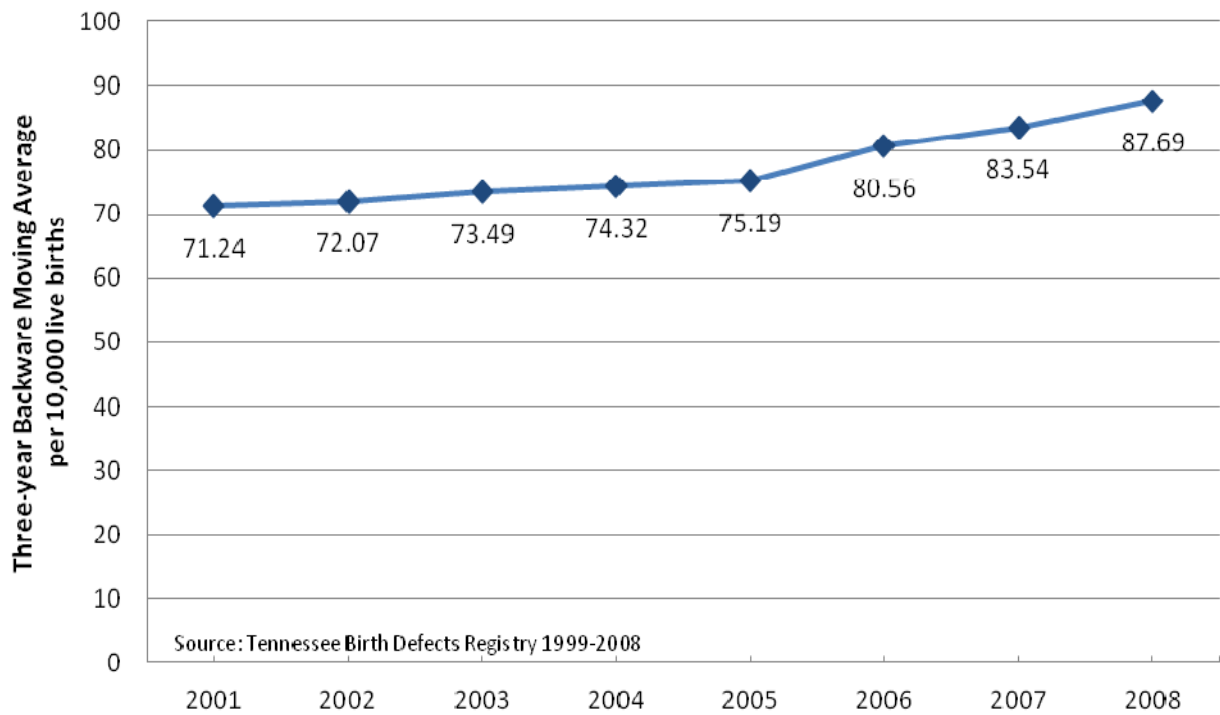


Figure 10. Tennessee Musculoskeletal Birth Defects 2001-2008

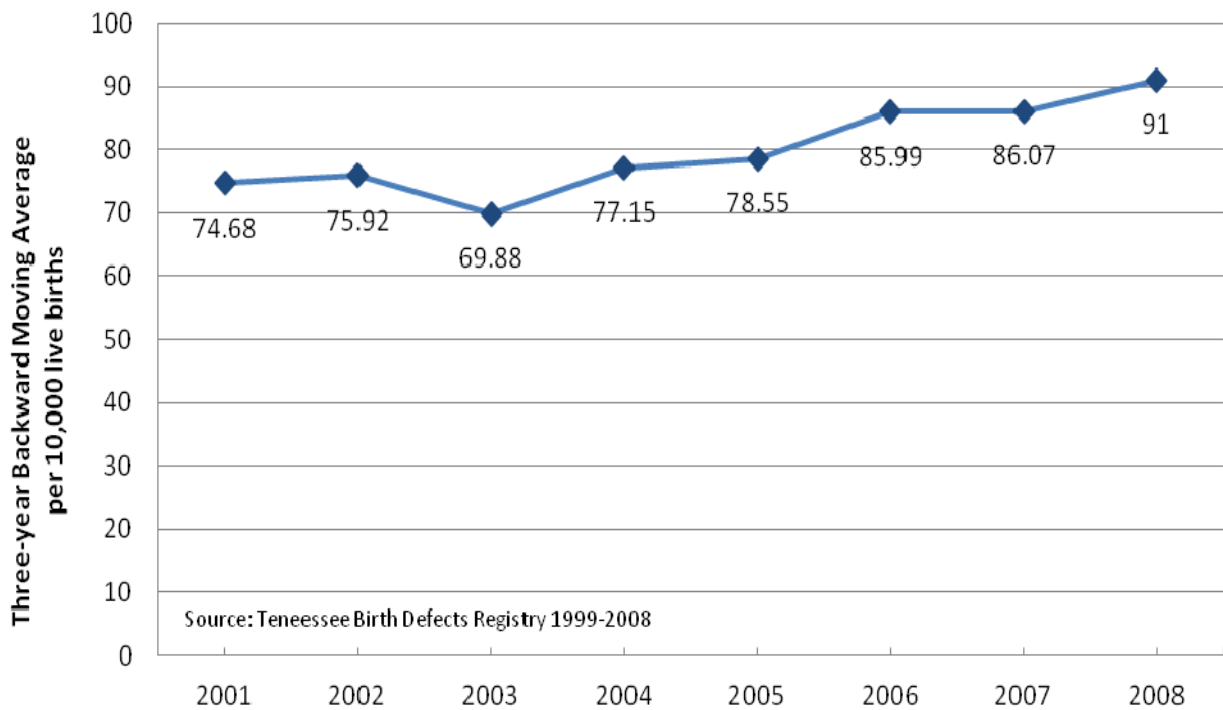
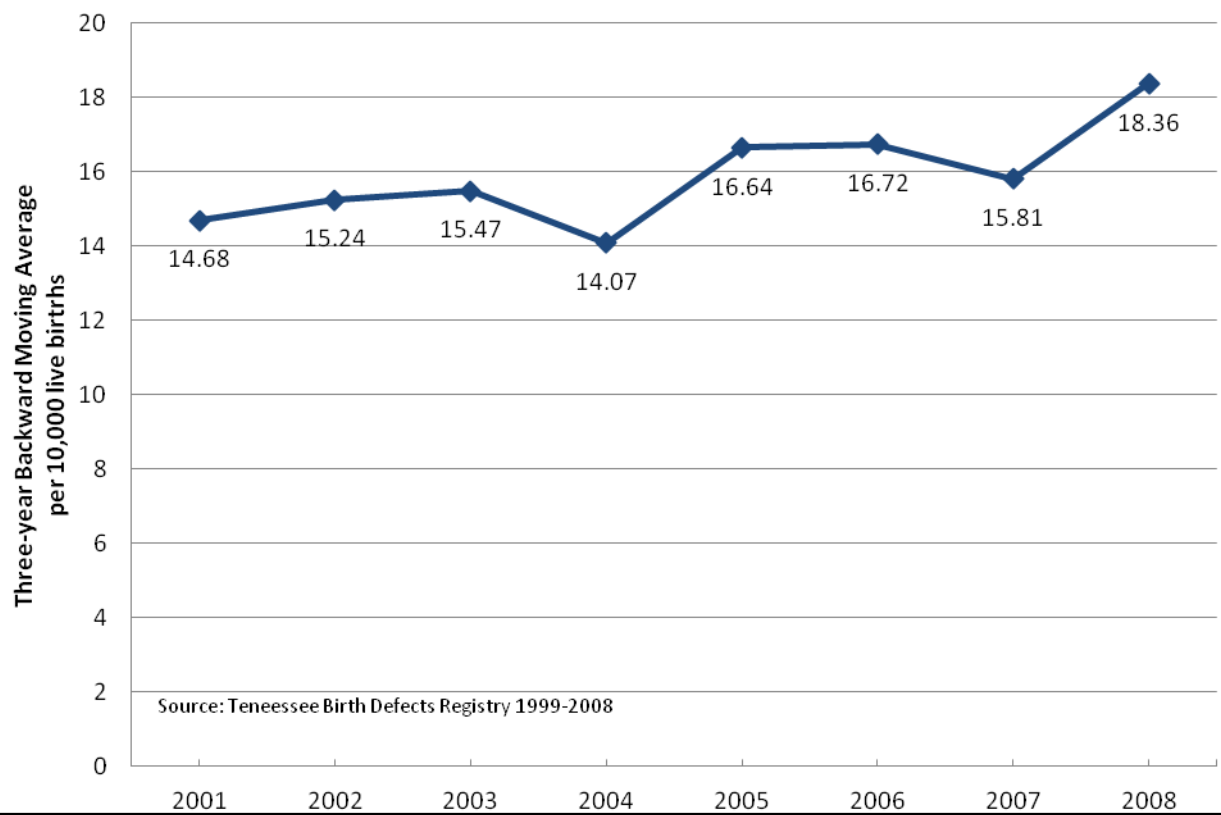


Figure 11: Tennessee Chromosomal Birth Defects Rates 2001-2008



**Table 2. Tennessee Birth Defects Rates by Infant Sex
2004-2008**

Birth Defect	Sex	Count ¹	Rate ²	LL ³	UL ⁴
Central Nervous System					
Anencephalus	Male	29	1.4	0.9	2.0
	Female	28	1.4	0.9	2.0
Spina Bifida	Male	84	3.9	3.1	4.9
	Female	96	4.7	3.8	5.7
Hydrocephalus	Male	164	7.7	6.6	9.0
	Female	139	6.8	5.7	8.0
Encephalocele	Male	24	1.1	0.7	1.7
	Female	29	1.4	1.0	2.0
Microcephalus * (p=0.0011)	Male	178	8.3	7.2	9.7
	Female	235	11.5	10.1	13.1
<i>Central Nervous System Cases *</i> (p=0.0187)	Male	459	21.5	19.6	23.6
	Female	511	25.0	22.9	27.3
Eye and Ear					
Anophthalmia/Microphthalmia	Male	19	0.9	0.5	1.4
	Female	19	0.9	0.6	1.5
Congenital Cataract	Male	56	2.6	2.0	3.4
	Female	52	2.5	1.9	3.3
Aniridia	Male	3	0.1	0.0	0.4
	Female	3	0.1	0.0	0.4
Anotia/Microtia	Male	14	0.7	0.4	1.1
	Female	12	0.6	0.3	1.0
Eye and Ear Cases	Male	90	4.2	3.4	5.2
	Female	81	4.0	3.2	4.9
Cardiovascular					
Common Truncus	Male	21	1.0	0.6	1.5
	Female	19	0.9	0.6	1.5
Transposition of Great Arteries * (p=0.0017)	Male	158	7.4	6.3	8.7
	Female	102	5.0	4.1	6.1
Tetralogy of Fallot	Male	118	5.5	4.6	6.6
	Female	118	5.8	4.8	6.9
Ventricular Septal Defect	Male	919	43.1	40.3	45.9
	Female	899	44.0	41.2	47.0
Atrial Septal Defect * (p=0.0006)	Male	1,778	83.3	79.5	87.3
	Female	1,509	73.9	70.2	77.7
Endocardial Cushion Defect	Male	71	3.3	2.6	4.2
	Female	91	4.5	3.6	5.5
Pulmonary Valve Atresia & Stenosis	Male	235	11.0	9.7	12.5
	Female	214	10.5	9.1	12.0
Tricuspid Valve Atresia & Stenosis	Male	26	1.2	0.8	1.8
	Female	19	0.9	0.6	1.5
Ebsteins Anomaly * (p=0.0054)	Male	9	0.4	0.2	0.8
	Female	24	1.2	0.8	1.8

**Table 2. Tennessee Birth Defects Rates by Infant Sex
2004-2008**

Birth Defect	Sex	Count ¹	Rate ²	LL ³	UL ⁴
Aortic Valve Stenosis *	Male	57	2.7	2.0	3.5
(p=0.0002)	Female	23	1.1	0.7	1.7
Hypoplastic Left Heart Syndrome *	Male	94	4.4	3.6	5.4
(p=0.0008)	Female	51	2.5	1.9	3.3
Patent Ductus Arteriosus *	Male	1,297	60.8	57.5	64.2
(p=0.0003)	Female	1,069	52.3	49.2	55.6
Coarctation of Aorta *	Male	168	7.9	6.7	9.2
(p<0.0001)	Female	95	4.7	3.8	5.7
<i>Cardiovascular Cases *</i>	Male	3,422	160.3	155.0	165.8
(p=0.0004)	Female	2,999	146.8	141.6	152.2
Orofacial					
Cleft Palate w/o Cleft Lip	Male	142	6.7	5.6	7.8
	Female	164	8.0	6.9	9.4
Cleft Lip w/ & w/o Cleft Palate *	Male	296	13.9	12.3	15.5
(p<0.0001)	Female	172	8.4	7.2	9.8
Choanal Atresia	Male	42	2.0	1.4	2.7
	Female	40	2.0	1.4	2.7
<i>Orofacial Cases *</i>	Male	477	22.3	20.4	24.5
(p=0.0033)	Female	373	18.3	16.5	20.2
Gastrointestinal					
Esophageal Atresia/Tracheoesophageal	Male	51	2.4	1.8	3.1
Fistula	Female	45	2.2	1.6	3.0
Rectal & Large Intestinal Atresia/Stenosis	Male	133	6.2	5.2	7.4
(p=0.0193)	Female	93	4.6	3.7	5.6
Pyloric Stenosis *	Male	1,505	70.5	67.0	74.2
(p<0.0001)	Female	364	17.8	16.0	19.8
Hirschsprungs Disease (congenital	Male	91	4.3	3.4	5.2
megacolon) (p<0.0001)	Female	30	1.5	1.0	2.1
Biliary Atresia	Male	15	0.7	0.4	1.2
	Female	23	1.1	0.7	1.7
<i>Gastrointestinal Cases *</i>	Male	1,784	83.6	79.8	87.6
(p<0.0001)	Female	548	26.8	24.6	29.2
Genitourinary					
Renal Agenesis/Hypoplasia *	Male	124	5.8	4.8	6.9
(p=0.0004)	Female	71	3.5	2.7	4.4
Bladder Exstrophy	Male	12	0.6	0.3	1.0
	Female	8	0.4	0.2	0.8
Hypospadias	Male	2,213	103.7	99.4	108.1
	Female	0	0.0	0.0	0.2
Epispadias	Male	43	2.0	1.5	2.7
	Female	0	0.0	0.0	0.2
Obstructive Genitourinary Defect *	Male	763	35.7	33.3	38.4
(p<0.0001)	Female	336	16.4	14.7	18.3

**Table 2. Tennessee Birth Defects Rates by Infant Sex
2004-2008**

Birth Defect	Sex	Count ¹	Rate ²	LL ³	UL ⁴
<i>Genitourinary Cases *</i> (<i>p</i> <0.0001)	Male	3095	145.0	139.9	150.2
	Female	407	19.9	18.0	22.0
Musculoskeletal					
Reduction Deformity (upper limbs)	Male	52	2.4	1.8	3.2
	Female	33	1.6	1.1	2.3
Reduction Deformity (lower limbs)	Male	37	1.7	1.2	2.4
	Female	38	1.9	1.3	2.6
Gastroschisis	Male	113	5.3	4.4	6.4
	Female	107	5.2	4.3	6.3
Omphalocele	Male	75	3.5	2.8	4.4
	Female	51	2.5	1.9	3.3
Diaphragmatic Hernia	Male	83	3.9	3.1	4.8
	Female	60	2.9	2.2	3.8
Congenital Hip Dislocation *	Male	86	4.0	3.2	5.0
	Female	207	10.1	8.8	11.6
<i>Musculoskeletal Cases *</i> (<i>p</i> =0.0080)	Male	424	19.9	18.0	21.9
	Female	484	23.7	21.6	25.9
Chromosomal					
Trisomy 13	Male	17	0.8	0.5	1.3
	Female	16	0.8	0.5	1.3
Down Syndrome	Male	323	15.1	13.5	16.9
	Female	269	13.2	11.6	14.8
Trisomy 18 *	Male	18	0.8	0.5	1.3
	Female	45	2.2	1.6	3.0
<i>Chromosomal Cases</i>	Male	357	16.7	15.0	18.6
	Female	326	16.0	14.3	17.8
Fetal Alcohol Syndrome	Male	50	2.3	1.7	3.1
	Female	37	1.8	1.3	2.5
<i>Total Cases *</i> (<i>p</i> <0.0001)	Male	9,198	430.9	422.2	439.8
	Female	5,099	249.6	242.8	256.5
Total Live Births	Male	213,438			
	Female	204,290			
Unknown Cases		4			
Unknown Live Births		13			

Source: Tennessee Birth Defects Registry 2004-2008

¹Counts include cases resulting from live births and fetal deaths. ²Per 10,000 live births. ³ 95% confidence interval lower limit. ⁴95 percent confidence interval upper limit. Confidence intervals for 100 or less cases are exact Poisson; otherwise confidence intervals are based on the normal approximation. *Indicates a statistically significant difference determined by Poisson regression.

Diagnostic data were derived from the Tennessee Hospital Discharge Data System (2004-2009), the Tennessee Death Statistical System (2004-2009) and the Tennessee Fetal Death Statistical System (2004-2008). Live births and sex were derived from the Tennessee Birth Statistical system (2004-2008).

**Table 3. Tennessee Birth Defects Rates by Race\Ethnicity
2004-2008**

Birth Defect	Race	Count¹	Rate²	LL³	UL⁴
Central Nervous System					
Anencephalus	White	34	1.2	0.8	1.7
	Black	11	1.3	0.6	2.3
	Hispanic	10	2.7	1.3	5.0
	Other	2	2.0	0.2	7.2
Spina Bifida * (p=0.0017)	White	125	4.4	3.7	5.2
	Black	27	3.2	2.1	4.6
	Hispanic	29	7.8	5.2	11.2
	Other	1	1.0	0.0	5.6
Hydrocephalus * (p=0.0025)	White	179	6.3	5.4	7.3
	Black	86	10.1	8.1	12.4
	Hispanic	33	8.9	6.1	12.5
	Other	5	5.0	1.6	11.7
Encephalocele	White	37	1.3	0.9	1.8
	Black	9	1.1	0.5	2.0
	Hispanic	7	1.9	0.8	3.9
	Other	0	0.0	0.0	3.7
Microcephalus * (p=0.0400)	White	263	9.2	8.1	10.4
	Black	106	12.4	10.2	15.0
	Hispanic	39	10.5	7.5	14.4
	Other	6	6.0	2.2	13.1
Central Nervous System Cases * (p=0.0003)					
	White	616	21.6	19.9	23.4
	Black	232	27.2	23.8	30.9
	Hispanic	110	29.7	24.4	35.8
	Other	14	14.0	7.7	23.5
Eye and Ear					
Anophthalmia/Microphthalmia * (p=0.0248)	White	19	0.7	0.4	1.0
	Black	16	1.9	1.1	3.0
	Hispanic	2	0.5	0.1	2.0
	Other	1	1.0	0.0	5.6
Congenital Cataract	White	78	2.7	2.2	3.4
	Black	20	2.3	1.4	3.6
	Hispanic	5	1.3	0.4	3.2
	Other	5	5.0	1.6	11.7
Aniridia	White	6	0.2	0.1	0.5
	Black	0	0.0	0.0	0.4
	Hispanic	0	0.0	0.0	1.0
	Other	0	0.0	0.0	3.7
Anotia/Microtia * (p=0.0334)	White	18	0.6	0.4	1.0
	Black	2	0.2	0.0	0.9
	Hispanic	6	1.6	0.6	3.5
	Other	0	0.0	0.0	3.7

**Table 3. Tennessee Birth Defects Rates by Race\Ethnicity
2004-2008**

Birth Defect	Race	Count¹	Rate²	LL³	UL⁴
Eye and Ear Cases	White	115	4.0	3.3	4.8
	Black	37	4.3	3.1	6.0
	Hispanic	13	3.5	1.9	6.0
	Other	6	6.0	2.2	13.1
Cardiovascular					
Common Truncus	White	34	1.2	0.8	1.7
	Black	4	0.5	0.1	1.2
	Hispanic	2	0.5	0.1	2.0
	Other	0	0.0	0.0	3.7
Transposition of Great Arteries	White	187	6.6	5.7	7.6
	Black	47	5.5	4.0	7.3
	Hispanic	24	6.5	4.2	9.6
	Other	2	2.0	0.2	7.2
Tetralogy of Fallot	White	163	5.7	4.9	6.7
	Black	52	6.1	4.6	8.0
	Hispanic	13	3.5	1.9	6.0
	Other	8	8.0	3.5	15.8
Ventricular Septal Defect * (p=0.0174)	White	1,276	44.7	42.3	47.3
	Black	353	41.3	37.1	45.9
	Hispanic	163	44.0	37.5	51.3
	Other	26	26.0	17.0	38.1
Atrial Septal Defect * (p<0.0001)	White	2,121	74.3	71.2	77.6
	Black	890	104.2	97.4	111.3
	Hispanic	224	60.5	52.8	68.9
	Other	52	52.1	38.9	68.3
Endocardial Cushion Defect	White	115	4.0	3.3	4.8
	Black	33	3.9	2.7	5.4
	Hispanic	12	3.2	1.7	5.7
	Other	2	2.0	0.2	7.2
Pulmonary Valve Atresia & Stenosis * (p=0.0059)	White	301	10.6	9.4	11.8
	Black	115	13.5	11.1	16.2
	Hispanic	26	7.0	4.6	10.3
	Other	7	7.0	2.8	14.4
Tricuspid Valve Atresia & Stenosis	White	34	1.2	0.8	1.7
	Black	8	0.9	0.4	1.9
	Hispanic	2	0.5	0.1	2.0
	Other	1	1.0	0.0	5.6
Ebsteins Anomaly	White	23	0.8	0.5	1.2
	Black	7	0.8	0.3	1.7
	Hispanic	2	0.5	0.1	2.0
	Other	1	1.0	0.0	5.6
Aortic Valve Stenosis * (p=0.0265)	White	65	2.3	1.8	2.9
	Black	7	0.8	0.3	1.7
	Hispanic	7	1.9	0.8	3.9
	Other	1	1.0	0.0	5.6

**Table 3. Tennessee Birth Defects Rates by Race\Ethnicity
2004-2008**

Birth Defect	Race	Count¹	Rate²	LL³	UL⁴
Hypoplastic Left Heart Syndrome	White	102	3.6	2.9	4.3
	Black	33	3.9	2.7	5.4
	Hispanic	9	2.4	1.1	4.6
	Other	1	1.0	0.0	5.6
Patent Ductus Arteriosus * (p<0.0001)	White	1,496	52.4	49.8	55.2
	Black	647	75.7	70.0	81.8
	Hispanic	189	51.0	44.0	58.8
	Other	34	34.0	23.6	47.6
Coarctation of Aorta * (p=0.0435)	White	191	6.7	5.8	7.7
	Black	49	5.7	4.2	7.6
	Hispanic	22	5.9	3.7	9.0
	Other	1	1.0	0.0	5.6
Cardiovascular Cases * (p<0.0001)	White	4,226	148.1	143.7	152.7
	Black	1,618	189.4	180.3	198.9
	Hispanic	476	128.5	117.2	140.6
	Other	101	101.1	82.4	122.9
Orofacial					
Cleft Palate w/o Cleft Lip * (p=0.0005)	White	238	8.3	7.3	9.5
	Black	42	4.9	3.5	6.7
	Hispanic	16	4.3	2.5	7.0
	Other	10	10.0	4.8	18.4
Cleft Lip w/ & w/o Cleft Palate * (p<0.0001)	White	372	13.0	11.8	14.4
	Black	56	6.6	5.0	8.5
	Hispanic	32	8.6	5.9	12.2
	Other	8	8.0	3.5	15.8
Choanal Atresia	White	64	2.2	1.7	2.9
	Black	13	1.5	0.8	2.6
	Hispanic	4	1.1	0.3	2.8
	Other	1	1.0	0.0	5.6
Orofacial Cases * (p<0.0001)	White	669	23.5	21.7	25.3
	Black	110	12.9	10.6	15.5
	Hispanic	52	14.0	10.5	18.4
	Other	19	19.0	11.5	29.7
Gastrointestinal					
Esophageal Atresia/Tracheoesophageal Fistula (p=0.0306)	White	78	2.7	2.2	3.4
	Black	11	1.3	0.6	2.3
	Hispanic	7	1.9	0.8	3.9
	Other	0	0.0	0.0	3.7
Rectal & Large Intestinal Atresia/Stenosis	White	153	5.4	4.6	6.3
	Black	44	5.2	3.7	6.9
	Hispanic	26	7.0	4.6	10.3
	Other	5	5.0	1.6	11.7
Pyloric Stenosis * (p<0.0001)	White	1,468	51.5	48.9	54.2
	Black	210	24.6	21.4	28.1
	Hispanic	176	47.5	40.8	55.1
	Other	15	15.0	8.4	24.8

**Table 3. Tennessee Birth Defects Rates by Race\Ethnicity
2004-2008**

Birth Defect	Race	Count¹	Rate²	LL³	UL⁴
Hirschsprungs Disease (congenital megacolon) (p=0.0117)	White	77	2.7	2.1	3.4
	Black	38	4.4	3.2	6.1
	Hispanic	6	1.6	0.6	3.5
	Other	0	0.0	0.0	3.7
Biliary Atresia * (p=0.0363)	White	21	0.7	0.5	1.1
	Black	11	1.3	0.6	2.3
	Hispanic	2	0.5	0.1	2.0
	Other	4	4.0	1.1	10.3
Gastrointestinal Cases * (p<0.0001)	White	1,784	62.5	59.7	65.5
	Black	312	36.5	32.6	40.8
	Hispanic	214	57.8	50.3	66.1
	Other	24	24.0	15.4	35.8
Genitourinary Cases					
Renal Agenesis/Hypoplasia	White	136	4.8	4.0	5.6
	Black	39	4.6	3.3	6.2
	Hispanic	19	5.1	3.1	8.0
	Other	3	3.0	0.6	8.8
Bladder Exstrophy	White	18	0.6	0.4	1.0
	Black	3	0.4	0.1	1.0
	Hispanic	0	0.0	0.0	1.0
	Other	0	0.0	0.0	3.7
Hypospadias * (p<0.0001)	White	1,661	58.2	55.5	61.1
	Black	458	53.6	48.8	58.8
	Hispanic	64	17.3	13.3	22.1
	Other	30	30.0	20.3	42.9
Epispadias	White	33	1.2	0.8	1.6
	Black	9	1.1	0.5	2.0
	Hispanic	1	0.3	0.0	1.5
	Other	0	0.0	0.0	3.7
Obstructive Genitourinary Defect * (p<0.0001)	White	842	29.5	27.6	31.6
	Black	148	17.3	14.6	20.4
	Hispanic	79	21.3	16.9	26.6
	Other	30	30.0	20.3	42.9
Genitourinary Cases * (p<0.0001)	White	2,635	92.4	88.9	96.0
	Black	647	75.7	70.0	81.8
	Hispanic	160	43.2	36.8	50.4
	Other	63	63.1	48.5	80.7
Musculoskeletal					
Reduction Deformity (upper limbs)	White	51	1.8	1.3	2.4
	Black	20	2.3	1.4	3.6
	Hispanic	12	3.2	1.7	5.7
	Other	2	2.0	0.2	7.2

**Table 3. Tennessee Birth Defects Rates by Race\Ethnicity
2004-2008**

Birth Defect	Race	Count ¹	Rate ²	LL ³	UL ⁴
Reduction Deformity (lower limbs)	White	42	1.5	1.1	2.0
	Black	24	2.8	1.8	4.2
	Hispanic	7	1.9	0.8	3.9
	Other	2	2.0	0.2	7.2
Gastroschisis * (p=0.0038)	White	173	6.1	5.2	7.0
	Black	26	3.0	2.0	4.5
	Hispanic	17	4.6	2.7	7.4
	Other	4	4.0	1.1	10.3
Omphalocele * (p=0.0030)	White	73	2.6	2.0	3.2
	Black	43	5.0	3.6	6.8
	Hispanic	9	2.4	1.1	4.6
	Other	1	1.0	0.0	5.6
Diaphragmatic Hernia	White	101	3.5	2.9	4.3
	Black	25	2.9	1.9	4.3
	Hispanic	13	3.5	1.9	6.0
	Other	4	4.0	1.1	10.3
Congenital Hip Dislocation * (p=0.0001)	White	235	8.2	7.2	9.4
	Black	33	3.9	2.7	5.4
	Hispanic	20	5.4	3.3	8.3
	Other	5	5.0	1.6	11.7
Musculoskeletal Cases	White	652	22.9	21.1	24.7
	Black	163	19.1	16.3	22.2
	Hispanic	75	20.2	15.9	25.4
	Other	18	18.0	10.7	28.5
Chromosomal					
Trisomy 13	White	18	0.6	0.4	1.0
	Black	11	1.3	0.6	2.3
	Hispanic	3	0.8	0.2	2.4
	Other	1	1.0	0.0	5.6
Down Syndrome	White	414	14.5	13.2	16.0
	Black	110	12.9	10.6	15.5
	Hispanic	57	15.4	11.7	19.9
	Other	11	11.0	5.5	19.7
Trisomy 18	White	44	1.5	1.1	2.1
	Black	11	1.3	0.6	2.3
	Hispanic	8	2.2	0.9	4.3
	Other	0	0.0	0.0	3.7
Chromosomal Cases	White	472	16.5	15.1	18.1
	Black	131	15.3	12.8	18.2
	Hispanic	68	18.4	14.3	23.3
	Other	12	12.0	6.2	21.0
Fetal Alcohol Syndrome * (p=0.0004)	White	50	1.8	1.3	2.3
	Black	36	4.2	3.0	5.8
	Hispanic	0	0.0	0.0	1.0
	Other	1	1.0	0.0	5.6

Table 3. Tennessee Birth Defects Rates by Race\Ethnicity 2004-2008					
Birth Defect	Race	Count¹	Rate²	LL³	UL⁴
Total Cases * (p<0.0001)	White	10,106	354.2	347.4	361.2
	Black	2,949	345.2	332.8	357.9
	Hispanic	1,016	274.3	257.7	291.7
	Other	230	230.3	201.5	262.0
Total Live Births	White	285,280			
	Black	85,433			
	Hispanic	37,040			
	Other	9,988			

Source: Tennessee Birth Defects Registry 2004-2008

¹Counts include cases resulting from live births and fetal deaths. ²Per 10,000 live births. ³ 95% confidence interval lower limit. ⁴95 percent confidence interval upper limit. Confidence intervals for 100 or less cases are exact Poisson; otherwise confidence intervals are based on the normal approximation. *Indicates a statistically significant difference determined by Poisson regression.

Diagnostic data were derived from the Tennessee Hospital Discharge Data System (2004-2009), the Tennessee Death Statistical System (2004-2009) and the Tennessee Fetal Death Statistical System (2004-2008). Live births and race\ethnicity were derived from the Tennessee Birth Statistical system and race\ethnicity (2004-2008).

Table 4. Tennessee Birth Defects by Perinatal Region 2004-2008						
Birth Defect	Region	Count ¹	Rate ²	LL ³	UL ⁴	
Central Nervous System						
Anencephalus * (p=0.0129)	Northeast	2	0.7	0.1	2.7	
	East	2	0.3	0.0	1.0	
	Southeast	6	1.6	0.6	3.5	
	Middle	28	1.7	1.1	2.5	
	West	19	1.7	1.0	2.6	
Spina Bifida	Northeast	10	3.7	1.8	6.8	
	East	35	4.7	3.3	6.6	
	Southeast	17	4.5	2.6	7.2	
	Middle	78	4.7	3.7	5.9	
	West	42	3.7	2.7	5.0	
Hydrocephalus	Northeast	23	8.4	5.4	12.7	
	East	43	5.8	4.2	7.9	
	Southeast	30	7.9	5.4	11.3	
	Middle	107	6.5	5.3	7.8	
	West	100	8.8	7.2	10.7	
Encephalocele	Northeast	4	1.5	0.4	3.8	
	East	7	0.9	0.4	2.0	
	Southeast	5	1.3	0.4	3.1	
	Middle	17	1.0	0.6	1.7	
	West	20	1.8	1.1	2.7	
Microcephalus * (p<0.0001)	Northeast	40	14.7	10.5	20.0	
	East	84	11.4	9.1	14.1	
	Southeast	54	14.3	10.7	18.6	
	Middle	99	6.0	4.9	7.3	
	West	137	12.0	10.1	14.2	
Central Nervous System Cases * (p=0.0001)		Northeast	79	29.0	23.0	36.2
		East	168	22.8	19.5	26.5
		Southeast	107	28.3	23.2	34.2
		Middle	317	19.2	17.1	21.4
		West	301	26.4	23.5	29.6
Eye and Ear						
Anophthalmia/Microthalmia * (p=0.0184)	Northeast	4	1.5	0.4	3.8	
	East	4	0.5	0.2	1.4	
	Southeast	3	0.8	0.2	2.3	
	Middle	8	0.5	0.2	1.0	
	West	19	1.7	1.0	2.6	
Congenital Cataract	Northeast	12	4.4	2.3	7.7	
	East	14	1.9	1.0	3.2	
	Southeast	8	2.1	0.9	4.2	
	Middle	38	2.3	1.6	3.2	
	West	36	3.2	2.2	4.4	

**Table 4. Tennessee Birth Defects by Perinatal Region
2004-2008**

Birth Defect	Region	Count¹	Rate²	LL³	UL⁴
Aniridia	Northeast	0	0.0	0.0	1.4
	East	0	0.0	0.0	0.5
	Southeast	0	0.0	0.0	1.0
	Middle	5	0.3	0.1	0.7
	West	1	0.1	0.0	0.5
Anotia/Microtia	Northeast	4	1.5	0.4	3.8
	East	7	0.9	0.4	2.0
	Southeast	4	1.1	0.3	2.7
	Middle	4	0.2	0.1	0.6
	West	7	0.6	0.3	1.3
Eye and Ear Cases * (p=0.0054)	Northeast	19	7.0	4.2	10.9
	East	22	3.0	1.9	4.5
	Southeast	14	3.7	2.0	6.2
	Middle	54	3.3	2.5	4.3
	West	62	5.4	4.2	7.0
Cardiovascular					
Common Truncus	Northeast	1	0.4	0.0	2.1
	East	11	1.5	0.8	2.7
	Southeast	5	1.3	0.4	3.1
	Middle	16	1.0	0.6	1.6
	West	7	0.6	0.3	1.3
Transposition of Great Arteries	Northeast	12	4.4	2.3	7.7
	East	50	6.8	5.0	8.9
	Southeast	26	6.9	4.5	10.1
	Middle	106	6.4	5.3	7.8
	West	66	5.8	4.5	7.4
Tetralogy of Fallot	Northeast	14	5.1	2.8	8.6
	East	46	6.2	4.6	8.3
	Southeast	24	6.3	4.1	9.4
	Middle	85	5.1	4.1	6.4
	West	67	5.9	4.6	7.5
Ventricular Septal Defect	Northeast	140	51.4	43.3	60.7
	East	351	47.6	42.8	52.9
	Southeast	155	41.0	34.8	48.0
	Middle	691	41.8	38.8	45.1
	West	481	42.3	38.6	46.2
Atrial Septal Defect *	Northeast	484	177.8	162.3	194.3
	East	546	74.1	68.0	80.6
	Southeast	198	52.3	45.3	60.2
	Middle	942	57.0	53.5	60.8
	West	1,117	98.1	92.5	104.1

**Table 4. Tennessee Birth Defects by Perinatal Region
2004-2008**

Birth Defect	Region	Count¹	Rate²	LL³	UL⁴
Endocardial Cushion Defect	Northeast	7	2.6	1.0	5.3
	East	38	5.2	3.7	7.1
	Southeast	17	4.5	2.6	7.2
	Middle	55	3.3	2.5	4.3
	West	45	4.0	2.9	5.3
Pulmonary Valve Atresia & Stenosis * (p<0.0001)	Northeast	43	15.8	11.4	21.3
	East	58	7.9	6.0	10.2
	Southeast	26	6.9	4.5	10.1
	Middle	216	13.1	11.4	14.9
	West	106	9.3	7.6	11.3
Tricuspid Valve Atresia & Stenosis	Northeast	3	1.1	0.2	3.2
	East	11	1.5	0.8	2.7
	Southeast	6	1.6	0.6	3.5
	Middle	12	0.7	0.4	1.3
	West	13	1.1	0.6	2.0
Ebsteins Anomaly	Northeast	0	0.0	0.0	1.4
	East	10	1.4	0.7	2.5
	Southeast	0	0.0	0.0	1.0
	Middle	17	1.0	0.6	1.7
	West	6	0.5	0.2	1.2
Aortic Valve Stenosis	Northeast	3	1.1	0.2	3.2
	East	17	2.3	1.3	3.7
	Southeast	6	1.6	0.6	3.5
	Middle	39	2.4	1.7	3.2
	West	15	1.3	0.7	2.2
Hypoplastic Left Heart Syndrome	Northeast	8	2.9	1.3	5.8
	East	32	4.3	3.0	6.1
	Southeast	15	4.0	2.2	6.5
	Middle	54	3.3	2.5	4.3
	West	36	3.2	2.2	4.4
Patent Ductus Arteriosus * (p<0.0001)	Northeast	305	112.0	99.8	125.3
	East	338	45.9	41.1	51.0
	Southeast	137	36.2	30.4	42.8
	Middle	739	44.7	41.6	48.1
	West	847	74.4	69.5	79.6
Coarctation of Aorta	Northeast	17	6.2	3.6	10.0
	East	43	5.8	4.2	7.9
	Southeast	25	6.6	4.3	9.8
	Middle	112	6.8	5.6	8.2
	West	66	5.8	4.5	7.4
Cardiovascular Cases * (p<0.0001)	Northeast	758	278.4	258.9	298.9
	East	1,119	151.8	143.1	161.0
	Southeast	425	112.4	101.9	123.6
	Middle	2,114	128.0	122.6	133.6
	West	2,005	176.1	168.5	184.0

**Table 4. Tennessee Birth Defects by Perinatal Region
2004-2008**

Birth Defect	Region	Count¹	Rate²	LL³	UL⁴
Orofacial					
Cleft Palate w/o Cleft Lip * (p=0.0139)	Northeast	31	11.4	7.7	16.2
	East	64	8.7	6.7	11.1
	Southeast	29	7.7	5.1	11.0
	Middle	119	7.2	6.0	8.6
	West	63	5.5	4.3	7.1
Cleft Lip w/ & w/o Cleft Palate * (p=0.0006)	Northeast	37	13.6	9.6	18.7
	East	105	14.2	11.7	17.3
	Southeast	43	11.4	8.2	15.3
	Middle	193	11.7	10.1	13.5
	West	90	7.9	6.4	9.7
Choanal Atresia	Northeast	7	2.6	1.0	5.3
	East	16	2.2	1.2	3.5
	Southeast	7	1.9	0.7	3.8
	Middle	34	2.1	1.4	2.9
	West	18	1.6	0.9	2.5
Orofacial Cases * (p<0.0001)	Northeast	74	27.2	21.3	34.1
	East	184	25.0	21.5	28.9
	Southeast	79	20.9	16.5	26.0
	Middle	343	20.8	18.6	23.1
	West	170	14.9	12.8	17.4
Gastrointestinal					
Esophageal Atresia/Tracheoesophageal Fistula	Northeast	5	1.8	0.6	4.3
	East	15	2.0	1.1	3.4
	Southeast	9	2.4	1.1	4.5
	Middle	45	2.7	2.0	3.7
	West	22	1.9	1.2	2.9
Rectal & Large Intestinal Atresia/Stenosis	Northeast	16	5.9	3.4	9.5
	East	46	6.2	4.6	8.3
	Southeast	22	5.8	3.6	8.8
	Middle	91	5.5	4.4	6.8
	West	53	4.7	3.5	6.1
Pyloric Stenosis * (p<0.0001)	Northeast	168	61.7	52.7	71.8
	East	384	52.1	47.0	57.6
	Southeast	171	45.2	38.7	52.5
	Middle	720	43.6	40.5	46.9
	West	426	37.4	34.0	41.2
Hirschsprungs Disease (congenital megacolon)	Northeast	12	4.4	2.3	7.7
	East	18	2.4	1.5	3.9
	Southeast	9	2.4	1.1	4.5
	Middle	42	2.5	1.8	3.4
	West	40	3.5	2.5	4.8

**Table 4. Tennessee Birth Defects by Perinatal Region
2004-2008**

Birth Defect	Region	Count¹	Rate²	LL³	UL⁴
Biliary Atresia	Northeast	1	0.4	0.0	2.1
	East	5	0.7	0.2	1.6
	Southeast	5	1.3	0.4	3.1
	Middle	22	1.3	0.8	2.0
	West	5	0.4	0.1	1.0
Gastrointestinal Cases * (p<0.0001)	Northeast	199	73.1	63.3	84.0
	East	466	63.2	57.6	69.2
	Southeast	216	57.1	49.7	65.3
	Middle	914	55.3	51.8	59.1
	West	539	47.4	43.4	51.5
Genitourinary					
Renal Agenesis/Hypoplasia	Northeast	11	4.0	2.0	7.2
	East	42	5.7	4.1	7.7
	Southeast	18	4.8	2.8	7.5
	Middle	75	4.5	3.6	5.7
	West	51	4.5	3.3	5.9
Bladder Exstrophy	Northeast	2	0.7	0.1	2.7
	East	6	0.8	0.3	1.8
	Southeast	2	0.5	0.1	1.9
	Middle	8	0.5	0.2	1.0
	West	3	0.3	0.1	0.8
Hypospadias *	Northeast	113	41.5	34.2	49.9
	East	413	56.0	50.8	61.7
	Southeast	179	47.3	40.6	54.8
	Middle	970	58.7	55.1	62.6
	West	538	47.3	43.4	51.4
Epispadias	Northeast	1	0.4	0.0	2.1
	East	10	1.4	0.7	2.5
	Southeast	4	1.1	0.3	2.7
	Middle	16	1.0	0.6	1.6
	West	12	1.1	0.5	1.8
Obstructive Genitourinary Defect *	Northeast	114	41.9	34.5	50.3
	East	278	37.7	33.4	42.4
	Southeast	81	21.4	17.0	26.6
	Middle	419	25.4	23.0	27.9
	West	207	18.2	15.8	20.8
Genitourinary Cases * (p<0.0001)	Northeast	229	84.1	73.6	95.7
	East	737	100.0	92.9	107.5
	Southeast	279	73.8	65.4	82.9
	Middle	1,463	88.6	84.1	93.2
	West	797	70.0	65.2	75.1

**Table 4. Tennessee Birth Defects by Perinatal Region
2004-2008**

Birth Defect	Region	Count¹	Rate²	LL³	UL⁴
Musculoskeletal					
Reduction Deformity (upper limbs)	Northeast	4	1.5	0.4	3.8
	East	19	2.6	1.6	4.0
	Southeast	14	3.7	2.0	6.2
	Middle	24	1.5	0.9	2.2
	West	24	2.1	1.4	3.1
Reduction Deformity (lower limbs)	Northeast	4	1.5	0.4	3.8
	East	11	1.5	0.8	2.7
	Southeast	6	1.6	0.6	3.5
	Middle	24	1.5	0.9	2.2
	West	30	2.6	1.8	3.8
Gastroschisis	Northeast	11	4.0	2.0	7.2
	East	44	6.0	4.3	8.0
	Southeast	19	5.0	3.0	7.8
	Middle	91	5.5	4.4	6.8
	West	55	4.8	3.6	6.3
Omphalocele	Northeast	4	1.5	0.4	3.8
	East	30	4.1	2.8	5.8
	Southeast	9	2.4	1.1	4.5
	Middle	53	3.2	2.4	4.2
	West	30	2.6	1.8	3.8
Diaphragmatic Hernia	Northeast	17	6.2	3.6	10.0
	East	26	3.5	2.3	5.2
	Southeast	8	2.1	0.9	4.2
	Middle	57	3.5	2.6	4.5
	West	35	3.1	2.1	4.3
Congenital Hip Dislocation * (p=0.0024)	Northeast	22	8.1	5.1	12.2
	East	50	6.8	5.0	8.9
	Southeast	45	11.9	8.7	15.9
	Middle	116	7.0	5.8	8.4
	West	60	5.3	4.0	6.8
Musculoskeletal Cases					
	Northeast	61	22.4	17.1	28.8
	East	174	23.6	20.2	27.4
	Southeast	98	25.9	21.0	31.6
	Middle	350	21.2	19.0	23.5
	West	225	19.8	17.3	22.5
Chromosomal					
Trisomy 13	Northeast	4	1.5	0.4	3.8
	East	4	0.5	0.2	1.4
	Southeast	0	0.0	0.0	1.0
	Middle	10	0.6	0.3	1.1
	West	15	1.3	0.7	2.2

**Table 4. Tennessee Birth Defects by Perinatal Region
2004-2008**

Birth Defect	Region	Count¹	Rate²	LL³	UL⁴
Down Syndrome	Northeast	32	11.8	8.0	16.6
	East	112	15.2	12.5	18.3
	Southeast	52	13.7	10.3	18.0
	Middle	244	14.8	13.0	16.8
	West	152	13.4	11.3	15.7
Trisomy 18	Northeast	3	1.1	0.2	3.2
	East	14	1.9	1.0	3.2
	Southeast	8	2.1	0.9	4.2
	Middle	25	1.5	1.0	2.2
	West	13	1.1	0.6	2.0
Chromosomal Cases	Northeast	39	14.3	10.2	19.6
	East	129	17.5	14.6	20.8
	Southeast	60	15.9	12.1	20.4
	Middle	277	16.8	14.9	18.9
	West	178	15.6	13.4	18.1
Fetal Alcohol Syndrome	Northeast	10	3.7	1.8	6.8
	East	19	2.6	1.6	4.0
	Southeast	12	3.2	1.6	5.5
	Middle	27	1.6	1.1	2.4
	West	19	1.7	1.0	2.6
Total Cases * (p<0.0001)	Northeast	1,328	487.7	461.9	514.7
	East	2,687	364.6	351.0	378.7
	Southeast	1,158	306.1	288.8	324.3
	Middle	5,239	317.2	308.7	325.9
	West	3,889	341.7	331.0	352.6
Total Live Births	Northeast	27,228			
	East	73,696			
	Southeast	37,827			
	Middle	165,161			
	West	113,824			
Unknown Cases		0			
Unknown Live Births		5			

Source: Tennessee Birth Defects Registry 2004-2008

¹Counts include cases resulting from live births and fetal deaths. ²Per 10,000 live births. ³ 95% confidence interval lower limit. ⁴95 percent confidence interval upper limit. Confidence intervals for 100 or less cases are exact Poisson; otherwise confidence intervals are based on the normal approximation. *Indicates a statistically significant difference based on Poisson regression.

Diagnostic data were derived from the Tennessee Hospital Discharge Data System (2004-2009), the Tennessee Death Statistical System (2004-2009) and the Tennessee Fetal Death Statistical System (2004-2008). Live births and perinatal region were derived from the Tennessee Birth Statistical system (2004-2008).

**Table 5. Tennessee Birth Defects by Maternal Age
2004-2008**

Birth Defect	Age Group	Count ¹	Rate ²	LL ³	UL ⁴
Central Nervous System					
Anencephalus	Less than 20	8	1.5	0.6	2.9
	20 - 24	20	1.6	1.0	2.5
	25 - 29	18	1.5	0.9	2.4
	30 - 34	9	1.1	0.5	2.2
	35 - 39	2	0.6	0.1	2.1
	40 and older	0	0.0	0.0	5.3
Spina Bifida	Less than 20	26	4.7	3.1	6.9
	20 - 24	46	3.7	2.7	4.9
	25 - 29	53	4.5	3.4	6.0
	30 - 34	30	3.8	2.6	5.4
	35 - 39	22	6.3	3.9	9.5
	40 and older	5	7.1	2.3	16.6
Hydrocephalus	Less than 20	47	8.6	6.3	11.4
	20 - 24	95	7.6	6.1	9.3
	25 - 29	77	6.6	5.2	8.3
	30 - 34	50	6.3	4.7	8.4
	35 - 39	31	8.8	6.0	12.5
	40 and older	3	4.3	0.9	12.5
Encephalocele	Less than 20	6	1.1	0.4	2.4
	20 - 24	14	1.1	0.6	1.9
	25 - 29	16	1.4	0.8	2.2
	30 - 34	13	1.6	0.9	2.8
	35 - 39	4	1.1	0.3	2.9
	40 and older	0	0.0	0.0	5.3
Microcephalus * (p=0.0042)	Less than 20	79	14.4	11.4	18.0
	20 - 24	123	9.8	8.2	11.7
	25 - 29	103	8.8	7.2	10.7
	30 - 34	60	7.6	5.8	9.8
	35 - 39	42	12.0	8.6	16.2
	40 and older	7	9.9	4.0	20.5
Central Nervous System Cases * (p=0.0027)	Less than 20	162	29.5	25.2	34.4
	20 - 24	287	22.9	20.3	25.7
	25 - 29	256	22.0	19.4	24.8
	30 - 34	154	19.5	16.6	22.9
	35 - 39	99	28.2	22.9	34.4
	40 and older	14	19.9	10.9	33.4
Eye and Ear					
Anophthalmia/Microphthalmia	Less than 20	9	1.6	0.8	3.1
	20 - 24	15	1.2	0.7	2.0
	25 - 29	5	0.4	0.1	1.0
	30 - 34	5	0.6	0.2	1.5
	35 - 39	3	0.9	0.2	2.5
	40 and older	1	1.4	0.0	7.9

**Table 5. Tennessee Birth Defects by Maternal Age
2004-2008**

Birth Defect	Age Group	Count ¹	Rate ²	LL ³	UL ⁴
Congenital Cataract	Less than 20	16	2.9	1.7	4.7
	20 - 24	37	3.0	2.1	4.1
	25 - 29	29	2.5	1.7	3.6
	30 - 34	14	1.8	1.0	3.0
	35 - 39	9	2.6	1.2	4.9
	40 and older	2	2.8	0.3	10.3
Aniridia	Less than 20	0	0.0	0.0	0.7
	20 - 24	2	0.2	0.0	0.6
	25 - 29	2	0.2	0.0	0.6
	30 - 34	2	0.3	0.0	0.9
	35 - 39	0	0.0	0.0	1.1
	40 and older	0	0.0	0.0	5.3
Anotia/Microtia	Less than 20	5	0.9	0.3	2.1
	20 - 24	8	0.6	0.3	1.3
	25 - 29	5	0.4	0.1	1.0
	30 - 34	3	0.4	0.1	1.1
	35 - 39	4	1.1	0.3	2.9
	40 and older	1	1.4	0.0	7.9
Eye and Ear Cases					
	Less than 20	28	5.1	3.4	7.4
	20 - 24	61	4.9	3.7	6.3
	25 - 29	40	3.4	2.5	4.7
	30 - 34	22	2.8	1.8	4.2
	35 - 39	15	4.3	2.4	7.1
	40 and older	4	5.7	1.6	14.6
Cardiovascular					
Common Truncus	Less than 20	7	1.3	0.5	2.6
	20 - 24	13	1.0	0.6	1.8
	25 - 29	11	0.9	0.5	1.7
	30 - 34	6	0.8	0.3	1.7
	35 - 39	2	0.6	0.1	2.1
	40 and older	1	1.4	0.0	7.9
Transposition of Great Arteries	Less than 20	33	6.0	4.1	8.5
	20 - 24	80	6.4	5.1	8.0
	25 - 29	61	5.2	4.0	6.7
	30 - 34	49	6.2	4.6	8.2
	35 - 39	34	9.7	6.7	13.6
	40 and older	3	4.3	0.9	12.5
Tetralogy of Fallot * (p=0.0296)	Less than 20	22	4.0	2.5	6.1
	20 - 24	75	6.0	4.7	7.5
	25 - 29	61	5.2	4.0	6.7
	30 - 34	39	4.9	3.5	6.8
	35 - 39	32	9.1	6.2	12.9
	40 and older	7	9.9	4.0	20.5

**Table 5. Tennessee Birth Defects by Maternal Age
2004-2008**

Birth Defect	Age Group	Count ¹	Rate ²	LL ³	UL ⁴
Ventricular Septal Defect * (p<0.0001)	Less than 20	229	41.7	36.5	47.5
	20 - 24	472	37.7	34.4	41.3
	25 - 29	498	42.7	39.1	46.7
	30 - 34	339	43.0	38.6	47.9
	35 - 39	226	64.4	56.3	73.4
	40 and older	54	76.7	57.6	100.1
Atrial Septal Defect * (p<0.0001)	Less than 20	474	86.4	78.8	94.5
	20 - 24	979	78.2	73.4	83.2
	25 - 29	858	73.6	68.8	78.7
	30 - 34	550	69.8	64.1	75.9
	35 - 39	350	99.8	89.6	110.8
	40 and older	75	106.5	83.8	133.5
Endocardial Cushion Defect * (p<0.0001)	Less than 20	27	4.9	3.2	7.2
	20 - 24	37	3.0	2.1	4.1
	25 - 29	30	2.6	1.7	3.7
	30 - 34	21	2.7	1.7	4.1
	35 - 39	29	8.3	5.5	11.9
	40 and older	18	25.6	15.2	40.4
Pulmonary Valve Atresia & Stenosis * (p=0.0444)	Less than 20	52	9.5	7.1	12.4
	20 - 24	139	11.1	9.3	13.1
	25 - 29	117	10.0	8.3	12.0
	30 - 34	74	9.4	7.4	11.8
	35 - 39	54	15.4	11.6	20.1
	40 and older	12	17.0	8.8	29.8
Tricuspid Valve Atresia & Stenosis	Less than 20	6	1.1	0.4	2.4
	20 - 24	9	0.7	0.3	1.4
	25 - 29	16	1.4	0.8	2.2
	30 - 34	4	0.5	0.1	1.3
	35 - 39	8	2.3	1.0	4.5
	40 and older	2	2.8	0.3	10.3
Ebsteins Anomaly	Less than 20	6	1.1	0.4	2.4
	20 - 24	15	1.2	0.7	2.0
	25 - 29	5	0.4	0.1	1.0
	30 - 34	6	0.8	0.3	1.7
	35 - 39	1	0.3	0.0	1.6
	40 and older	0	0.0	0.0	5.3
Aortic Valve Stenosis	Less than 20	13	2.4	1.3	4.1
	20 - 24	21	1.7	1.0	2.6
	25 - 29	27	2.3	1.5	3.4
	30 - 34	10	1.3	0.6	2.3
	35 - 39	9	2.6	1.2	4.9
	40 and older	0	0.0	0.0	5.3

**Table 5. Tennessee Birth Defects by Maternal Age
2004-2008**

Birth Defect	Age Group	Count ¹	Rate ²	LL ³	UL ⁴
Hypoplastic Left Heart Syndrome	Less than 20	21	3.8	2.4	5.9
	20 - 24	46	3.7	2.7	4.9
	25 - 29	35	3.0	2.1	4.2
	30 - 34	29	3.7	2.5	5.3
	35 - 39	14	4.0	2.2	6.7
	40 and older	0	0.0	0.0	5.3
Patent Ductus Arteriosus * (p<0.0001)	Less than 20	317	57.8	51.6	64.5
	20 - 24	624	49.8	46.0	53.9
	25 - 29	632	54.2	50.1	58.6
	30 - 34	469	59.5	54.3	65.2
	35 - 39	262	74.7	65.9	84.3
	40 and older	61	86.6	66.3	111.3
Coarctation of Aorta * (p=0.0002)	Less than 20	49	8.9	6.6	11.8
	20 - 24	59	4.7	3.6	6.1
	25 - 29	79	6.8	5.4	8.5
	30 - 34	35	4.4	3.1	6.2
	35 - 39	31	8.8	6.0	12.5
	40 and older	10	14.2	6.8	26.1
Cardiovascular Cases * (p<0.0001)	Less than 20	852	155.3	145.0	166.1
	20 - 24	1,833	146.4	139.8	153.2
	25 - 29	1,698	145.7	138.9	152.8
	30 - 34	1,173	148.9	140.5	157.6
	35 - 39	701	199.9	185.3	215.2
	40 and older	162	230.1	196.0	268.4
Orofacial					
Cleft Palate w/o Cleft Lip * (p=0.0008)	Less than 20	35	6.4	4.4	8.9
	20 - 24	88	7.0	5.6	8.7
	25 - 29	72	6.2	4.8	7.8
	30 - 34	54	6.9	5.2	8.9
	35 - 39	48	13.7	10.1	18.1
	40 and older	9	12.8	5.9	24.3
Cleft Lip w/ & w/o Cleft Palate	Less than 20	58	10.6	8.0	13.7
	20 - 24	166	13.3	11.3	15.4
	25 - 29	120	10.3	8.5	12.3
	30 - 34	71	9.0	7.0	11.4
	35 - 39	43	12.3	8.9	16.5
	40 and older	10	14.2	6.8	26.1
Choanal Atresia	Less than 20	8	1.5	0.6	2.9
	20 - 24	23	1.8	1.2	2.8
	25 - 29	21	1.8	1.1	2.8
	30 - 34	15	1.9	1.1	3.1
	35 - 39	10	2.9	1.4	5.2
	40 and older	5	7.1	2.3	16.6

**Table 5. Tennessee Birth Defects by Maternal Age
2004-2008**

Birth Defect	Age Group	Count ¹	Rate ²	LL ³	UL ⁴
Orofacial Cases * <i>(p=0.0002)</i>	Less than 20	100	18.2	14.8	22.2
	20 - 24	275	22.0	19.4	24.7
	25 - 29	211	18.1	15.8	20.7
	30 - 34	140	17.8	15.0	21.0
	35 - 39	100	28.5	23.2	34.7
	40 and older	24	34.1	21.8	50.7
Gastrointestinal					
Esophageal Atresia/Tracheoesophageal Fistula	Less than 20	12	2.2	1.1	3.8
	20 - 24	28	2.2	1.5	3.2
	25 - 29	29	2.5	1.7	3.6
	30 - 34	11	1.4	0.7	2.5
	35 - 39	10	2.9	1.4	5.2
	40 and older	6	8.5	3.1	18.6
	Less than 20	35	6.4	4.4	8.9
Rectal & Large Intestinal Atresia/Stenosis	20 - 24	71	5.7	4.4	7.2
	25 - 29	52	4.5	3.3	5.9
	30 - 34	45	5.7	4.2	7.6
	35 - 39	22	6.3	3.9	9.5
	40 and older	3	4.3	0.9	12.5
	Less than 20	343	62.5	56.1	69.5
	20 - 24	659	52.6	48.7	56.8
Pyloric Stenosis *	25 - 29	472	40.5	36.9	44.3
	30 - 34	272	34.5	30.5	38.9
	35 - 39	111	31.6	26.0	38.1
	40 and older	12	17.0	8.8	29.8
Hirschsprungs Disease (congenital megacolon)	Less than 20	19	3.5	2.1	5.4
	20 - 24	41	3.3	2.4	4.4
	25 - 29	32	2.7	1.9	3.9
	30 - 34	17	2.2	1.3	3.5
	35 - 39	8	2.3	1.0	4.5
	40 and older	4	5.7	1.6	14.6
	Less than 20	4	0.7	0.2	1.9
Biliary Atresia	20 - 24	10	0.8	0.4	1.5
	25 - 29	14	1.2	0.7	2.0
	30 - 34	4	0.5	0.1	1.3
	35 - 39	5	1.4	0.5	3.3
	40 and older	1	1.4	0.0	7.9
	Less than 20	409	74.5	67.5	82.1
	20 - 24	805	64.3	59.9	68.9
Gastrointestinal Cases * <i>(p<0.0001)</i>	25 - 29	593	50.9	46.9	55.2
	30 - 34	347	44.0	39.5	48.9
	35 - 39	154	43.9	37.2	51.4
	40 and older	26	36.9	24.1	54.1

**Table 5. Tennessee Birth Defects by Maternal Age
2004-2008**

Birth Defect	Age Group	Count ¹	Rate ²	LL ³	UL ⁴
Genitourinary					
Renal Agenesis/Hypoplasia * (p=0.0365)	Less than 20	15	2.7	1.5	4.5
	20 - 24	50	4.0	3.0	5.3
	25 - 29	62	5.3	4.1	6.8
	30 - 34	47	6.0	4.4	7.9
	35 - 39	17	4.8	2.8	7.8
	40 and older	6	8.5	3.1	18.6
Bladder Exstrophy	Less than 20	3	0.5	0.1	1.6
	20 - 24	8	0.6	0.3	1.3
	25 - 29	4	0.3	0.1	0.9
	30 - 34	3	0.4	0.1	1.1
	35 - 39	2	0.6	0.1	2.1
	40 and older	1	1.4	0.0	7.9
Hypospadias	Less than 20	270	49.2	43.5	55.5
	20 - 24	652	52.1	48.2	56.2
	25 - 29	652	56.0	51.7	60.4
	30 - 34	407	51.6	46.8	56.9
	35 - 39	194	55.3	47.8	63.7
	40 and older	38	54.0	38.2	74.1
Epispadias	Less than 20	8	1.5	0.6	2.9
	20 - 24	12	1.0	0.5	1.7
	25 - 29	11	0.9	0.5	1.7
	30 - 34	10	1.3	0.6	2.3
	35 - 39	2	0.6	0.1	2.1
	40 and older	0	0.0	0.0	5.3
Obstructive Genitourinary Defect * (p=0.0118)	Less than 20	137	25.0	21.0	29.5
	20 - 24	285	22.8	20.2	25.6
	25 - 29	308	26.4	23.6	29.6
	30 - 34	245	31.1	27.3	35.2
	35 - 39	104	29.7	24.2	35.9
	40 and older	20	28.4	17.4	43.9
Genitourinary Cases * (p=0.0304)	Less than 20	429	78.2	71.0	86.0
	20 - 24	982	78.4	73.6	83.5
	25 - 29	1,013	86.9	81.7	92.5
	30 - 34	701	89.0	82.5	95.8
	35 - 39	317	90.4	80.7	100.9
	40 and older	63	89.5	68.8	114.5
Musculoskeletal					
Reduction Deformity (upper limbs)	Less than 20	11	2.0	1.0	3.6
	20 - 24	31	2.5	1.7	3.5
	25 - 29	26	2.2	1.5	3.3
	30 - 34	12	1.5	0.8	2.7
	35 - 39	4	1.1	0.3	2.9
	40 and older	1	1.4	0.0	7.9

**Table 5. Tennessee Birth Defects by Maternal Age
2004-2008**

Birth Defect	Age Group	Count ¹	Rate ²	LL ³	UL ⁴
Reduction Deformity (lower limbs)	Less than 20	11	2.0	1.0	3.6
	20 - 24	23	1.8	1.2	2.8
	25 - 29	23	2.0	1.3	3.0
	30 - 34	13	1.6	0.9	2.8
	35 - 39	4	1.1	0.3	2.9
	40 and older	1	1.4	0.0	7.9
Gastroschisis * (p<0.0001)	Less than 20	85	15.5	12.4	19.2
	20 - 24	89	7.1	5.7	8.8
	25 - 29	31	2.7	1.8	3.8
	30 - 34	14	1.8	1.0	3.0
	35 - 39	1	0.3	0.0	1.6
	40 and older	0	0.0	0.0	5.3
Omphalocele	Less than 20	19	3.5	2.1	5.4
	20 - 24	52	4.2	3.1	5.5
	25 - 29	26	2.2	1.5	3.3
	30 - 34	18	2.3	1.4	3.6
	35 - 39	8	2.3	1.0	4.5
	40 and older	3	4.3	0.9	12.5
Diaphragmatic Hernia	Less than 20	18	3.3	1.9	5.2
	20 - 24	46	3.7	2.7	4.9
	25 - 29	36	3.1	2.2	4.3
	30 - 34	30	3.8	2.6	5.4
	35 - 39	11	3.1	1.6	5.6
	40 and older	2	2.8	0.3	10.3
Congenital Hip Dislocation	Less than 20	36	6.6	4.6	9.1
	20 - 24	76	6.1	4.8	7.6
	25 - 29	75	6.4	5.1	8.1
	30 - 34	66	8.4	6.5	10.7
	35 - 39	33	9.4	6.5	13.2
	40 and older	7	9.9	4.0	20.5
Musculoskeletal Cases * (p<0.0001)	Less than 20	175	31.9	27.4	37.0
	20 - 24	306	24.4	21.8	27.3
	25 - 29	207	17.8	15.4	20.4
	30 - 34	147	18.7	15.8	21.9
	35 - 39	60	17.1	13.1	22.0
	40 and older	13	18.5	9.8	31.6
Chromosomal					
Trisomy 13	Less than 20	3	0.5	0.1	1.6
	20 - 24	6	0.5	0.2	1.0
	25 - 29	12	1.0	0.5	1.8
	30 - 34	4	0.5	0.1	1.3
	35 - 39	6	1.7	0.6	3.7
	40 and older	2	2.8	0.3	10.3

**Table 5. Tennessee Birth Defects by Maternal Age
2004-2008**

Birth Defect	Age Group	Count ¹	Rate ²	LL ³	UL ⁴
Down Syndrome * (p<0.0001)	Less than 20	46	8.4	6.1	11.2
	20 - 24	94	7.5	6.1	9.2
	25 - 29	106	9.1	7.5	11.0
	30 - 34	102	12.9	10.6	15.7
	35 - 39	144	41.1	34.6	48.3
	40 and older	100	142.0	115.6	172.8
Trisomy 18 * (p<0.0001)	Less than 20	7	1.3	0.5	2.6
	20 - 24	13	1.0	0.6	1.8
	25 - 29	13	1.1	0.6	1.9
	30 - 34	7	0.9	0.4	1.8
	35 - 39	15	4.3	2.4	7.1
	40 and older	8	11.4	4.9	22.4
Chromosomal Cases * (p<0.0001)	Less than 20	55	10.0	7.6	13.1
	20 - 24	113	9.0	7.4	10.9
	25 - 29	129	11.1	9.2	13.2
	30 - 34	112	14.2	11.7	17.1
	35 - 39	165	47.0	40.1	54.8
	40 and older	109	154.8	127.1	186.8
Fetal Alcohol Syndrome * (p=0.0001)	Less than 20	6	1.1	0.4	2.4
	20 - 24	20	1.6	1.0	2.5
	25 - 29	23	2.0	1.3	3.0
	30 - 34	13	1.6	0.9	2.8
	35 - 39	20	5.7	3.5	8.8
	40 and older	5	7.1	2.3	16.6
Total Cases * (p<0.0001)	Less than 20	2,015	367.3	351.4	383.7
	20 - 24	4,232	338.0	327.9	348.3
	25 - 29	3,819	327.7	317.4	338.3
	30 - 34	2,527	320.7	308.3	333.4
	35 - 39	1,387	395.4	374.9	416.8
	40 and older	318	451.6	403.4	504.1
Total Live Births	Less than 20	54,865			
	20 - 24	125,220			
	25 - 29	116,527			
	30 - 34	78,801			
	35 - 39	35,075			
	40 and older	7,041			
Unknown Cases		3			
Unknown Live Births		212			

Source: Tennessee Birth Defects Registry 2004-2008

¹Counts include cases resulting from live births and fetal deaths. ²Per 10,000 live births. ³ 95% confidence interval lower limit. ⁴95 percent confidence interval upper limit. Confidence intervals for 100 or less cases are exact Poisson; otherwise confidence intervals are based on the normal approximation. *Indicates a statistically significant difference.

Diagnostic data were derived from the Tennessee Hospital Discharge Data System (2004-2009), the Tennessee Death Statistical System (2004-2009) and the Tennessee Fetal Death Statistical System (2004-2008). Live births and maternal age were derived from the Tennessee Birth Statistical system (2004-2008).

**Table 6. Tennessee Birth Defects by Maternal Education
2004-2008**

Birth Defect	Maternal Education	Count¹	Rate²	LL³	UL⁴
Central Nervous System					
Anencephalus	No High School Diploma	17	1.8	1.1	2.9
	High School Diploma	19	1.5	0.9	2.4
	Bachelor or Some				
	College	17	1.0	0.6	1.6
	Graduate Degree	3	1.1	0.2	3.3
Spina Bifida	No High School Diploma	54	5.7	4.3	7.5
	High School Diploma	43	3.5	2.5	4.7
	Bachelor or Some				
	College	74	4.3	3.4	5.4
	Graduate Degree	9	3.4	1.5	6.4
Hydrocephalus * (p<0.0001)	No High School Diploma	106	11.3	9.2	13.6
	High School Diploma	98	7.9	6.4	9.6
	Bachelor or Some				
	College	87	5.1	4.1	6.3
	Graduate Degree	10	3.7	1.8	6.9
Encephalocele	No High School Diploma	13	1.4	0.7	2.4
	High School Diploma	19	1.5	0.9	2.4
	Bachelor or Some				
	College	18	1.1	0.6	1.7
	Graduate Degree	3	1.1	0.2	3.3
Microcephalus * (p<0.0001)	No High School Diploma	142	15.1	12.7	17.8
	High School Diploma	121	9.7	8.1	11.7
	Bachelor or Some				
	College	132	7.7	6.5	9.1
	Graduate Degree	16	6.0	3.4	9.7
Central Nervous System Cases * (p<0.0001)	No High School Diploma	322	34.2	30.6	38.2
	High School Diploma	287	23.1	20.5	26.0
	Bachelor or Some				
	College	316	18.5	16.5	20.6
	Graduate Degree	40	15.0	10.7	20.4
Eye and Ear					
Anophthalmia/Microphthalmia	No High School Diploma	8	0.9	0.4	1.7
	High School Diploma	12	1.0	0.5	1.7
	Bachelor or Some				
	College	16	0.9	0.5	1.5
	Graduate Degree	1	0.4	0.0	2.1
Congenital Cataract	No High School Diploma	25	2.7	1.7	3.9
	High School Diploma	42	3.4	2.4	4.6
	Bachelor or Some				
	College	32	1.9	1.3	2.6
	Graduate Degree	9	3.4	1.5	6.4
Aniridia	No High School Diploma	1	0.1	0.0	0.6
	High School Diploma	2	0.2	0.0	0.6
	Bachelor or Some				
	College	2	0.1	0.0	0.4
	Graduate Degree	1	0.4	0.0	2.1

**Table 6. Tennessee Birth Defects by Maternal Education
2004-2008**

Birth Defect	Maternal Education	Count¹	Rate²	LL³	UL⁴
Anotia/Microtia	No High School Diploma	9	1.0	0.4	1.8
	High School Diploma	6	0.5	0.2	1.1
	Bachelor or Some College	9	0.5	0.2	1.0
	Graduate Degree	1	0.4	0.0	2.1
Eye and Ear Cases	No High School Diploma	43	4.6	3.3	6.2
	High School Diploma	58	4.7	3.6	6.0
	Bachelor or Some College	56	3.3	2.5	4.3
	Graduate Degree	12	4.5	2.3	7.8
Cardiovascular					
Common Truncus * (p=0.0243)	No High School Diploma	7	0.7	0.3	1.5
	High School Diploma	21	1.7	1.1	2.6
	Bachelor or Some College	11	0.6	0.3	1.2
	Graduate Degree	1	0.4	0.0	2.1
Transposition of Great Arteries * (p=0.0383)	No High School Diploma	58	6.2	4.7	8.0
	High School Diploma	92	7.4	6.0	9.1
	Bachelor or Some College	102	6.0	4.9	7.2
	Graduate Degree	8	3.0	1.3	5.9
Tetralogy of Fallot	No High School Diploma	55	5.8	4.4	7.6
	High School Diploma	72	5.8	4.5	7.3
	Bachelor or Some College	91	5.3	4.3	6.5
	Graduate Degree	18	6.7	4.0	10.6
Ventricular Septal Defect	No High School Diploma	454	48.2	43.9	52.9
	High School Diploma	544	43.8	40.2	47.7
	Bachelor or Some College	700	40.9	37.9	44.0
	Graduate Degree	114	42.6	35.2	51.2
Atrial Septal Defect * (p<0.0001)	No High School Diploma	867	92.1	86.1	98.5
	High School Diploma	1,079	86.9	81.8	92.3
	Bachelor or Some College	1,170	68.3	64.5	72.4
	Graduate Degree	162	60.6	51.6	70.7
Endocardial Cushion Defect	No High School Diploma	32	3.4	2.3	4.8
	High School Diploma	52	4.2	3.1	5.5
	Bachelor or Some College	65	3.8	2.9	4.8
	Graduate Degree	13	4.9	2.6	8.3
Pulmonary Valve Atresia & Stenosis	No High School Diploma	114	12.1	10.0	14.6
	High School Diploma	130	10.5	8.8	12.4
	Bachelor or Some College	180	10.5	9.0	12.2
	Graduate Degree	25	9.4	6.1	13.8

**Table 6. Tennessee Birth Defects by Maternal Education
2004-2008**

Birth Defect	Maternal Education	Count¹	Rate²	LL³	UL⁴
Tricuspid Valve Atresia & Stenosis	No High School Diploma	11	1.2	0.6	2.1
	High School Diploma	18	1.4	0.9	2.3
	Bachelor or Some College	16	0.9	0.5	1.5
	Graduate Degree	0	0.0	0.0	1.4
Ebsteins Anomaly	No High School Diploma	9	1.0	0.4	1.8
	High School Diploma	8	0.6	0.3	1.3
	Bachelor or Some College	16	0.9	0.5	1.5
	Graduate Degree	0	0.0	0.0	1.4
Aortic Valve Stenosis	No High School Diploma	20	2.1	1.3	3.3
	High School Diploma	23	1.9	1.2	2.8
	Bachelor or Some College	32	1.9	1.3	2.6
	Graduate Degree	5	1.9	0.6	4.4
Hypoplastic Left Heart Syndrome	No High School Diploma	35	3.7	2.6	5.2
	High School Diploma	53	4.3	3.2	5.6
	Bachelor or Some College	46	2.7	2.0	3.6
	Graduate Degree	11	4.1	2.1	7.4
Patent Ductus Arteriosus * (p=0.0410)	No High School Diploma	535	56.8	52.1	61.9
	High School Diploma	759	61.1	56.9	65.6
	Bachelor or Some College	938	54.8	51.3	58.4
	Graduate Degree	131	49.0	41.0	58.2
Coarctation of Aorta	No High School Diploma	70	7.4	5.8	9.4
	High School Diploma	86	6.9	5.5	8.6
	Bachelor or Some College	92	5.4	4.3	6.6
	Graduate Degree	14	5.2	2.9	8.8
Cardiovascular Cases * (p<0.0001)	No High School Diploma	1,597	169.7	161.5	178.2
	High School Diploma	2,041	164.4	157.3	171.7
	Bachelor or Some College	2,407	140.6	135.0	146.3
	Graduate Degree	359	134.3	120.8	148.9
Orofacial					
Cleft Palate w/o Cleft Lip	No High School Diploma	70	7.4	5.8	9.4
	High School Diploma	87	7.0	5.6	8.6
	Bachelor or Some College	122	7.1	5.9	8.5
	Graduate Degree	25	9.4	6.1	13.8

**Table 6. Tennessee Birth Defects by Maternal Education
2004-2008**

Birth Defect	Maternal Education	Count¹	Rate²	LL³	UL⁴
Cleft Lip w/ & w/o Cleft Palate	No High School Diploma	104	11.1	9.0	13.4
	High School Diploma	164	13.2	11.3	15.4
	Bachelor or Some College	173	10.1	8.7	11.7
	Graduate Degree	27	10.1	6.7	14.7
Choanal Atresia	No High School Diploma	16	1.7	1.0	2.8
	High School Diploma	26	2.1	1.4	3.1
	Bachelor or Some College	35	2.0	1.4	2.8
	Graduate Degree	4	1.5	0.4	3.8
Orofacial Cases					
	No High School Diploma	190	20.2	17.4	23.3
	High School Diploma	276	22.2	19.7	25.0
	Bachelor or Some College	326	19.0	17.0	21.2
	Graduate Degree	55	20.6	15.5	26.8
Gastrointestinal					
Esophageal Atresia/Tracheoesophageal Fistula	No High School Diploma	20	2.1	1.3	3.3
	High School Diploma	30	2.4	1.6	3.5
	Bachelor or Some College	37	2.2	1.5	3.0
	Graduate Degree	8	3.0	1.3	5.9
Rectal & Large Intestinal Atresia/Stenosis	No High School Diploma	55	5.8	4.4	7.6
	High School Diploma	76	6.1	4.8	7.7
	Bachelor or Some College	83	4.8	3.9	6.0
	Graduate Degree	14	5.2	2.9	8.8
Pyloric Stenosis * (p<0.0001)	No High School Diploma	539	57.3	52.5	62.3
	High School Diploma	669	53.9	49.9	58.1
	Bachelor or Some College	599	35.0	32.2	37.9
	Graduate Degree	56	20.9	15.8	27.2
Hirschsprungs Disease (congenital megacolon) (p=0.0187)	No High School Diploma	38	4.0	2.9	5.5
	High School Diploma	40	3.2	2.3	4.4
	Bachelor or Some College	40	2.3	1.7	3.2
	Graduate Degree	3	1.1	0.2	3.3
Biliary Atresia	No High School Diploma	8	0.9	0.4	1.7
	High School Diploma	10	0.8	0.4	1.5
	Bachelor or Some College	17	1.0	0.6	1.6
	Graduate Degree	3	1.1	0.2	3.3
Gastrointestinal Cases * (p<0.0001)					
	No High School Diploma	657	69.8	64.6	75.4
	High School Diploma	819	66.0	61.5	70.6
	Bachelor or Some College	769	44.9	41.8	48.2
	Graduate Degree	82	30.7	24.4	38.1

**Table 6. Tennessee Birth Defects by Maternal Education
2004-2008**

Birth Defect	Maternal Education	Count¹	Rate²	LL³	UL⁴
Genitourinary					
Renal Agenesis/Hypoplasia	No High School Diploma	50	5.3	3.9	7.0
	High School Diploma	59	4.8	3.6	6.1
	Bachelor or Some College	78	4.6	3.6	5.7
	Graduate Degree	10	3.7	1.8	6.9
Bladder Exstrophy	No High School Diploma	4	0.4	0.1	1.1
	High School Diploma	8	0.6	0.3	1.3
	Bachelor or Some College	9	0.5	0.2	1.0
	Graduate Degree	0	0.0	0.0	1.4
Hypospadias * (p<0.0001)	No High School Diploma	408	43.4	39.3	47.8
	High School Diploma	676	54.4	50.4	58.7
	Bachelor or Some College	958	55.9	52.5	59.6
	Graduate Degree	167	62.5	53.4	72.7
Epispadias	No High School Diploma	10	1.1	0.5	2.0
	High School Diploma	14	1.1	0.6	1.9
	Bachelor or Some College	18	1.1	0.6	1.7
	Graduate Degree	1	0.4	0.0	2.1
Obstructive Genitourinary Defect * (p=0.0021)	No High School Diploma	237	25.2	22.1	28.6
	High School Diploma	309	24.9	22.2	27.8
	Bachelor or Some College	449	26.2	23.9	28.8
	Graduate Degree	103	38.5	31.5	46.7
Genitourinary Cases * (p<0.0001)					
	No High School Diploma	689	73.2	67.8	78.9
	High School Diploma	1,049	84.5	79.5	89.8
	Bachelor or Some College	1,481	86.5	82.1	91.0
	Graduate Degree	281	105.1	93.2	118.2
Musculoskeletal					
Reduction Deformity (upper limbs)	No High School Diploma	24	2.6	1.6	3.8
	High School Diploma	32	2.6	1.8	3.6
	Bachelor or Some College	27	1.6	1.0	2.3
	Graduate Degree	2	0.7	0.1	2.7
Reduction Deformity (lower limbs)	No High School Diploma	21	2.2	1.4	3.4
	High School Diploma	27	2.2	1.4	3.2
	Bachelor or Some College	26	1.5	1.0	2.2
	Graduate Degree	1	0.4	0.0	2.1

**Table 6. Tennessee Birth Defects by Maternal Education
2004-2008**

Birth Defect	Maternal Education	Count ¹	Rate ²	LL ³	UL ⁴
Gastroschisis * (p<0.0001)	No High School Diploma	74	7.9	6.2	9.9
	High School Diploma	76	6.1	4.8	7.7
	Bachelor or Some College	66	3.9	3.0	4.9
	Graduate Degree	4	1.5	0.4	3.8
Omphalocele	No High School Diploma	35	3.7	2.6	5.2
	High School Diploma	40	3.2	2.3	4.4
	Bachelor or Some College	48	2.8	2.1	3.7
	Graduate Degree	3	1.1	0.2	3.3
Diaphragmatic Hernia	No High School Diploma	38	4.0	2.9	5.5
	High School Diploma	49	3.9	2.9	5.2
	Bachelor or Some College	52	3.0	2.3	4.0
	Graduate Degree	4	1.5	0.4	3.8
Congenital Hip Dislocation * (p=0.0008)	No High School Diploma	54	5.7	4.3	7.5
	High School Diploma	80	6.4	5.1	8.0
	Bachelor or Some College	120	7.0	5.8	8.4
	Graduate Degree	37	13.8	9.8	19.1
Musculoskeletal Cases * (p=0.0048)	No High School Diploma	238	25.3	22.2	28.7
	High School Diploma	289	23.3	20.7	26.1
	Bachelor or Some College	329	19.2	17.2	21.4
	Graduate Degree	50	18.7	13.9	24.7
Chromosomal					
Trisomy 13	No High School Diploma	9	1.0	0.4	1.8
	High School Diploma	7	0.6	0.2	1.2
	Bachelor or Some College	14	0.8	0.5	1.4
	Graduate Degree	3	1.1	0.2	3.3
Down Syndrome * (p=0.0001)	No High School Diploma	116	12.3	10.2	14.8
	High School Diploma	150	12.1	10.2	14.2
	Bachelor or Some College	259	15.1	13.3	17.1
	Graduate Degree	63	23.6	18.1	30.2
Trisomy 18	No High School Diploma	15	1.6	0.9	2.6
	High School Diploma	17	1.4	0.8	2.2
	Bachelor or Some College	28	1.6	1.1	2.4
	Graduate Degree	3	1.1	0.2	3.3
Chromosomal Cases * (p=0.0002)	No High School Diploma	139	14.8	12.4	17.4
	High School Diploma	174	14.0	12.0	16.3
	Bachelor or Some College	297	17.3	15.4	19.4
	Graduate Degree	69	25.8	20.1	32.7

**Table 6. Tennessee Birth Defects by Maternal Education
2004-2008**

Birth Defect	Maternal Education	Count¹	Rate²	LL³	UL⁴
Fetal Alcohol Syndrome * (p<0.0001)	No High School Diploma	41	4.4	3.1	5.9
	High School Diploma	29	2.3	1.6	3.4
	Bachelor or Some College	15	0.9	0.5	1.4
	Graduate Degree	1	0.4	0.0	2.1
Total Cases * (p<0.0001)	No High School Diploma	3,500	371.9	359.7	384.4
	High School Diploma	4,533	365.1	354.6	375.9
	Bachelor or Some College	5,381	314.2	305.9	322.7
	Graduate Degree	843	315.4	294.4	337.4
Total Live Births	No High School Diploma	94,114			
	High School Diploma	124,156			
	Bachelor or Some College	171,247			
	Graduate Degree	26,732			
Unknown Cases		44			

Source: Tennessee Birth Defects Registry 2004-2008

¹Counts include cases resulting from live births and fetal deaths. ²Per 10,000 live births. ³ 95% confidence interval lower limit. ⁴95 percent confidence interval upper limit. Confidence intervals for 100 or less cases are exact Poisson; otherwise confidence intervals are based on the normal approximation. *Indicates a statistically significant difference based on Poisson regression.

Diagnostic data were derived from the Tennessee Hospital Discharge Data System (2004-2009), the Tennessee Death Statistical System (2004-2009) and the Tennessee Fetal Death Statistical System (2004-2008). Live births and maternal education were derived from the Tennessee Birth Statistical system (2004-2008).

**Table 7: Tennessee Birth Defects by Maternal Smoking
2004-2008**

Birth Defect	Smoking	Count¹	Rate²	LL³	UL⁴
Central Nervous System					
Anencephalus	None	50	1.5	1.1	2.0
	Moderate	4	0.8	0.2	2.1
	Heavy	3	1.0	0.2	2.9
Spina Bifida	None	152	4.5	3.8	5.3
	Moderate	16	3.2	1.8	5.2
	Heavy	13	4.3	2.3	7.4
Hydrocephalus	None	236	7.0	6.1	8.0
	Moderate	42	8.4	6.1	11.4
	Heavy	23	7.6	4.8	11.4
Encephalocele	None	38	1.1	0.8	1.6
	Moderate	7	1.4	0.6	2.9
	Heavy	8	2.6	1.1	5.2
Microcephalus	None	323	9.6	8.6	10.7
	Moderate	54	10.8	8.1	14.1
	Heavy	35	11.6	8.1	16.1
Central Nervous System Cases		None	769	22.8	21.2
		Moderate	118	23.6	19.6
		Heavy	81	26.8	21.3
Eye and Ear					
Anophthalmia/Microphthalmia * (p=0.0408)	None	36	1.1	0.8	1.5
	Moderate	1	0.2	0.0	1.1
	Heavy	1	0.3	0.0	1.8
Congenital Cataract	None	91	2.7	2.2	3.3
	Moderate	12	2.4	1.2	4.2
	Heavy	5	1.7	0.5	3.9
Aniridia	None	6	0.2	0.1	0.4
	Moderate	0	0.0	0.0	0.7
	Heavy	0	0.0	0.0	1.2
Anotia/Microtia	None	23	0.7	0.4	1.0
	Moderate	1	0.2	0.0	1.1
	Heavy	2	0.7	0.1	2.4
Ear and Eye Cases		None	149	4.4	3.7
		Moderate	14	2.8	1.5
		Heavy	8	2.6	1.1
Cardiovascular					
Common Truncus	None	30	0.9	0.6	1.3
	Moderate	3	0.6	0.1	1.8
	Heavy	7	2.3	0.9	4.8
Transposition of Great Arteries	None	204	6.0	5.2	6.9
	Moderate	29	5.8	3.9	8.4
	Heavy	27	8.9	5.9	13.0

**Table 7: Tennessee Birth Defects by Maternal Smoking
2004-2008**

Birth Defect	Smoking	Count¹	Rate²	LL³	UL⁴
Tetralogy of Fallot	None	179	5.3	4.6	6.1
	Moderate	41	8.2	5.9	11.2
	Heavy	16	5.3	3.0	8.6
Ventricular Septal Defect	None	1,446	42.9	40.7	45.1
	Moderate	228	45.7	40.0	52.0
	Heavy	143	47.3	39.9	55.7
Atrial Septal Defect * (p<0.0001)	None	2,544	75.4	72.5	78.4
	Moderate	454	91.0	82.8	99.8
	Heavy	288	95.3	84.6	107.0
Endocardial Cushion Defect	None	132	3.9	3.3	4.6
	Moderate	20	4.0	2.5	6.2
	Heavy	10	3.3	1.6	6.1
Pulmonary Valve Atresia & Stenosis * (p<0.0001)	None	330	9.8	8.8	10.9
	Moderate	55	11.0	8.3	14.4
	Heavy	64	21.2	16.3	27.0
Tricuspid Valve Atresia & Stenosis * (p=0.0216)	None	31	0.9	0.6	1.3
	Moderate	5	1.0	0.3	2.3
	Heavy	9	3.0	1.4	5.7
Ebsteins Anomaly	None	24	0.7	0.5	1.1
	Moderate	6	1.2	0.4	2.6
	Heavy	3	1.0	0.2	2.9
Aortic Valve Stenosis	None	65	1.9	1.5	2.5
	Moderate	7	1.4	0.6	2.9
	Heavy	8	2.6	1.1	5.2
Hypoplastic Left Heart Syndrome	None	112	3.3	2.7	4.0
	Moderate	19	3.8	2.3	6.0
	Heavy	14	4.6	2.5	7.8
Patent Ductus Arteriosus * (p<0.0001)	None	1,999	59.2	56.7	61.9
	Moderate	229	45.9	40.1	52.2
	Heavy	138	45.7	38.4	54.0
Coarctation of Aorta	None	214	6.3	5.5	7.3
	Moderate	28	5.6	3.7	8.1
	Heavy	21	6.9	4.3	10.6
Cardiovascular Cases * (p=0.002)	None	5,082	150.6	146.5	154.8
	Moderate	811	162.5	151.5	174.1
	Heavy	526	174.1	159.5	189.6
Orofacial					
Cleft Palate w/o Cleft Lip	None	235	7.0	6.1	7.9
	Moderate	44	8.8	6.4	11.8
	Heavy	27	8.9	5.9	13.0
Cleft Lip w/ & w/o Cleft Palate * (p=0.0004)	None	341	10.1	9.1	11.2
	Moderate	71	14.2	11.1	18.0
	Heavy	52	17.2	12.9	22.6

**Table 7: Tennessee Birth Defects by Maternal Smoking
2004-2008**

Birth Defect	Smoking	Count¹	Rate²	LL³	UL⁴
Choanal Atresia	None	63	1.9	1.4	2.4
	Moderate	10	2.0	1.0	3.7
	Heavy	9	3.0	1.4	5.7
Orofacial Cases * (p=0.0001)	None	635	18.8	17.4	20.3
	Moderate	124	24.8	20.7	29.6
	Heavy	87	28.8	23.1	35.5
Gastrointestinal					
Esophageal Atresia/Tracheoesophageal Fistula (p=0.0058)	None	65	1.9	1.5	2.5
	Moderate	22	4.4	2.8	6.7
	Heavy	9	3.0	1.4	5.7
Rectal & Large Intestinal Atresia Stenosis	None	175	5.2	4.5	6.0
	Moderate	35	7.0	4.9	9.8
	Heavy	18	6.0	3.5	9.4
Pyloric Stenosis * (p<0.0001)	None	1,300	38.5	36.5	40.7
	Moderate	339	67.9	60.9	75.6
	Heavy	230	76.1	66.6	86.6
Hirschsprungs Disease (congenital megacolon)	None	92	2.7	2.2	3.3
	Moderate	21	4.2	2.6	6.4
	Heavy	8	2.6	1.1	5.2
Biliary Atresia	None	32	0.9	0.7	1.3
	Moderate	2	0.4	0.1	1.5
	Heavy	4	1.3	0.4	3.4
Gastrointestinal Cases * (p<0.0001)	None	1,651	48.9	46.6	51.3
	Moderate	416	83.4	75.6	91.8
	Heavy	267	88.4	78.1	99.6
Genitourinary					
Renal Agenesis/Hypoplasia	None	154	4.6	3.9	5.3
	Moderate	30	6.0	4.1	8.6
	Heavy	12	4.0	2.1	6.9
Bladder Exstrophy	None	16	0.5	0.3	0.8
	Moderate	2	0.4	0.1	1.5
	Heavy	3	1.0	0.2	2.9
Hypospadias	None	1,805	53.5	51.1	56.0
	Moderate	259	51.9	45.8	58.6
	Heavy	148	49.0	41.4	57.5
Epispadias	None	33	1.0	0.7	1.4
	Moderate	7	1.4	0.6	2.9
	Heavy	3	1.0	0.2	2.9
Obstructive Genitourinary Defect	None	890	26.4	24.7	28.2
	Moderate	140	28.1	23.6	33.1
	Heavy	69	22.8	17.8	28.9

**Table 7: Tennessee Birth Defects by Maternal Smoking
2004-2008**

Birth Defect	Smoking	Count¹	Rate²	LL³	UL⁴
Genitourinary Cases	None	2,847	84.4	81.3	87.5
	Moderate	425	85.2	77.3	93.7
	Heavy	231	76.4	66.9	87.0
Musculoskeletal					
Reduction Deformity (upper limbs)	None	62	1.8	1.4	2.4
	Moderate	14	2.8	1.5	4.7
	Heavy	9	3.0	1.4	5.7
Reduction Deformity (lower limbs)	None	60	1.8	1.4	2.3
	Moderate	10	2.0	1.0	3.7
	Heavy	5	1.7	0.5	3.9
Gastroschisis * (p<0.0001)	None	140	4.1	3.5	4.9
	Moderate	48	9.6	7.1	12.8
	Heavy	32	10.6	7.2	15.0
Omphalocele	None	97	2.9	2.3	3.5
	Moderate	14	2.8	1.5	4.7
	Heavy	14	4.6	2.5	7.8
Diaphragmatic Hernia	None	111	3.3	2.7	4.0
	Moderate	19	3.8	2.3	6.0
	Heavy	13	4.3	2.3	7.4
Congenital Hip Dislocation * (p=0.0085)	None	248	7.3	6.5	8.3
	Moderate	36	7.2	5.1	10.0
	Heavy	9	3.0	1.4	5.7
Musculoskeletal Cases * (p=0.0121)	None	697	20.7	19.2	22.3
	Moderate	129	25.9	21.6	30.7
	Heavy	81	26.8	21.3	33.3
Chromosomal					
Trisomy 13	None	30	0.9	0.6	1.3
	Moderate	3	0.6	0.1	1.8
	Heavy	0	0.0	0.0	1.2
Down Syndrome	None	494	14.6	13.4	16.0
	Moderate	64	12.8	9.9	16.4
	Heavy	33	10.9	7.5	15.3
Trisomy 18	None	47	1.4	1.0	1.9
	Moderate	9	1.8	0.8	3.4
	Heavy	7	2.3	0.9	4.8
Chromosomal Cases	None	566	16.8	15.4	18.2
	Moderate	76	15.2	12.0	19.1
	Heavy	40	13.2	9.5	18.0
Fetal Alcohol Syndrome * (p<0.0001)	None	29	0.9	0.6	1.2
	Moderate	30	6.0	4.1	8.6
	Heavy	28	9.3	6.2	13.4

**Table 7: Tennessee Birth Defects by Maternal Smoking
2004-2008**

Birth Defect	Smoking	Count¹	Rate²	LL³	UL⁴
Total Cases * (p<0.0001)	None	11,150	330.4	324.3	336.6
	Moderate	1,917	384.2	367.2	401.8
	Heavy	1,220	403.7	381.4	427.0
Total Live Births	None	337,451			
	Moderate	49,901			
	Heavy	30,220			
Unknown Cases		14			
Unknown Live Births		169			

Source: Tennessee Birth Defects Registry 2004-2008

¹Counts include cases resulting from live births and fetal deaths. ²Per 10,000 live births. ³ 95% confidence interval lower limit. ⁴95 percent confidence interval upper limit. Confidence intervals for 100 or less cases are exact Poisson; otherwise confidence intervals are based on the normal approximation.

*Indicates a statistically significant difference based on Poisson regression.

Diagnostic data were derived from the Tennessee Hospital Discharge Data System (2004-2009), the Tennessee Death Statistical System (2004-2009) and the Tennessee Fetal Death Statistical System (2004-2008). Live births and maternal smoking were derived from the Tennessee Birth Statistical system (2004-2008).

**Table 8. Tennessee Birth Defects by Maternal Diabetes (Type I/Type II)
2004-2008**

Birth Defect	Diabetes	Count¹	Rate²	LL³	UL⁴
Central Nervous System					
Anencephalus	Yes	0	0.0	0.0	9.3
	No	46	1.1	0.8	1.5
Spina Bifida * (p=0.0373)	Yes	5	12.6	4.1	29.5
	No	172	4.2	3.6	4.8
Hydrocephalus * (p<0.0001)	Yes	13	32.8	17.5	56.1
	No	285	6.9	6.1	7.7
Encephalocele	Yes	1	2.5	0.1	14.1
	No	52	1.3	0.9	1.7
Microcephalus	Yes	8	20.2	8.7	39.8
	No	404	9.8	8.8	10.8
Central Nervous System Cases * (p<0.0001)		26	65.6	42.9	96.2
		924	22.3	20.9	23.8
Eye and Ear					
Anophthalmia/Microphthalmia	Yes	0	0.0	0.0	9.3
	No	38	0.9	0.7	1.3
Congenital Cataract	Yes	0	0.0	0.0	9.3
	No	108	2.6	2.1	3.2
Aniridia	Yes	0	0.0	0.0	9.3
	No	6	0.1	0.1	0.3
Anotia/Microtia	Yes	0	0.0	0.0	9.3
	No	26	0.6	0.4	0.9
Eye and Ear Cases		0	0.0	0.0	9.3
		171	4.1	3.5	4.8
Cardiovascular					
Common Truncus * (p=0.0067)	Yes	3	7.6	1.6	22.1
	No	37	0.9	0.6	1.2
Transposition of Great Arteries * (p<0.0001)	Yes	14	35.3	19.3	59.3
	No	246	5.9	5.2	6.7
Tetralogy of Fallot * (p=0.0027)	Yes	8	20.2	8.7	39.8
	No	228	5.5	4.8	6.3
Ventricular Septal Defect * (p<0.0001)	Yes	70	176.7	137.7	223.2
	No	1,748	42.2	40.3	44.3
Atrial Septal Defect * (p<0.0001)	Yes	116	292.8	241.9	351.2
	No	3,171	76.6	74.0	79.4
Endocardial Cushion Defect * (p<0.0001)	Yes	9	22.7	10.4	43.1
	No	153	3.7	3.1	4.3
Pulmonary Valve Atresia & Stenosis * (p=0.0020)	Yes	12	30.3	15.7	52.9
	No	437	10.6	9.6	11.6
Tricuspid Valve Atresia & Stenosis	Yes	2	5.0	0.6	18.2
	No	43	1.0	0.8	1.4
Ebsteins Anomaly	Yes	1	2.5	0.1	14.1
	No	32	0.8	0.5	1.1

**Table 8. Tennessee Birth Defects by Maternal Diabetes (Type I/Type II)
2004-2008**

Birth Defect	Diabetes	Count¹	Rate²	LL³	UL⁴
Aortic Valve Stenosis	Yes	1	2.5	0.1	14.1
	No	79	1.9	1.5	2.4
Hypoplastic Left Heart Syndrome *	Yes	7	17.7	7.1	36.4
(p=0.0006)	No	138	3.3	2.8	3.9
Patent Ductus Arteriosus *	Yes	102	257.4	209.9	312.5
(p<0.0001)	No	2,264	54.7	52.5	57.0
Coarctation of Aorta *	Yes	13	32.8	17.5	56.1
(p<0.0001)	No	250	6.0	5.3	6.8
Cardiovascular Cases *	Yes	245	618.4	543.4	700.9
(p<0.0001)	No	6,176	149.3	145.6	153.0
Orofacial					
Cleft Palate w/o Cleft Lip	Yes	5	12.6	4.1	29.5
	No	301	7.3	6.5	8.1
Cleft Lip w/ & w/o Cleft Palate	Yes	3	7.6	1.6	22.1
	No	449	10.9	9.9	11.9
Choanal Atresia	Yes	2	5.0	0.6	18.2
	No	80	1.9	1.5	2.4
Orofacial Cases	Yes	10	25.2	12.1	46.4
	No	824	19.9	18.6	21.3
Gastrointestinal					
Esophageal Atresia/Tracheoesophagea	Yes	4	10.1	2.8	25.9
I Fistula (p=0.0164)	No	92	2.2	1.8	2.7
Rectal & Large Intestinal	Yes	3	7.6	1.6	22.1
Atresia/Stenosis	No	223	5.4	4.7	6.2
Pyloric Stenosis	Yes	17	42.9	25.0	68.7
	No	1,852	44.8	42.7	46.8
Hirschsprungs Disease (congenital	Yes	2	5.0	0.6	18.2
megacolon	No	119	2.9	2.4	3.4
Biliary Atresia	Yes	1	2.5	0.1	14.1
	No	37	0.9	0.6	1.2
Gastrointestinal Cases	Yes	26	65.6	42.9	96.2
	No	2,306	55.7	53.5	58.1
Genitourinary					
Renal Agenesis/Hypoplasia *	Yes	13	32.8	17.5	56.1
(p<0.0001)	No	180	4.4	3.7	5.0
Bladder Exstrophy	Yes	0	0.0	0.0	9.3
	No	21	0.5	0.3	0.8
Hypospadias *	Yes	43	108.5	78.5	146.2
(p<0.0001)	No	2,170	52.4	50.3	54.7
Epispadias	Yes	1	2.5	0.1	14.1
	No	42	1.0	0.7	1.4

**Table 8. Tennessee Birth Defects by Maternal Diabetes (Type I/Type II)
2004-2008**

Birth Defect	Diabetes	Count¹	Rate²	LL³	UL⁴
Obstructive Genitourinary Defect *	Yes	21	53.0	32.8	81.0
(p=0.0038)	No	1,078	26.1	24.5	27.7
Genitourinary Cases *	Yes	74	186.8	146.7	234.5
(p<0.0001)	No	3,427	82.8	80.1	85.6
Musculoskeletal					
Reduction Deformity (upper limbs)	Yes	2	5.0	0.6	18.2
	No	83	2.0	1.6	2.5
Reduction Deformity (lower limbs)*	Yes	3	7.6	1.6	22.1
(p=0.0421)	No	72	1.7	1.4	2.2
Gastroschisis	Yes	1	2.5	0.1	14.1
	No	219	5.3	4.6	6.0
Omphalocele	Yes	2	5.0	0.6	18.2
	No	122	2.9	2.5	3.5
Diaphragmatic Hernia	Yes	2	5.0	0.6	18.2
	No	139	3.4	2.8	4.0
Congenital Hip Dislocation	Yes	6	15.1	5.6	33.0
	No	287	6.9	6.2	7.8
Musculoskeletal Cases	Yes	14	35.3	19.3	59.3
	No	890	21.5	20.1	23.0
Chromosomal					
Trisomy 13	Yes	1	2.5	0.1	14.1
	No	32	0.8	0.5	1.1
Down Syndrome	Yes	6	15.1	5.6	33.0
	No	570	13.8	12.7	15.0
Trisomy 18	Yes	1	2.5	0.1	14.1
	No	62	1.5	1.2	1.9
Chromosomal Cases	Yes	8	20.2	8.7	39.8
	No	659	15.9	14.7	17.2
Fetal Alcohol Syndrome	Yes	0	0.0	0.0	9.3
	No	87	2.1	1.7	2.6
Total Cases *	Yes	349	880.9	790.9	978.3
(p<0.0001)	No	13,893	335.8	330.2	341.4
Total Live Births	Yes	3,962			
	No	413,779			
Unknown Cases		59			
Unknown Live Births		0			

Source: Tennessee Birth Defects Registry 2004-2008

¹Counts include cases resulting from live births and fetal deaths. ²Per 10,000 live births. ³ 95% confidence interval lower limit. ⁴95 percent confidence interval upper limit. Confidence intervals for 100 or less cases are exact Poisson; otherwise confidence intervals are based on the normal approximation. *Indicates a statistically significant difference based on Poisson regression.

Diagnostic data were derived from the Tennessee Hospital Discharge Data System (2004-2009), the Tennessee Death Statistical System (2004-2009) and the Tennessee Fetal Death Statistical System (2004-2008). Live births and maternal diabetes were derived from the Tennessee Birth Statistical system (2004-2008).

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Anderson	Total Cases	172	395.0	338.2	458.7
Anderson	Central Nervous System	11	25.3	12.6	45.2
Anderson	Eye and Ear	2	4.6	0.6	16.6
Anderson	Cardiovascular	63	144.7	111.2	185.1
Anderson	Orofacial	10	23.0	11.0	42.2
Anderson	Gastrointestinal	28	64.3	42.7	93.0
Anderson	Genitourinary	58	133.2	101.2	172.2
Anderson	Musculoskeletal	18	41.3	24.5	65.3
Anderson	Chromosomal	8	18.4	7.9	36.2
Bedford	Total Cases	103	296.5	242.0	359.6
Bedford	Central Nervous System	13	37.4	19.9	64.0
Bedford	Cardiovascular	36	103.6	72.6	143.5
Bedford	Orofacial	6	17.3	6.3	37.6
Bedford	Gastrointestinal	22	63.3	39.7	95.9
Bedford	Genitourinary	22	63.3	39.7	95.9
Bedford	Musculoskeletal	12	34.5	17.9	60.3
Bedford	Chromosomal	6	17.3	6.3	37.6
Benton	Total Cases	30	355.5	239.8	507.4
Benton	Central Nervous System	2	23.7	2.9	85.6
Benton	Eye and Ear	1	11.8	0.3	66.0
Benton	Cardiovascular	7	82.9	33.4	170.9
Benton	Orofacial	3	35.5	7.3	103.9
Benton	Gastrointestinal	3	35.5	7.3	103.9
Benton	Genitourinary	10	118.5	56.8	217.9
Benton	Musculoskeletal	4	47.4	12.9	121.4
Benton	Chromosomal	2	23.7	2.9	85.6
Bledsoe	Total Cases	13	195.5	104.1	334.3
Bledsoe	Central Nervous System	1	15.0	0.4	83.8
Bledsoe	Eye and Ear	1	15.0	0.4	83.8
Bledsoe	Cardiovascular	5	75.2	24.4	175.5
Bledsoe	Orofacial	2	30.1	3.6	108.6
Bledsoe	Gastrointestinal	4	60.2	16.4	154.0
Bledsoe	Musculoskeletal	2	30.1	3.6	108.6
Bledsoe	Chromosomal	1	15.0	0.4	83.8
Blount	Total Cases	246	366.1	321.8	414.9
Blount	Central Nervous System	21	31.3	19.4	47.8
Blount	Eye and Ear	3	4.5	0.9	13.1
Blount	Cardiovascular	96	142.9	115.7	174.5

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Blount	Orofacial	21	31.3	19.4	47.8
Blount	Gastrointestinal	34	50.6	35.0	70.7
Blount	Genitourinary	74	110.1	86.5	138.3
Blount	Musculoskeletal	13	19.3	10.3	33.1
Blount	Chromosomal	10	14.9	7.1	27.4
Bradley	Total Cases	157	257.9	219.1	301.5
Bradley	Central Nervous System	16	26.3	15.0	42.7
Bradley	Eye and Ear	3	4.9	1.0	14.4
Bradley	Cardiovascular	47	77.2	56.7	102.7
Bradley	Orofacial	18	29.6	17.5	46.7
Bradley	Gastrointestinal	30	49.3	33.3	70.4
Bradley	Genitourinary	31	50.9	34.6	72.3
Bradley	Musculoskeletal	19	31.2	18.8	48.7
Bradley	Chromosomal	3	4.9	1.0	14.4
Campbell	Total Cases	105	434.1	355.0	525.5
Campbell	Central Nervous System	8	33.1	14.3	65.2
Campbell	Cardiovascular	41	169.5	121.6	229.9
Campbell	Orofacial	4	16.5	4.5	42.3
Campbell	Gastrointestinal	15	62.0	34.7	102.3
Campbell	Genitourinary	38	157.1	111.2	215.6
Campbell	Musculoskeletal	4	16.5	4.5	42.3
Campbell	Chromosomal	4	16.5	4.5	42.3
Cannon	Total Cases	28	356.2	236.7	514.9
Cannon	Central Nervous System	4	50.9	13.9	130.3
Cannon	Eye and Ear	1	12.7	0.3	70.9
Cannon	Cardiovascular	7	89.1	35.8	183.5
Cannon	Orofacial	1	12.7	0.3	70.9
Cannon	Gastrointestinal	6	76.3	28.0	166.2
Cannon	Genitourinary	7	89.1	35.8	183.5
Cannon	Musculoskeletal	2	25.4	3.1	91.9
Cannon	Chromosomal	2	25.4	3.1	91.9
Carroll	Total Cases	75	424.2	333.7	531.7
Carroll	Central Nervous System	4	22.6	6.2	57.9
Carroll	Eye and Ear	3	17.0	3.5	49.6
Carroll	Cardiovascular	20	113.1	69.1	174.7
Carroll	Orofacial	4	22.6	6.2	57.9
Carroll	Gastrointestinal	14	79.2	43.3	132.9
Carroll	Genitourinary	26	147.1	96.1	215.5
Carroll	Musculoskeletal	6	33.9	12.5	73.9

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Carroll	Chromosomal	1	5.7	0.1	31.5
Carter	Total Cases	177	579.0	496.8	670.9
Carter	Central Nervous System	4	13.1	3.6	33.5
Carter	Eye and Ear	3	9.8	2.0	28.7
Carter	Cardiovascular	98	320.6	260.2	390.7
Carter	Orofacial	9	29.4	13.5	55.9
Carter	Gastrointestinal	30	98.1	66.2	140.1
Carter	Genitourinary	38	124.3	88.0	170.6
Carter	Musculoskeletal	7	22.9	9.2	47.2
Carter	Chromosomal	2	6.5	0.8	23.6
Cheatham	Total Cases	89	359.2	288.4	442.0
Cheatham	Central Nervous System	6	24.2	8.9	52.7
Cheatham	Eye and Ear	1	4.0	0.1	22.5
Cheatham	Cardiovascular	37	149.3	105.1	205.8
Cheatham	Orofacial	7	28.2	11.4	58.2
Cheatham	Gastrointestinal	15	60.5	33.9	99.8
Cheatham	Genitourinary	23	92.8	58.8	139.3
Cheatham	Musculoskeletal	6	24.2	8.9	52.7
Cheatham	Chromosomal	3	12.1	2.5	35.4
Chester	Total Cases	29	315.6	211.3	453.2
Chester	Central Nervous System	1	10.9	0.3	60.6
Chester	Cardiovascular	18	195.9	116.1	309.6
Chester	Orofacial	1	10.9	0.3	60.6
Chester	Gastrointestinal	1	10.9	0.3	60.6
Chester	Genitourinary	5	54.4	17.7	127.0
Chester	Musculoskeletal	4	43.5	11.9	111.4
Chester	Chromosomal	2	21.8	2.6	78.6
Claiborne	Total Cases	55	307.6	231.7	400.4
Claiborne	Central Nervous System	3	16.8	3.5	49.0
Claiborne	Eye and Ear	1	5.6	0.1	31.2
Claiborne	Cardiovascular	20	111.9	68.3	172.8
Claiborne	Orofacial	4	22.4	6.1	57.3
Claiborne	Gastrointestinal	14	78.3	42.8	131.4
Claiborne	Genitourinary	14	78.3	42.8	131.4
Claiborne	Musculoskeletal	1	5.6	0.1	31.2
Claiborne	Chromosomal	2	11.2	1.4	40.4
Clay	Total Cases	22	458.3	287.2	693.9
Clay	Cardiovascular	8	166.7	72.0	328.4

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Clay	Orofacial	2	41.7	5.1	150.5
Clay	Gastrointestinal	12	250.0	129.2	436.7
Clay	Genitourinary	1	20.8	0.5	116.1
Cocke	Total Cases	78	364.5	288.1	454.9
Cocke	Central Nervous System	4	18.7	5.1	47.9
Cocke	Eye and Ear	1	4.7	0.1	26.0
Cocke	Cardiovascular	37	172.9	121.7	238.3
Cocke	Orofacial	4	18.7	5.1	47.9
Cocke	Gastrointestinal	18	84.1	49.9	132.9
Cocke	Genitourinary	16	74.8	42.7	121.4
Cocke	Musculoskeletal	4	18.7	5.1	47.9
Cocke	Chromosomal	3	14.0	2.9	41.0
Coffee	Total Cases	131	360.8	301.6	428.1
Coffee	Central Nervous System	9	24.8	11.3	47.1
Coffee	Eye and Ear	1	2.8	0.1	15.3
Coffee	Cardiovascular	40	110.2	78.7	150.0
Coffee	Orofacial	10	27.5	13.2	50.7
Coffee	Gastrointestinal	36	99.1	69.4	137.3
Coffee	Genitourinary	32	88.1	60.3	124.4
Coffee	Musculoskeletal	7	19.3	7.8	39.7
Coffee	Chromosomal	6	16.5	6.1	36.0
Crockett	Total Cases	35	370.4	258.0	515.1
Crockett	Central Nervous System	4	42.3	11.5	108.4
Crockett	Eye and Ear	2	21.2	2.6	76.5
Crockett	Cardiovascular	16	169.3	96.8	275.0
Crockett	Orofacial	1	10.6	0.3	59.0
Crockett	Gastrointestinal	8	84.7	36.6	166.8
Crockett	Genitourinary	4	42.3	11.5	108.4
Crockett	Musculoskeletal	4	42.3	11.5	108.4
Crockett	Chromosomal	1	10.6	0.3	59.0
Cumberland	Total Cases	103	382.9	312.5	464.4
Cumberland	Central Nervous System	5	18.6	6.0	43.4
Cumberland	Cardiovascular	39	145.0	103.1	198.2
Cumberland	Orofacial	15	55.8	31.2	92.0
Cumberland	Gastrointestinal	31	115.2	78.3	163.6
Cumberland	Genitourinary	23	85.5	54.2	128.3
Cumberland	Musculoskeletal	4	14.9	4.1	38.1
Cumberland	Chromosomal	3	11.2	2.3	32.6

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Davidson	Total Cases	1,623	334.8	318.8	351.5
Davidson	Central Nervous System	92	19.0	15.3	23.3
Davidson	Eye and Ear	23	4.7	3.0	7.1
Davidson	Cardiovascular	684	141.1	130.7	152.1
Davidson	Orofacial	101	20.8	17.0	25.3
Davidson	Gastrointestinal	219	45.2	39.4	51.6
Davidson	Genitourinary	487	100.5	91.8	109.8
Davidson	Musculoskeletal	107	22.1	18.1	26.7
Davidson	Chromosomal	94	19.4	15.7	23.7
Decatur	Total Cases	19	288.8	173.9	450.9
Decatur	Central Nervous System	5	76.0	24.7	177.3
Decatur	Cardiovascular	1	15.2	0.4	84.7
Decatur	Gastrointestinal	5	76.0	24.7	177.3
Decatur	Genitourinary	10	152.0	72.9	279.5
Dekalb	Total Cases	40	309.6	221.2	421.6
Dekalb	Central Nervous System	2	15.5	1.9	55.9
Dekalb	Cardiovascular	14	108.4	59.2	181.8
Dekalb	Orofacial	2	15.5	1.9	55.9
Dekalb	Gastrointestinal	10	77.4	37.1	142.3
Dekalb	Genitourinary	10	77.4	37.1	142.3
Dekalb	Musculoskeletal	6	46.4	17.0	101.1
Dekalb	Chromosomal	2	15.5	1.9	55.9
Dickson	Total Cases	124	364.3	303.0	434.3
Dickson	Central Nervous System	5	14.7	4.8	34.3
Dickson	Cardiovascular	51	149.8	111.6	197.0
Dickson	Orofacial	5	14.7	4.8	34.3
Dickson	Gastrointestinal	24	70.5	45.2	104.9
Dickson	Genitourinary	40	117.5	84.0	160.0
Dickson	Musculoskeletal	9	26.4	12.1	50.2
Dickson	Chromosomal	4	11.8	3.2	30.1
Dyer	Total Cases	98	377.9	306.8	460.6
Dyer	Central Nervous System	3	11.6	2.4	33.8
Dyer	Eye and Ear	3	11.6	2.4	33.8
Dyer	Cardiovascular	36	138.8	97.2	192.2
Dyer	Orofacial	4	15.4	4.2	39.5
Dyer	Gastrointestinal	21	81.0	50.1	123.8
Dyer	Genitourinary	18	69.4	41.1	109.7
Dyer	Musculoskeletal	13	50.1	26.7	85.7

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Dyer	Chromosomal	2	7.7	0.9	27.9
Fayette	Total Cases	73	306.9	240.5	385.8
Fayette	Central Nervous System	7	29.4	11.8	60.6
Fayette	Cardiovascular	37	155.5	109.5	214.4
Fayette	Orofacial	4	16.8	4.6	43.1
Fayette	Gastrointestinal	14	58.8	32.2	98.7
Fayette	Genitourinary	16	67.3	38.4	109.2
Fayette	Musculoskeletal	3	12.6	2.6	36.9
Fayette	Chromosomal	5	21.0	6.8	49.1
Fentress	Total Cases	40	388.7	277.7	529.3
Fentress	Central Nervous System	5	48.6	15.8	113.4
Fentress	Cardiovascular	16	155.5	88.9	252.5
Fentress	Orofacial	2	19.4	2.4	70.2
Fentress	Gastrointestinal	9	87.5	40.0	166.0
Fentress	Genitourinary	10	97.2	46.6	178.7
Fentress	Musculoskeletal	3	29.2	6.0	85.2
Fentress	Chromosomal	2	19.4	2.4	70.2
Franklin	Total Cases	77	353.5	279.0	441.9
Franklin	Central Nervous System	2	9.2	1.1	33.2
Franklin	Eye and Ear	1	4.6	0.1	25.6
Franklin	Cardiovascular	40	183.7	131.2	250.1
Franklin	Orofacial	4	18.4	5.0	47.0
Franklin	Gastrointestinal	10	45.9	22.0	84.4
Franklin	Genitourinary	15	68.9	38.6	113.6
Franklin	Musculoskeletal	9	41.3	18.9	78.4
Franklin	Chromosomal	1	4.6	0.1	25.6
Gibson	Total Cases	107	342.6	280.8	414.0
Gibson	Central Nervous System	5	16.0	5.2	37.4
Gibson	Cardiovascular	52	166.5	124.4	218.4
Gibson	Orofacial	10	32.0	15.4	58.9
Gibson	Gastrointestinal	23	73.6	46.7	110.5
Gibson	Genitourinary	22	70.4	44.2	106.7
Gibson	Musculoskeletal	3	9.6	2.0	28.1
Gibson	Chromosomal	2	6.4	0.8	23.1
Giles	Total Cases	42	248.1	178.8	335.3
Giles	Central Nervous System	4	23.6	6.4	60.5
Giles	Eye and Ear	2	11.8	1.4	42.7

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Giles	Cardiovascular	16	94.5	54.0	153.5
Giles	Orofacial	1	5.9	0.2	32.9
Giles	Gastrointestinal	11	65.0	32.4	116.3
Giles	Genitourinary	9	53.2	24.3	100.9
Giles	Musculoskeletal	1	5.9	0.2	32.9
Giles	Chromosomal	5	29.5	9.6	68.9
Grainger	Total Cases	53	403.3	302.2	527.6
Grainger	Central Nervous System	4	30.4	8.3	77.9
Grainger	Eye and Ear	1	7.6	0.2	42.4
Grainger	Cardiovascular	23	175.0	111.0	262.6
Grainger	Orofacial	3	22.8	4.7	66.7
Grainger	Gastrointestinal	10	76.1	36.5	140.0
Grainger	Genitourinary	11	83.7	41.8	149.8
Grainger	Musculoskeletal	3	22.8	4.7	66.7
Grainger	Chromosomal	3	22.8	4.7	66.7
Greene	Total Cases	142	391.0	329.3	460.8
Greene	Central Nervous System	11	30.3	15.1	54.2
Greene	Eye and Ear	2	5.5	0.7	19.9
Greene	Cardiovascular	86	236.8	189.4	292.4
Greene	Orofacial	14	38.5	21.1	64.7
Greene	Gastrointestinal	17	46.8	27.3	74.9
Greene	Genitourinary	23	63.3	40.1	95.0
Greene	Musculoskeletal	9	24.8	11.3	47.0
Greene	Chromosomal	4	11.0	3.0	28.2
Grundy	Total Cases	25	272.0	176.0	401.6
Grundy	Cardiovascular	10	108.8	52.2	200.1
Grundy	Gastrointestinal	6	65.3	24.0	142.1
Grundy	Genitourinary	8	87.1	37.6	171.5
Grundy	Musculoskeletal	3	32.6	6.7	95.4
Grundy	Chromosomal	3	32.6	6.7	95.4
Hamblen	Total Cases	155	354.0	300.4	414.3
Hamblen	Central Nervous System	8	18.3	7.9	36.0
Hamblen	Cardiovascular	67	153.0	118.6	194.3
Hamblen	Orofacial	8	18.3	7.9	36.0
Hamblen	Gastrointestinal	30	68.5	46.2	97.8
Hamblen	Genitourinary	31	70.8	48.1	100.5
Hamblen	Musculoskeletal	14	32.0	17.5	53.6
Hamblen	Chromosomal	9	20.6	9.4	39.0
Hamilton	Total Cases	659	316.0	292.3	341.1

**Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories
2004-2008**

County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Hamilton	Central Nervous System	57	27.3	20.7	35.4
Hamilton	Eye and Ear	5	2.4	0.8	5.6
Hamilton	Cardiovascular	258	123.7	109.1	139.8
Hamilton	Orofacial	44	21.1	15.3	28.3
Hamilton	Gastrointestinal	100	47.9	39.0	58.3
Hamilton	Genitourinary	172	82.5	70.6	95.8
Hamilton	Musculoskeletal	48	23.0	17.0	30.5
Hamilton	Chromosomal	40	19.2	13.7	26.1
Hancock	Total Cases	15	355.5	199.0	586.2
Hancock	Central Nervous System	1	23.7	0.6	132.0
Hancock	Eye and Ear	1	23.7	0.6	132.0
Hancock	Cardiovascular	5	118.5	38.5	276.5
Hancock	Orofacial	2	47.4	5.7	171.2
Hancock	Gastrointestinal	3	71.1	14.7	207.8
Hancock	Genitourinary	4	94.8	25.8	242.7
Hancock	Musculoskeletal	2	47.4	5.7	171.2
Hancock	Chromosomal	1	23.7	0.6	132.0
Hardeman	Total Cases	54	323.4	242.9	421.9
Hardeman	Central Nervous System	3	18.0	3.7	52.5
Hardeman	Cardiovascular	34	203.6	141.0	284.5
Hardeman	Orofacial	2	12.0	1.5	43.3
Hardeman	Gastrointestinal	4	24.0	6.5	61.3
Hardeman	Genitourinary	7	41.9	16.9	86.4
Hardeman	Musculoskeletal	4	24.0	6.5	61.3
Hardeman	Chromosomal	3	18.0	3.7	52.5
Hardin	Total Cases	57	394.5	298.8	511.1
Hardin	Central Nervous System	7	48.4	19.5	99.8
Hardin	Cardiovascular	23	159.2	100.9	238.8
Hardin	Orofacial	3	20.8	4.3	60.7
Hardin	Gastrointestinal	18	124.6	73.8	196.9
Hardin	Genitourinary	7	48.4	19.5	99.8
Hardin	Musculoskeletal	3	20.8	4.3	60.7
Hardin	Chromosomal	3	20.8	4.3	60.7
Hawkins	Total Cases	159	500.9	426.1	585.2
Hawkins	Central Nervous System	10	31.5	15.1	57.9
Hawkins	Eye and Ear	3	9.5	2.0	27.6
Hawkins	Cardiovascular	101	318.2	259.2	386.7
Hawkins	Orofacial	10	31.5	15.1	57.9

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Hawkins	Gastrointestinal	18	56.7	33.6	89.6
Hawkins	Genitourinary	16	50.4	28.8	81.9
Hawkins	Musculoskeletal	4	12.6	3.4	32.3
Hawkins	Chromosomal	6	18.9	6.9	41.2
Haywood	Total Cases	55	424.4	319.7	552.4
Haywood	Central Nervous System	5	38.6	12.5	90.0
Haywood	Cardiovascular	32	246.9	168.9	348.6
Haywood	Orofacial	7	54.0	21.7	111.3
Haywood	Gastrointestinal	8	61.7	26.7	121.6
Haywood	Genitourinary	7	54.0	21.7	111.3
Haywood	Chromosomal	1	7.7	0.2	43.0
Henderson	Total Cases	71	381.5	298.0	481.2
Henderson	Central Nervous System	3	16.1	3.3	47.1
Henderson	Eye and Ear	2	10.7	1.3	38.8
Henderson	Cardiovascular	33	177.3	122.1	249.0
Henderson	Orofacial	4	21.5	5.9	55.0
Henderson	Gastrointestinal	12	64.5	33.3	112.6
Henderson	Genitourinary	15	80.6	45.1	132.9
Henderson	Musculoskeletal	4	21.5	5.9	55.0
Henderson	Chromosomal	1	5.4	0.1	29.9
Henry	Total Cases	65	342.8	264.6	437.0
Henry	Central Nervous System	7	36.9	14.9	76.1
Henry	Eye and Ear	2	10.5	1.3	38.1
Henry	Cardiovascular	23	121.3	76.9	182.0
Henry	Orofacial	3	15.8	3.3	46.2
Henry	Gastrointestinal	16	84.4	48.2	137.0
Henry	Genitourinary	17	89.7	52.2	143.6
Henry	Musculoskeletal	1	5.3	0.1	29.4
Henry	Chromosomal	3	15.8	3.3	46.2
Hickman	Total Cases	50	364.7	270.7	480.8
Hickman	Central Nervous System	1	7.3	0.2	40.6
Hickman	Eye and Ear	1	7.3	0.2	40.6
Hickman	Cardiovascular	11	80.2	40.1	143.6
Hickman	Orofacial	1	7.3	0.2	40.6
Hickman	Gastrointestinal	19	138.6	83.4	216.4
Hickman	Genitourinary	13	94.8	50.5	162.1
Hickman	Musculoskeletal	6	43.8	16.1	95.3
Hickman	Chromosomal	3	21.9	4.5	64.0

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Houston	Total Cases	14	272.4	148.9	457.0
Houston	Cardiovascular	6	116.7	42.8	254.1
Houston	Gastrointestinal	4	77.8	21.2	199.3
Houston	Genitourinary	3	58.4	12.0	170.6
Houston	Chromosomal	1	19.5	0.5	108.4
Humphreys	Total Cases	38	354.8	251.1	487.0
Humphreys	Central Nervous System	4	37.3	10.2	95.6
Humphreys	Cardiovascular	13	121.4	64.6	207.6
Humphreys	Orofacial	1	9.3	0.2	52.0
Humphreys	Gastrointestinal	3	28.0	5.8	81.9
Humphreys	Genitourinary	13	121.4	64.6	207.6
Humphreys	Musculoskeletal	3	28.0	5.8	81.9
Humphreys	Chromosomal	1	9.3	0.2	52.0
Jackson	Total Cases	18	332.1	196.8	524.9
Jackson	Cardiovascular	11	203.0	101.3	363.1
Jackson	Orofacial	2	36.9	4.5	133.3
Jackson	Gastrointestinal	4	73.8	20.1	189.0
Jackson	Musculoskeletal	2	36.9	4.5	133.3
Jackson	Chromosomal	1	18.5	0.5	102.8
Jefferson	Total Cases	118	406.9	336.8	487.3
Jefferson	Central Nervous System	9	31.0	14.2	58.9
Jefferson	Eye and Ear	2	6.9	0.8	24.9
Jefferson	Cardiovascular	52	179.3	133.9	235.2
Jefferson	Orofacial	7	24.1	9.7	49.7
Jefferson	Gastrointestinal	26	89.7	58.6	131.4
Jefferson	Genitourinary	26	89.7	58.6	131.4
Jefferson	Musculoskeletal	12	41.4	21.4	72.3
Jefferson	Chromosomal	3	10.3	2.1	30.2
Johnson	Total Cases	36	408.6	286.2	565.7
Johnson	Central Nervous System	1	11.4	0.3	63.2
Johnson	Cardiovascular	23	261.1	165.5	391.7
Johnson	Orofacial	2	22.7	2.8	82.0
Johnson	Gastrointestinal	7	79.5	32.0	163.7
Johnson	Genitourinary	5	56.8	18.4	132.5
Knox	Total Cases	890	338.0	316.2	361.0
Knox	Central Nervous System	45	17.1	12.5	22.9
Knox	Eye and Ear	5	1.9	0.6	4.4
Knox	Cardiovascular	410	155.7	141.0	171.6

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Knox	Orofacial	54	20.5	15.4	26.8
Knox	Gastrointestinal	119	45.2	37.4	54.1
Knox	Genitourinary	254	96.5	85.0	109.1
Knox	Musculoskeletal	57	21.6	16.4	28.1
Knox	Chromosomal	41	15.6	11.2	21.1
Lake	Total Cases	15	424.9	237.8	700.8
Lake	Cardiovascular	6	170.0	62.4	370.0
Lake	Orofacial	1	28.3	0.7	157.8
Lake	Gastrointestinal	5	141.6	46.0	330.6
Lake	Genitourinary	4	113.3	30.9	290.1
Lake	Chromosomal	1	28.3	0.7	157.8
Lauderdale	Total Cases	45	243.6	177.7	326.0
Lauderdale	Central Nervous System	2	10.8	1.3	39.1
Lauderdale	Eye and Ear	1	5.4	0.1	30.2
Lauderdale	Cardiovascular	20	108.3	66.1	167.2
Lauderdale	Orofacial	2	10.8	1.3	39.1
Lauderdale	Gastrointestinal	10	54.1	26.0	99.6
Lauderdale	Genitourinary	9	48.7	22.3	92.5
Lauderdale	Musculoskeletal	2	10.8	1.3	39.1
Lauderdale	Chromosomal	3	16.2	3.4	47.5
Lawrence	Total Cases	93	322.7	260.5	395.3
Lawrence	Central Nervous System	3	10.4	2.2	30.4
Lawrence	Cardiovascular	30	104.1	70.2	148.6
Lawrence	Orofacial	7	24.3	9.8	50.0
Lawrence	Gastrointestinal	21	72.9	45.1	111.4
Lawrence	Genitourinary	29	100.6	67.4	144.5
Lawrence	Musculoskeletal	5	17.3	5.6	40.5
Lawrence	Chromosomal	7	24.3	9.8	50.0
Lewis	Total Cases	23	301.8	191.3	452.9
Lewis	Cardiovascular	8	105.0	45.3	206.9
Lewis	Orofacial	3	39.4	8.1	115.1
Lewis	Gastrointestinal	4	52.5	14.3	134.4
Lewis	Genitourinary	5	65.6	21.3	153.1
Lewis	Musculoskeletal	4	52.5	14.3	134.4
Lewis	Chromosomal	2	26.2	3.2	94.8
Lincoln	Total Cases	55	256.2	193.0	333.4
Lincoln	Central Nervous System	5	23.3	7.6	54.4
Lincoln	Cardiovascular	28	130.4	86.7	188.5
Lincoln	Orofacial	7	32.6	13.1	67.2

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Lincoln	Gastrointestinal	7	32.6	13.1	67.2
Lincoln	Genitourinary	10	46.6	22.3	85.7
Lincoln	Musculoskeletal	3	14.0	2.9	40.8
Lincoln	Chromosomal	4	18.6	5.1	47.7
Loudon	Total Cases	101	387.6	315.7	470.9
Loudon	Central Nervous System	4	15.3	4.2	39.3
Loudon	Cardiovascular	35	134.3	93.5	186.8
Loudon	Orofacial	10	38.4	18.4	70.6
Loudon	Gastrointestinal	16	61.4	35.1	99.7
Loudon	Genitourinary	31	119.0	80.8	168.9
Loudon	Musculoskeletal	7	26.9	10.8	55.3
Loudon	Chromosomal	9	34.5	15.8	65.6
McMinn	Total Cases	106	344.7	282.2	416.9
McMinn	Central Nervous System	16	52.0	29.7	84.5
McMinn	Eye and Ear	1	3.3	0.1	18.1
McMinn	Cardiovascular	32	104.1	71.2	146.9
McMinn	Orofacial	7	22.8	9.2	46.9
McMinn	Gastrointestinal	25	81.3	52.6	120.0
McMinn	Genitourinary	20	65.0	39.7	100.5
McMinn	Musculoskeletal	12	39.0	20.2	68.2
McMinn	Chromosomal	6	19.5	7.2	42.5
McNairy	Total Cases	56	360.4	272.2	468.0
McNairy	Central Nervous System	3	19.3	4.0	56.4
McNairy	Eye and Ear	1	6.4	0.2	35.9
McNairy	Cardiovascular	24	154.4	99.0	229.8
McNairy	Orofacial	4	25.7	7.0	65.9
McNairy	Gastrointestinal	10	64.4	30.9	118.3
McNairy	Genitourinary	11	70.8	35.3	126.7
McNairy	Musculoskeletal	5	32.2	10.5	75.1
McNairy	Chromosomal	4	25.7	7.0	65.9
Macon	Total Cases	40	276.1	197.2	375.9
Macon	Central Nervous System	3	20.7	4.3	60.5
Macon	Cardiovascular	17	117.3	68.3	187.8
Macon	Orofacial	3	20.7	4.3	60.5
Macon	Gastrointestinal	10	69.0	33.1	126.9
Macon	Genitourinary	7	48.3	19.4	99.5
Macon	Musculoskeletal	2	13.8	1.7	49.9
Macon	Chromosomal	5	34.5	11.2	80.5

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Madison	Total Cases	229	328.9	287.7	374.4
Madison	Central Nervous System	15	21.5	12.1	35.5
Madison	Eye and Ear	4	5.7	1.6	14.7
Madison	Cardiovascular	122	175.2	145.5	209.2
Madison	Orofacial	9	12.9	5.9	24.5
Madison	Gastrointestinal	31	44.5	30.3	63.2
Madison	Genitourinary	51	73.2	54.5	96.3
Madison	Musculoskeletal	8	11.5	5.0	22.6
Madison	Chromosomal	14	20.1	11.0	33.7
Marion	Total Cases	56	335.5	253.5	435.7
Marion	Central Nervous System	6	35.9	13.2	78.3
Marion	Eye and Ear	1	6.0	0.2	33.4
Marion	Cardiovascular	23	137.8	87.4	206.8
Marion	Orofacial	2	12.0	1.5	43.3
Marion	Gastrointestinal	12	71.9	37.2	125.6
Marion	Genitourinary	18	107.8	63.9	170.4
Marion	Musculoskeletal	3	18.0	3.7	52.5
Marion	Chromosomal	3	18.0	3.7	52.5
Marshall	Total Cases	70	357.0	278.3	451.0
Marshall	Central Nervous System	7	35.7	14.4	73.6
Marshall	Cardiovascular	16	81.6	46.6	132.5
Marshall	Orofacial	4	20.4	5.6	52.2
Marshall	Gastrointestinal	16	81.6	46.6	132.5
Marshall	Genitourinary	24	122.4	78.4	182.1
Marshall	Musculoskeletal	6	30.6	11.2	66.6
Marshall	Chromosomal	4	20.4	5.6	52.2
Maury	Total Cases	190	344.8	297.5	397.4
Maury	Central Nervous System	20	36.3	22.2	56.1
Maury	Cardiovascular	59	107.1	81.5	138.1
Maury	Orofacial	9	16.3	7.5	31.0
Maury	Gastrointestinal	45	81.7	59.6	109.3
Maury	Genitourinary	60	108.9	83.1	140.1
Maury	Musculoskeletal	16	29.0	16.6	47.2
Maury	Chromosomal	5	9.1	3.0	21.2
Meigs	Total Cases	20	310.6	189.7	479.6
Meigs	Central Nervous System	3	46.6	9.6	136.1
Meigs	Cardiovascular	5	77.6	25.2	181.2
Meigs	Gastrointestinal	6	93.2	34.2	202.8

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Meigs	Genitourinary	5	77.6	25.2	181.2
Meigs	Chromosomal	1	15.5	0.4	86.5
Monroe	Total Cases	103	375.1	306.2	454.9
Monroe	Central Nervous System	10	36.4	17.5	67.0
Monroe	Eye and Ear	3	10.9	2.3	31.9
Monroe	Cardiovascular	40	145.7	104.1	198.4
Monroe	Orofacial	7	25.5	10.3	52.5
Monroe	Gastrointestinal	19	69.2	41.7	108.1
Monroe	Genitourinary	27	98.3	64.8	143.1
Monroe	Musculoskeletal	6	21.8	8.0	47.6
Monroe	Chromosomal	5	18.2	5.9	42.5
Montgomery	Total Cases	405	293.5	265.7	323.6
Montgomery	Central Nervous System	25	18.1	11.7	26.8
Montgomery	Eye and Ear	4	2.9	0.8	7.4
Montgomery	Cardiovascular	187	135.5	116.8	156.4
Montgomery	Orofacial	26	18.8	12.3	27.6
Montgomery	Gastrointestinal	75	54.4	42.8	68.1
Montgomery	Genitourinary	94	68.1	55.1	83.4
Montgomery	Musculoskeletal	24	17.4	11.2	25.9
Montgomery	Chromosomal	22	15.9	10.0	24.1
Moore	Total Cases	11	387.3	193.4	693.0
Moore	Cardiovascular	3	105.6	21.8	308.7
Moore	Orofacial	2	70.4	8.5	254.4
Moore	Gastrointestinal	2	70.4	8.5	254.4
Moore	Genitourinary	3	105.6	21.8	308.7
Moore	Musculoskeletal	1	35.2	0.9	196.2
Moore	Chromosomal	2	70.4	8.5	254.4
Morgan	Total Cases	54	476.2	357.7	621.3
Morgan	Central Nervous System	2	17.6	2.1	63.7
Morgan	Eye and Ear	1	8.8	0.2	49.1
Morgan	Cardiovascular	16	141.1	80.7	229.1
Morgan	Orofacial	4	35.3	9.6	90.3
Morgan	Gastrointestinal	10	88.2	42.3	162.2
Morgan	Genitourinary	20	176.4	107.7	272.4
Morgan	Musculoskeletal	3	26.5	5.5	77.3
Morgan	Chromosomal	2	17.6	2.1	63.7
Obion	Total Cases	59	307.8	234.3	397.0
Obion	Central Nervous System	5	26.1	8.5	60.9

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Obion	Cardiovascular	31	161.7	109.9	229.5
Obion	Orofacial	1	5.2	0.1	29.1
Obion	Gastrointestinal	10	52.2	25.0	95.9
Obion	Genitourinary	10	52.2	25.0	95.9
Obion	Musculoskeletal	6	31.3	11.5	68.1
Obion	Chromosomal	1	5.2	0.1	29.1
Overton	Total Cases	45	355.2	259.1	475.3
Overton	Central Nervous System	5	39.5	12.8	92.1
Overton	Cardiovascular	12	94.7	48.9	165.4
Overton	Orofacial	7	55.2	22.2	113.8
Overton	Gastrointestinal	8	63.1	27.3	124.4
Overton	Genitourinary	9	71.0	32.5	134.8
Overton	Musculoskeletal	5	39.5	12.8	92.1
Overton	Chromosomal	2	15.8	1.9	57.0
Perry	Total Cases	13	278.4	148.2	476.0
Perry	Central Nervous System	1	21.4	0.5	119.3
Perry	Eye and Ear	1	21.4	0.5	119.3
Perry	Cardiovascular	4	85.7	23.3	219.3
Perry	Gastrointestinal	2	42.8	5.2	154.7
Perry	Genitourinary	3	64.2	13.3	187.7
Perry	Musculoskeletal	2	42.8	5.2	154.7
Perry	Chromosomal	1	21.4	0.5	119.3
Pickett	Total Cases	12	434.8	224.7	759.5
Pickett	Cardiovascular	5	181.2	58.8	422.8
Pickett	Orofacial	2	72.5	8.8	261.8
Pickett	Gastrointestinal	4	144.9	39.5	371.1
Pickett	Genitourinary	3	108.7	22.4	317.7
Pickett	Musculoskeletal	2	72.5	8.8	261.8
Polk	Total Cases	25	266.5	172.5	393.4
Polk	Central Nervous System	2	21.3	2.6	77.0
Polk	Cardiovascular	7	74.6	30.0	153.8
Polk	Orofacial	1	10.7	0.3	59.4
Polk	Gastrointestinal	8	85.3	36.8	168.1
Polk	Genitourinary	5	53.3	17.3	124.4
Polk	Musculoskeletal	2	21.3	2.6	77.0
Putnam	Total Cases	140	296.9	249.8	350.4
Putnam	Central Nervous System	11	23.3	11.7	41.7
Putnam	Eye and Ear	2	4.2	0.5	15.3

**Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories
2004-2008**

County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Putnam	Cardiovascular	51	108.2	80.5	142.2
Putnam	Orofacial	9	19.1	8.7	36.2
Putnam	Gastrointestinal	38	80.6	57.0	110.6
Putnam	Genitourinary	26	55.1	36.0	80.8
Putnam	Musculoskeletal	11	23.3	11.7	41.7
Putnam	Chromosomal	6	12.7	4.7	27.7
Rhea	Total Cases	64	305.5	235.3	390.1
Rhea	Central Nervous System	3	14.3	3.0	41.9
Rhea	Eye and Ear	2	9.5	1.2	34.5
Rhea	Cardiovascular	25	119.3	77.2	176.2
Rhea	Orofacial	4	19.1	5.2	48.9
Rhea	Gastrointestinal	18	85.9	50.9	135.8
Rhea	Genitourinary	10	47.7	22.9	87.8
Rhea	Musculoskeletal	7	33.4	13.4	68.8
Rhea	Chromosomal	2	9.5	1.2	34.5
Roane	Total Cases	107	398.2	326.3	481.2
Roane	Central Nervous System	10	37.2	17.9	68.4
Roane	Eye and Ear	1	3.7	0.1	20.7
Roane	Cardiovascular	37	137.7	97.0	189.8
Roane	Orofacial	9	33.5	15.3	63.6
Roane	Gastrointestinal	20	74.4	45.5	115.0
Roane	Genitourinary	27	100.5	66.2	146.2
Roane	Musculoskeletal	9	33.5	15.3	63.6
Roane	Chromosomal	8	29.8	12.9	58.7
Robertson	Total Cases	153	297.1	251.9	348.1
Robertson	Central Nervous System	5	9.7	3.2	22.7
Robertson	Eye and Ear	1	1.9	0.1	10.8
Robertson	Cardiovascular	65	126.2	97.4	160.9
Robertson	Orofacial	16	31.1	17.8	50.5
Robertson	Gastrointestinal	25	48.6	31.4	71.7
Robertson	Genitourinary	36	69.9	49.0	96.8
Robertson	Musculoskeletal	13	25.2	13.4	43.2
Robertson	Chromosomal	8	15.5	6.7	30.6
Rutherford	Total Cases	552	298.1	273.8	324.0
Rutherford	Central Nervous System	34	18.4	12.7	25.7
Rutherford	Eye and Ear	6	3.2	1.2	7.1
Rutherford	Cardiovascular	214	115.6	100.6	132.1
Rutherford	Orofacial	35	18.9	13.2	26.3
Rutherford	Gastrointestinal	75	40.5	31.9	50.8

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Rutherford	Genitourinary	197	106.4	92.1	122.3
Rutherford	Musculoskeletal	29	15.7	10.5	22.5
Rutherford	Chromosomal	27	14.6	9.6	21.2
Scott	Total Cases	61	392.5	300.3	504.2
Scott	Central Nervous System	4	25.7	7.0	65.9
Scott	Cardiovascular	23	148.0	93.8	222.1
Scott	Orofacial	5	32.2	10.5	75.1
Scott	Gastrointestinal	14	90.1	49.3	151.2
Scott	Genitourinary	16	103.0	58.9	167.2
Scott	Musculoskeletal	7	45.0	18.1	92.8
Scott	Chromosomal	4	25.7	7.0	65.9
Sequatchie	Total Cases	33	375.9	258.7	527.9
Sequatchie	Central Nervous System	3	34.2	7.1	99.9
Sequatchie	Eye and Ear	1	11.4	0.3	63.5
Sequatchie	Cardiovascular	13	148.1	78.8	253.2
Sequatchie	Orofacial	1	11.4	0.3	63.5
Sequatchie	Gastrointestinal	7	79.7	32.1	164.3
Sequatchie	Genitourinary	10	113.9	54.6	209.5
Sequatchie	Musculoskeletal	2	22.8	2.8	82.3
Sequatchie	Chromosomal	1	11.4	0.3	63.5
Sevier	Total Cases	182	338.3	290.9	391.2
Sevier	Central Nervous System	11	20.4	10.2	36.6
Sevier	Eye and Ear	2	3.7	0.5	13.4
Sevier	Cardiovascular	72	133.8	104.7	168.5
Sevier	Orofacial	10	18.6	8.9	34.2
Sevier	Gastrointestinal	41	76.2	54.7	103.4
Sevier	Genitourinary	49	91.1	67.4	120.4
Sevier	Musculoskeletal	7	13.0	5.2	26.8
Sevier	Chromosomal	10	18.6	8.9	34.2
Shelby	Total Cases	2,529	340.9	327.8	354.5
Shelby	Central Nervous System	210	28.3	24.6	32.4
Shelby	Eye and Ear	41	5.5	4.0	7.5
Shelby	Cardiovascular	1,382	186.3	176.6	196.4
Shelby	Orofacial	100	13.5	11.0	16.4
Shelby	Gastrointestinal	290	39.1	34.7	43.9
Shelby	Genitourinary	508	68.5	62.7	74.7
Shelby	Musculoskeletal	144	19.4	16.4	22.9
Shelby	Chromosomal	122	16.4	13.7	19.6

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Smith	Total Cases	32	275.9	188.7	389.4
Smith	Central Nervous System	2	17.2	2.1	62.3
Smith	Cardiovascular	14	120.7	66.0	202.5
Smith	Orofacial	1	8.6	0.2	48.0
Smith	Gastrointestinal	10	86.2	41.3	158.5
Smith	Genitourinary	6	51.7	19.0	112.6
Smith	Chromosomal	1	8.6	0.2	48.0
Stewart	Total Cases	30	434.8	293.4	620.7
Stewart	Central Nervous System	1	14.5	0.4	80.8
Stewart	Eye and Ear	1	14.5	0.4	80.8
Stewart	Cardiovascular	15	217.4	121.7	358.5
Stewart	Orofacial	1	14.5	0.4	80.8
Stewart	Gastrointestinal	5	72.5	23.5	169.1
Stewart	Genitourinary	6	87.0	31.9	189.3
Stewart	Musculoskeletal	1	14.5	0.4	80.8
Stewart	Chromosomal	1	14.5	0.4	80.8
Sullivan	Total Cases	442	531.3	482.9	583.2
Sullivan	Central Nervous System	33	39.7	27.3	55.7
Sullivan	Eye and Ear	7	8.4	3.4	17.3
Sullivan	Cardiovascular	253	304.1	267.8	344.0
Sullivan	Orofacial	18	21.6	12.8	34.2
Sullivan	Gastrointestinal	65	78.1	60.3	99.6
Sullivan	Genitourinary	77	92.6	73.1	115.7
Sullivan	Musculoskeletal	20	24.0	14.7	37.1
Sullivan	Chromosomal	16	19.2	11.0	31.2
Sumner	Total Cases	323	322.7	288.5	359.9
Sumner	Central Nervous System	19	19.0	11.4	29.6
Sumner	Eye and Ear	3	3.0	0.6	8.8
Sumner	Cardiovascular	140	139.9	117.7	165.1
Sumner	Orofacial	24	24.0	15.4	35.7
Sumner	Gastrointestinal	74	73.9	58.1	92.8
Sumner	Genitourinary	81	80.9	64.3	100.6
Sumner	Musculoskeletal	19	19.0	11.4	29.6
Sumner	Chromosomal	13	13.0	6.9	22.2
Tipton	Total Cases	130	334.0	279.1	396.6
Tipton	Central Nervous System	8	20.6	8.9	40.5
Tipton	Eye and Ear	1	2.6	0.1	14.3
Tipton	Cardiovascular	64	164.4	126.6	210.0

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Tipton	Orofacial	3	7.7	1.6	22.5
Tipton	Gastrointestinal	20	51.4	31.4	79.4
Tipton	Genitourinary	29	74.5	49.9	107.0
Tipton	Musculoskeletal	10	25.7	12.3	47.3
Tipton	Chromosomal	5	12.8	4.2	30.0
Trousdale	Total Cases	13	280.8	149.5	480.1
Trousdale	Central Nervous System	3	64.8	13.4	189.4
Trousdale	Cardiovascular	3	64.8	13.4	189.4
Trousdale	Gastrointestinal	2	43.2	5.2	156.0
Trousdale	Genitourinary	4	86.4	23.5	221.2
Trousdale	Musculoskeletal	1	21.6	0.6	120.3
Unicoi	Total Cases	52	559.1	417.6	733.3
Unicoi	Central Nervous System	2	21.5	2.6	77.7
Unicoi	Eye and Ear	1	10.8	0.3	59.9
Unicoi	Cardiovascular	20	215.1	131.4	332.1
Unicoi	Orofacial	5	53.8	17.5	125.5
Unicoi	Gastrointestinal	13	139.8	74.4	239.0
Unicoi	Genitourinary	7	75.3	30.3	155.1
Unicoi	Musculoskeletal	3	32.3	6.7	94.3
Unicoi	Chromosomal	2	21.5	2.6	77.7
Union	Total Cases	52	415.0	309.9	544.2
Union	Central Nervous System	4	31.9	8.7	81.7
Union	Cardiovascular	27	215.5	142.0	313.5
Union	Orofacial	5	39.9	13.0	93.1
Union	Gastrointestinal	8	63.8	27.6	125.8
Union	Genitourinary	9	71.8	32.9	136.4
Union	Chromosomal	3	23.9	4.9	70.0
Van Buren	Total Cases	6	209.1	76.7	455.0
Van Buren	Eye and Ear	1	34.8	0.9	194.1
Van Buren	Cardiovascular	1	34.8	0.9	194.1
Van Buren	Orofacial	1	34.8	0.9	194.1
Van Buren	Gastrointestinal	1	34.8	0.9	194.1
Van Buren	Musculoskeletal	2	69.7	8.4	251.7
Van Buren	Chromosomal	1	34.8	0.9	194.1
Warren	Total Cases	74	278.5	218.7	349.6
Warren	Central Nervous System	6	22.6	8.3	49.2
Warren	Cardiovascular	32	120.4	82.4	170.0
Warren	Orofacial	5	18.8	6.1	43.9

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Warren	Gastrointestinal	19	71.5	43.1	111.7
Warren	Genitourinary	12	45.2	23.3	78.9
Warren	Musculoskeletal	5	18.8	6.1	43.9
Warren	Chromosomal	3	11.3	2.3	33.0
Washington	Total Cases	305	447.7	398.8	500.8
Washington	Central Nervous System	17	25.0	14.5	40.0
Washington	Eye and Ear	2	2.9	0.4	10.6
Washington	Cardiovascular	172	252.5	216.1	293.1
Washington	Orofacial	14	20.5	11.2	34.5
Washington	Gastrointestinal	46	67.5	49.4	90.1
Washington	Genitourinary	59	86.6	65.9	111.7
Washington	Musculoskeletal	16	23.5	13.4	38.1
Washington	Chromosomal	8	11.7	5.1	23.1
Wayne	Total Cases	30	365.0	246.2	521.0
Wayne	Central Nervous System	1	12.2	0.3	67.8
Wayne	Cardiovascular	13	158.2	84.2	270.4
Wayne	Orofacial	1	12.2	0.3	67.8
Wayne	Gastrointestinal	7	85.2	34.2	175.5
Wayne	Genitourinary	9	109.5	50.1	207.8
Wayne	Musculoskeletal	3	36.5	7.5	106.7
Wayne	Chromosomal	1	12.2	0.3	67.8
Weakley	Total Cases	58	336.8	255.8	435.4
Weakley	Central Nervous System	2	11.6	1.4	42.0
Weakley	Eye and Ear	1	5.8	0.2	32.4
Weakley	Cardiovascular	24	139.4	89.3	207.4
Weakley	Orofacial	4	23.2	6.3	59.5
Weakley	Gastrointestinal	16	92.9	53.1	150.9
Weakley	Genitourinary	11	63.9	31.9	114.3
Weakley	Musculoskeletal	1	5.8	0.2	32.4
Weakley	Chromosomal	2	11.6	1.4	42.0
White	Total Cases	41	263.7	189.2	357.7
White	Central Nervous System	3	19.3	4.0	56.4
White	Cardiovascular	18	115.8	68.6	182.9
White	Orofacial	4	25.7	7.0	65.9
White	Gastrointestinal	7	45.0	18.1	92.8
White	Genitourinary	10	64.3	30.8	118.3
White	Musculoskeletal	2	12.9	1.6	46.5
White	Chromosomal	1	6.4	0.2	35.8

Table 9. Tennessee County Birth Defects Rates by Diagnostic Categories 2004-2008					
County	Birth Defect	Count¹	Rate²	LL³	UL⁴
Williamson	Total Cases	311	298.6	266.4	333.7
Williamson	Central Nervous System	15	14.4	8.1	23.8
Williamson	Eye and Ear	2	1.9	0.2	6.9
Williamson	Cardiovascular	127	122.0	101.7	145.1
Williamson	Orofacial	21	20.2	12.5	30.8
Williamson	Gastrointestinal	38	36.5	25.8	50.1
Williamson	Genitourinary	102	97.9	79.9	118.9
Williamson	Musculoskeletal	15	14.4	8.1	23.8
Williamson	Chromosomal	22	21.1	13.2	32.0
Wilson	Total Cases	190	279.0	240.7	321.6
Wilson	Central Nervous System	6	8.8	3.2	19.2
Wilson	Eye and Ear	3	4.4	0.9	12.9
Wilson	Cardiovascular	83	121.9	97.1	151.1
Wilson	Orofacial	14	20.6	11.2	34.5
Wilson	Gastrointestinal	28	41.1	27.3	59.4
Wilson	Genitourinary	55	80.8	60.8	105.1
Wilson	Musculoskeletal	11	16.2	8.1	28.9
Wilson	Chromosomal	10	14.7	7.0	27.0

Source: Tennessee Birth Defects Registry 2004-2008

¹Counts include cases resulting from live births and fetal deaths. ²Per 10,000 live births. ³ 95% confidence interval lower limit. ⁴95 percent confidence interval upper limit. Confidence intervals for 100 or less cases are exact Poisson; otherwise confidence intervals are based on the normal approximation.

Diagnostic data were derived from the Tennessee Hospital Discharge Data System (2004-2009), the Tennessee Death Statistical System (2004-2009) and the Tennessee Fetal Death Statistical System (2004-2008). Live births were derived from the Tennessee Birth Statistical system (2004-2008).

Glossary of Terms

Agenesis	Absence of part(s) of the body. Lack of development or failure to develop part(s) of the body.	Chromosome abnormalities	A major group of genetic diseases in which alterations of chromosome number or structure occur and are observable by microscope.
Alpha-fetoprotein	A protein produced by the fetus during gestation. The level of this protein can be measured during the pregnancy. The level of this protein is elevated in pregnancies with neural tube defects and may be decreased in pregnancies with Down syndrome.	Cleft lip	The congenital failure of the fetal components of the lip to fuse or join, forming a groove or fissure in the lip. Infants with this condition can have difficulty feeding and may use assistive devices for feeding. This condition is corrected when the infant can tolerate surgery.
Amniocentesis	A method of prenatal diagnosis which a small amount of amniotic fluid is withdrawn to obtain fetal cells, which can be tested for the presence of some genetic diseases.	Cleft palate	The congenital failure of the palate to fuse properly forming a grooved depression or fissure in the roof of the mouth. This defect varies in degree of severity. The fissure can extend into the hard and soft palate and into the nasal cavities. Infants with this condition have difficulty feeding, and may use assistive devices for feeding. Surgical correction is begun as soon as possible. Children with cleft palates are at high risk for hearing problems due to ear infections.
Anencephalus	Congenital absence of the skull, with cerebral hemispheres completely missing or reduced to small masses attached to the base of the skull. Anencephaly is not compatible with life.	Coarctation of the aorta	Localized narrowing of the aorta. This condition can vary from mild to severe.
Aniridia	The complete absence of the iris of the eye or a defect of the iris.	Common truncus arteriosus	A congenital heart defect in which the common arterial trunk fails to divide into pulmonary artery and aorta.
Anophthalmia	A developmental defect characterized by complete absence of the eyes, or by the presence of vestigial eyes.	Confidence interval (95%)	The interval that contains the true prevalence (which can only be estimated) 95% of the time.
Anotia	A congenital absence of one or both ears.	Congenital	Existing at or dating from birth although the defect may not be recognized at the time of birth.
Aortic valve stenosis	A cardiac anomaly characterized by a narrowing or stricture of the aortic valve.	Congenital hip dislocation	Location of the head of the femur (bone of the upper leg) outside its normal location in the cup-shaped cavity formed by the hip bones (acetabulum).
Aplasia	Absence of a tissue or organ due to lack of cell proliferation.	Diaphragmatic hernia	A failure of the diaphragm to form completely, leaving a hole. Abdominal organs can protrude through the hole into the chest cavity and interfere with development of the heart and lungs. Usually life-threatening and requires emergent surgery.
Atresia	Absence or closure of a normal opening.	Down syndrome (Trisomy 21)	The chromosomal abnormality characterized by an extra copy of chromosome 21. In rare cases this syndrome is caused by translocation. Down syndrome is characterized by moderate to severe retardation, sloping forehead, small ear canals, flat-bridge of the nose and short fingers and toes. Many infants have congenital heart disease.
Atrial septal defect	A congenital cardiac malformation in which there are one or several openings in the atrial septum (wall between the right and left atria). Most common type is called ostium secundum defect.	Dysgenesis	Anomalous or disorganized formation of an organ.
Biliary atresia	A congenital absence or underdevelopment of one or more of the ducts in the biliary tract.	Dysplasia	Disorganized cell structure or arrangement within a tissue or organ.
Bladder exstrophy	Incomplete closure of the anterior wall of the bladder and the abdominal cavity. The upper urinary tract is generally normal. Often associated with anorectal and genital malformations.		
Congenital cataract	An opacity (clouding) of the lens of the eye that has its origin prenatally.		
Choanal atresia or stenosis	A congenital anomaly in which a bony or membranous formation blocks the passageway between the nose and the pharynx.		
Chromosome	Threadlike structure in cells that individual genes are arranged along.		

Ebstein anomaly A congenital heart defect in which the tricuspid valve is displaced downward into the right ventricle.

Edwards syndrome See Trisomy 18.

Embryonic period The first eight weeks after fertilization, during which most, but not all, organs are formed.

Encephalocele Herniation of the brain through a defect in the skull.

Endocardial cushion defect In the complete form, a septal defect involving both the upper chambers (atria, atrial septal defect) and lower chambers (ventricles, ventricular septal defect) such that there is a single large atrioventricular septal defect. There are incomplete forms as well.

Epispadias Displacement of the opening of the urethra (urethral meatus) dorsally and proximally (on top and closer to the body) in relation to the tip of the glans of the penis.

Esophageal stenosis or atresia A narrowing or incomplete formation of the esophagus. Usually a surgical emergency. Frequently associated with a Tracheoesophageal Fistula.

Extremely low birth weight Birth weight less than 1,000 grams, regardless of gestational age.

Fetal alcohol syndrome A constellation of physical abnormalities (including characteristic abnormal facial features and growth retardation), and problems of behavior and cognition in children born to mothers who drank alcohol during pregnancy.

Fetal death (stillborn) Death prior to complete expulsion or extraction of an infant or fetus of 500 grams or more, or, in absence of weight, of 22 weeks' gestation or greater; death is indicated by the fact that, after expulsion or extraction, the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles (68-3-102).

Fetal period The period from the ninth week after fertilization through delivery.

Fetal ultrasound A diagnostic examination of the fetus using ultrasound (sound waves at a frequency above what is detectable to human hearing).

Fistula An abnormal passage from an internal organ to the body surface or between two internal organs or structures.

Folic acid deficiency A lack of folic acid in the mother's diet which may lead to an increased risk for neural tube defects. Current recommendations from the March of Dimes indicate that women who are or may become pregnant should take a folic acid supplement to decrease the risk of neural tube defect.

Gastroschisis A congenital opening of the abdominal wall with protrusion of the intestines. This condition is surgically treated.

Genetic counseling The delivery of information about the risks, natural history, and management of genetic diseases to patients and/or their families.

Hirschsprung's disease The congenital absence of autonomic ganglia (nerves controlling involuntary and reflexive movement) in the muscles of the colon. This results in immobility of the intestines and may cause obstruction or stretching of the intestines. This condition is repaired surgically in early childhood by the removal of the affected portion of the intestine.

Holocephalus The abnormal accumulation of fluid within the spaces of the brain.

Hydrocephalus The abnormal accumulation of fluid within the skull.

Hyperplasia Overgrowth characterized by an increase in the number of cells of tissue.

Hypoplasia A condition of arrested development in which an organ or part remains below the normal size or in an immature state.

Hypoplastic left heart syndrome Atresia, or a marked hypoplasia, of the aortic valve, atresia or marked hypoplasia for the mitral valve, with hypoplasia of the ascending aorta and underdevelopment of the left ventricle.

Hypospadias A congenital defect in which the urinary meatus (urinary outlet) is on the underside of the penis or on the perineum (area between the genitals and anus). The urinary sphincters are not defective so incontinence does not occur. The condition may be surgically corrected if needed for cosmetic, urologic, or reproductive reasons.

Infant death Death of a live-born infant before 12 months of age.

Live birth Spontaneous delivery of an infant that exhibits signs of life, including a heartbeat, spontaneous breathing, or movement of voluntary muscles. Transient cardiac contractions and fleeting respiratory efforts or gasps are not necessarily considered signs of life by all programs.

Lower limb reduction defects The congenital absence of a portion of the lower limb. There are two general types of defect, transverse and longitudinal. Transverse defects appear like amputations, or like missing segments of the limb. Longitudinal defects are missing rays of the limb (for example, a missing tibia and great toe).

Low birth weight Birth weight less than 2,500 grams, regardless of gestational age.

Malformation A primary morphologic defect resulting from an abnormal developmental process.

Maternal serum screening A diagnostic method that examines the mother's blood serum for indicators of anomalies in the process of fetal development.

Mental retardation A condition of below average intellectual ability (IQ less than 70) that is present from birth or infancy.

Microcephaly	Congenital smallness of the head, with corresponding smallness of the brain.	Pulmonary artery anomaly	Abnormality in the formation of the pulmonary artery such as stenosis or atresia.
Microphthalmia	The congenital abnormal smallness of one or both eyes. Can occur in the presence of other ocular defects.	Pulmonary valve atresia or stenosis	Failure of formation of the pulmonary valve or a narrowing or obstruction of the pulmonary valve, resulting in obstruction of blood flow from the right ventricle to the pulmonary artery.
Microtia	A small or maldeveloped external ear and atretic or stenotic external auditory canal.	Pyloric stenosis	A narrowing of the outlet from the stomach to the small intestine resulting in complete or partial obstruction of the passage of food and gastric contents.
Multifactorial	A term used to describe characteristics or diseases that are caused by a combination of multiple genetic and environmental factors.	Rectal and large intestinal atresia/stenosis	Complete or partial occlusion of the lumen of one or more segments of the large intestine and/or rectum.
Multiple congenital anomaly	Term used to describe the presence of more than one anomaly at birth.	Reduction defects: lower and upper limbs	The congenital absence of a portion of the lower or upper limbs. There are two general types of defect, transverse and longitudinal. Transverse defects appear like amputations with the complete or partial absence of the arm or leg. Longitudinal defects are missing rays of the limb and may involve the preaxial (thumb or big toe side) or central parts of the arm or leg.
Mutagen	Substance that is known to cause a mutation.	Renal agenesis or dysgenesis	The failure, or deviation, of embryonic development of the kidney.
Mutations	Alterations in the sequence of DNA.	Spina bifida	An incomplete closure of the vertebral spine (usually posterior) through which spinal cord tissue or membranes (meninges) covering the spine herniated.
Neonatal death	Death of a live-born infant within the first 28 days after birth. Early neonatal death refers to death during the first 7 days. Late neonatal death refers to death after 7 days but before 29 days.	Stenosis	A narrowing or constriction the diameter of a bodily passage or orifice.
Neonatal (newborn) period	The first 28 days following delivery of a live-born infant.	Stenosis or atresia of the small intestine	A narrowing or incomplete formation of the small intestine obstructing movement through the digestive tract.
Neural tube defect	A defect resulting from failure of the neural tube to close in the first month of pregnancy. The major conditions include anencephaly, spina bifida, and encephalocele.	Syndrome	A pattern of multiple primary malformations or defects all due to a single underlying cause (for example, Down syndrome).
Obstructive genitourinary defect	Stenosis or atresia of the urinary tract at any level. Severity of the defect depends largely upon the level of the obstruction. Urine accumulates behind the obstruction.	Teratogen	A substance in the environment that can cause a birth defect.
Omphalocele	The protrusion of intestines into the umbilicus. The defect is usually closed surgically soon after birth.	Term infant	An infant born after 37 complete weeks and before 42 complete weeks of gestation.
Patau Syndrome	See Trisomy 13	Tetralogy of Fallot	The simultaneous presence of a ventricular septal defect, pulmonic stenosis, a malpositioned aorta that overrides the ventricular septum, and right ventricular hypertrophy.
Patent ductus arteriosus	A blood vessel between the pulmonary artery and the aorta. This is normal in fetal life, but can cause problems after birth, particularly in premature infants.	Transposition of the great arteries	A congenital malformation in which the aorta arises from the right ventricle and the pulmonary artery from the left ventricle (opposite of normal), so that the venous return from the peripheral circulation is recirculated without being oxygenated in the lungs. Immediate surgical correction is needed. When this is not associated with other cardiac defects, and not corrected, it is fatal.
Periconceptual	At or around the time of conception.	Tricuspid valve atresia or stenosis	A congenital cardiac condition characterized by the absence or constriction of the tricuspid valve.
Perinatal	Before, during, or after delivery. The exact time period may vary from 20 to 28 complete weeks of gestation through 7 to 28 days after delivery, depending on the context in which the term is used.	Trisomy	A chromosomal abnormality characterized by one
Postnatal	After delivery.		
Postterm infant	An infant born after 42 completed weeks of gestation.		
Prenatal	Before delivery.		
Preterm infant	An infant born before 37 completed weeks of gestation.		

more than the normal number of chromosomes. Normally, cells contain two of each chromosome. In trisomy, cells contain three copies of a specific chromosome.

**Trisomy 13
(Patau
syndrome)**

The chromosomal abnormality caused by an extra chromosome 13. Characterized by impaired midline facial development, cleft lip and palate, polydactyly and severe mental retardation. Most infants do not survive beyond 6 months of life.

**Trisomy 18
(Edwards
syndrome)**

The chromosomal abnormality caused by an extra copy of chromosome 18. It is characterized by mental retardation, growth retardation, low-set ears, skull malformation and short digits. Survival for more than a few months is rare.

**Trisomy 21
Ventricular
Septal Defect**

See Down Syndrome.

A congenital cardiac malformation in which there are one or several openings in the ventricular system (Muscular and fibrous wall between the right and left ventricle or right and left lower chambers of the heart).

**Very Low Birth
Weight**

Birthweight less than 1,500 grams, regardless of gestational age.

References

- ¹Tennessee Death Statistical System (2008). Tennessee Department of Health, Office of Policy, Planning and Assessment, Division of Health Statistics.
- ²Grosse SD, Ouyang L, Collins JS, Green D, Dean JH, Stevenson RE (2008). Economic evaluation of a neural tube defect recurrence-prevention program. *American Journal of Preventive Medicine*, 572-577.
- ³Recommendations for use of Folic Acid to Reduce Number of Spina Bifida Cases and Other Neural Tube Defects Morbidity and Mortality Weekly Report; 1992: 41(RR-14): 1-7
- ⁴Wolff T, Catherine TW, Miller T, Shamsuzzoha BS (2009). Folic Acid Supplementation for the Prevention of Neural Tube Defects: An Update of the Evidence for the U.S. Preventive Services Task Force *Annals of Internal Medicine*, 150 :632-639
- ⁵Russo, C.A. and Elixhauser, A. (2007). Hospitalizations for birth defects, 2004. *HCUP Statistical Brief #24*. U.S. Agency for Healthcare Research and Quality, Rockville, MD. <http://www.hcup-us.ahrq.gov/reports/statbriefs/sb24.pdf>. Accessed 12/19/11
- ⁶Torfs, C.P., Katz, E.A., Bateson, T.F., Lam, P.K. and Curry, C.J. (1996). Maternal medications and environmental exposures as risk factors for gastroschisis. *Teratology*, 54(2): 84-92.
- ⁷Werler, M.M., Mitchell, A.A. and Shapiro, S. (1992). Demographic, reproductive, medical and environmental factors in relation to gastroschisis. *Teratology*, 45(4): 353-360.
- ⁸ Lammer EJ, Edmonds LD. (1987) Trends in pyloric stenosis incidence, Atlanta, 1968 to 1982. *Journal of Medical Genetics*, 24: 482-487.
- ⁹ Lary JM, Paulozzi LJ. Sex differences in the prevalence of human birth defects: a population-based study. *Teratology* 2001; 64: 237-251.
- ¹⁰ Centers for Disease Control and Prevention. Diabetes and pregnancy. Available at http://www.cdc.gov/ncbddd/pregnancy_gateway/diabetes.html. Accessed 12/19/11
- ¹¹www.uwhealth.org/news/diabetic-moms-need-a-plan-before-they-conceive/20508 Accessed 12/19/11.