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Tennessee Birth Defects 2006-2010

Tennessee. Department of Health.

TENNESSEE Birth Defects 2006-2010

TENNESSEE DEPARTMENT OF HEALTH
DIVISION OF POLICY, PLANNING AND ASSESSMENT

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Executive Summary

"Birth defects, also called congenital anomalies, are physical abnormalities that occur before a baby is born. They are usually obvious at birth or by 1 year of age." [1]

Birth Defects (BD) continue to be one of the leading causes of death in infants less than one year old nationally and in Tennessee, with 665 deaths in Tennessee between 2006-2010 related to birth defects. Although not all birth defects result in death, according to the Center for Disease Control (CDC), an infant is born every four and half minutes with a birth defect with hospital costs that may exceed 2.5 billion dollars.

This BD report is a statewide population-based report produced by the Tennessee Birth Defects Registry (TBDR) detailing the birth prevalence of 45 major birth defects and fetal alcohol syndrome for Tennessee infants born in the years 2006 through 2010. Sections in this report detail counts and rates presented by infant gender, race/ethnicity, perinatal region, age of mother, education of mother, maternal county of residence, and maternal diabetes. The two most common reported birth defects overall were members of the cardiovascular group: 1) atrial septal defect ((ASD), a hole or opening in the upper chambers of the heart)) and 2) patent ductus arteriosus ((PDA, opening that failed to close from fetal circulation)).

- Prevention is the best option for minimizing the occurrence of birth defects. This report concludes with a section on birth defects prevention. Some examples include:
    - Intake of folic acid (a B-vitamin) supplements by women of childbearing age has been shown to reduce neural tube defects (like spina bifida) by at least 50%. *Pediatrics Vol. 104 No. 2 August 1, 1999 pp. 325 -327*

    - Making healthy living choices remain the most effective way to reduce the risk of birth defects. These choices include all women who may become or

[1] Accessed on December 23, 2013 2010-2013 Merck Sharp & Dohme Corp., a subsidiary of Merck & Co., Inc., Whitehouse Station, N.J., U.S.A
http://www.merckmanuals.com/home/childrens_health_issues/birth_defects/overview_of_birth_defects.html

want to become pregnant should have contact with a trusted medical professional who will assist in monitoring their health status and provide preconception care. They should be current on their immunizations and take precautions to avoid common infections. For those with type 1 or type 2 diabetes it is critical to maintain normal blood sugar levels.

- Fetal alcohol spectrum disorders (FASD) are 100% preventable. http://www.cdc.gov/NCBDDD/fasd/alcohol-use.html. Women who do not drink while pregnant do not have babies with FASD.
- Avoidance of even seemingly benign, everyday exposures can reduce the risk for birth defects—for example, pregnant women who are exposed to cat feces during the process of changing a litter box can develop an infection called toxoplasmosis, and their infants may be born with vision problems or seizures

- The three-year moving averages of the overall annual birth defects rates (Figure 1a) shows an increasing trend from 2002 through 2010 with only one year's average, 2008, showing decline. While there is no one clear reason for the increase in birth defects rates, several possibilities exist: there may be a true increase in birth defects rates related to familial, maternal or environmental risk factors; there may be improved birth defects surveillance; or the increase may have resulted from changes in clinical practice and awareness in coding of birth defects diagnoses or other neonatal diagnoses in hospitals. It is probable that the increase is a result of a combination of these factors.

- Birth defects in general were more common among the white population, males, and babies born to mothers aged 35 and older; however, this is not the case for all birth defects as several categories women under age 20 had the highest rate.

- Birth defect rates vary by perinatal region with the highest rates in the Northeast, East, and West perinatal regions and lower rates in the Southeast and Middle 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.

This regional difference mimics the trends of the Neonatal Abstinence Syndrome (NAS) of the recent 2011-2012 years. The department is closely reviewing data cases to evaluate the coding variation of the years to determine differences and identify population characteristics, if any. A limitation of the data collection methodology is the timeliness of the data availability. The lag in the birth defect registry data is more apparent in this example as it is difficult to tell whether the cases have been more appropriately reclassified or these are now additional cases affecting our infant population.

- The Tennessee Department of Health has a number of statewide maternal and infant programs and tracking areas that assist in identifying at risk populations; such programs include the Pregnancy Risk Assessment Monitoring System (PRAMS) and the Newborn Screening and Follow-Up program, which includes a new screening (implemented in 2013) for critical congenital heart disease. These programs and the collaboration of others across the state have assisted in the **improvement of Tennessee's infant mortality rate by 23% over the last decade**—from 9.4 in 2002 to 8.7 in 2006 and most recently to 7.2 in 2012. While alarming that the rate of birth defects has increased, the overall infant mortality rate has decreased, perhaps programs leading to early diagnosis and interventions have positively impacted the severity of the defects.

Figure 1

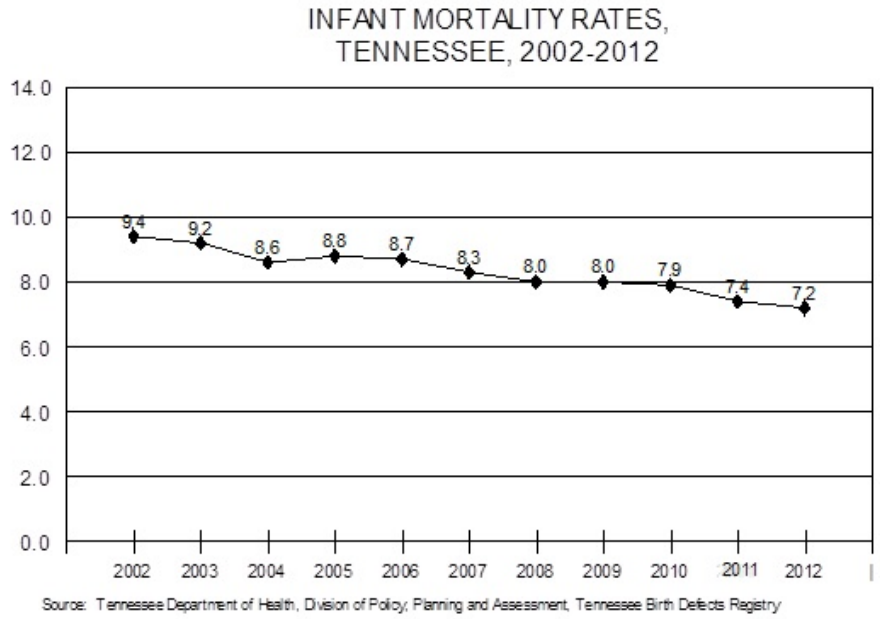
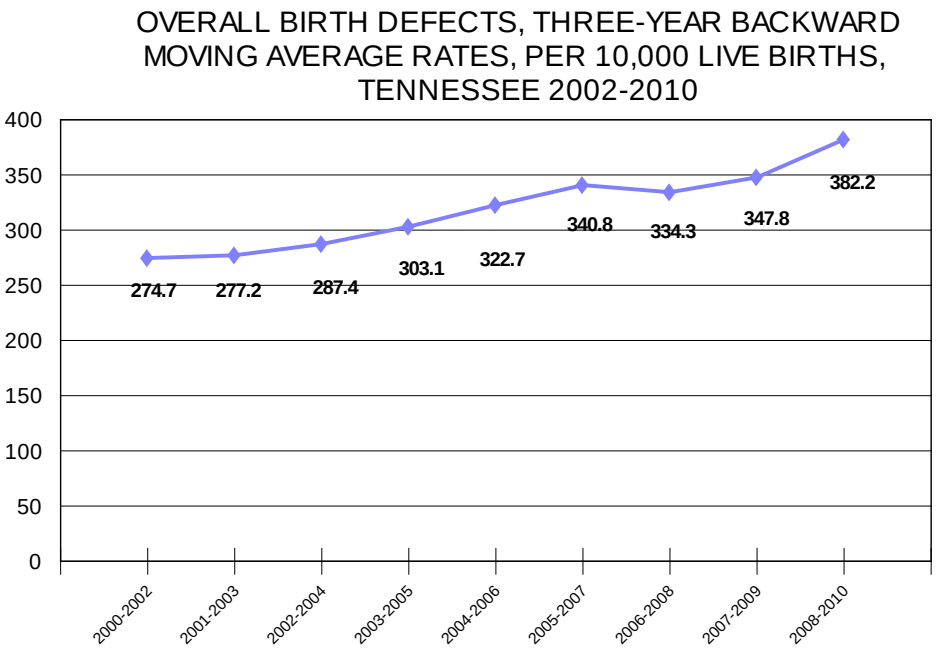


Figure 1a



Source: Tennessee Department of Health, Division of Policy, Planning and Assessment, Tennessee Birth Defects Registry

Birth Defects Overview

Birth defects occur during 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[2]. 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. Surgery and medical interventions may correct others, but not without cost.

Unfortunately, the underlying causes of individual birth defects are largely unknown; with a high percentage of infant birth defects having 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 births defects can assist with the task of addressing these questions. While the direct causes of birth defects are not fully understood, there are known risk factors that affect birth defects prevalence.

[2] Accessed on December 23, 2013. http://www.cdc.gov/ncbddd/birthdefects/index.html

For example: drinking alcohol during pregnancy, smoking during pregnancy, low blood folate levels, poorly controlled blood sugar levels in diabetic mothers, and maternal infections are all associated with increased risk of having a baby born with a birth defect.

The primary use of data collected by TBDR is to observe patterns and detect changes in the patterns of leading birth defects. The data provides the basis for research studies into the causes of birth defects and provides information to evaluate the effectiveness of birth defects prevention efforts. It also serves as an historic baseline used to evaluate the existence of suspected birth defects clusters.

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. Since 2003, the program has expanded to provide population-based birth defects surveillance for the entire state of Tennessee. Annually the department receives less than five (5) inquiries specific to the birth defects registry data. Currently, the registry is undergoing a complete review in order to evaluate its effectiveness and ability to meet the requirements of its intent.

Birth Defect Definition

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). The department does not receive federal funding for participation in the network. Currently, 41 states maintain a birth defects registry or report its data to the CDC. Unfortunately, rates across states should not be compared as collection methodology,

years collected, and individual definitions vary widely. This report details the birth prevalence of 45 major birth defects for Tennessee infants who were born to resident mothers during the period 2006 through 2010.

Tennessee's Birth defects are classified as major birth defects when 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 corresponding to eight major organ systems: 1) Central Nervous System; 2) Eye and Ear; 3) Cardiovascular; 4) Orofacial; 5) Gastrointestinal; 6) Genitourinary; 7) Musculoskeletal; and 8) 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. As of July 1, 2010, the Department of Health's fetal death definition changed to include cases of at least 350 grams or 20 weeks completed gestation. However, the fetal death cases included in this report were not covered by the new definition with the last year of data being 2010. The denominators used for calculating birth defects rates include only live births and are reported per 10,000 live births.

Data Sources

Currently, the primary data sources for the TBDR 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 Office of Health Statistics in the Division of Policy, Planning, and Assessment (PPA). The Tennessee Birth Defects Registry (TBDR), which produces this report, is also housed within 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. Diagnostic data are also obtained from the fetal death and death certificate data systems. For the fetal death certificate identified cases, demographic, geographic, and risk factor information are obtained from the fetal death certificate system. For the death certificate identified cases, demographic, geographic, and risk factor information are obtained from the death certificate data system. Together they provide statewide population-based birth defects surveillance for Tennessee.

Data Limitations

The current methodology inhibits timeliness of the data availability and evaluation. The department is evaluating alternative methods that would permit at least the prior year's data available. This report's data only captures those infants born through 2009 as the HDDS data is always one year behind the birth year. Additional limitations of administrative data systems such as these for birth defects surveillance include coding errors. Some of the diagnostic codes used in the HDDS correspond to both the major and minor variants of a given birth defect. Thus, the coding system used in the HDDS, The International Classification of Diseases Revision 9 Clinical Modification (ICD-9-CM), prevents distinguishing these differences for certain birth defects. This may have the effect of elevating rates for some of the more common birth defects, such as atrial septal defects, which are congenital heart defects, and hypospadias, a common genitourinary defect. Less systematically, there are simple coding errors that result in both non-cases being miscoded as having a birth defect and valid cases not being recorded as having a birth defect. However, the new ICD-10 system should assist in correct coding.

Some options to assist with the current data limitations include required provider reporting similar to newborn screening and neonatal abstinence syndrome (NAS); active surveillance which is very resource and time intensive, and changing administrative collection methodology; each of these options may present new challenges such as poor response rates with provider reporting, prohibitive resourcing needs for active

surveillance and others that the department and Advisory Committee will need to consider as it moves forward in its evaluation.

Data Tables

Individual birth defect counts and rates are presented in tabular form for the state overall and presented by infant sex; race/ethnicity; age of mother; education of mother; maternal county of residence; maternal diabetes; and the five perinatal regions that are served by Tennessee's five designated Regional Perinatal Center Hospitals (Tables 1-8). Within the tables, counts and rates are organized by the affected organ system: 1) central nervous system; 2) eye and ear; 3) cardiovascular, 4) orofacial; 5) gastrointestinal; 6) genitourinary; 7) musculoskeletal; 8) chromosomal; and 9) fetal alcohol syndrome. Definitions and brief descriptions for each of the reported birth defects are provided in the glossary at the end of the report.

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. Prevalence is all cases with a diagnosis; it includes both old and new cases. 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 more rare birth defects. Accordingly, rate estimates for rarer birth defects and small populations should be interpreted with caution. Confidence intervals are effective for determining the likely range for birth defects rate estimates affected by random error. Confidence intervals are less effective for determining the likely range of birth defects rate estimates that are affected by systematic error, such as limitations in the ICD-9-CM disease classification coding system 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. Of the 15,437 cases diagnosed with a birth defect between 2006 and 2010, 3,595 (23.3 percent) had more than one birth defect. Thus, while each represents at least a single case within a diagnostic category, some are counted as cases in more than one diagnostic category and some may have multiple diagnoses within a category.

Overall Tennessee Birth Defects Rates 2006-2010

Table 1 contains the overall birth defect counts, rates and 95% confidence intervals for each of the 45 major birth defects diagnoses organized within their respective organ systems. The central nervous system category contains five birth defects, three of which, anencephalus, spina bifida, and encephalocele are classified as neural tube defects (NTDs). NTDs occur when there is a failure of the neural tube to close during the first month of pregnancy. Over the five year period 2006-2010, there were 45 anencephalus cases, 165 spina bifida cases, and 57 encephalocele cases. Babies affected by anencephalus are born missing parts of their skull and the cerebral hemispheres. Anencephalus is almost always fatal soon after birth[3]. Spina bifida is the incomplete closure of the vertebral spine with the spinal cord and meninges that cover the spinal cord herniating through the opening. Though not fatal, spina bifida generally requires multiple surgeries with disabilities such as lower limb paralysis, curvature of the spine, and lack of bowel and bladder control

[3] Division of Birth Defects and Developmental Disabilities, NCBDDD, Centers for Disease Control and Prevention accessed on December 23, 2013. http://www.cdc.gov/ncbddd/birthdefects/anencephaly.html

persisting post-surgery. In spite of these obstacles, many of the babies born with spina bifida live full, productive and, rewarding lives

Although the causes of neural tube defects are not fully understood, research has shown that women who take 400 micrograms of a B vitamin known as folic acid significantly reduce the likelihood of conceiving a baby with an NTD. The American College of Obstetrics and Gynecology and the United States Preventative Task Force recommend that all who may become pregnant take a multivitamin containing 400 micrograms of folic acid every day[4]. Taking a daily multivitamin before pregnancy is especially important because most birth defects including NTDs are thought to originate in the period before a woman knows she is pregnant.

The cardiovascular category contains counts and rates for thirteen congenital heart defects. Six of the defects are labeled as CCHD, for critical congenital heart defect. Undiagnosed and untreated newborns affected by CCHDs are at risk of serious morbidity and mortality. In January 2013, Tennessee hospitals began a critical congenital heart defect screening program, using pulse oximetry testing to assess newborn blood oxygen levels. Newborns with blood oxygenation below a critical level will receive follow-up screening, diagnosis, treatment, and care as necessary for those with confirmed CCHD diagnoses. For newborns with one of these CCHD diagnoses, the care may be life-saving. In the past, many newborns with CCHD may have been sent home undiagnosed and experience complications leading to death or lifelong disability. The CCHD screening program has become part of a nationwide effort initiated to identify and begin treatment of CCHD affected newborns immediately after birth.

[4] U.S. Preventive Services Task Force. *Folic Acid for the Prevention of Neural Tube Defects: U.S. Preventive Services Task Force Recommendation Statement*. AHRQ Publication No. 09-05132-EF-2, May 2009. http://www.uspreventiveservicestaskforce.org/uspstf09/folicacid/folicacidrs.htm Accessed December 23, 2013.

The six CCHD diagnoses in Table 1 are common truncus (CT), also known as truncus arteriosus (TA); transposition of great arteries (TGA); tetralogy of fallot (TOF); pulmonary valve atresia (PVA); tricuspid valve atresia (TVA); and hypoplastic left heart syndrome (HLHS). The seventh CCHD diagnosis, total anomalous pulmonary venous return (TAPVR), will also be screened for in the pulse oximetry screening program. TAPVR will be added to the standard TBDR data system in upcoming TBDR reports. Ebstein's anomaly, which is currently tracked by TBDR is also considered a CCHD, but will not be screened for in the CCHD screening program as it is not likely to be detected via the pulse oximetry methodology. As such, it was not labeled as a CCHD diagnosis in Table 1. The Tennessee CCHD pulse oximetry screening program follow-up will include diagnosis by a cardiologist, which is entered in the Neometrics Newborn Screening Database.

The two most common reported birth defects overall were members of the cardiovascular group: atrial septal defect (ASD) and patent ductus arteriosus (PDA). An ASD is a hole in the atrial septum, which is the anatomical wall separating the two upper chambers of the heart[5]. In order for an ASD to be coded the hole should be at least 4mm in diameter. If smaller than 4mm, the defect is classified as patent foramen ovale (PFO). Patent foramen ovale is an artifact of the fetal circulation system and unlike an ASD, which will likely require surgery, a PFO will likely close on its own, or remaining, may have little impact on health[6]. According to the American Heart Association, PFO prevalence in the current United States adult population is 27 percent. Both ASD and PFO share the same ICD-9-CM code, they

[5] Parker SE, Mai CT, Canfield MA, et al; for the National Birth Defects Prevention Network. Updated national birth prevalence estimates for selected birth defects in the United States, 2004-2006. Birth Defects Res A Clin Mol Teratol. 2010;88:1008-16. Accessed December 23, 2013. http://www.cdc.gov/ncbddd/heartdefects/atrialseptaldefect.html

[6] Webb GD, Smallhorn JF, Therrien J, Redington AN. Congenital heart disease. In: Bonow RO, Mann DL, Zipes DP, Libby P, eds. *Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine*. 9th ed. Philadelphia, Pa: Saunders Elsevier; 2011:chap 65. Updated by: Kurt R. Schumacher, MD, Pediatric Cardiology, University of Michigan Congenital Heart Center, Ann Arbor, MI. Review provided by VeriMed Healthcare Network. Also reviewed by David Zieve, MD, MHA, Medical Director, A.D.A.M., Inc. accessed December 23, 2013.

are indistinguishable in the HDDS data system and therefore properly coded PFO cases are counted as ASD.

Like PFO, patent ductus arteriosus (PDA) is a remnant of the fetal circulation system. The ductus arteriosus is a blood vessel that allows blood to bypass the fetus' lungs while in the womb. Normally, the ductus arteriosus closes within days of birth. In the case of PDA the ductus arteriosus fails to close. In some cases, PDA may actually be a benefit, such as when a newborn has both PDA and HLHS. In that case, the open ductus provides a temporary open circulatory pathway that may save the newborn's life until surgery can be performed to resolve the HLHS. Under normal conditions however, PDA results in low oxygenation of the blood and puts the infant at risk. If the PDA does not close on its own, it will be treated with catheterization or surgery. Overall, three of the five most prevalent birth defects in Tennessee during the period 2006-2010 (Table 1) were cardiovascular defects: 1) atrial septal defect (4,574); 2) patent ductus arteriosus (2,663), and 3) ventricular septal defect (1,983). The two remaining top five birth defects were a genitourinary defect, hypospadias (2,254) and a gastrointestinal defect, pyloric stenosis (1,772).

Orofacial birth defects monitored are cleft palate without cleft lip, cleft lip with and without cleft palate, and choanal atresia. Cleft lip is a defect resulting from the incomplete fusion of the parts of the lip. Cleft lip may be central, unilateral or bilateral. Cleft palate results from the incomplete fusion of the palate, may be central, unilateral, and bilateral, and may include hard palate, soft palate or both. Clefts require surgical repair and the initial surgery generally takes place in six to twelve weeks following delivery. Choanal atresia involves a membrane blocking the nasal passages and preventing nasal breathing. Choanal atresia is treated with the surgical removal of the membrane.

Among the gastrointestinal birth defects in Table 1 biliary atresia (BA) is the least common, but most deadly. In (BA) bile flow from the liver to the gallbladder is blocked,

damaging the liver and leading to cirrhosis. A surgical procedure known as the Kasai procedure that allows bile to drain into the small intestine performed is crucial for survival of affected newborns. Esophageal atresia (EA) is a blockage of the esophagus, where the upper esophagus does not connect to the lower esophagus. EA is usually diagnosed early due to the newborn's inability to feed either normally or through a feeding tube and is then surgically corrected.

Among the genitourinary birth defects in Table 1 hypospadias was most common, accounting for 2,254 cases. Its counterpart, epispadias, accounted for only 62 cases. Hypospadias and epispadias both involve a displacement of the urethral opening on the penile shaft rather than at the tip of the glans. In hypospadias the displacement of the urethra is ventral, on the underside of the penis, whereas epispadias is dorsal on the top of the penis. Surgical repair of hypospadias and epispadias is generally performed within the first year. Obstructive genitourinary defect (OGD) affected 1,314 newborns. OGD is a partial or complete obstruction of the flow of urine at any level of the genitourinary system from the kidney to the urethra. As such, it includes a large number of more specific less common birth defects. Renal agenesis, which is the failure of the kidney or kidneys to develop, affected 225 newborns. Renal agenesis may be unilateral or bilateral[7]. As long as the remaining kidney remains healthy, unilateral agenesis does not a have significant impact on health.

Looking at the musculoskeletal defects in Table 1, reduction deformities of the upper limbs may involve the complete or partial absence of the upper arm, lower arm, wrist hand or fingers. Reduction deformities of the lower limb involve the complete or partial absence of the upper leg, lower leg or foot or toes. Upper and lower limb deformities affected 95 and 89 newborns, respectively. Gastroschisis and omphalocele are both defects of the abdominal wall. Gastroschisis results from the

[7] Genital and urinary tract defects. (February 2013). *March of Dimes*. Retrieved June 6, 2013, from 2013http://www.marchofdimes.com/baby/birth- accessed December 29, 2013 http://www.healthline.com/health/renal-agenesis

failure of the abdominal wall to fuse completely, allowing the small intestines and other digestive organs to protrude out of the abdominal cavity. The opening is lateral to, and usually to the right of the umbilicus. An infant born with gastroschisis[8] requires surgery within days of birth. During the time the baby is waiting for surgery the protruding organs are suspended in a plastic pouch or silo above the baby and slowly lowered into the abdominal cavity over a period of days. The process allows for the cavity to expand in order to receive the organs. Once completed the abdomen is closed by the surgeon. Gastroschisis is more common among young mothers and some studies have shown relationships to tobacco and drug use[9]. In the case of omphalocele the small intestine, part of the large intestine and sometimes the liver and spleen herniate into the umbilical cord covered by a nearly transparent membranous sac. The surgical repair of omphalocele is similar to the gastroschisis repair and in serious cases may take several weeks for the organs to be fully positioned within the abdominal cavity.

Down syndrome or trisomy 21 was the most common chromosomal anomaly, accounting for 586 cases or 14.0 per 10,000 live births (Table 1). Down syndrome occurs when a baby is born with an extra copy of chromosome 21. Though the majority of Down syndrome babies are born to younger mothers, mothers thirty-five years and older are at greater risk of having babies with Down syndrome. Most children affected by Down syndrome have mild to moderate intellectual deficits. Down syndrome children are at elevated risk for a number of health problems affecting different systems including: congenital heart disease, hearing deficits, intestinal disorders, eye, thyroid, and skeletal problems[10]. Today many Down

[8] Neil K. Kaneshiro, MD, MHA, Clinical Assistant Professor of Pediatrics, University of Washington School of Medicine. Also reviewed by David Zieve, MD, MHA, Medical Director, A.D.A.M., Inc. accessed December 30, 2013 http://www.nlm.nih.gov/medlineplus/ency/article/000992.htm

[9] Division of Birth Defects and Developmental Disabilities, NCBDDD, Centers for Disease Control and Prevention. http://www.cdc.gov/ncbddd/birthdefects/gastroschisis.html accessed December 30, 2013

- [10] Division of Birth Defects and Developmental Disabilities, NCBDDD, Centers for Disease Control and Prevention accessed December 30, 2013 http://www.cdc.gov/ncbddd/birthdefects/downsyndrome.html

syndrome children are integrated into regular school classrooms. Much rarer than Down syndrome, there were only 35 trisomy 13 births, or 0.8 per 10,000 live births. Trisomy 13, also known as Patau syndrome, occurs when a baby is born with an extra copy of chromosome 13. Most infants with trisomy 13 have congenital heart disease and 80 percent die within the first year. Trisomy 18 occurs when a baby is born with an extra copy of chromosome 18. Half of those born with trisomy 18 fail to survive the first week. Though some may live to their teens, it is rare. In all there were 76 births affected by trisomy 18, accounting for 1.8 cases per 10,000 live births.

Figure 2 (Page 16) shows the five perinatal regions and the locations of the five regional perinatal center hospitals in Johnson City, Knoxville, Chattanooga, Nashville, and Memphis.

Figure 3 (Pages 17 and 47) illustrates the overall birth defects rates by county for 2006-2010 given in Table 7.

Figure 2. Tennessee Perinatal Regions and Perinatal Center Hospitals

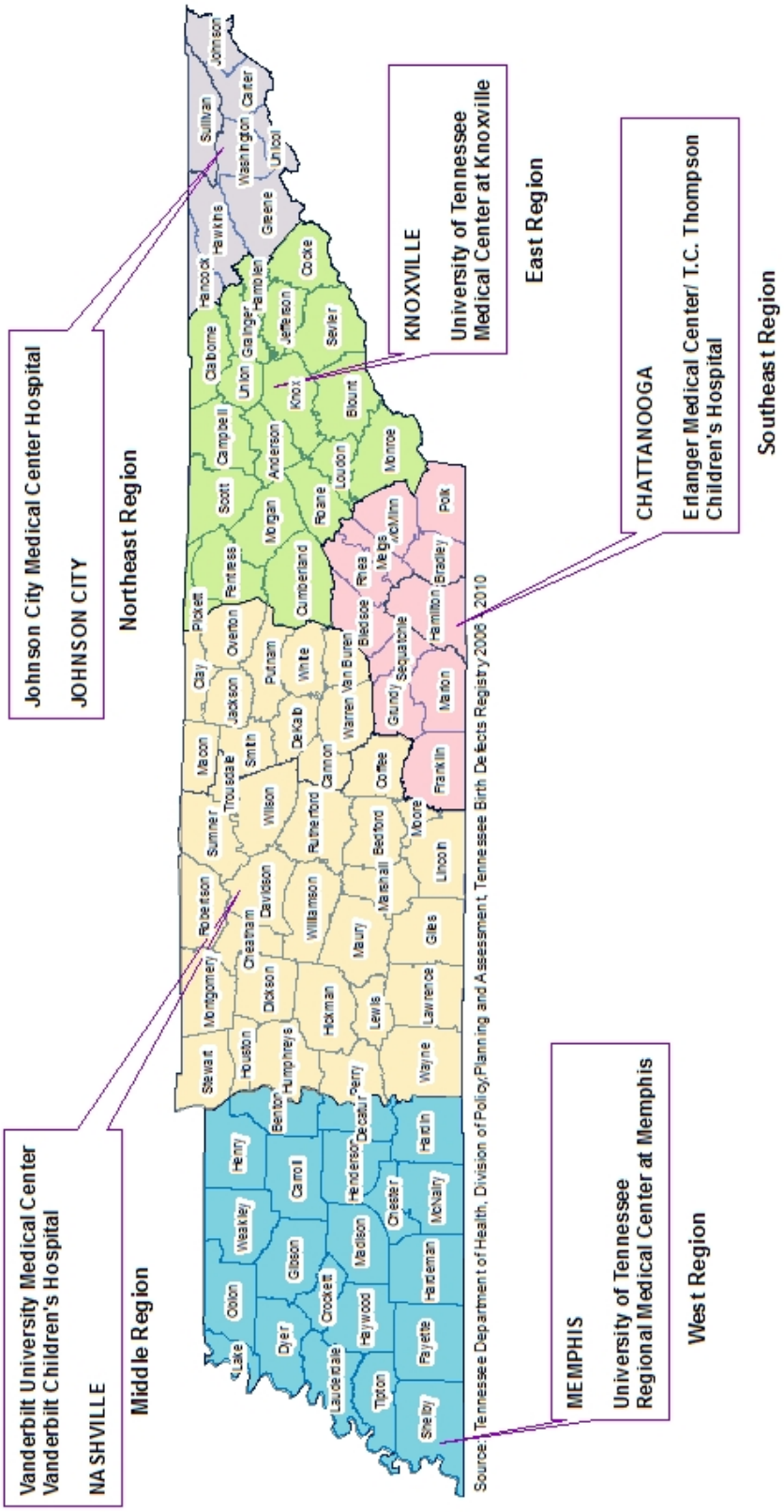


Figure 3. Birth Defects Rates by Maternal Resident County, Tennessee, 2006 - 2010

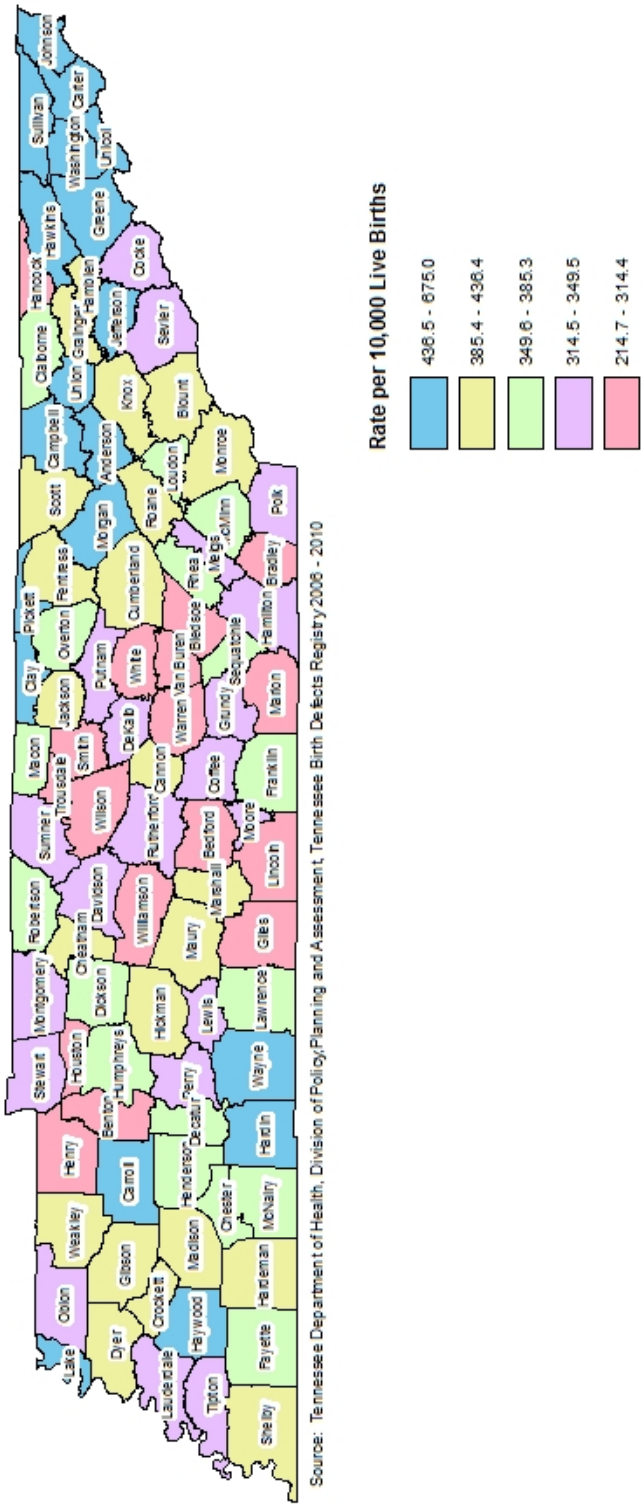


Table 1. Overall Tennessee Birth Defects Rates by Organ System, 2006-2010

Birth Defect	*Count*[1]	*Rate*[2]	*95%CI*[3]
Central Nervous System	**1,036**	**24.8**	**23.3-26.3**
Anencephalus	45	1.1	1.0-1.4
Spina bifida without anencephalus	165	3.9	3.4-4.6
Hydrocephalus without spina bifida	327	7.8	7.0-8.7
Encephalocele	57	1.4	1.2-1.8
Microcephalus	486	11.6	10.6-12.7
Ear and Eye	**175**	**4.2**	**3.6-4.9**
Aniridia	8	0.2	0.1-0.4
Anophthalmia/microphthalmia	46	1.1	1.0-1.5
Congenital cataract	99	2.4	2.2-2.9
Anotia/microtia	30	0.7	0.6-1.0
Cardiovascular	**7,503**	**179.5**	**175.5-183.6**
Common truncus(CCHD)	41	1.0	0.9-1.3
Transposition of great arteries	242	5.8	5.1-6.6
Transposition of great arteries(CCHD)	95	2.3	2.1-2.8
Tetralogy of fallot(CCHD)	258	6.2	5.4-7.0
Ventricular septal defect	1,983	47.5	45.4-49.6
Atrial septal defect	4,574	109.5	106.3-112.7
Atrioventricular septal defect	166	4.0	3.4-4.6
Pulmonary valve atresia and stenosis	405	9.7	8.8-10.7
Pulmonary valve atresia and stenosis(CCHD)	71	1.7	1.6-2.1
Tricuspid valve atresia and stenosis(CCHD)	52	1.2	1.1-1.6
Ebstein's anomaly	42	1.0	0.9-1.4
Aortic valve stenosis	79	1.9	1.7-2.4
Hypoplastic left heart syndrome(CCHD)	154	3.7	3.1-4.3
Patent ductus arteriosus	2,663	63.7	61.3-66.2
Coarctation of aorta	287	6.9	6.1-7.7
Orofacial	**805**	**19.3**	**18.0-20.6**
Cleft palate without cleft lip	331	7.9	7.1-8.8
Cleft lip with and without cleft palate	451	10.8	9.8-11.8
Choanal atresia	71	1.7	1.6-2.1
Gastrointestinal	**2,275**	**54.4**	**52.2-56.7**
Esophageal atresia/tracheoesophageal fistula	104	2.5	2.0-3.0

Table 1. Overall Tennessee Birth Defects Rates by Organ System, 2006-2010

Birth Defect	*Count*[1]	*Rate*[2]	*95%CI*[3]
Rectal and large intestinal atresia/stenosis	256	6.1	5.4-6.9
Pyloric stenosis	1,772	42.4	40.5-44.4
Hirshsprung's disease (congenital megacolon)	128	3.1	2.6-3.6
Biliary atresia	33	0.8	0.7-1.1
Genitourinary	**3,780**	**90.5**	**87.6-93.4**
Bladder exstrophy	21	0.5	0.4-0.8
Hypospadias	2,254	105.4	101.1-109.8
Epispadias	62	1.5	1.4-1.9
Obstructive genitourinary defect	1,314	31.4	29.8-33.2
Renal agensis/hypoplasia	225	5.4	4.7-6.1
Musculoskeletal	**1,011**	**24.2**	**22.7-25.7**
Reduction deformity, upper limbs	95	2.3	2.1-2.8
Reduction deformity, lower limbs	89	2.1	2.0-2.6
Gastroschisis	237	5.7	5.0-6.4
Omphalocele	112	2.7	2.2-3.2
Diaphragmatic hernia	178	4.3	3.7-4.9
Congenital hip dislocation	338	8.1	7.2-9.0
Chromosomal	**694**	**16.6**	**15.4-17.9**
Trisomy 13	35	0.8	0.7-1.2
Down syndrome	586	14.0	12.9-15.2
Trisomy 18	76	1.8	1.7-2.3
Fetus or newborn affected by maternal alcohol use	**83**	**2.0**	**1.8-2.5**
Total Cases	**15,437**	**369.4**	**363.6-375.3**
Total Live Birth	**417,903**		

Source: Tennessee Department of Health, Division of Policy, Planning and Assessment, Tennessee Birth Defects Registry 2006-2010

[1]Counts include cases resulting from live births and fetal deaths.
[2]Rates were computed per 10,000 live births except for Hypospadias per 10,000 live male births.
[3]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 (2006-2011), the Tennessee Death Statistical System (2006-2011) and the Tennessee Fetal Death Statistical System (2006-2010).
Total live births were derived from the Tennessee Birth Statistical System (2006-2010).

Table 2. Birth Defects by Infant Gender 2006-2010

- The 2006-2010 birth defects counts, rates, and confidence intervals by infant gender for the 45 major birth defects are presented in Table 2.
- There were 9,743 male infant birth defects, corresponding to a rate of 455.6 birth defects per 10,000 live male births and 5,692 female infant birth defects, corresponding to a rate of 279.0 birth defects per 10,000 live female births for 2006-2010.

Table 3. Birth Defects by Infant Race/Ethnicity 2006-2010

- Table 3 shows the birth defects counts, rates, and confidence intervals by infant race/ethnicity for the 45 major birth defects for the years 2006-2010.
- There were 10,624 white infant birth defects, corresponding to a rate of 378.4 birth defects per 10,000 live births.
- The number of black infant birth defects was 3,347 with a rate of 384.8. Although the number of birth defects was highest for white infants, the black rate per 10,000 live births exceeded the white infant rate for 2006-2010.
- The number for other races was 269 with a corresponding rate of 245.4 birth defects per 10,000 live births.
- The ethnic population group of Hispanic had 1,197 infant birth defects with a rate of 309.1 per 10,000 live births for 2006-2010.

Table 4. Birth Defects by Perinatal Region 2006-2010

- The birth defects counts, rates, and confidence intervals by perinatal region for the 45 major birth defects for the years 2006-2010 are presented in Table 4. The regions were evaluated in comparison to the Middle Tennessee Perinatal Region.
- The Middle and Southeast regions had approximately the same overall birth defects rates of 330.4 and 341.4 birth defects per 10,000 live births, respectively. The Middle region was chosen as the standard due to its larger birth population.
- The Northeast Perinatal Region birth defects rate (499.0) was the highest regional rate for 2006-2010.

Table 5. Birth Defects by Age of Mother 2006-2010

- Table 5 gives the birth defects counts, rates, and confidence intervals by maternal age group for the 45 major birth defects for the years 2006-2010.
- The maternal age groups 35 years and older overall had the highest rates for infant birth defects.
- Mothers less than 20 years of age also had high birth defects rates. For several of the eight diagnostic categories the rates were highest for this age group.

Table 6. Birth Defects by Maternal Education 2006-2010

- Birth defects counts, rates, and confidence intervals by maternal education for the 45 major birth defects for the years 2006-2010 are presented in Table 6.
- The total birth defect rate decreased as the education of mother increased.

Table 7. Birth Defects by Maternal County of Residence 2006-2010

- Table 7 gives the birth defects counts, rates, and confidence intervals by maternal county of residence for 2006-2010.
- Within each county the counts and rates are organized by the eight organ systems: 1) central nervous system; 2) eye and ear; 3) cardiovascular, 4) orofacial; 5) gastrointestinal; 6) genitourinary; 7) musculoskeletal; and 8) chromosomal.

Table 8. Birth Defects by Maternal Diabetes 2006-2010

- The 2006-2010 birth defects counts, rates, and confidence intervals by maternal diabetes for the 45 major birth defects are presented in Table 8. Babies born to mothers with diabetes are at increased risk for birth defects
- The birth defects rate for maternal diabetes was 963.0 per 10,000 live births for 2006-2010.

Table 2. Tennessee Birth Defects Counts and Rates by Gender, 2006-2010

Birth Defect	*Male*	*Female*
Central Nervous System **	**479**	**556**
Rate	**22.4**	**27.3**
95% confidence interval	**20.4-24.5**	**25.0-29.6**
Anencephalus	23	22
Rate	1.1	1.1
95% confidence interval	0.9-1.6	0.9-1.6
Spina bifida without anencephalus	78	86
Rate	3.6	4.2
95% confidence interval	3.4-4.6	3.9-5.2
Hydrocephalus without spina bifida	166	161
Rate	7.8	7.9
95% confidence interval	6.6-9.0	6.7-9.2
Encephalocele	24	33
Rate	1.1	1.6
95% confidence interval	1.0-1.7	1.4-2.3
Microcephalus ***	208	277
Rate	9.7	13.6
95% confidence interval	8.4-11.1	12.0-15.3
Ear and Eye	**92**	**83**
Rate	**4.3**	**4.1**
95% confidence interval	**4.0-5.3**	**3.8-5.0**
Aniridia	3	5
Rate	0.1	0.2
95% confidence interval	0.1-0.4	0.2-0.6
Anophthalmia/microphthalmia	24	22
Rate	1.1	1.1
95% confidence interval	1.0-1.7	0.9-1.6
Congenital cataract	52	47
Rate	2.4	2.3
95% confidence interval	2.2-3.2	2.1-3.1
Anotia/microtia	16	14
Rate	0.7	0.7
95% confidence interval	0.6-1.2	0.6-1.2
Cardiovascular *	**3,946**	**3,557**
Rate	**184.5**	**174.3**
95% confidence interval	**178.8-190.4**	**168.7-180.2**

Table 2. Tennessee Birth Defects Counts and Rates by Gender, 2006-2010

Birth Defect	*Male*	*Female*
Common truncus(CCHD)	23	18
Rate	1.1	0.9
95% confidence interval	0.9-1.6	0.7-1.4
Transposition of great arteries **	146	96
Rate	6.8	4.7
95% confidence interval	5.8-8.0	4.4-5.7
Transposition of great arteries(CCHD) **	62	33
Rate	2.9	1.6
95% confidence interval	2.6-3.7	1.4-2.3
Tetralogy of fallot(CCHD)	136	122
Rate	6.4	6.0
95% confidence interval	5.3-7.5	5.0-7.1
Ventricular septal defect	983	1,000
Rate	46.0	49.0
95% confidence interval	43.1-48.9	46.0-52.1
Atrial septal defect **	2,446	2,128
Rate	114.4	104.3
95% confidence interval	109.9-119.0	99.9-108.8
Atrioventricular septal defect	75	91
Rate	3.5	4.5
95% confidence interval	3.2-4.4	4.1-5.5
Pulmonary valve atresia and stenosis	222	183
Rate	10.4	9.0
95% confidence interval	9.1-11.8	7.7-10.4
Pulmonary valve atresia and stenosis(CCHD)	38	33
Rate	1.8	1.6
95% confidence interval	1.6-2.4	1.4-2.3
Tricuspid valve atresia and stenosis(CCHD)	31	21
Rate	1.4	1.0
95% confidence interval	1.3-2.1	0.9-1.6
Ebstein's anomaly	18	24
Rate	0.8	1.2
95% confidence interval	0.7-1.3	1.0-1.8
Aortic valve stenosis	48	31
Rate	2.2	1.5
95% confidence interval	2.0-3.0	1.3-2.2

Table 2. Tennessee Birth Defects Counts and Rates by Gender, 2006-2010

Birth Defect	Male	Female
Hypoplastic left heart syndrome(CCHD) ***	105	49
Rate	4.9	2.4
95% confidence interval	4.0-5.9	2.2-3.2
Patent ductus arteriosus *	1,427	1,236
Rate	66.7	60.6
95% confidence interval	63.3-70.3	57.2-64.1
Coarctation of aorta	156	131
Rate	7.3	6.4
95% confidence interval	6.2-8.5	5.4-7.6
**Orofacial ** **	**454**	**351**
Rate	**21.2**	**17.2**
95% confidence interval	**19.3-23.3**	**15.5-19.1**
Cleft palate without cleft lip	158	173
Rate	7.4	8.5
95% confidence interval	6.3-8.6	7.3-9.8
Cleft lip with and without cleft palate ***	286	165
Rate	13.4	8.1
95% confidence interval	11.9-15.0	6.9-9.4
Choanal atresia	39	32
Rate	1.8	1.6
95% confidence interval	1.6-2.5	1.4-2.2
Gastrointestinal * **	**1,730**	**545**
Rate	**80.9**	**26.7**
95% confidence interval	**77.1-84.8**	**24.5-29.1**
Esophageal atresia/tracheoesophageal fistula	60	44
Rate	2.8	2.2
95% confidence interval	2.6-3.6	1.9-2.9
Rectal and large intestinal atresia/stenosis	143	113
Rate	6.7	5.5
95% confidence interval	5.6-7.9	4.6-6.7
Pyloric stenosis ***	1,434	338
Rate	67.1	16.6
95% confidence interval	63.6-70.6	14.8-18.4
Hirshsprung's disease (congenital megacolon) ***	90	38
Rate	4.2	1.9
95% confidence interval	3.9-5.2	1.7-2.6

Table 2. Tennessee Birth Defects Counts and Rates by Gender, 2006-2010

Birth Defect	*Male*	*Female*
Biliary atresia	16	17
Rate	0.7	0.8
95% confidence interval	0.6-1.2	0.7-1.3
Genitourinary * **	**3,293**	**486**
Rate	**154.0**	**23.8**
95% confidence interval	**148.8-159.3**	**21.7-26.0**
Bladder exstrophy	11	10
Rate	0.5	0.5
95% confidence interval	0.4-0.9	0.4-0.9
Hypospadias	2,254	0
Rate	105.4	--
95% confidence interval	101.1-109.8	--
Epispadias	62	0
Rate	2.9	--
95% confidence interval	2.6-3.7	--
Obstructive genitourinary defect ***	910	404
Rate	42.6	19.8
95% confidence interval	39.8-45.4	17.9-21.8
Renal agensis/hypoplasia **	136	88
Rate	6.4	4.3
95% confidence interval	5.3-7.5	4.0-5.3
Musculoskeletal * **	**462**	**549**
Rate	**21.6**	**26.9**
95% confidence interval	**19.7-23.7**	**24.7-29.3**
Reduction deformity, upper limbs	52	43
Rate	2.4	2.1
95% confidence interval	2.2-3.2	1.9-2.8
Reduction deformity, lower limbs *	57	32
Rate	2.7	1.6
95% confidence interval	2.4-3.5	1.4-2.2
Gastroschisis	120	117
Rate	5.6	5.7
95% confidence interval	4.7-6.7	4.7-6.9
Omphalocele	60	52
Rate	2.8	2.5
95% confidence interval	2.6-3.6	2.3-3.3

Table 2. Tennessee Birth Defects Counts and Rates by Gender, 2006-2010

Birth Defect	*Male*	*Female*
Diaphragmatic hernia	100	78
Rate	4.7	3.8
95% confidence interval	4.4-5.7	3.5-4.8
Congenital hip dislocation ***	95	243
Rate	4.4	11.9
95% confidence interval	4.1-5.4	10.5-13.5
Chromosomal	**364**	**330**
Rate	**17.0**	**16.2**
95% confidence interval	**15.3-18.9**	**14.5-18.0**
Trisomy 13	20	15
Rate	0.9	0.7
95% confidence interval	0.8-1.4	0.6-1.2
Down syndrome	319	267
Rate	14.9	13.1
95% confidence interval	13.3-16.6	11.6-14.8
Trisomy 18 **	26	50
Rate	1.2	2.5
95% confidence interval	1.0-1.8	2.2-3.2
Fetus or newborn affected by maternal alcohol use	**41**	**42**
Rate	**1.9**	**2.1**
95% confidence interval	**1.7-2.6**	**1.8-2.8**
Total Cases * **	**9,743**	**5,692**
Rate	**455.6**	**279.0**
95% confidence interval	**446.6-464.7**	**271.8-286.3**
Total Live Births	**213,856**	**204,033**

Source: Tennessee Department of Health, Division of Policy, Planning and Assessment, Tennessee Birth Defects Registry 2006-2010

Note:
[1]Counts include cases resulting from live births and fetal deaths.
[2]Rates were computed per 10,000 live births.
[3]Statistical significance was determined by Poisson regression with statistical probabilities indicated as: p < 0.001***, P < 0.01** , p < 0.05*.
[4]95 percent confidence intervals for 100 or less cases are exact Poisson; otherwise confidence intervals are based on the normal approximation.
[5]Diagnostic data were derived from the Tennessee Hospital Discharge Data System (2006-2011), the Tennessee Death Statistical System (2006-2011) and the Tennessee Fetal Death Statistical System (2006-2010).There were 2 unknown sex cases.
[6]Total live births were derived from the Tennessee Birth Statistical system (2006-2010). There were 14 unknown sex live births

Table 3. Tennessee Birth Defects Counts and Rates by Race/Ethnicity, 2006-2010

Birth Defect	*White*	*Black*	*Hispanic*	*Other*
Central Nervous System **	**664**	**232**	**124**	**16**
Rate	**23.6**	**26.7**	**32.0**	**14.0**
95% confidence interval	**21.9-25.5**	**23.4-30.3**	**26.6-38.2**	**11.5-22.7**
Anencephalus	28	8	7	2
Rate	1.0	0.9	1.8	1.8
95% confidence interval	0.9-1.4	0.7-1.8	1.3-3.7	0.8-6.3
Spina bifida without anencephalus	113	26	23	3
Rate	4.0	3.0	5.9	2.6
95% confidence interval	3.3-4.8	2.6-4.4	5.1-8.9	1.5-7.7
Hydrocephalus without spina bifida	199	83	40	5
Rate	7.1	9.5	10.3	4.4
95% confidence interval	6.1-8.1	8.8-11.8	9.2-14.1	2.9-10.2
Encephalocele	36	11	10	0
Rate	1.3	1.3	2.6	0.0
95% confidence interval	1.1-1.8	1.0-2.3	2.0-4.7	0.0-3.2
Microcephalus ***	318	110	52	6
Rate	11.3	12.6	13.4	5.3
95% confidence interval	10.1-12.6	10.4-15.2	12.1-17.6	3.7-11.4
Ear and Eye	**116**	**40**	**12**	**7**
Rate	**4.1**	**4.6**	**3.1**	**6.1**
95% confidence interval	**3.4-5.0**	**4.1-6.3**	**2.5-5.4**	**4.4-12.6**
Aniridia	7	0	1	0
Rate	0.2	0.0	0.3	0.0
95% confidence interval	0.2-0.5	0.0-0.4	0.1-1.4	0.0-3.2
Anophthalmia/microphthalmia	26	15	3	2
Rate	0.9	1.7	0.8	1.8
95% confidence interval	0.8-1.4	1.4-2.8	0.4-2.3	0.8-6.3
Congenital cataract	71	22	2	4
Rate	2.5	2.5	0.5	3.5
95% confidence interval	2.3-3.2	2.1-3.8	0.2-1.9	2.2-9.0
Anotia/microtia	19	3	7	1
Rate	0.7	0.3	1.8	0.9
95% confidence interval	0.6-1.1	0.2-1.0	1.3-3.7	0.3-4.9
Cardiovascular *	**4,782**	**1,998**	**598**	**125**
Rate	**170.3**	**229.7**	**154.4**	**109.4**
95% confidence interval	**165.5-175.2**	**219.8-240.0**	**142.3-167.3**	**91.1-130.3**

Table 3. Tennessee Birth Defects Counts and Rates by Race/Ethnicity, 2006-2010

Birth Defect	*White*	*Black*	*Hispanic*	*Other*
Common truncus(CCHD)	32	5	3	1
Rate	1.1	0.6	0.8	0.9
95% confidence interval	1.0-1.6	0.4-1.3	0.4-2.3	0.3-4.9
Transposition of great arteries **	165	47	24	6
Rate	5.9	5.4	6.2	5.3
95% confidence interval	5.0-6.8	4.9-7.2	5.3-9.2	3.7-11.4
Transposition of great arteries(CCHD) **	67	17	8	3
Rate	2.4	2.0	2.1	2.6
95% confidence interval	2.2-3.0	1.6-3.1	1.5-4.1	1.5-7.7
Tetralogy of fallot(CCHD)	185	49	21	3
Rate	6.6	5.6	5.4	2.6
95% confidence interval	5.7-7.6	5.1-7.4	4.6-8.3	1.5-7.7
Ventricular septal defect	1,348	405	195	35
Rate	48.0	46.6	50.4	30.6
95% confidence interval	45.5-50.6	42.1-51.3	43.5-57.9	27.0-42.6
Atrial septal defect **	2,801	1,370	337	66
Rate	99.8	157.5	87.0	57.8
95% confidence interval	96.1-103.5	149.3-166.1	78.0-96.8	52.8-73.5
Atrioventricular septal defect	118	36	11	1
Rate	4.2	4.1	2.8	0.9
95% confidence interval	3.5-5.0	3.7-5.7	2.2-5.1	0.3-4.9
Pulmonary valve atresia and stenosis	278	90	26	11
Rate	9.9	10.3	6.7	9.6
95% confidence interval	8.8-11.1	9.6-12.7	5.8-9.8	7.5-17.2
Pulmonary valve atresia and stenosis(CCHD)	45	16	7	3
Rate	1.6	1.8	1.8	2.6
95% confidence interval	1.4-2.1	1.5-3.0	1.3-3.7	1.5-7.7
Tricuspid valve atresia and stenosis(CCHD)	43	6	2	1
Rate	1.5	0.7	0.5	0.9
95% confidence interval	1.4-2.1	0.5-1.5	0.2-1.9	0.3-4.9
Ebstein's anomaly	28	8	4	2
Rate	1.0	0.9	1.0	1.8
95% confidence interval	0.9-1.4	0.7-1.8	0.7-2.6	0.8-6.3
Aortic valve stenosis	68	3	7	1
Rate	2.4	0.3	1.8	0.9
95% confidence interval	2.2-3.1	0.2-1.0	1.3-3.7	0.3-4.9

Table 3. Tennessee Birth Defects Counts and Rates by Race/Ethnicity, 2006-2010

Birth Defect	*White*	*Black*	*Hispanic*	*Other*
Hypoplastic left heart syndrome(CCHD) ***	104	33	16	1
Rate	3.7	3.8	4.1	0.9
95% confidence interval	3.0-4.5	3.3-5.3	3.4-6.7	0.3-4.9
Patent ductus arteriosus *	1,667	716	235	45
Rate	59.4	82.3	60.7	39.4
95% confidence interval	56.6-62.3	76.4-88.6	53.2-69.0	35.3-52.7
Coarctation of aorta	202	51	32	2
Rate	7.2	5.9	8.3	1.8
95% confidence interval	6.2-8.3	5.3-7.7	7.2-11.7	0.8-6.3
Orofacial **	**621**	**111**	**58**	**15**
Rate	**22.1**	**12.8**	**15.0**	**13.1**
95% confidence interval	**20.4-23.9**	**10.5-15.4**	**13.6-19.4**	**10.7-21.7**
Cleft palate without cleft lip	252	50	22	7
Rate	9.0	5.7	5.7	6.1
95% confidence interval	7.9-10.2	5.2-7.6	4.8-8.6	4.4-12.6
Cleft lip with and without cleft palate ***	351	57	35	8
Rate	12.5	6.6	9.0	7.0
95% confidence interval	11.2-13.9	5.9-8.5	8.0-12.6	5.2-13.8
Choanal atresia	57	9	4	1
Rate	2.0	1.0	1.0	0.9
95% confidence interval	1.8-2.6	0.8-2.0	0.7-2.6	0.3-4.9
Gastrointestinal ***	**1,689**	**328**	**231**	**27**
Rate	**60.2**	**37.7**	**59.7**	**23.6**
95% confidence interval	**57.3-63.1**	**33.7-42.0**	**52.2-67.9**	**20.4-34.4**
Esophageal atresia/tracheoesophageal fistula	77	15	12	0
Rate	2.7	1.7	3.1	0.0
95% confidence interval	2.5-3.4	1.4-2.8	2.5-5.4	0.0-3.2
Rectal and large intestinal atresia/stenosis	180	47	25	4
Rate	6.4	5.4	6.5	3.5
95% confidence interval	5.5-7.4	4.9-7.2	5.5-9.5	2.2-9.0
Pyloric stenosis ***	1,347	221	185	19
Rate	48.0	25.4	47.8	16.6
95% confidence interval	45.4-50.6	22.2-29.0	41.1-55.2	13.9-26.0
Hirshsprung's disease (congenital megacolon) ***	77	43	6	2
Rate	2.7	4.9	1.5	1.8
95% confidence interval	2.5-3.4	4.4-6.7	1.1-3.4	0.8-6.3

Table 3. Tennessee Birth Defects Counts and Rates by Race/Ethnicity, 2006-2010

Birth Defect	*White*	*Black*	*Hispanic*	*Other*
Biliary atresia	20	5	5	3
Rate	0.7	0.6	1.3	2.6
95% confidence interval	0.6-1.1	0.4-1.3	0.9-3.0	1.5-7.7
Genitourinary * **	**2,817**	**705**	**185**	**73**
Rate	**100.3**	**81.1**	**47.8**	**63.9**
95% confidence interval	**96.7-104.1**	**75.2-87.3**	**41.1-55.2**	**58.7-80.3**
Bladder exstrophy	17	4	0	0
Rate	0.6	0.5	0.0	0.0
95% confidence interval	0.5-1.0	0.3-1.2	0.0-1.0	0.0-3.2
Hypospadias ***	1,684	466	69	35
Rate	117.0	105.0	34.9	60.5
95% confidence interval	111.5-122.8	95.7-115.0	31.9-44.1	53.3-84.2
Epispadias ***	47	12	3	0
Rate	1.7	1.4	0.8	0.0
95% confidence interval	1.5-2.2	1.1-2.4	0.4-2.3	0.0-3.2
Obstructive genitourinary defect ***	999	185	96	34
Rate	35.6	21.3	24.8	29.8
95% confidence interval	33.4-37.9	18.3-24.6	23.0-30.3	26.2-41.6
Renal agensis/hypoplasia **	145	54	22	4
Rate	5.2	6.2	5.7	3.5
95% confidence interval	4.4-6.1	5.6-8.1	4.8-8.6	2.2-9.0
Musculoskeletal * **	**726**	**175**	**93**	**17**
Rate	**25.9**	**20.1**	**24.0**	**14.9**
95% confidence interval	**24.0-27.8**	**17.3-23.3**	**22.3-29.4**	**12.3-23.8**
Reduction deformity, upper limbs	60	19	14	2
Rate	2.1	2.2	3.6	1.8
95% confidence interval	1.9-2.8	1.8-3.4	2.9-6.1	0.8-6.3
Reduction deformity, lower limbs *	57	23	6	3
Rate	2.0	2.6	1.5	2.6
95% confidence interval	1.8-2.6	2.3-4.0	1.1-3.4	1.5-7.7
Gastroschisis	190	25	19	3
Rate	6.8	2.9	4.9	2.6
95% confidence interval	5.8-7.8	2.5-4.2	4.1-7.7	1.5-7.7
Omphalocele	74	29	9	0
Rate	2.6	3.3	2.3	0.0
95% confidence interval	2.4-3.3	2.9-4.8	1.8-4.4	0.0-3.2

Table 3. Tennessee Birth Defects Counts and Rates by Race/Ethnicity, 2006-2010

Birth Defect	*White*	*Black*	*Hispanic*	*Other*
Diaphragmatic hernia	117	39	17	5
Rate	4.2	4.5	4.4	4.4
95% confidence interval	3.4-5.0	4.0-6.1	3.6-7.0	2.9-10.2
Congenital hip dislocation ***	255	47	32	4
Rate	9.1	5.4	8.3	3.5
95% confidence interval	8.0-10.3	4.9-7.2	7.2-11.7	2.2-9.0
Chromosomal	**458**	**142**	**77**	**17**
Rate	**16.3**	**16.3**	**19.9**	**14.9**
95% confidence interval	**14.9-17.9**	**13.8-19.2**	**18.3-24.9**	**12.3-23.8**
Trisomy 13	17	12	3	3
Rate	0.6	1.4	0.8	2.6
95% confidence interval	0.5-1.0	1.1-2.4	0.4-2.3	1.5-7.7
Down syndrome	393	116	64	13
Rate	14.0	13.3	16.5	11.4
95% confidence interval	12.6-15.5	11.0-16.0	15.1-21.1	9.1-19.5
Trisomy 18 **	51	14	10	1
Rate	1.8	1.6	2.6	0.9
95% confidence interval	1.6-2.4	1.3-2.7	2.0-4.7	0.3-4.9
Fetus or newborn affected by maternal alcohol use	**52**	**31**	**0**	**0**
Rate	**1.9**	**3.6**	**0.0**	**0.0**
95% confidence interval	**1.7-2.4**	**3.1-5.1**	**0.0-1.0**	**0.0-3.2**
Total Cases * **	**10,624**	**3,347**	**1,197**	**269**
Rate	**378.4**	**384.8**	**309.1**	**235.4**
95% confidence interval	**371.2-385.6**	**371.9-398.1**	**291.8-327.1**	**208.1-265.3**
Total Live Births	**280,780**	**86,972**	**38,725**	**11,426**

Source: Tennessee Department of Health, Division of Policy, Planning and Assessment, Tennessee Birth Defects Registry 2006-2010.

Note:
[1]Counts include cases resulting from live births and fetal deaths.
[2]Rates were computed per 10,000 live births except for Hypospadias per 10,000 live male births.
[3]Statistical significance was determined by Poisson regression with statistical probabilities indicated as: p < 0.001***, P < 0.01** , p < 0.05*.
[4]95 percent confidence intervals for 100 or less cases are exact Poisson; otherwise confidence intervals are based on the normal approximation.
[5]Diagnostic data were derived from the Tennessee Hospital Discharge Data System (2006-2011), the Tennessee Death Statistical System (2005-2010) and the Tennessee Fetal Death Statistical System (2006-2011).
[6]Total live births were derived from the Tennessee Birth Statistical system (2006-2010).

Table 4. Tennessee Birth Defects Counts and Rates by Perinatal Region, 2006-2010

Birth Defect	*Northeast*	*East*	*Southeast*	*Middle*	*West*
Central Nervous System ***	**77**	**208**	**112**	**341**	**298**
Rate	**28.8**	**28.4**	**29.6**	**20.4**	**26.4**
95% confidence interval	**26.5-36.0**	**24.6-32.5**	**24.4-35.7**	**18.3-22.7**	**23.5-29.5**
Anencephalus	3	5	3	17	17
Rate	1.1	0.7	0.8	1.0	1.5
95% confidence interval	0.6-3.3	0.5-1.6	0.5-2.3	0.8-1.6	1.2-2.4
Spina bifida without anencephalus	5	37	14	68	41
Rate	1.9	5.0	3.7	4.1	3.6
95% confidence interval	1.3-4.4	4.5-7.0	3.0-6.2	3.7-5.2	3.2-4.9
Hydrocephalus without spina bifida	26	52	36	117	96
Rate	9.7	7.1	9.5	7.0	8.5
95% confidence interval	8.4-14.3	6.4-9.3	8.4-13.2	5.8-8.4	7.9-10.4
Encephalocele	2	10	7	23	15
Rate	0.7	1.4	1.9	1.4	1.3
95% confidence interval	0.4-2.7	1.1-2.5	1.3-3.8	1.2-2.1	1.1-2.2
Microcephalus ***	42	108	61	131	144
Rate	15.7	14.7	16.1	7.8	12.7
95% confidence interval	14.0-21.2	12.1-17.8	14.7-20.7	6.6-9.3	10.7-15.0
Ear and Eye **	**20**	**31**	**17**	**48**	**59**
Rate	**7.5**	**4.2**	**4.5**	**2.9**	**5.2**
95% confidence interval	**6.3-11.6**	**3.7-6.0**	**3.7-7.2**	**2.6-3.8**	**4.7-6.7**
Aniridia	1	1	1	3	2
Rate	0.4	0.1	0.3	0.2	0.2
95% confidence interval	0.1-2.1	0.0-0.8	0.1-1.5	0.1-0.5	0.1-0.6
Anophthalmia/microphthalmia	5	6	5	11	19
Rate	1.9	0.8	1.3	0.7	1.7
95% confidence interval	1.3-4.4	0.6-1.8	0.9-3.1	0.5-1.2	1.4-2.6
Congenital cataract	10	21	8	28	32
Rate	3.7	2.9	2.1	1.7	2.8
95% confidence interval	2.9-6.9	2.4-4.4	1.6-4.2	1.5-2.4	2.5-4.0
Anotia/microtia	5	5	4	8	8
Rate	1.9	0.7	1.1	0.5	0.7
95% confidence interval	1.3-4.4	0.5-1.6	0.7-2.7	0.4-0.9	0.5-1.4
Cardiovascular ***	**766**	**1,349**	**531**	**2,371**	**2,486**
Rate	**286.5**	**184.0**	**140.5**	**142.0**	**220.0**
95% confidence interval	**266.6-307.6**	**174.3-194.0**	**128.8-153.0**	**136.3-147.8**	**211.4-228.8**

Table 4. Tennessee Birth Defects Counts and Rates by Perinatal Region, 2006-2010

Birth Defect	Northeast	East	Southeast	Middle	West
Common truncus(CCHD)	4	11	4	17	5
Rate	1.5	1.5	1.1	1.0	0.4
95% confidence interval	0.9-3.8	1.2-2.7	0.7-2.7	0.8-1.6	0.3-1.0
Transposition of great arteries	13	39	26	97	67
Rate	4.9	5.3	6.9	5.8	5.9
95% confidence interval	3.9-8.3	4.7-7.3	5.9-10.1	5.4-7.1	5.4-7.5
Transposition of great arteries(CCHD) *	5	22	9	23	36
Rate	1.9	3.0	2.4	1.4	3.2
95% confidence interval	1.3-4.4	2.5-4.5	1.8-4.5	1.2-2.1	2.8-4.4
Tetralogy of fallot(CCHD)	13	55	24	90	76
Rate	4.9	7.5	6.4	5.4	6.7
95% confidence interval	3.9-8.3	6.8-9.8	5.4-9.4	5.0-6.6	6.2-8.4
Ventricular septal defect	148	347	175	755	558
Rate	55.4	47.3	46.3	45.2	49.4
95% confidence interval	46.8-65.0	42.5-52.6	39.7-53.7	42.0-48.5	45.4-53.6
Atrial septal defect ***	537	783	286	1,280	1,688
Rate	200.9	106.8	75.7	76.6	149.3
95% confidence interval	184.2-218.6	99.4-114.5	67.2-85.0	72.5-81.0	142.3-156.6
Atrioventricular septal defect	9	34	19	61	43
Rate	3.4	4.6	5.0	3.7	3.8
95% confidence interval	2.6-6.4	4.1-6.5	4.2-7.9	3.3-4.7	3.4-5.1
Pulmonary valve atresia and stenosis **	46	68	35	146	110
Rate	17.2	9.3	9.3	8.7	9.7
95% confidence interval	15.4-23.0	8.5-11.8	8.2-12.9	7.4-10.3	8.0-11.7
Pulmonary valve atresia and stenosis(CCHD) **	8	4	5	24	30
Rate	3.0	0.5	1.3	1.4	2.7
95% confidence interval	2.2-5.9	0.3-1.4	0.9-3.1	1.2-2.1	2.3-3.8
Tricuspid valve atresia and stenosis(CCHD)	4	9	7	19	13
Rate	1.5	1.2	1.9	1.1	1.2
95% confidence interval	0.9-3.8	0.9-2.3	1.3-3.8	1.0-1.8	0.9-2.0
Ebstein's anomaly	3	12	5	12	10
Rate	1.1	1.6	1.3	0.7	0.9
95% confidence interval	0.6-3.3	1.3-2.9	0.9-3.1	0.6-1.3	0.7-1.6
Aortic valve stenosis *	5	15	8	41	10
Rate	1.9	2.0	2.1	2.5	0.9
95% confidence interval	1.3-4.4	1.7-3.4	1.6-4.2	2.2-3.3	0.7-1.6

Table 4. Tennessee Birth Defects Counts and Rates by Perinatal Region, 2006-2010

Birth Defect	*Northeast*	*East*	*Southeast*	*Middle*	*West*
Hypoplastic left heart syndrome(CCHD)	7	30	16	59	42
Rate	2.6	4.1	4.2	3.5	3.7
95% confidence interval	1.9-5.4	3.6-5.8	3.5-6.9	3.2-4.6	3.3-5.0
Patent ductus arteriosus ***	300	396	176	834	957
Rate	112.2	54.0	46.6	49.9	84.7
95% confidence interval	99.9-125.7	48.8-59.6	39.9-54.0	46.6-53.4	79.4-90.2
Coarctation of aorta *	8	47	33	130	69
Rate	3.0	6.4	8.7	7.8	6.1
95% confidence interval	2.2-5.9	5.8-8.5	7.7-12.3	6.5-9.2	5.6-7.7
Orofacial ***	**75**	**166**	**82**	**310**	**172**
Rate	**28.1**	**22.6**	**21.7**	**18.6**	**15.2**
95% confidence interval	**25.8-35.2**	**19.3-26.4**	**20.0-26.9**	**16.6-20.7**	**13.0-17.7**
Cleft palate without cleft lip **	35	59	36	134	67
Rate	13.1	8.0	9.5	8.0	5.9
95% confidence interval	11.5-18.2	7.3-10.4	8.4-13.2	6.7-9.5	5.4-7.5
Cleft lip with and without cleft palate **	42	95	42	174	98
Rate	15.7	13.0	11.1	10.4	8.7
95% confidence interval	14.0-21.2	12.0-15.8	9.9-15.0	8.9-12.1	8.1-10.6
Choanal atresia	4	16	8	29	14
Rate	1.5	2.2	2.1	1.7	1.2
95% confidence interval	0.9-3.8	1.8-3.5	1.6-4.2	1.5-2.5	1.0-2.1
Gastrointestinal ***	**192**	**470**	**222**	**840**	**551**
Rate	**71.8**	**64.1**	**58.7**	**50.3**	**48.8**
95% confidence interval	**62.0-82.7**	**58.4-70.2**	**51.3-67.0**	**47.0-53.8**	**44.8-53.0**
Esophageal atresia/tracheoesophageal fistula	5	15	12	48	24
Rate	1.9	2.0	3.2	2.9	2.1
95% confidence interval	1.3-4.4	1.7-3.4	2.5-5.5	2.6-3.8	1.8-3.2
Rectal and large intestinal atresia/stenosis	17	48	29	102	60
Rate	6.4	6.5	7.7	6.1	5.3
95% confidence interval	5.3-10.2	5.9-8.7	6.7-11.0	5.0-7.4	4.8-6.8
Pyloric stenosis ***	160	388	166	626	432
Rate	59.9	52.9	43.9	37.5	38.2
95% confidence interval	50.9-69.9	47.8-58.4	37.5-51.1	34.6-40.5	34.7-42.0
Hirshsprung's disease (congenital megacolon)	12	16	10	56	34
Rate	4.5	2.2	2.6	3.4	3.0
95% confidence interval	3.6-7.8	1.8-3.5	2.0-4.9	3.0-4.4	2.6-4.2

Table 4. Tennessee Birth Defects Counts and Rates by Perinatal Region, 2006-2010

Birth Defect	*Northeast*	*East*	*Southeast*	*Middle*	*West*
Biliary atresia	0	4	5	18	6
Rate	0.0	0.5	1.3	1.1	0.5
95% confidence interval	0.0-1.4	0.3-1.4	0.9-3.1	0.9-1.7	0.4-1.2
Genitourinary * **	**252**	**765**	**295**	**1,627**	**841**
Rate	**94.3**	**104.3**	**78.1**	**97.4**	**74.4**
95% confidence interval	**83.0-106.7**	**97.1-112.0**	**69.4-87.5**	**92.7-102.3**	**69.5-79.6**
Bladder exstrophy	1	4	3	10	3
Rate	0.4	0.5	0.8	0.6	0.3
95% confidence interval	0.1-2.1	0.3-1.4	0.5-2.3	0.5-1.1	0.2-0.8
Hypospadias ***	110	406	168	1,038	532
Rate	80.3	108.2	86.5	121.5	92.1
95% confidence interval	66.0-96.7	97.9-119.2	73.9-100.6	114.2-129.1	84.4-100.3
Epispadias	1	15	8	23	15
Rate	0.4	2.0	2.1	1.4	1.3
95% confidence interval	0.1-2.1	1.7-3.4	1.6-4.2	1.2-2.1	1.1-2.2
Obstructive genitourinary defect ***	143	308	105	504	254
Rate	53.5	42.0	27.8	30.2	22.5
95% confidence interval	45.1-63.0	37.4-47.0	22.7-33.6	27.6-32.9	19.8-25.4
Renal agensis/hypoplasia	13	51	19	86	56
Rate	4.9	7.0	5.0	5.1	5.0
95% confidence interval	3.9-8.3	6.3-9.1	4.2-7.9	4.8-6.4	4.5-6.4
Musculoskeletal	**66**	**183**	**109**	**397**	**256**
Rate	**24.7**	**25.0**	**28.8**	**23.8**	**22.6**
95% confidence interval	**22.6-31.4**	**21.5-28.8**	**23.7-34.8**	**21.5-26.2**	**20.0-25.6**
Reduction deformity, upper limbs	8	21	10	31	25
Rate	3.0	2.9	2.6	1.9	2.2
95% confidence interval	2.2-5.9	2.4-4.4	2.0-4.9	1.6-2.6	1.9-3.3
Reduction deformity, lower limbs	5	11	12	32	29
Rate	1.9	1.5	3.2	1.9	2.6
95% confidence interval	1.3-4.4	1.2-2.7	2.5-5.5	1.7-2.7	2.2-3.7
Gastroschisis	16	46	22	98	55
Rate	6.0	6.3	5.8	5.9	4.9
95% confidence interval	4.9-9.7	5.6-8.4	4.9-8.8	5.5-7.2	4.4-6.3
Omphalocele	3	23	12	49	25
Rate	1.1	3.1	3.2	2.9	2.2
95% confidence interval	0.6-3.3	2.7-4.7	2.5-5.5	2.6-3.9	1.9-3.3

Table 4. Tennessee Birth Defects Counts and Rates by Perinatal Region, 2006-2010

Birth Defect	*Northeast*	*East*	*Southeast*	*Middle*	*West*
Diaphragmatic hernia	20	30	13	68	47
Rate	7.5	4.1	3.4	4.1	4.2
95% confidence interval	6.3-11.6	3.6-5.8	2.8-5.9	3.7-5.2	3.7-5.5
Congenital hip dislocation	16	59	45	139	79
Rate	6.0	8.0	11.9	8.3	7.0
95% confidence interval	4.9-9.7	7.3-10.4	10.7-15.9	7.0-9.8	6.4-8.7
Chromosomal	**40**	**112**	**63**	**289**	**190**
Rate	**15.0**	**15.3**	**16.7**	**17.3**	**16.8**
95% confidence interval	**13.3-20.4**	**12.6-18.4**	**15.2-21.3**	**15.4-19.4**	**14.5-19.4**
Trisomy 13	3	3	1	12	16
Rate	1.1	0.4	0.3	0.7	1.4
95% confidence interval	0.6-3.3	0.2-1.2	0.1-1.5	0.6-1.3	1.2-2.3
Down syndrome	34	98	53	246	155
Rate	12.7	13.4	14.0	14.7	13.7
95% confidence interval	11.2-17.8	12.4-16.3	12.7-18.3	12.9-16.7	11.6-16.1
Trisomy 18	4	11	9	32	20
Rate	1.5	1.5	2.4	1.9	1.8
95% confidence interval	0.9-3.8	1.2-2.7	1.8-4.5	1.7-2.7	1.5-2.7
Fetus or newborn affected by maternal alcohol use *	**10**	**19**	**13**	**24**	**17**
Rate	**3.7**	**2.6**	**3.4**	**1.4**	**1.5**
95% confidence interval	**2.9-6.9**	**2.2-4.0**	**2.8-5.9**	**1.2-2.1**	**1.2-2.4**
Total Cases * **	**1,334**	**2,948**	**1,290**	**5,518**	**4,347**
Rate	**499.0**	**402.0**	**341.4**	**330.4**	**384.6**
95% confidence interval	**472.6-526.5**	**387.6-416.8**	**323.0-360.5**	**321.7-339.2**	**373.3-396.2**
Total Live Births	**26,733**	**73,335**	**37,789**	**167,016**	**113,025**

Source: Tennessee Department of Health, Division of Policy, Planning and Assessment, Tennessee Birth Defects Registry 2006-2010.

Note:
[1]Counts include cases resulting from live births and fetal deaths.
[2]Rates were computed per 10,000 live births except for Hypospadias per 10,000 live male births.
[3]Statistical significance was determined by Poisson regression with statistical probabilities indicated as: $p < 0.001$***, $P < 0.01$** , $p < 0.05$*.
[4]95 percent confidence intervals for 100 or less cases are exact Poisson; otherwise confidence intervals are based on the normal approximation.
[5]Diagnostic data were derived from the Tennessee Hospital Discharge Data System (2006-2011), the Tennessee Death Statistical System (2005-2010) and the Tennessee Fetal Death Statistical System (2006-2011).
[6]Total live births were derived from the Tennessee Birth Statistical system (2006-2010).

Table 5. Tennessee Birth Defects Counts and Rates by Age of Mother, 2006-2010

Birth Defect	*<20*	*20-24*	*25-29*	*30-34*	*35-39*	*>=40*
Central Nervous System	**158**	**327**	**275**	**170**	**89**	**17**
Rate	**29.5**	**26.4**	**23.3**	**21.4**	**25.0**	**23.4**
95% confidence interval	**25.1-34.5**	**23.7-29.5**	**20.6-26.2**	**18.3-24.8**	**23.1-30.7**	**19.4-37.5**
Anencephalus	9	15	12	6	3	0
Rate	1.7	1.2	1.0	0.8	0.8	0.0
95% confidence interval	1.3-3.2	1.0-2.0	0.8-1.8	0.5-1.6	0.5-2.5	0.0-5.1
Spina bifida without anencephalus	21	40	54	26	21	3
Rate	3.9	3.2	4.6	3.3	5.9	4.1
95% confidence interval	3.3-6.0	2.9-4.4	4.1-6.0	2.8-4.8	5.0-9.0	2.4-12.1
Hydrocephalus without spina bifida *	43	120	70	65	24	5
Rate	8.0	9.7	5.9	8.2	6.7	6.9
95% confidence interval	7.2-10.8	8.0-11.6	5.4-7.5	7.5-10.4	5.8-10.0	4.6-16.1
Encephalocele	8	13	16	15	5	0
Rate	1.5	1.1	1.4	1.9	1.4	0.0
95% confidence interval	1.1-2.9	0.8-1.8	1.1-2.2	1.5-3.1	0.9-3.3	0.0-5.1
Microcephalus **	81	157	132	66	40	10
Rate	15.1	12.7	11.2	8.3	11.2	13.8
95% confidence interval	14.0-18.8	10.8-14.8	9.3-13.2	7.6-10.6	10.0-15.3	10.6-25.3
Ear and Eye *	**36**	**53**	**38**	**27**	**18**	**3**
Rate	**6.7**	**4.3**	**3.2**	**3.4**	**5.0**	**4.1**
95% confidence interval	**5.9-9.3**	**3.9-5.6**	**2.8-4.4**	**2.9-4.9**	**4.2-8.0**	**2.4-12.1**
Aniridia	2	0	2	4	0	0
Rate	0.4	0.0	0.2	0.5	0.0	0.0
95% confidence interval	0.2-1.4	0.0-0.3	0.1-0.6	0.3-1.3	0.0-1.0	0.0-5.1
Anophthalmia/microphthalmia	10	16	8	7	4	1
Rate	1.9	1.3	0.7	0.9	1.1	1.4
95% confidence interval	1.4-3.4	1.1-2.1	0.5-1.3	0.6-1.8	0.7-2.9	0.4-7.7
Congenital cataract	20	29	23	15	10	2
Rate	3.7	2.3	1.9	1.9	2.8	2.8
95% confidence interval	3.1-5.8	2.0-3.4	1.7-2.9	1.5-3.1	2.2-5.2	1.3-10.0
Anotia/microtia	8	8	6	3	5	0
Rate	1.5	0.6	0.5	0.4	1.4	0.0
95% confidence interval	1.1-2.9	0.5-1.3	0.4-1.1	0.2-1.1	0.9-3.3	0.0-5.1
Cardiovascular * **	**1,013**	**2,163**	**1,995**	**1,349**	**785**	**194**
Rate	**189.4**	**175.0**	**168.8**	**169.6**	**220.1**	**267.3**
95% confidence interval	**177.9-201.4**	**167.7-182.5**	**161.5-176.4**	**160.7-178.9**	**205.0-236.1**	**231.0-307.7**

Table 5. Tennessee Birth Defects Counts and Rates by Age of Mother, 2006-2010

Birth Defect	<20	20-24	25-29	30-34	35-39	>=40
Common truncus(CCHD)	10	10	11	4	4	2
Rate	1.9	0.8	0.9	0.5	1.1	2.8
95% confidence interval	1.4-3.4	0.6-1.5	0.7-1.7	0.3-1.3	0.7-2.9	1.3-10.0
Transposition of great arteries	36	66	60	51	25	4
Rate	6.7	5.3	5.1	6.4	7.0	5.5
95% confidence interval	5.9-9.3	4.9-6.8	4.6-6.5	5.8-8.4	6.0-10.3	3.5-14.1
Transposition of great arteries(CCHD)	11	27	26	22	7	2
Rate	2.1	2.2	2.2	2.8	2.0	2.8
95% confidence interval	1.6-3.7	1.9-3.2	1.9-3.2	2.3-4.2	1.4-4.0	1.3-10.0
Tetralogy of fallot(CCHD)	29	77	68	43	34	7
Rate	5.4	6.2	5.8	5.4	9.5	9.6
95% confidence interval	4.7-7.8	5.7-7.8	5.3-7.3	4.8-7.3	8.4-13.3	7.0-19.9
Ventricular septal defect ***	253	521	546	351	249	63
Rate	47.3	42.1	46.2	44.1	69.8	86.8
95% confidence interval	41.6-53.5	38.6-45.9	42.4-50.2	39.6-49.0	61.4-79.1	79.2-111.1
Atrial septal defect ***	647	1,378	1,207	793	440	107
Rate	120.9	111.5	102.1	99.7	123.4	147.4
95% confidence interval	111.8-130.6	105.7-117.5	96.4-108.1	92.9-106.9	112.1-135.5	120.8-178.2
Atrioventricular septal defect ***	29	41	32	19	31	14
Rate	5.4	3.3	2.7	2.4	8.7	19.3
95% confidence interval	4.7-7.8	3.0-4.5	2.4-3.8	2.0-3.7	7.6-12.3	15.6-32.4
Pulmonary valve atresia and stenosis *	51	131	109	57	44	12
Rate	9.5	10.6	9.2	7.2	12.3	16.5
95% confidence interval	8.6-12.5	8.9-12.6	7.6-11.1	6.5-9.3	11.0-16.6	13.1-28.9
Pulmonary valve atresia and stenosis(CCHD)	12	20	22	7	6	4
Rate	2.2	1.6	1.9	0.9	1.7	5.5
95% confidence interval	1.8-3.9	1.4-2.5	1.6-2.8	0.6-1.8	1.2-3.7	3.5-14.1
Tricuspid valve atresia and stenosis(CCHD)	6	10	19	9	7	1
Rate	1.1	0.8	1.6	1.1	2.0	1.4
95% confidence interval	0.8-2.4	0.6-1.5	1.3-2.5	0.9-2.1	1.4-4.0	0.4-7.7
Ebstein's anomaly	4	20	8	9	1	0
Rate	0.7	1.6	0.7	1.1	0.3	0.0
95% confidence interval	0.5-1.9	1.4-2.5	0.5-1.3	0.9-2.1	0.1-1.6	0.0-5.1
Aortic valve stenosis	10	23	27	9	10	0
Rate	1.9	1.9	2.3	1.1	2.8	0.0
95% confidence interval	1.4-3.4	1.6-2.8	2.0-3.3	0.9-2.1	2.2-5.2	0.0-5.1

Table 5. Tennessee Birth Defects Counts and Rates by Age of Mother, 2006-2010

Birth Defect	*<20*	*20-24*	*25-29*	*30-34*	*35-39*	*>=40*
Hypoplastic left heart syndrome(CCHD)	23	46	41	34	10	0
Rate	4.3	3.7	3.5	4.3	2.8	0.0
95% confidence interval	3.7-6.5	3.3-5.0	3.1-4.7	3.8-6.0	2.2-5.2	0.0-5.1
Patent ductus arteriosus ***	347	688	718	529	306	73
Rate	64.9	55.6	60.8	66.5	85.8	100.6
95% confidence interval	58.2-72.1	51.6-60.0	56.4-65.4	61.0-72.4	76.5-96.0	92.4-126.5
Coarctation of aorta ***	53	59	77	55	34	9
Rate	9.9	4.8	6.5	6.9	9.5	12.4
95% confidence interval	9.0-13.0	4.3-6.2	6.0-8.1	6.3-9.0	8.4-13.3	9.4-23.5
Orofacial *	**94**	**259**	**202**	**143**	**88**	**19**
Rate	**17.6**	**20.9**	**17.1**	**18.0**	**24.7**	**26.2**
95% confidence interval	**16.3-21.5**	**18.5-23.7**	**14.8-19.6**	**15.2-21.2**	**22.9-30.4**	**21.9-40.9**
Cleft palate without cleft lip	36	99	81	65	40	10
Rate	6.7	8.0	6.9	8.2	11.2	13.8
95% confidence interval	5.9-9.3	7.5-9.7	6.3-8.5	7.5-10.4	10.0-15.3	10.6-25.3
Cleft lip with and without cleft palate	56	154	114	76	42	9
Rate	10.5	12.5	9.6	9.6	11.8	12.4
95% confidence interval	9.5-13.6	10.6-14.6	8.0-11.6	8.8-12.0	10.5-15.9	9.4-23.5
Choanal atresia	5	23	19	13	10	1
Rate	0.9	1.9	1.6	1.6	2.8	1.4
95% confidence interval	0.6-2.2	1.6-2.8	1.3-2.5	1.3-2.8	2.2-5.2	0.4-7.7
Gastrointestinal *	**404**	**770**	**584**	**320**	**166**	**30**
Rate	**75.5**	**62.3**	**49.4**	**40.2**	**46.6**	**41.3**
95% confidence interval	**68.3-83.3**	**58.0-66.8**	**45.5-53.6**	**35.9-44.9**	**39.7-54.2**	**36.0-59.0**
Esophageal atresia/tracheoesophageal fistula *	16	21	35	14	13	5
Rate	3.0	1.7	3.0	1.8	3.6	6.9
95% confidence interval	2.5-4.9	1.4-2.6	2.6-4.1	1.4-3.0	2.9-6.2	4.6-16.1
Rectal and large intestinal atresia/stenosis	43	76	68	43	22	4
Rate	8.0	6.1	5.8	5.4	6.2	5.5
95% confidence interval	7.2-10.8	5.7-7.7	5.3-7.3	4.8-7.3	5.2-9.3	3.5-14.1
Pyloric stenosis ***	329	622	450	241	113	16
Rate	61.5	50.3	38.1	30.3	31.7	22.0
95% confidence interval	55.0-68.5	46.4-54.4	34.6-41.8	26.6-34.4	26.1-38.1	18.1-35.8
Hirshsprung's disease (congenital megacolon)	18	42	29	22	12	5
Rate	3.4	3.4	2.5	2.8	3.4	6.9
95% confidence interval	2.8-5.3	3.0-4.6	2.1-3.5	2.3-4.2	2.7-5.9	4.6-16.1

Table 5. Tennessee Birth Defects Counts and Rates by Age of Mother, 2006-2010

Birth Defect	*<20*	*20-24*	*25-29*	*30-34*	*35-39*	*>=40*
Biliary atresia *	2	12	10	2	7	0
Rate	0.4	1.0	0.8	0.3	2.0	0.0
95% confidence interval	0.2-1.4	0.8-1.7	0.7-1.6	0.1-0.9	1.4-4.0	0.0-5.1
Genitourinary **	**459**	**1,053**	**1,063**	**769**	**349**	**87**
Rate	**85.8**	**85.2**	**89.9**	**96.7**	**97.9**	**119.9**
95% confidence interval	**78.1-94.0**	**80.1-90.5**	**84.6-95.5**	**90.0-103.8**	**87.9-108.7**	**111.0-147.9**
Bladder exstrophy	4	6	5	2	3	1
Rate	0.7	0.5	0.4	0.3	0.8	1.4
95% confidence interval	0.5-1.9	0.3-1.1	0.3-1.0	0.1-0.9	0.5-2.5	0.4-7.7
Hypospadias	278	635	634	467	191	49
Rate	101.1	100.7	104.6	114.5	105.3	133.9
95% confidence interval	89.5-113.7	93.0-108.8	96.6-113.0	104.3-125.4	90.9-121.4	120.6-177.0
Epispadias	8	21	16	13	4	0
Rate	1.5	1.7	1.4	1.6	1.1	0.0
95% confidence interval	1.1-2.9	1.4-2.6	1.1-2.2	1.3-2.8	0.7-2.9	0.0-5.1
Obstructive genitourinary defect *	155	354	373	260	138	34
Rate	29.0	28.6	31.6	32.7	38.7	46.9
95% confidence interval	24.6-33.9	25.7-31.8	28.4-34.9	28.8-36.9	32.5-45.7	41.2-65.5
Renal agensis/hypoplasia	25	72	64	42	17	5
Rate	4.7	5.8	5.4	5.3	4.8	6.9
95% confidence interval	4.0-6.9	5.3-7.3	4.9-6.9	4.7-7.1	3.9-7.6	4.6-16.1
Musculoskeletal ***	**168**	**350**	**240**	**163**	**69**	**21**
Rate	**31.4**	**28.3**	**20.3**	**20.5**	**19.4**	**28.9**
95% confidence interval	**26.8-36.5**	**25.4-31.4**	**17.8-23.0**	**17.5-23.9**	**17.7-24.5**	**24.5-44.2**
Reduction deformity, upper limbs	10	36	23	17	6	3
Rate	1.9	2.9	1.9	2.1	1.7	4.1
95% confidence interval	1.4-3.4	2.6-4.0	1.7-2.9	1.8-3.4	1.2-3.7	2.4-12.1
Reduction deformity, lower limbs	11	32	20	19	7	0
Rate	2.1	2.6	1.7	2.4	2.0	0.0
95% confidence interval	1.6-3.7	2.3-3.7	1.4-2.6	2.0-3.7	1.4-4.0	0.0-5.1
Gastroschisis ***	79	107	36	15	0	0
Rate	14.8	8.7	3.0	1.9	0.0	0.0
95% confidence interval	13.6-18.4	7.1-10.5	2.7-4.2	1.5-3.1	0.0-1.0	0.0-5.1
Omphalocele	16	34	28	23	7	4
Rate	3.0	2.8	2.4	2.9	2.0	5.5
95% confidence interval	2.5-4.9	2.4-3.8	2.1-3.4	2.5-4.3	1.4-4.0	3.5-14.1

Table 5. Tennessee Birth Defects Counts and Rates by Age of Mother, 2006-2010

Birth Defect	*<20*	*20-24*	*25-29*	*30-34*	*35-39*	*>=40*
Diaphragmatic hernia	23	56	48	35	11	5
Rate	4.3	4.5	4.1	4.4	3.1	6.9
95% confidence interval	3.7-6.5	4.1-5.9	3.7-5.4	3.9-6.1	2.4-5.5	4.6-16.1
Congenital hip dislocation	35	99	93	61	41	9
Rate	6.5	8.0	7.9	7.7	11.5	12.4
95% confidence interval	5.8-9.1	7.5-9.7	7.3-9.6	7.0-9.9	10.2-15.6	9.4-23.5
Chromosomal * **	**58**	**124**	**135**	**106**	**167**	**104**
Rate	**10.8**	**10.0**	**11.4**	**13.3**	**46.8**	**143.3**
95% confidence interval	**9.9-14.0**	**8.3-12.0**	**9.6-13.5**	**10.9-16.1**	**40.0-54.5**	**117.1-173.6**
Trisomy 13	3	9	11	5	6	1
Rate	0.6	0.7	0.9	0.6	1.7	1.4
95% confidence interval	0.3-1.6	0.6-1.4	0.7-1.7	0.4-1.5	1.2-3.7	0.4-7.7
Down syndrome ***	46	97	109	97	144	93
Rate	8.6	7.8	9.2	12.2	40.4	128.2
95% confidence interval	7.7-11.5	7.3-9.6	7.6-11.1	11.3-14.9	34.1-47.5	119.0-157.0
Trisomy 18 ***	9	18	17	4	18	10
Rate	1.7	1.5	1.4	0.5	5.0	13.8
95% confidence interval	1.3-3.2	1.2-2.3	1.2-2.3	0.3-1.3	4.2-8.0	10.6-25.3
**Fetus or newborn affected by maternal alcohol use ** **	**7**	**20**	**22**	**13**	**17**	**4**
Rate	**1.3**	**1.6**	**1.9**	**1.6**	**4.8**	**5.5**
95% confidence interval	**1.0-2.7**	**1.4-2.5**	**1.6-2.8**	**1.3-2.8**	**3.9-7.6**	**3.5-14.1**
Total Cases * **	**2,137**	**4,574**	**4,119**	**2,742**	**1,488**	**372**
Rate	**399.5**	**370.0**	**348.5**	**344.7**	**417.3**	**512.6**
95% confidence interval	**382.7-416.8**	**359.3-380.8**	**338.0-359.3**	**332.0-357.9**	**396.4-439.1**	**461.8-567.4**
Total Live Births	**53,494**	**123,633**	**118,183**	**79,536**	**35,658**	**7,257**

Source: Tennessee Department of Health, Division of Policy, Planning and Assessment, Tennessee Birth Defects Registry 2006-2010.

Note:
[1]Counts include cases resulting from live births and fetal deaths.
[2]Rates were computed per 10,000 live births except for Hypospadias per 10,000 live male births.
[3]Statistical significance was determined by Poisson regression with statistical probabilities indicated as: p < 0.001***, P < 0.01** , p < 0.05*.
[4]95 percent confidence intervals for 100 or less cases are exact Poisson; otherwise confidence intervals are based on the normal approximation.
[5]Diagnostic data were derived from the Tennessee Hospital Discharge Data System (2006-2011), the Tennessee Death Statistical System (2005-2010) and the Tennessee Fetal Death Statistical System (2006-2011).
[6]Total live births were derived from the Tennessee Birth Statistical system (2006-2010).

Table 6. Tennessee Birth Defects Counts and Rates by Maternal Education, 2006-2010

Birth Defect	*No High School Diploma*	*Diploma or GED*	*Some College or Bachelor*	*Graduate Degree*
Central Nervous System * **	**309**	**319**	**355**	**45**
Rate	**34.2**	**26.2**	**20.2**	**15.8**
95% confidence interval	**30.5-38.3**	**23.4-29.2**	**18.2-22.4**	**14.1-21.1**
Anencephalus	11	19	12	2
Rate	1.2	1.6	0.7	0.7
95% confidence interval	1.0-2.2	1.3-2.4	0.5-1.2	0.3-2.5
Spina bifida without anencephalus	44	41	68	10
Rate	4.9	3.4	3.9	3.5
95% confidence interval	4.4-6.5	3.0-4.6	3.5-4.9	2.7-6.4
Hydrocephalus without spina bifida ***	95	106	111	12
Rate	10.5	8.7	6.3	4.2
95% confidence interval	9.8-12.9	7.1-10.5	5.2-7.6	3.3-7.3
Encephalocele	12	19	23	3
Rate	1.3	1.6	1.3	1.1
95% confidence interval	1.1-2.3	1.3-2.4	1.1-2.0	0.6-3.1
Microcephalus ***	157	150	157	18
Rate	17.4	12.3	8.9	6.3
95% confidence interval	14.8-20.3	10.4-14.4	7.6-10.4	5.2-10.0
Ear and Eye	**41**	**48**	**73**	**13**
Rate	**4.5**	**3.9**	**4.2**	**4.6**
95% confidence interval	**4.0-6.2**	**3.5-5.2**	**3.8-5.2**	**3.6-7.8**
Aniridia	0	3	5	0
Rate	0.0	0.2	0.3	0.0
95% confidence interval	0.0-0.4	0.1-0.7	0.2-0.7	0.0-1.3
Anophthalmia/microphthalmia	8	13	24	1
Rate	0.9	1.1	1.4	0.4
95% confidence interval	0.7-1.7	0.9-1.8	1.2-2.0	0.1-2.0
Congenital cataract	22	31	37	9
Rate	2.4	2.5	2.1	3.2
95% confidence interval	2.1-3.7	2.2-3.6	1.9-2.9	2.4-6.0
Anotia/microtia	12	6	9	3
Rate	1.3	0.5	0.5	1.1
95% confidence interval	1.1-2.3	0.3-1.1	0.4-1.0	0.6-3.1
Cardiovascular * **	**1,868**	**2,356**	**2,833**	**426**
Rate	**206.9**	**193.3**	**161.2**	**149.2**
95% confidence interval	**197.6-216.5**	**185.6-201.3**	**155.3-167.3**	**135.4-164.1**

Table 6. Tennessee Birth Defects Counts and Rates by Maternal Education, 2006-2010

Birth Defect	*No High School Diploma*	*Diploma or GED*	*Some College or Bachelor*	*Graduate Degree*
Common truncus(CCHD)	9	15	17	0
Rate	1.0	1.2	1.0	0.0
95% confidence interval	0.8-1.9	1.0-2.0	0.8-1.5	0.0-1.3
Transposition of great arteries	55	70	101	16
Rate	6.1	5.7	5.7	5.6
95% confidence interval	5.5-7.9	5.3-7.3	4.7-7.0	4.6-9.1
Transposition of great arteries(CCHD)	19	27	42	7
Rate	2.1	2.2	2.4	2.5
95% confidence interval	1.8-3.3	1.9-3.2	2.1-3.2	1.8-5.1
Tetralogy of fallot(CCHD)	65	80	98	15
Rate	7.2	6.6	5.6	5.3
95% confidence interval	6.6-9.2	6.1-8.2	5.2-6.8	4.3-8.7
Ventricular septal defect **	481	601	771	123
Rate	53.3	49.3	43.9	43.1
95% confidence interval	48.6-58.3	45.5-53.4	40.8-47.1	35.8-51.4
Atrial septal defect ***	1,197	1,482	1,645	239
Rate	132.6	121.6	93.6	83.7
95% confidence interval	125.2-140.3	115.5-128.0	89.1-98.2	73.4-95.0
Atrioventricular septal defect	32	60	62	12
Rate	3.5	4.9	3.5	4.2
95% confidence interval	3.1-5.0	4.5-6.3	3.2-4.5	3.3-7.3
Pulmonary valve atresia and stenosis	103	117	164	20
Rate	11.4	9.6	9.3	7.0
95% confidence interval	9.3-13.8	7.9-11.5	8.0-10.9	5.9-10.8
Pulmonary valve atresia and stenosis(CCHD)	18	17	31	3
Rate	2.0	1.4	1.8	1.1
95% confidence interval	1.7-3.2	1.2-2.2	1.5-2.5	0.6-3.1
Tricuspid valve atresia and stenosis(CCHD)	11	18	19	3
Rate	1.2	1.5	1.1	1.1
95% confidence interval	1.0-2.2	1.2-2.3	0.9-1.7	0.6-3.1
Ebstein's anomaly	11	10	20	1
Rate	1.2	0.8	1.1	0.4
95% confidence interval	1.0-2.2	0.6-1.5	1.0-1.8	0.1-2.0
Aortic valve stenosis	15	23	38	3
Rate	1.7	1.9	2.2	1.1
95% confidence interval	1.4-2.7	1.6-2.8	1.9-3.0	0.6-3.1

Table 6. Tennessee Birth Defects Counts and Rates by Maternal Education, 2006-2010

Birth Defect	*No High School Diploma*	*Diploma or GED*	*Some College or Bachelor*	*Graduate Degree*
Hypoplastic left heart syndrome(CCHD)	42	50	50	12
Rate	4.7	4.1	2.8	4.2
95% confidence interval	4.1-6.3	3.7-5.4	2.6-3.8	3.3-7.3
Patent ductus arteriosus **	613	831	1,044	168
Rate	67.9	68.2	59.4	58.8
95% confidence interval	62.6-73.5	63.6-73.0	55.9-63.1	50.3-68.4
Coarctation of aorta	78	79	105	24
Rate	8.6	6.5	6.0	8.4
95% confidence interval	8.0-10.8	6.0-8.1	4.9-7.2	7.2-12.5
Orofacial *	**159**	**276**	**318**	**48**
Rate	**17.6**	**22.6**	**18.1**	**16.8**
95% confidence interval	**15.0-20.6**	**20.1-25.5**	**16.2-20.2**	**15.1-22.3**
Cleft palate without cleft lip	68	103	132	26
Rate	7.5	8.5	7.5	9.1
95% confidence interval	6.9-9.5	6.9-10.3	6.3-8.9	7.8-13.3
Cleft lip with and without cleft palate *	91	160	177	22
Rate	10.1	13.1	10.1	7.7
95% confidence interval	9.3-12.4	11.2-15.3	8.6-11.7	6.5-11.7
Choanal atresia	7	24	35	4
Rate	0.8	2.0	2.0	1.4
95% confidence interval	0.6-1.6	1.7-2.9	1.8-2.8	0.9-3.6
Gastrointestinal * **	**641**	**790**	**748**	**89**
Rate	**71.0**	**64.8**	**42.6**	**31.2**
95% confidence interval	**65.6-76.7**	**60.4-69.5**	**39.6-45.7**	**28.9-38.4**
Esophageal atresia/tracheoesophageal fistula	28	28	37	10
Rate	3.1	2.3	2.1	3.5
95% confidence interval	2.7-4.5	2.0-3.3	1.9-2.9	2.7-6.4
Rectal and large intestinal atresia/stenosis	56	87	97	16
Rate	6.2	7.1	5.5	5.6
95% confidence interval	5.6-8.1	6.6-8.8	5.1-6.7	4.6-9.1
Pyloric stenosis ***	519	626	561	60
Rate	57.5	51.4	31.9	21.0
95% confidence interval	52.6-62.6	47.4-55.6	29.3-34.7	19.1-27.0
Hirshsprung's disease (congenital megacolon) *	35	44	46	3
Rate	3.9	3.6	2.6	1.1
95% confidence interval	3.4-5.4	3.2-4.8	2.3-3.5	0.6-3.1

Table 6. Tennessee Birth Defects Counts and Rates by Maternal Education, 2006-2010

Birth Defect	*No High School Diploma*	*Diploma or GED*	*Some College or Bachelor*	*Graduate Degree*
Biliary atresia	8	10	13	2
Rate	0.9	0.8	0.7	0.7
95% confidence interval	0.7-1.7	0.6-1.5	0.6-1.3	0.3-2.5
Genitourinary * **	**721**	**1,087**	**1,637**	**329**
Rate	**79.9**	**89.2**	**93.1**	**115.2**
95% confidence interval	**74.1-85.9**	**84.0-94.7**	**88.7-97.8**	**103.1-128.4**
Bladder exstrophy	5	9	6	1
Rate	0.6	0.7	0.3	0.4
95% confidence interval	0.4-1.3	0.6-1.4	0.2-0.7	0.1-2.0
Hypospadias ***	382	648	1,011	207
Rate	82.4	104.3	112.4	141.6
95% confidence interval	74.3-91.1	96.4-112.6	105.5-119.5	122.9-162.2
Epispadias	12	20	25	5
Rate	1.3	1.6	1.4	1.8
95% confidence interval	1.1-2.3	1.4-2.5	1.2-2.1	1.2-4.1
Obstructive genitourinary defect	285	373	543	113
Rate	31.6	30.6	30.9	39.6
95% confidence interval	28.0-35.5	27.6-33.9	28.4-33.6	32.6-47.6
Renal agensis/hypoplasia **	66	64	89	6
Rate	7.3	5.3	5.1	2.1
95% confidence interval	6.7-9.3	4.8-6.7	4.7-6.2	1.5-4.6
**Musculoskeletal ** **	**255**	**317**	**377**	**59**
Rate	**28.2**	**26.0**	**21.5**	**20.7**
95% confidence interval	**24.9-31.9**	**23.2-29.0**	**19.3-23.7**	**18.8-26.7**
Reduction deformity, upper limbs *	28	31	34	2
Rate	3.1	2.5	1.9	0.7
95% confidence interval	2.7-4.5	2.2-3.6	1.7-2.7	0.3-2.5
Reduction deformity, lower limbs	19	32	35	3
Rate	2.1	2.6	2.0	1.1
95% confidence interval	1.8-3.3	2.3-3.7	1.8-2.8	0.6-3.1
Gastroschisis ***	73	80	80	4
Rate	8.1	6.6	4.6	1.4
95% confidence interval	7.4-10.2	6.1-8.2	4.2-5.7	0.9-3.6
Omphalocele	30	30	47	4
Rate	3.3	2.5	2.7	1.4
95% confidence interval	2.9-4.7	2.1-3.5	2.4-3.6	0.9-3.6

Table 6. Tennessee Birth Defects Counts and Rates by Maternal Education, 2006-2010

Birth Defect	*No High School Diploma*	*Diploma or GED*	*Some College or Bachelor*	*Graduate Degree*
Diaphragmatic hernia *	48	60	63	7
Rate	5.3	4.9	3.6	2.5
95% confidence interval	4.8-7.0	4.5-6.3	3.3-4.6	1.8-5.1
Congenital hip dislocation **	67	98	131	40
Rate	7.4	8.0	7.5	14.0
95% confidence interval	6.8-9.4	7.5-9.8	6.2-8.8	12.5-19.1
Chromosomal	**141**	**184**	**301**	**64**
Rate	**15.6**	**15.1**	**17.1**	**22.4**
95% confidence interval	**13.1-18.4**	**13.0-17.4**	**15.2-19.2**	**20.5-28.6**
Trisomy 13	7	8	18	2
Rate	0.8	0.7	1.0	0.7
95% confidence interval	0.6-1.6	0.5-1.3	0.9-1.6	0.3-2.5
Down syndrome *	121	152	250	59
Rate	13.4	12.5	14.2	20.7
95% confidence interval	11.1-16.0	10.6-14.6	12.5-16.1	18.8-26.7
Trisomy 18	13	24	36	3
Rate	1.4	2.0	2.0	1.1
95% confidence interval	1.2-2.5	1.7-2.9	1.8-2.8	0.6-3.1
Fetus or newborn affected by maternal alcohol use * **	**44**	**27**	**9**	**2**
Rate	**4.9**	**2.2**	**0.5**	**0.7**
95% confidence interval	**4.4-6.5**	**1.9-3.2**	**0.4-1.0**	**0.3-2.5**
Total Cases * **	**3,692**	**4,808**	**5,922**	**965**
Rate	**408.9**	**394.5**	**337.0**	**338.0**
95% confidence interval	**395.8-422.3**	**383.5-405.8**	**328.4-345.7**	**317.0-360.0**
Total Live Births	**90,291**	**121,865**	**175,741**	**28,553**

Source: Tennessee Department of Health, Division of Policy, Planning and Assessment, Tennessee Birth Defects Registry 2006-2010.

Note:
[1]Counts include cases resulting from live births and fetal deaths.
[2]Rates were computed per 10,000 live births except for Hypospadias per 10,000 live male births.
[3]Statistical significance was determined by Poisson regression with statistical probabilities indicated as: p < 0.001***, P < 0.01** , p < 0.05*.
[4]95 percent confidence intervals for 100 or less cases are exact Poisson; otherwise confidence intervals are based on the normal approximation.
[5]Diagnostic data were derived from the Tennessee Hospital Discharge Data System (2006-2011), the Tennessee Death Statistical System (2005-2010) and the Tennessee Fetal Death Statistical System (2006-2011).
[6]Total live births were derived from the Tennessee Birth Statistical system (2006-2010).

Figure 3. Birth Defects Rates by Maternal Resident County, Tennessee, 2006 - 2010

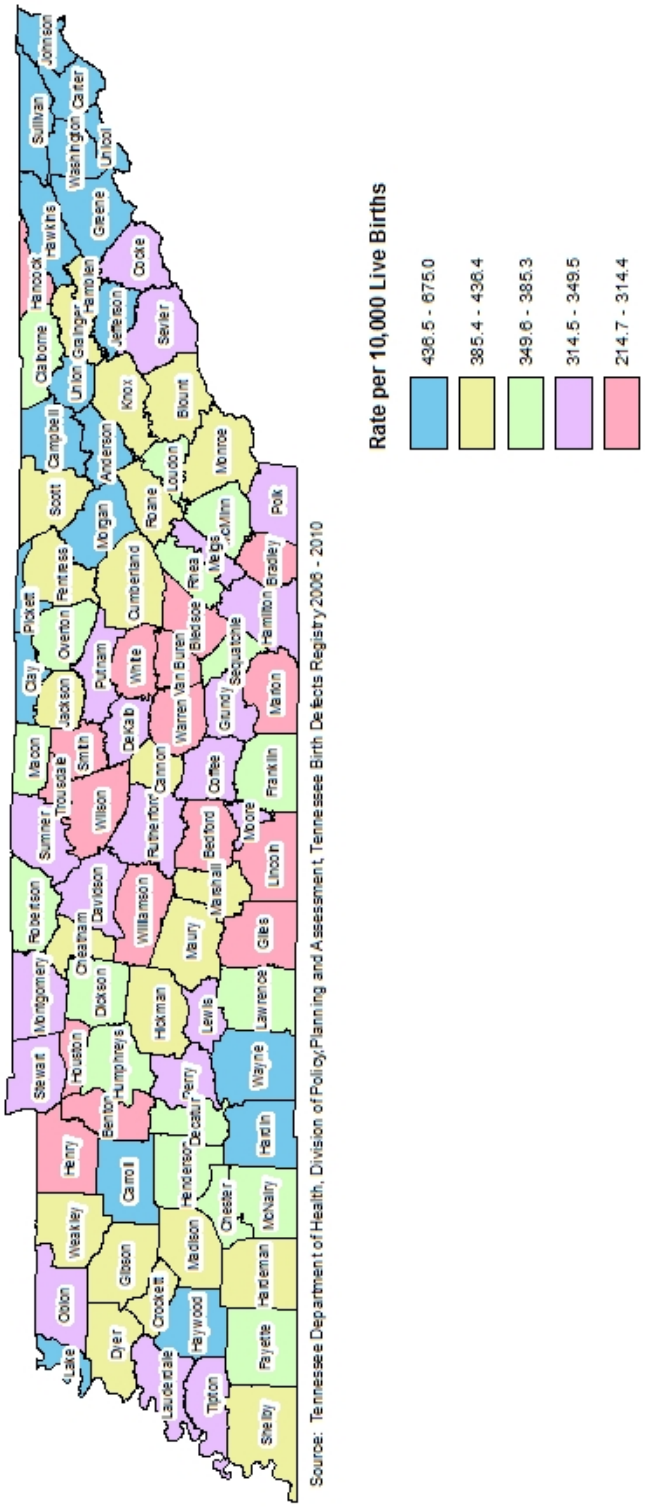


Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Anderson	**Total Cases**	**193**	**453.3**	**391.6-521.9**
	Central Nervous System	12	28.2	22.4-49.2
	Ear and Eye	2	4.7	2.3-17.0
	Cardiovascular	89	209.0	193.7-257.2
	Orofacial	7	16.4	11.9-33.9
	Gastrointestinal	26	61.1	52.6-89.5
	Genitourinary	64	150.3	137.2-191.9
	Musculoskeletal	15	35.2	28.7-58.1
	Chromosomal	7	16.4	11.9-33.9
Bedford	**Total Cases**	**105**	**307.2**	**251.3-371.9**
	Central Nervous System	6	17.6	12.3-38.2
	Ear and Eye	0	0.0	0.0-10.8
	Cardiovascular	46	134.6	120.7-179.5
	Orofacial	5	14.6	9.9-34.1
	Gastrointestinal	20	58.5	49.2-90.4
	Genitourinary	27	79.0	68.3-114.9
	Musculoskeletal	9	26.3	20.0-50.0
	Chromosomal	5	14.6	9.9-34.1
Benton	**Total Cases**	**30**	**355.9**	**310.2-508.0**
	Central Nervous System	2	23.7	11.4-85.7
	Ear and Eye	0	0.0	0.0-43.8
	Cardiovascular	8	94.9	70.7-187.0
	Orofacial	3	35.6	20.5-104.0
	Gastrointestinal	5	59.3	40.0-138.4
	Genitourinary	9	106.8	81.1-202.7
	Musculoskeletal	2	23.7	11.4-85.7
	Chromosomal	2	23.7	11.4-85.7
Bledsoe	**Total Cases**	**15**	**229.4**	**187.1-378.3**
	Central Nervous System	1	15.3	4.4-85.2
	Ear and Eye	1	15.3	4.4-85.2
	Cardiovascular	5	76.5	51.5-178.4
	Orofacial	2	30.6	14.7-110.5
	Gastrointestinal	6	91.7	64.5-199.7
	Genitourinary	1	15.3	4.4-85.2
	Musculoskeletal	2	30.6	14.7-110.5
	Chromosomal	0	0.0	0.0-56.4

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Blount	**Total Cases**	**262**	**398.5**	**351.7-449.8**
	Central Nervous System	17	25.9	21.4-41.4
	Ear and Eye	5	7.6	5.1-17.7
	Cardiovascular	119	181.0	149.9-216.6
	Orofacial	13	19.8	15.9-33.8
	Gastrointestinal	41	62.4	55.5-84.6
	Genitourinary	72	109.5	100.5-137.9
	Musculoskeletal	15	22.8	18.6-37.6
	Chromosomal	7	10.6	7.7-21.9
Bradley	**Total Cases**	**177**	**296.1**	**254.1-343.1**
	Central Nervous System	14	23.4	19.0-39.3
	Ear and Eye	3	5.0	2.9-14.7
	Cardiovascular	63	105.4	96.2-134.9
	Orofacial	17	28.4	23.5-45.5
	Gastrointestinal	35	58.6	51.6-81.4
	Genitourinary	37	61.9	54.8-85.3
	Musculoskeletal	15	25.1	20.5-41.4
	Chromosomal	6	10.0	7.1-21.8
Campbell	**Total Cases**	**109**	**473.7**	**389.0-571.4**
	Central Nervous System	11	47.8	37.5-85.5
	Ear and Eye	1	4.3	1.3-24.2
	Cardiovascular	50	217.3	195.9-286.5
	Orofacial	3	13.0	7.5-38.1
	Gastrointestinal	13	56.5	45.3-96.6
	Genitourinary	34	147.8	130.0-206.5
	Musculoskeletal	3	13.0	7.5-38.1
	Chromosomal	4	17.4	11.0-44.5
Cannon	**Total Cases**	**30**	**388.1**	**338.3-554.0**
	Central Nervous System	3	38.8	22.3-113.4
	Ear and Eye	1	12.9	3.7-72.1
	Cardiovascular	11	142.3	111.5-254.6
	Orofacial	1	12.9	3.7-72.1
	Gastrointestinal	4	51.7	32.8-132.5
	Genitourinary	10	129.4	99.9-237.9
	Musculoskeletal	1	12.9	3.7-72.1
	Chromosomal	2	25.9	12.4-93.5

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Carroll	**Total Cases**	**80**	**459.0**	**423.4-571.2**
	Central Nervous System	4	22.9	14.5-58.8
	Ear and Eye	2	11.5	5.5-41.4
	Cardiovascular	31	177.9	155.4-252.4
	Orofacial	4	22.9	14.5-58.8
	Gastrointestinal	12	68.8	54.6-120.3
	Genitourinary	18	103.3	86.0-163.2
	Musculoskeletal	10	57.4	44.3-105.5
	Chromosomal	1	5.7	1.7-32.0
Carter	**Total Cases**	**200**	**675.0**	**584.7-775.3**
	Central Nervous System	6	20.2	14.2-44.1
	Ear and Eye	4	13.5	8.6-34.6
	Cardiovascular	127	428.6	357.3-510.0
	Orofacial	7	23.6	17.2-48.7
	Gastrointestinal	26	87.7	75.6-128.6
	Genitourinary	38	128.2	113.7-176.0
	Musculoskeletal	9	30.4	23.1-57.7
	Chromosomal	3	10.1	5.8-29.6
Cheatham	**Total Cases**	**97**	**410.7**	**381.8-501.0**
	Central Nervous System	5	21.2	14.3-49.4
	Ear and Eye	1	4.2	1.2-23.6
	Cardiovascular	38	160.9	142.6-220.8
	Orofacial	8	33.9	25.2-66.7
	Gastrointestinal	14	59.3	48.0-99.4
	Genitourinary	33	139.7	122.6-196.2
	Musculoskeletal	7	29.6	21.5-61.1
	Chromosomal	3	12.7	7.3-37.1
Chester	**Total Cases**	**33**	**352.6**	**309.5-495.1**
	Central Nervous System	3	32.1	18.5-93.7
	Ear and Eye	0	0.0	0.0-39.4
	Cardiovascular	20	213.7	179.8-330.0
	Orofacial	2	21.4	10.3-77.2
	Gastrointestinal	3	32.1	18.5-93.7
	Genitourinary	5	53.4	36.0-124.7
	Musculoskeletal	4	42.7	27.1-109.4
	Chromosomal	0	0.0	0.0-39.4

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Claiborne	**Total Cases**	**63**	**366.1**	**334.0-468.4**
	Central Nervous System	3	17.4	10.0-50.9
	Ear and Eye	1	5.8	1.7-32.4
	Cardiovascular	32	185.9	162.8-262.5
	Orofacial	4	23.2	14.7-59.5
	Gastrointestinal	12	69.7	55.3-121.8
	Genitourinary	16	93.0	76.4-151.0
	Musculoskeletal	1	5.8	1.7-32.4
	Chromosomal	3	17.4	10.0-50.9
Clay	**Total Cases**	**30**	**649.4**	**566.0-927.0**
	Central Nervous System	1	21.6	6.2-120.6
	Ear and Eye	0	0.0	0.0-79.8
	Cardiovascular	12	259.7	206.0-453.7
	Orofacial	3	64.9	37.4-189.8
	Gastrointestinal	12	259.7	206.0-453.7
	Genitourinary	5	108.2	72.9-252.6
	Musculoskeletal	1	21.6	6.2-120.6
	Chromosomal	1	21.6	6.2-120.6
Cocke	**Total Cases**	**69**	**330.9**	**303.3-418.8**
	Central Nervous System	5	24.0	16.2-56.0
	Ear and Eye	1	4.8	1.4-26.7
	Cardiovascular	30	143.9	125.4-205.4
	Orofacial	5	24.0	16.2-56.0
	Gastrointestinal	18	86.3	71.9-136.4
	Genitourinary	13	62.4	50.0-106.6
	Musculoskeletal	2	9.6	4.6-34.7
	Chromosomal	2	9.6	4.6-34.7
Coffee	**Total Cases**	**122**	**340.6**	**282.8-406.7**
	Central Nervous System	9	25.1	19.1-47.7
	Ear and Eye	1	2.8	0.8-15.6
	Cardiovascular	44	122.8	109.9-164.9
	Orofacial	11	30.7	24.1-54.9
	Gastrointestinal	26	72.6	62.5-106.4
	Genitourinary	28	78.2	67.8-113.0
	Musculoskeletal	9	25.1	19.1-47.7
	Chromosomal	5	14.0	9.4-32.6

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Crockett	**Total Cases**	**41**	**433.4**	**386.0-588.0**
	Central Nervous System	5	52.9	35.6-123.3
	Ear and Eye	2	21.1	10.2-76.4
	Cardiovascular	18	190.3	158.4-300.7
	Orofacial	1	10.6	3.0-58.9
	Gastrointestinal	9	95.1	72.3-180.6
	Genitourinary	6	63.4	44.6-138.0
	Musculoskeletal	4	42.3	26.8-108.3
	Chromosomal	0	0.0	0.0-39.0
Cumberland	**Total Cases**	**111**	**396.3**	**326.0-477.2**
	Central Nervous System	4	14.3	9.1-36.6
	Ear and Eye	0	0.0	0.0-13.2
	Cardiovascular	58	207.1	188.1-267.7
	Orofacial	10	35.7	27.6-65.7
	Gastrointestinal	24	85.7	73.3-127.5
	Genitourinary	21	75.0	63.4-114.6
	Musculoskeletal	4	14.3	9.1-36.6
	Chromosomal	2	7.1	3.4-25.8
Davidson	**Total Cases**	**1681**	**340.4**	**324.3-357.0**
	Central Nervous System	93	18.8	17.5-23.1
	Ear and Eye	17	3.4	2.8-5.5
	Cardiovascular	759	153.7	142.9-165.0
	Orofacial	88	17.8	16.5-22.0
	Gastrointestinal	196	39.7	34.3-45.6
	Genitourinary	535	108.3	99.3-117.9
	Musculoskeletal	102	20.7	16.8-25.1
	Chromosomal	87	17.6	16.3-21.7
Decatur	**Total Cases**	**23**	**361.6**	**308.3-542.6**
	Central Nervous System	3	47.2	27.2-137.9
	Ear and Eye	0	0.0	0.0-58.0
	Cardiovascular	4	62.9	39.9-161.0
	Orofacial	1	15.7	4.5-87.6
	Gastrointestinal	5	78.6	53.0-183.5
	Genitourinary	10	157.2	121.5-289.2
	Musculoskeletal	1	15.7	4.5-87.6
	Chromosomal	1	15.7	4.5-87.6

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Dekalb	**Total Cases**	**39**	**316.6**	**281.1-432.7**
	Central Nervous System	4	32.5	20.6-83.1
	Ear and Eye	0	0.0	0.0-29.9
	Cardiovascular	16	129.9	106.8-210.9
	Orofacial	6	48.7	34.2-106.0
	Gastrointestinal	5	40.6	27.3-94.7
	Genitourinary	8	64.9	48.3-127.9
	Musculoskeletal	6	48.7	34.2-106.0
	Chromosomal	7	56.8	41.3-117.1
Dickson	**Total Cases**	**121**	**364.2**	**302.2-435.2**
	Central Nervous System	4	12.0	7.6-30.8
	Ear and Eye	0	0.0	0.0-11.1
	Cardiovascular	49	147.5	132.8-195.0
	Orofacial	7	21.1	15.3-43.4
	Gastrointestinal	15	45.2	36.8-74.5
	Genitourinary	48	144.5	129.9-191.6
	Musculoskeletal	9	27.1	20.6-51.4
	Chromosomal	7	21.1	15.3-43.4
Dyer	**Total Cases**	**103**	**399.5**	**326.1-484.6**
	Central Nervous System	4	15.5	9.8-39.7
	Ear and Eye	1	3.9	1.1-21.6
	Cardiovascular	52	201.7	182.2-264.5
	Orofacial	2	7.8	3.7-28.0
	Gastrointestinal	22	85.3	72.5-129.2
	Genitourinary	13	50.4	40.4-86.2
	Musculoskeletal	10	38.8	30.0-71.3
	Chromosomal	5	19.4	13.1-45.3
Fayette	**Total Cases**	**90**	**360.9**	**334.5-443.6**
	Central Nervous System	8	32.1	23.9-63.2
	Ear and Eye	2	8.0	3.9-29.0
	Cardiovascular	46	184.4	165.4-246.0
	Orofacial	3	12.0	6.9-35.2
	Gastrointestinal	14	56.1	45.4-94.2
	Genitourinary	20	80.2	67.5-123.9
	Musculoskeletal	6	24.1	16.9-52.4
	Chromosomal	5	20.0	13.5-46.8

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Fentress	**Total Cases**	**43**	**428.7**	**383.0-577.5**
	Central Nervous System	5	49.9	33.6-116.3
	Ear and Eye	1	10.0	2.9-55.5
	Cardiovascular	18	179.5	149.4-283.6
	Orofacial	3	29.9	17.2-87.4
	Gastrointestinal	8	79.8	59.4-157.2
	Genitourinary	14	139.6	112.9-234.2
	Musculoskeletal	2	19.9	9.6-72.0
	Chromosomal	2	19.9	9.6-72.0
Franklin	**Total Cases**	**73**	**353.2**	**324.5-444.1**
	Central Nervous System	2	9.7	4.7-35.0
	Ear and Eye	1	4.8	1.4-27.0
	Cardiovascular	40	193.5	172.1-263.5
	Orofacial	3	14.5	8.4-42.4
	Gastrointestinal	10	48.4	37.4-89.0
	Genitourinary	15	72.6	59.2-119.7
	Musculoskeletal	7	33.9	24.6-69.8
	Chromosomal	0	0.0	0.0-17.8
Gibson	**Total Cases**	**125**	**400.1**	**333.1-476.7**
	Central Nervous System	7	22.4	16.3-46.2
	Ear and Eye	1	3.2	0.9-17.8
	Cardiovascular	66	211.3	193.2-268.8
	Orofacial	9	28.8	21.9-54.7
	Gastrointestinal	24	76.8	65.7-114.3
	Genitourinary	24	76.8	65.7-114.3
	Musculoskeletal	3	9.6	5.5-28.1
	Chromosomal	4	12.8	8.1-32.8
Giles	**Total Cases**	**40**	**236.7**	**210.5-322.3**
	Central Nervous System	2	11.8	5.7-42.7
	Ear and Eye	2	11.8	5.7-42.7
	Cardiovascular	14	82.8	67.0-139.0
	Orofacial	2	11.8	5.7-42.7
	Gastrointestinal	11	65.1	51.0-116.5
	Genitourinary	10	59.2	45.7-108.8
	Musculoskeletal	0	0.0	0.0-21.8
	Chromosomal	4	23.7	15.0-60.6

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Grainger	**Total Cases**	**57**	**434.1**	**394.1-562.5**
	Central Nervous System	6	45.7	32.1-99.5
	Ear and Eye	0	0.0	0.0-28.1
	Cardiovascular	29	220.9	192.0-317.2
	Orofacial	2	15.2	7.3-55.0
	Gastrointestinal	5	38.1	25.7-88.9
	Genitourinary	13	99.0	79.4-169.3
	Musculoskeletal	3	22.8	13.2-66.8
	Chromosomal	4	30.5	19.3-78.0
Greene	**Total Cases**	**154**	**437.9**	**371.4-512.8**
	Central Nervous System	9	25.6	19.4-48.6
	Ear and Eye	1	2.8	0.8-15.8
	Cardiovascular	88	250.2	231.7-308.3
	Orofacial	13	37.0	29.6-63.2
	Gastrointestinal	17	48.3	40.0-77.4
	Genitourinary	31	88.1	77.0-125.1
	Musculoskeletal	13	37.0	29.6-63.2
	Chromosomal	3	8.5	4.9-24.9
Grundy	**Total Cases**	**29**	**331.8**	**288.4-476.5**
	Central Nervous System	0	0.0	0.0-42.2
	Ear and Eye	0	0.0	0.0-42.2
	Cardiovascular	14	160.2	129.6-268.8
	Orofacial	2	22.9	11.0-82.7
	Gastrointestinal	4	45.8	29.0-117.2
	Genitourinary	7	80.1	58.2-165.0
	Musculoskeletal	4	45.8	29.0-117.2
	Chromosomal	1	11.4	3.3-63.7
Hamblen	**Total Cases**	**183**	**430.9**	**370.7-498.0**
	Central Nervous System	13	30.6	24.5-52.3
	Ear and Eye	0	0.0	0.0-8.7
	Cardiovascular	81	190.7	176.0-237.1
	Orofacial	12	28.3	22.4-49.4
	Gastrointestinal	36	84.8	74.9-117.4
	Genitourinary	35	82.4	72.6-114.6
	Musculoskeletal	16	37.7	31.0-61.2
	Chromosomal	6	14.1	9.9-30.7

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Hamilton	**Total Cases**	**738**	**347.6**	**322.9-373.6**
	Central Nervous System	70	33.0	30.2-41.7
	Ear and Eye	10	4.7	3.6-8.7
	Cardiovascular	319	150.2	134.2-167.7
	Orofacial	44	20.7	18.5-27.8
	Gastrointestinal	96	45.2	42.0-55.2
	Genitourinary	180	84.8	72.8-98.1
	Musculoskeletal	62	29.2	26.6-37.4
	Chromosomal	41	19.3	17.2-26.2
Hancock	**Total Cases**	**12**	**312.5**	**247.9-545.9**
	Central Nervous System	2	52.1	25.0-188.1
	Ear and Eye	0	0.0	0.0-96.1
	Cardiovascular	6	156.3	109.9-340.1
	Orofacial	2	52.1	25.0-188.1
	Gastrointestinal	1	26.0	7.5-145.1
	Genitourinary	2	52.1	25.0-188.1
	Musculoskeletal	0	0.0	0.0-96.1
	Chromosomal	0	0.0	0.0-96.1
Hardeman	**Total Cases**	**65**	**404.7**	**369.8-515.9**
	Central Nervous System	3	18.7	10.8-54.6
	Ear and Eye	0	0.0	0.0-23.0
	Cardiovascular	40	249.1	221.5-339.2
	Orofacial	3	18.7	10.8-54.6
	Gastrointestinal	3	18.7	10.8-54.6
	Genitourinary	13	80.9	64.9-138.4
	Musculoskeletal	6	37.4	26.3-81.3
	Chromosomal	4	24.9	15.8-63.8
Hardin	**Total Cases**	**67**	**467.6**	**427.9-593.8**
	Central Nervous System	10	69.8	53.9-128.3
	Ear and Eye	0	0.0	0.0-25.7
	Cardiovascular	34	237.3	208.7-331.6
	Orofacial	2	14.0	6.7-50.4
	Gastrointestinal	18	125.6	104.6-198.5
	Genitourinary	10	69.8	53.9-128.3
	Musculoskeletal	3	20.9	12.1-61.2
	Chromosomal	3	20.9	12.1-61.2

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Hawkins	**Total Cases**	**147**	**487.4**	**411.8-572.9**
	Central Nervous System	13	43.1	34.6-73.7
	Ear and Eye	5	16.6	11.2-38.7
	Cardiovascular	92	305.0	283.0-374.1
	Orofacial	10	33.2	25.6-61.0
	Gastrointestinal	16	53.1	43.6-86.2
	Genitourinary	19	63.0	52.7-98.4
	Musculoskeletal	6	19.9	14.0-43.3
	Chromosomal	4	13.3	8.4-34.0
Haywood	**Total Cases**	**60**	**473.6**	**431.0-609.6**
	Central Nervous System	4	31.6	20.0-80.8
	Ear and Eye	0	0.0	0.0-29.1
	Cardiovascular	33	260.5	228.6-365.8
	Orofacial	6	47.4	33.3-103.1
	Gastrointestinal	8	63.1	47.0-124.4
	Genitourinary	13	102.6	82.3-175.5
	Musculoskeletal	0	0.0	0.0-29.1
	Chromosomal	0	0.0	0.0-29.1
Henderson	**Total Cases**	**70**	**383.6**	**351.7-484.6**
	Central Nervous System	5	27.4	18.5-63.9
	Ear and Eye	2	11.0	5.3-39.6
	Cardiovascular	38	208.2	184.6-285.8
	Orofacial	1	5.5	1.6-30.5
	Gastrointestinal	10	54.8	42.3-100.8
	Genitourinary	15	82.2	67.1-135.6
	Musculoskeletal	3	16.4	9.5-48.0
	Chromosomal	2	11.0	5.3-39.6
Henry	**Total Cases**	**53**	**288.8**	**261.2-377.8**
	Central Nervous System	4	21.8	13.8-55.8
	Ear and Eye	1	5.4	1.6-30.4
	Cardiovascular	18	98.1	81.7-155.0
	Orofacial	1	5.4	1.6-30.4
	Gastrointestinal	12	65.4	51.9-114.2
	Genitourinary	19	103.5	86.7-161.7
	Musculoskeletal	3	16.3	9.4-47.8
	Chromosomal	0	0.0	0.0-20.1

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Hickman	**Total Cases**	**56**	**417.6**	**378.7-542.3**
	Central Nervous System	5	37.3	25.1-87.0
	Ear and Eye	0	0.0	0.0-27.5
	Cardiovascular	18	134.2	111.8-212.1
	Orofacial	0	0.0	0.0-27.5
	Gastrointestinal	21	156.6	132.4-239.4
	Genitourinary	14	104.4	84.5-175.2
	Musculoskeletal	4	29.8	18.9-76.4
	Chromosomal	2	14.9	7.2-53.9
Houston	**Total Cases**	**14**	**270.8**	**219.1-454.3**
	Central Nervous System	0	0.0	0.0-71.4
	Ear and Eye	0	0.0	0.0-71.4
	Cardiovascular	8	154.7	115.2-304.9
	Orofacial	0	0.0	0.0-71.4
	Gastrointestinal	5	96.7	65.2-225.7
	Genitourinary	1	19.3	5.6-107.8
	Musculoskeletal	0	0.0	0.0-71.4
	Chromosomal	0	0.0	0.0-71.4
Humphreys	**Total Cases**	**40**	**382.0**	**339.8-520.2**
	Central Nervous System	3	28.7	16.5-83.7
	Ear and Eye	0	0.0	0.0-35.2
	Cardiovascular	13	124.2	99.5-212.3
	Orofacial	2	19.1	9.2-69.0
	Gastrointestinal	6	57.3	40.3-124.7
	Genitourinary	14	133.7	108.2-224.4
	Musculoskeletal	3	28.7	16.5-83.7
	Chromosomal	1	9.6	2.7-53.2
Jackson	**Total Cases**	**20**	**385.4**	**324.3-595.2**
	Central Nervous System	0	0.0	0.0-71.1
	Ear and Eye	0	0.0	0.0-71.1
	Cardiovascular	9	173.4	131.7-329.2
	Orofacial	1	19.3	5.5-107.4
	Gastrointestinal	5	96.3	64.9-224.8
	Genitourinary	3	57.8	33.3-168.9
	Musculoskeletal	3	57.8	33.3-168.9
	Chromosomal	0	0.0	0.0-71.1

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Jefferson	**Total Cases**	**129**	**447.5**	**373.6-531.7**
	Central Nervous System	9	31.2	23.7-59.3
	Ear and Eye	2	6.9	3.3-25.1
	Cardiovascular	59	204.6	186.1-264.0
	Orofacial	13	45.1	36.1-77.1
	Gastrointestinal	28	97.1	84.2-140.4
	Genitourinary	23	79.8	68.0-119.7
	Musculoskeletal	8	27.7	20.7-54.7
	Chromosomal	4	13.9	8.8-35.5
Johnson	**Total Cases**	**39**	**454.5**	**403.6-621.4**
	Central Nervous System	1	11.7	3.4-64.9
	Ear and Eye	0	0.0	0.0-43.0
	Cardiovascular	28	326.3	282.9-471.7
	Orofacial	2	23.3	11.2-84.2
	Gastrointestinal	5	58.3	39.3-136.0
	Genitourinary	5	58.3	39.3-136.0
	Musculoskeletal	1	11.7	3.4-64.9
	Chromosomal	2	23.3	11.2-84.2
Knox	**Total Cases**	**1031**	**387.1**	**363.9-411.5**
	Central Nervous System	73	27.4	25.2-34.5
	Ear and Eye	9	3.4	2.6-6.4
	Cardiovascular	497	186.6	170.6-203.8
	Orofacial	49	18.4	16.6-24.3
	Gastrointestinal	121	45.4	37.7-54.3
	Genitourinary	286	107.4	95.3-120.6
	Musculoskeletal	65	24.4	22.3-31.1
	Chromosomal	42	15.8	14.1-21.3
Lake	**Total Cases**	**16**	**458.5**	**376.8-744.5**
	Central Nervous System	0	0.0	0.0-105.7
	Ear and Eye	0	0.0	0.0-105.7
	Cardiovascular	8	229.2	170.7-451.7
	Orofacial	1	28.7	8.2-159.6
	Gastrointestinal	3	86.0	49.5-251.2
	Genitourinary	2	57.3	27.5-207.0
	Musculoskeletal	2	57.3	27.5-207.0
	Chromosomal	1	28.7	8.2-159.6

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Lauderdale	**Total Cases**	**61**	**333.9**	**304.1-428.9**
	Central Nervous System	5	27.4	18.4-63.9
	Ear and Eye	0	0.0	0.0-20.2
	Cardiovascular	32	175.2	153.4-247.3
	Orofacial	3	16.4	9.5-48.0
	Gastrointestinal	13	71.2	57.0-121.7
	Genitourinary	16	87.6	72.0-142.2
	Musculoskeletal	0	0.0	0.0-20.2
	Chromosomal	2	10.9	5.3-39.5
Lawrence	**Total Cases**	**109**	**376.4**	**309.0-454.0**
	Central Nervous System	7	24.2	17.6-49.8
	Ear and Eye	0	0.0	0.0-12.7
	Cardiovascular	39	134.7	119.6-184.1
	Orofacial	9	31.1	23.6-59.0
	Gastrointestinal	22	76.0	64.5-115.0
	Genitourinary	31	107.0	93.5-151.9
	Musculoskeletal	7	24.2	17.6-49.8
	Chromosomal	7	24.2	17.6-49.8
Lewis	**Total Cases**	**23**	**326.2**	**278.2-489.5**
	Central Nervous System	0	0.0	0.0-52.3
	Ear and Eye	0	0.0	0.0-52.3
	Cardiovascular	7	99.3	72.1-204.6
	Orofacial	1	14.2	4.1-79.0
	Gastrointestinal	5	70.9	47.8-165.5
	Genitourinary	7	99.3	72.1-204.6
	Musculoskeletal	5	70.9	47.8-165.5
	Chromosomal	2	28.4	13.6-102.5
Lincoln	**Total Cases**	**45**	**222.2**	**199.1-297.4**
	Central Nervous System	7	34.6	25.1-71.2
	Ear and Eye	1	4.9	1.4-27.5
	Cardiovascular	16	79.0	64.9-128.3
	Orofacial	8	39.5	29.4-77.8
	Gastrointestinal	5	24.7	16.6-57.6
	Genitourinary	14	69.1	55.9-116.0
	Musculoskeletal	5	24.7	16.6-57.6
	Chromosomal	1	4.9	1.4-27.5

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Loudon	**Total Cases**	**100**	**378.2**	**352.1-460.0**
	Central Nervous System	3	11.3	6.5-33.2
	Ear and Eye	1	3.8	1.1-21.1
	Cardiovascular	43	162.6	145.3-219.1
	Orofacial	10	37.8	29.2-69.6
	Gastrointestinal	18	68.1	56.7-107.6
	Genitourinary	22	83.2	70.7-126.0
	Musculoskeletal	9	34.0	25.9-64.6
	Chromosomal	6	22.7	16.0-49.4
McMinn	**Total Cases**	**110**	**372.5**	**306.1-449.0**
	Central Nervous System	11	37.3	29.2-66.7
	Ear and Eye	1	3.4	1.0-18.9
	Cardiovascular	45	152.4	136.5-203.9
	Orofacial	7	23.7	17.2-48.8
	Gastrointestinal	27	91.4	79.0-133.0
	Genitourinary	17	57.6	47.6-92.2
	Musculoskeletal	9	30.5	23.2-57.9
	Chromosomal	3	10.2	5.8-29.7
McNairy	**Total Cases**	**56**	**379.9**	**344.6-493.4**
	Central Nervous System	2	13.6	6.5-49.0
	Ear and Eye	1	6.8	2.0-37.8
	Cardiovascular	26	176.4	152.0-258.5
	Orofacial	4	27.1	17.2-69.5
	Gastrointestinal	11	74.6	58.5-133.5
	Genitourinary	12	81.4	64.6-142.2
	Musculoskeletal	3	20.4	11.7-59.5
	Chromosomal	2	13.6	6.5-49.0
Macon	**Total Cases**	**43**	**285.5**	**255.1-384.6**
	Central Nervous System	3	19.9	11.5-58.2
	Ear and Eye	1	6.6	1.9-37.0
	Cardiovascular	19	126.2	105.6-197.0
	Orofacial	3	19.9	11.5-58.2
	Gastrointestinal	11	73.0	57.2-130.7
	Genitourinary	9	59.8	45.4-113.4
	Musculoskeletal	0	0.0	0.0-24.5
	Chromosomal	4	26.6	16.8-68.0

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Madison	**Total Cases**	**272**	**397.5**	**351.6-447.6**
	Central Nervous System	10	14.6	11.3-26.9
	Ear and Eye	4	5.8	3.7-15.0
	Cardiovascular	171	249.9	213.8-290.3
	Orofacial	8	11.7	8.7-23.0
	Gastrointestinal	28	40.9	35.5-59.1
	Genitourinary	56	81.8	74.2-106.3
	Musculoskeletal	16	23.4	19.2-38.0
	Chromosomal	14	20.5	16.6-34.3
Marion	**Total Cases**	**64**	**387.6**	**354.0-495.0**
	Central Nervous System	5	30.3	20.4-70.7
	Ear and Eye	1	6.1	1.7-33.7
	Cardiovascular	25	151.4	130.0-223.5
	Orofacial	3	18.2	10.5-53.1
	Gastrointestinal	10	60.6	46.8-111.4
	Genitourinary	24	145.4	124.4-216.3
	Musculoskeletal	4	24.2	15.4-62.0
	Chromosomal	5	30.3	20.4-70.7
Marshall	**Total Cases**	**75**	**383.6**	**352.9-480.9**
	Central Nervous System	8	40.9	30.5-80.6
	Ear and Eye	0	0.0	0.0-18.9
	Cardiovascular	26	133.0	114.6-194.9
	Orofacial	1	5.1	1.5-28.5
	Gastrointestinal	13	66.5	53.3-113.7
	Genitourinary	24	122.8	105.1-182.7
	Musculoskeletal	8	40.9	30.5-80.6
	Chromosomal	4	20.5	13.0-52.4
Maury	**Total Cases**	**204**	**353.3**	**306.5-405.3**
	Central Nervous System	19	32.9	27.5-51.4
	Ear and Eye	1	1.7	0.5-9.6
	Cardiovascular	83	143.7	132.8-178.2
	Orofacial	7	12.1	8.8-25.0
	Gastrointestinal	39	67.5	60.0-92.3
	Genitourinary	69	119.5	109.5-151.2
	Musculoskeletal	14	24.2	19.6-40.7
	Chromosomal	6	10.4	7.3-22.6

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Meigs	**Total Cases**	**23**	**349.5**	**298.0-524.5**
	Central Nervous System	5	76.0	51.2-177.3
	Ear and Eye	0	0.0	0.0-56.1
	Cardiovascular	7	106.4	77.2-219.2
	Orofacial	0	0.0	0.0-56.1
	Gastrointestinal	7	106.4	77.2-219.2
	Genitourinary	5	76.0	51.2-177.3
	Musculoskeletal	0	0.0	0.0-56.1
	Chromosomal	1	15.2	4.4-84.7
Monroe	**Total Cases**	**109**	**411.0**	**337.5-495.8**
	Central Nervous System	11	41.5	32.5-74.2
	Ear and Eye	1	3.8	1.1-21.0
	Cardiovascular	49	184.8	166.3-244.3
	Orofacial	5	18.9	12.7-44.0
	Gastrointestinal	15	56.6	46.1-93.3
	Genitourinary	26	98.0	84.5-143.7
	Musculoskeletal	9	33.9	25.8-64.4
	Chromosomal	3	11.3	6.5-33.1
Montgomery	**Total Cases**	**468**	**317.5**	**289.4-347.6**
	Central Nervous System	34	23.1	20.3-32.2
	Ear and Eye	5	3.4	2.3-7.9
	Cardiovascular	221	149.9	130.8-171.1
	Orofacial	20	13.6	11.4-21.0
	Gastrointestinal	77	52.2	48.1-65.3
	Genitourinary	113	76.7	63.2-92.2
	Musculoskeletal	42	28.5	25.4-38.5
	Chromosomal	29	19.7	17.1-28.3
Moore	**Total Cases**	**9**	**348.8**	**265.0-662.2**
	Central Nervous System	0	0.0	0.0-143.0
	Ear and Eye	0	0.0	0.0-143.0
	Cardiovascular	5	193.8	130.6-452.3
	Orofacial	1	38.8	11.2-216.0
	Gastrointestinal	0	0.0	0.0-143.0
	Genitourinary	2	77.5	37.3-280.0
	Musculoskeletal	1	38.8	11.2-216.0
	Chromosomal	1	38.8	11.2-216.0

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Morgan	**Total Cases**	**55**	**505.5**	**458.0-658.0**
	Central Nervous System	4	36.8	23.3-94.1
	Ear and Eye	2	18.4	8.8-66.4
	Cardiovascular	16	147.1	120.9-238.8
	Orofacial	5	46.0	31.0-107.2
	Gastrointestinal	11	101.1	79.2-180.9
	Genitourinary	19	174.6	146.2-272.7
	Musculoskeletal	6	55.1	38.8-120.0
	Chromosomal	1	9.2	2.6-51.2
Obion	**Total Cases**	**58**	**315.0**	**286.2-407.3**
	Central Nervous System	4	21.7	13.8-55.6
	Ear and Eye	0	0.0	0.0-20.0
	Cardiovascular	34	184.7	162.4-258.1
	Orofacial	2	10.9	5.2-39.2
	Gastrointestinal	7	38.0	27.6-78.3
	Genitourinary	12	65.2	51.7-113.9
	Musculoskeletal	7	38.0	27.6-78.3
	Chromosomal	1	5.4	1.6-30.3
Overton	**Total Cases**	**43**	**351.6**	**314.1-473.6**
	Central Nervous System	5	40.9	27.5-95.4
	Ear and Eye	0	0.0	0.0-30.2
	Cardiovascular	16	130.8	107.5-212.5
	Orofacial	4	32.7	20.7-83.7
	Gastrointestinal	7	57.2	41.6-117.9
	Genitourinary	12	98.1	77.8-171.4
	Musculoskeletal	5	40.9	27.5-95.4
	Chromosomal	1	8.2	2.4-45.6
Perry	**Total Cases**	**17**	**346.2**	**286.5-554.4**
	Central Nervous System	2	40.7	19.6-147.1
	Ear and Eye	0	0.0	0.0-75.1
	Cardiovascular	4	81.5	51.6-208.6
	Orofacial	0	0.0	0.0-75.1
	Gastrointestinal	4	81.5	51.6-208.6
	Genitourinary	5	101.8	68.6-237.6
	Musculoskeletal	3	61.1	35.2-178.6
	Chromosomal	1	20.4	5.9-113.5

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Pickett	**Total Cases**	**13**	**505.8**	**405.5-865.0**
	Central Nervous System	1	38.9	11.2-216.8
	Ear and Eye	0	0.0	0.0-143.5
	Cardiovascular	4	155.6	98.7-398.5
	Orofacial	1	38.9	11.2-216.8
	Gastrointestinal	5	194.6	131.1-454.0
	Genitourinary	5	194.6	131.1-454.0
	Musculoskeletal	0	0.0	0.0-143.5
	Chromosomal	0	0.0	0.0-143.5
Polk	**Total Cases**	**28**	**316.4**	**274.3-457.3**
	Central Nervous System	3	33.9	19.5-99.1
	Ear and Eye	0	0.0	0.0-41.7
	Cardiovascular	8	90.4	67.3-178.1
	Orofacial	2	22.6	10.9-81.6
	Gastrointestinal	9	101.7	77.3-193.0
	Genitourinary	4	45.2	28.6-115.7
	Musculoskeletal	3	33.9	19.5-99.1
	Chromosomal	0	0.0	0.0-41.7
Putnam	**Total Cases**	**162**	**345.7**	**294.5-403.2**
	Central Nervous System	16	34.1	28.1-55.4
	Ear and Eye	2	4.3	2.1-15.4
	Cardiovascular	60	128.0	116.5-164.8
	Orofacial	10	21.3	16.5-39.2
	Gastrointestinal	35	74.7	65.8-103.9
	Genitourinary	37	79.0	69.9-108.8
	Musculoskeletal	12	25.6	20.3-44.7
	Chromosomal	6	12.8	9.0-27.9
Rhea	**Total Cases**	**73**	**359.4**	**330.2-451.9**
	Central Nervous System	2	9.8	4.7-35.6
	Ear and Eye	0	0.0	0.0-18.2
	Cardiovascular	31	152.6	133.4-216.7
	Orofacial	4	19.7	12.5-50.4
	Gastrointestinal	22	108.3	92.0-164.0
	Genitourinary	12	59.1	46.9-103.2
	Musculoskeletal	5	24.6	16.6-57.5
	Chromosomal	4	19.7	12.5-50.4

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Roane	**Total Cases**	**116**	**432.2**	**357.1-518.4**
	Central Nervous System	10	37.3	28.8-68.5
	Ear and Eye	3	11.2	6.4-32.7
	Cardiovascular	47	175.1	157.3-232.9
	Orofacial	3	11.2	6.4-32.7
	Gastrointestinal	21	78.2	66.2-119.6
	Genitourinary	30	111.8	97.4-159.6
	Musculoskeletal	12	44.7	35.5-78.1
	Chromosomal	7	26.1	18.9-53.7
Robertson	**Total Cases**	**184**	**364.1**	**313.4-420.6**
	Central Nervous System	11	21.8	17.1-38.9
	Ear and Eye	1	2.0	0.6-11.0
	Cardiovascular	84	166.2	153.6-205.8
	Orofacial	14	27.7	22.4-46.5
	Gastrointestinal	23	45.5	38.8-68.3
	Genitourinary	51	100.9	91.1-132.7
	Musculoskeletal	13	25.7	20.6-44.0
	Chromosomal	9	17.8	13.5-33.8
Rutherford	**Total Cases**	**605**	**315.8**	**291.2-342.0**
	Central Nervous System	35	18.3	16.1-25.4
	Ear and Eye	5	2.6	1.8-6.1
	Cardiovascular	252	131.6	115.8-148.8
	Orofacial	35	18.3	16.1-25.4
	Gastrointestinal	81	42.3	39.0-52.6
	Genitourinary	200	104.4	90.4-119.9
	Musculoskeletal	40	20.9	18.6-28.4
	Chromosomal	32	16.7	14.6-23.6
Scott	**Total Cases**	**58**	**408.7**	**371.4-528.4**
	Central Nervous System	2	14.1	6.8-50.9
	Ear and Eye	0	0.0	0.0-26.0
	Cardiovascular	25	176.2	151.3-260.1
	Orofacial	4	28.2	17.9-72.2
	Gastrointestinal	13	91.6	73.4-156.7
	Genitourinary	16	112.8	92.7-183.1
	Musculoskeletal	4	28.2	17.9-72.2
	Chromosomal	4	28.2	17.9-72.2

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Sequatchie	**Total Cases**	**33**	**378.4**	**332.2-531.5**
	Central Nervous System	1	11.5	3.3-63.9
	Ear and Eye	1	11.5	3.3-63.9
	Cardiovascular	14	160.6	129.9-269.4
	Orofacial	1	11.5	3.3-63.9
	Gastrointestinal	6	68.8	48.4-149.8
	Genitourinary	8	91.7	68.3-180.8
	Musculoskeletal	5	57.3	38.6-133.8
	Chromosomal	2	22.9	11.0-82.9
Sevier	**Total Cases**	**190**	**340.3**	**293.6-392.2**
	Central Nervous System	14	25.1	20.3-42.1
	Ear and Eye	1	1.8	0.5-10.0
	Cardiovascular	77	137.9	127.0-172.3
	Orofacial	11	19.7	15.4-35.2
	Gastrointestinal	46	82.4	73.9-109.9
	Genitourinary	43	77.0	68.8-103.7
	Musculoskeletal	8	14.3	10.7-28.2
	Chromosomal	6	10.7	7.6-23.4
Shelby	**Total Cases**	**2840**	**385.7**	**371.6-400.1**
	Central Nervous System	205	27.8	24.2-31.9
	Ear and Eye	41	5.6	5.0-7.6
	Cardiovascular	1701	231.0	220.1-242.2
	Orofacial	110	14.9	12.3-18.0
	Gastrointestinal	313	42.5	37.9-47.5
	Genitourinary	520	70.6	64.7-77.0
	Musculoskeletal	163	22.1	18.9-25.8
	Chromosomal	135	18.3	15.4-21.7
Smith	**Total Cases**	**24**	**214.7**	**183.7-319.4**
	Central Nervous System	2	17.9	8.6-64.6
	Ear and Eye	0	0.0	0.0-33.0
	Cardiovascular	10	89.4	69.1-164.5
	Orofacial	0	0.0	0.0-33.0
	Gastrointestinal	7	62.6	45.5-129.0
	Genitourinary	5	44.7	30.1-104.4
	Musculoskeletal	0	0.0	0.0-33.0
	Chromosomal	1	8.9	2.6-49.8

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Stewart	**Total Cases**	**21**	**320.1**	**270.7-489.3**
	Central Nervous System	0	0.0	0.0-56.2
	Ear and Eye	0	0.0	0.0-56.2
	Cardiovascular	14	213.4	172.7-358.1
	Orofacial	0	0.0	0.0-56.2
	Gastrointestinal	1	15.2	4.4-84.9
	Genitourinary	5	76.2	51.4-177.9
	Musculoskeletal	1	15.2	4.4-84.9
	Chromosomal	0	0.0	0.0-56.2
Sullivan	**Total Cases**	**417**	**503.0**	**455.8-553.6**
	Central Nervous System	25	30.2	25.9-44.5
	Ear and Eye	6	7.2	5.1-15.8
	Cardiovascular	226	272.6	238.2-310.5
	Orofacial	26	31.4	27.0-45.9
	Gastrointestinal	67	80.8	74.0-102.6
	Genitourinary	77	92.9	85.5-116.1
	Musculoskeletal	21	25.3	21.4-38.7
	Chromosomal	19	22.9	19.2-35.8
Sumner	**Total Cases**	**349**	**344.5**	**309.3-382.6**
	Central Nervous System	19	18.8	15.7-29.3
	Ear and Eye	1	1.0	0.3-5.5
	Cardiovascular	150	148.0	125.3-173.7
	Orofacial	22	21.7	18.4-32.9
	Gastrointestinal	64	63.2	57.7-80.7
	Genitourinary	93	91.8	85.2-112.4
	Musculoskeletal	30	29.6	25.8-42.3
	Chromosomal	18	17.8	14.8-28.1
Tipton	**Total Cases**	**132**	**332.1**	**277.8-393.8**
	Central Nervous System	7	17.6	12.8-36.3
	Ear and Eye	1	2.5	0.7-14.0
	Cardiovascular	71	178.6	163.9-225.3
	Orofacial	4	10.1	6.4-25.8
	Gastrointestinal	14	35.2	28.5-59.1
	Genitourinary	34	85.5	75.2-119.5
	Musculoskeletal	9	22.6	17.2-43.0
	Chromosomal	5	12.6	8.5-29.4

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Trousdale	**Total Cases**	**10**	**215.1**	**166.1-395.5**
	Central Nervous System	0	0.0	0.0-79.3
	Ear and Eye	0	0.0	0.0-79.3
	Cardiovascular	2	43.0	20.7-155.4
	Orofacial	0	0.0	0.0-79.3
	Gastrointestinal	3	64.5	37.1-188.5
	Genitourinary	4	86.0	54.5-220.2
	Musculoskeletal	2	43.0	20.7-155.4
	Chromosomal	0	0.0	0.0-79.3
Unicoi	**Total Cases**	**50**	**571.4**	**515.0-753.4**
	Central Nervous System	1	11.4	3.3-63.7
	Ear and Eye	1	11.4	3.3-63.7
	Cardiovascular	22	251.4	213.5-380.7
	Orofacial	3	34.3	19.7-100.2
	Gastrointestinal	12	137.1	108.8-239.6
	Genitourinary	10	114.3	88.3-210.2
	Musculoskeletal	1	11.4	3.3-63.7
	Chromosomal	2	22.9	11.0-82.6
Union	**Total Cases**	**57**	**479.4**	**435.2-621.1**
	Central Nervous System	5	42.1	28.3-98.1
	Ear and Eye	1	8.4	2.4-46.9
	Cardiovascular	26	218.7	188.4-320.4
	Orofacial	6	50.5	35.5-109.8
	Gastrointestinal	9	75.7	57.5-143.7
	Genitourinary	13	109.3	87.7-187.0
	Musculoskeletal	1	8.4	2.4-46.9
	Chromosomal	2	16.8	8.1-60.8
Van Buren	**Total Cases**	**7**	**247.3**	**179.6-509.6**
	Central Nervous System	0	0.0	0.0-130.3
	Ear and Eye	1	35.3	10.2-196.9
	Cardiovascular	3	106.0	61.0-309.8
	Orofacial	0	0.0	0.0-130.3
	Gastrointestinal	3	106.0	61.0-309.8
	Genitourinary	1	35.3	10.2-196.9
	Musculoskeletal	0	0.0	0.0-130.3
	Chromosomal	1	35.3	10.2-196.9

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
Warren	**Total Cases**	**78**	**300.3**	**276.8-374.8**
	Central Nervous System	6	23.1	16.2-50.3
	Ear and Eye	0	0.0	0.0-14.2
	Cardiovascular	39	150.2	133.3-205.3
	Orofacial	2	7.7	3.7-27.8
	Gastrointestinal	22	84.7	71.9-128.3
	Genitourinary	12	46.2	36.7-80.7
	Musculoskeletal	8	30.8	22.9-60.7
	Chromosomal	4	15.4	9.8-39.4
Washington	**Total Cases**	**315**	**461.3**	**411.7-515.1**
	Central Nervous System	20	29.3	24.6-45.2
	Ear and Eye	3	4.4	2.5-12.8
	Cardiovascular	177	259.2	222.4-300.3
	Orofacial	12	17.6	13.9-30.7
	Gastrointestinal	48	70.3	63.2-93.2
	Genitourinary	70	102.5	94.0-129.5
	Musculoskeletal	15	22.0	17.9-36.2
	Chromosomal	7	10.3	7.4-21.1
Wayne	**Total Cases**	**34**	**442.1**	**388.9-617.8**
	Central Nervous System	1	13.0	3.7-72.5
	Ear and Eye	0	0.0	0.0-48.0
	Cardiovascular	17	221.1	182.9-353.9
	Orofacial	1	13.0	3.7-72.5
	Gastrointestinal	6	78.0	54.9-169.8
	Genitourinary	9	117.0	88.9-222.2
	Musculoskeletal	5	65.0	43.8-151.7
	Chromosomal	2	26.0	12.5-93.9
Weakley	**Total Cases**	**72**	**397.1**	**364.6-500.1**
	Central Nervous System	3	16.5	9.5-48.4
	Ear and Eye	1	5.5	1.6-30.7
	Cardiovascular	35	193.1	170.2-268.5
	Orofacial	2	11.0	5.3-39.8
	Gastrointestinal	17	93.8	77.6-150.1
	Genitourinary	14	77.2	62.5-129.6
	Musculoskeletal	1	5.5	1.6-30.7
	Chromosomal	3	16.5	9.5-48.4

Table 7. Tennessee Birth Defects Counts and Rates by Maternal Resident County, 2006-2010

County	*Birth Defect*	*Count*	*Rate*	*95%CI*
White	**Total Cases**	**38**	**258.7**	**229.3-355.1**
	Central Nervous System	4	27.2	17.3-69.7
	Ear and Eye	0	0.0	0.0-25.1
	Cardiovascular	14	95.3	77.1-159.9
	Orofacial	7	47.7	34.6-98.2
	Gastrointestinal	6	40.8	28.7-88.9
	Genitourinary	13	88.5	70.9-151.3
	Musculoskeletal	2	13.6	6.5-49.2
	Chromosomal	3	20.4	11.8-59.7
Williamson	**Total Cases**	**314**	**299.1**	**267.0-334.1**
	Central Nervous System	18	17.1	14.3-27.1
	Ear and Eye	5	4.8	3.2-11.1
	Cardiovascular	130	123.8	103.5-147.1
	Orofacial	15	14.3	11.7-23.6
	Gastrointestinal	33	31.4	27.6-44.2
	Genitourinary	103	98.1	80.1-119.0
	Musculoskeletal	21	20.0	16.9-30.6
	Chromosomal	22	21.0	17.8-31.7
Wilson	**Total Cases**	**188**	**274.8**	**236.9-317.0**
	Central Nervous System	7	10.2	7.4-21.1
	Ear and Eye	2	2.9	1.4-10.6
	Cardiovascular	83	121.3	112.1-150.4
	Orofacial	13	19.0	15.2-32.5
	Gastrointestinal	23	33.6	28.7-50.4
	Genitourinary	57	83.3	75.6-107.9
	Musculoskeletal	12	17.5	13.9-30.6
	Chromosomal	11	16.1	12.6-28.8

Source: Tennessee Department of Health, Division of Policy, Planning and Assessment, Tennessee Birth Defects Registry 2006-2010.

[1]Counts include cases resulting from live births and fetal deaths.
[2]Rates were computed per 10,000 live births except for Hypospadias per 10,000 live male births.
[3]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 (2006-2011), the Tennessee Death Statistical System (2006-2011) and the Tennessee Fetal Death Statistical System (2006-2010).
Total live births were derived from the Tennessee Birth Statistical System (2006-2010).

Table 8. Tennessee Birth Defects Counts and Rates by Maternal Diabetes, 2006-2010

Birth Defect	*No Diabetes*	*Diabetes*
Central Nervous System ***	**994**	**28**
Rate	**24.0**	**69.1**
95% confidence interval	**22.5-25.6**	**59.9-99.9**
Anencephalus	38	0
Rate	0.9	0.0
95% confidence interval	0.8-1.3	0.0-9.1
Spina bifida without anencephalus	160	3
Rate	3.9	7.4
95% confidence interval	3.3-4.5	4.3-21.6
Hydrocephalus without spina bifida ***	306	16
Rate	7.4	39.5
95% confidence interval	6.6-8.3	32.5-64.2
Encephalocele	56	1
Rate	1.4	2.5
95% confidence interval	1.2-1.8	0.7-13.8
Microcephalus	476	9
Rate	11.5	22.2
95% confidence interval	10.5-12.6	16.9-42.2
Ear and Eye	**172**	**3**
Rate	**4.2**	**7.4**
95% confidence interval	**3.6-4.8**	**4.3-21.6**
Aniridia **	6	2
Rate	0.1	4.9
95% confidence interval	0.1-0.3	2.4-17.8
Anophthalmia/microphthalmia	45	1
Rate	1.1	2.5
95% confidence interval	1.0-1.5	0.7-13.8
Congenital cataract	98	1
Rate	2.4	2.5
95% confidence interval	2.2-2.9	0.7-13.8
Anotia/microtia	30	0
Rate	0.7	0.0
95% confidence interval	0.6-1.0	0.0-9.1
Cardiovascular ***	**7,218**	**285**
Rate	**174.4**	**703.7**
95% confidence interval	**170.4-178.5**	**624.4-790.3**

Table 8. Tennessee Birth Defects Counts and Rates by Maternal Diabetes, 2006-2010

Birth Defect	*No Diabetes*	*Diabetes*
Common truncus(CCHD) ***	37	4
Rate	0.9	9.9
95% confidence interval	0.8-1.2	6.3-25.3
Transposition of great arteries ***	230	12
Rate	5.6	29.6
95% confidence interval	4.9-6.3	23.5-51.8
Transposition of great arteries(CCHD) *	91	4
Rate	2.2	9.9
95% confidence interval	2.0-2.7	6.3-25.3
Tetralogy of fallot(CCHD) **	250	8
Rate	6.0	19.8
95% confidence interval	5.3-6.8	14.7-38.9
Ventricular septal defect ***	1,913	70
Rate	46.2	172.8
95% confidence interval	44.2-48.3	158.5-218.4
Atrial septal defect ***	4,410	164
Rate	106.6	404.9
95% confidence interval	103.4-109.8	345.3-471.9
Atrioventricular septal defect **	160	6
Rate	3.9	14.8
95% confidence interval	3.3-4.5	10.4-32.2
Pulmonary valve atresia and stenosis *	396	9
Rate	9.6	22.2
95% confidence interval	8.6-10.6	16.9-42.2
Pulmonary valve atresia and stenosis(CCHD)	69	2
Rate	1.7	4.9
95% confidence interval	1.5-2.1	2.4-17.8
Tricuspid valve atresia and stenosis(CCHD)	51	1
Rate	1.2	2.5
95% confidence interval	1.1-1.6	0.7-13.8
Ebstein's anomaly	42	0
Rate	1.0	0.0
95% confidence interval	0.9-1.4	0.0-9.1
Aortic valve stenosis	78	1
Rate	1.9	2.5
95% confidence interval	1.7-2.4	0.7-13.8

Table 8. Tennessee Birth Defects Counts and Rates by Maternal Diabetes, 2006-2010

Birth Defect	*No Diabetes*	*Diabetes*
Hypoplastic left heart syndrome(CCHD) **	147	7
Rate	3.6	17.3
95% confidence interval	3.0-4.2	12.5-35.6
Patent ductus arteriosus ***	2,532	131
Rate	61.2	323.5
95% confidence interval	58.8-63.6	270.4-383.8
Coarctation of aorta ***	276	11
Rate	6.7	27.2
95% confidence interval	5.9-7.5	21.3-48.6
Orofacial	**782**	**10**
Rate	**18.9**	**24.7**
95% confidence interval	**17.6-20.3**	**19.1-45.4**
Cleft palate without cleft lip	324	7
Rate	7.8	17.3
95% confidence interval	7.0-8.7	12.5-35.6
Cleft lip with and without cleft palate	436	2
Rate	10.5	4.9
95% confidence interval	9.6-11.6	2.4-17.8
Choanal atresia	70	1
Rate	1.7	2.5
95% confidence interval	1.6-2.1	0.7-13.8
Gastrointestinal *	**2,241**	**34**
Rate	**54.1**	**84.0**
95% confidence interval	**51.9-56.4**	**73.8-117.3**
Esophageal atresia/tracheoesophageal fistula	101	3
Rate	2.4	7.4
95% confidence interval	2.0-3.0	4.3-21.6
Rectal and large intestinal atresia/stenosis *	249	7
Rate	6.0	17.3
95% confidence interval	5.3-6.8	12.5-35.6
Pyloric stenosis	1,751	21
Rate	42.3	51.9
95% confidence interval	40.4-44.3	43.8-79.3
Hirshsprung's disease (congenital megacolon)	126	2
Rate	3.0	4.9
95% confidence interval	2.5-3.6	2.4-17.8

Table 8. Tennessee Birth Defects Counts and Rates by Maternal Diabetes, 2006-2010

Birth Defect	*No Diabetes*	*Diabetes*
Biliary atresia	32	1
Rate	0.8	2.5
95% confidence interval	0.7-1.1	0.7-13.8
Genitourinary * **	**3,711**	**66**
Rate	**89.7**	**163.0**
95% confidence interval	**86.8-92.6**	**149.0-207.3**
Bladder exstrophy	21	0
Rate	0.5	0.0
95% confidence interval	0.4-0.8	0.0-9.1
Hypospadias **	2,218	36
Rate	104.7	177.6
95% confidence interval	100.4-109.2	156.8-245.9
Epispadias	62	0
Rate	1.5	0.0
95% confidence interval	1.4-1.9	0.0-9.1
Obstructive genitourinary defect **	1,289	25
Rate	31.1	61.7
95% confidence interval	29.5-32.9	53.0-91.1
Renal agensis/hypoplasia ***	212	10
Rate	5.1	24.7
95% confidence interval	4.5-5.9	19.1-45.4
Musculoskeletal	**984**	**15**
Rate	**23.8**	**37.0**
95% confidence interval	**22.3-25.3**	**30.2-61.1**
Reduction deformity, upper limbs	93	2
Rate	2.2	4.9
95% confidence interval	2.1-2.8	2.4-17.8
Reduction deformity, lower limbs	86	3
Rate	2.1	7.4
95% confidence interval	1.9-2.6	4.3-21.6
Gastroschisis	236	1
Rate	5.7	2.5
95% confidence interval	5.0-6.5	0.7-13.8
Omphalocele	98	2
Rate	2.4	4.9
95% confidence interval	2.2-2.9	2.4-17.8

Table 8. Tennessee Birth Defects Counts and Rates by Maternal Diabetes, 2006-2010

Birth Defect	*No Diabetes*	*Diabetes*
Diaphragmatic hernia	175	3
Rate	4.2	7.4
95% confidence interval	3.6-4.9	4.3-21.6
Congenital hip dislocation	332	6
Rate	8.0	14.8
95% confidence interval	7.2-8.9	10.4-32.2
Chromosomal	**672**	**7**
Rate	**16.2**	**17.3**
95% confidence interval	**15.0-17.5**	**12.5-35.6**
Trisomy 13	34	1
Rate	0.8	2.5
95% confidence interval	0.7-1.1	0.7-13.8
Down syndrome	566	5
Rate	13.7	12.3
95% confidence interval	12.6-14.9	8.3-28.8
Trisomy 18	75	1
Rate	1.8	2.5
95% confidence interval	1.7-2.3	0.7-13.8
Fetus or newborn affected by maternal alcohol use	**83**	**0**
Rate	**2.0**	**0.0**
95% confidence interval	**1.9-2.5**	**0.0-9.1**
Total Cases ***	**14,993**	**390**
Rate	**362.3**	**963.0**
95% confidence interval	**356.5-368.1**	**869.7-1063**
Total Live Births	**413,853**	**4,050**

Source: Tennessee Department of Health, Division of Policy, Planning and Assessment, Tennessee Birth Defects Registry 2006-2010.

Note:
[1]Counts include cases resulting from live births and fetal deaths.
[2]Rates were computed per 10,000 live births except for Hypospadias per 10,000 live male births.
[3]Statistical significance was determined by Poisson regression with statistical probabilities indicated as: p < 0.001***, P < 0.01** , p < 0.05*.
[4]95 percent confidence intervals for 100 or less cases are exact Poisson; otherwise confidence intervals are based on the normal approximation.
[5]Diagnostic data were derived from the Tennessee Hospital Discharge Data System (2006-2011), the Tennessee Death Statistical System (2005-2010) and the Tennessee Fetal Death Statistical System (2006-2011).
[6]Total live births were derived from the Tennessee Birth Statistical system (2006-2010).

Risk Factors and Prevention

Though the causal mechanisms of most birth defects are not fully understood, there are known risk factors that increase the likelihood of giving birth to a baby with a birth defect. Likewise, there are known ways to reduce one's risk of having a baby with a birth defect.

Prevention is the best strategy in public health. A woman can reduce her risk of delivering a baby born with a birth defect or other adverse outcome by taking precautions before and during pregnancy. The best time to start preventing pregnancy related complications is before a woman becomes pregnant. Most of the baby's vital organs and systems are formed in the first four to eight weeks of gestation, often before a woman knows she is pregnant. The majority of birth defects occur in this four to eight week period, and there are a number of actions a woman can take to improve her baby's health. However many of these actions are only effective if begun prior to pregnancy.

Preconception Health

- One of the best actions a woman can do to protect against birth defects and other negative health outcomes for herself and her baby is to connect with a healthcare provider that is regularly available to assess the woman's health prior to and post conception. Screening, monitoring, and treating common health problems such as high blood pressure and diabetes will help promote a healthy mother and baby. Making sure healthcare providers are aware of any prescription or nonprescription drugs and dietary supplements in use, as many of these could have adverse effects on a fetus. And, keeping regular appointments with healthcare providers, so they can monitor a woman's progress and help in dealing with any problems that could affect mother or baby.

Immunizations

- Being current on immunizations such as rubella and the flu is important too. Due to vaccinations, rubella also known as German measles is not as common as it once was, but international travel has brought it to the United States in recent years and minor epidemics have occurred among unvaccinated populations. Women who develop rubella during pregnancy risk affecting the fetus and their baby being born with congenital rubella syndrome.

- Babies affected by congenital rubella syndrome are at high risk of being born with birth defects of the heart and eyes, micorcephaly and sensorineural deafness. Receiving vaccinations prior to pregnancy protects both the baby and the mother from having to cope with the consequences of preventable infections. Chances of a fetus developing congenital rubella syndrome are estimated as greater than 50 percent, when the mother is infected early in pregnancy. The mumps, measles, rubella (MMR) vaccine is readily available and recommended for every person born after 1957 who has not had rubella. Influenza or the flu is another infection that can be minimized via vaccination.

Infections

- Toxoplasmosis is an additional infection to be avoided by women who are or may become pregnant. Babies born to women with a toxoplasmosis infection are at risk for hydrocephalus. Toxoplasmosis is caused by the parasite, Toxoplasma gondii. Toxoplasmosis is spread in several different ways, but cats are the primary vector of infection. Cats are infected from eating infected birds, rodents, and other small animals and pass the bacteria in their feces. For this reason, pregnant women are recommended to have someone else clean the cat litter box, or if they must to wear gloves while doing so, and wash their hands afterwards. Toxoplasma gondii is also spread through persons eating raw or undercooked meat, or handling it and not washing their hands afterwards. It is recommended to wash or peel all fruits and vegetables before eating; to thoroughly wash all cutting boards with soap and water; and to wear gloves when gardening or handling sand from a sandbox.

- Diabetes is a chronic disease affecting an increasing number of mothers. Babies born to mothers with type 1 and type 2 diabetes are at increased risk for: hydrocephaly; anotia/microtia; limb reduction defects; omphalocele; esophageal atresia; cleft lip with and without cleft palate; cleft palate; and hypospadias. Also the increased risk for the heart defects: atrioventricular septal defects; atrial septal defects; total anomalous return; tetralogy of Fallot; transposition of great arteries; atrial septal defect; and ventricular septal defect. Many of these birth defects may be prevented with prenatal care focused on controlling the diabetic mother’s blood sugar levels during pregnancy.

- Gestational diabetes is not associated with birth defects, because it develops later in pregnancy than the birth defect inception period. However, babies born to mothers with gestational diabetes are at risk of being born with a condition known as macrosomia, which is an extremely large body. This puts both the mother and baby at risk of serious birth trauma. Macrosomia babies are also at elevated risk for obesity and developing type 2 diabetes later in life.

- Folic Acid is a B-complex vitamin that is proven to be protective against neural tube defects such as anencephlus and spina bifida. It may also provide protection against other birth defects. To be fully effective a woman needs to begin taking the recommended daily dose of 400 micrograms at least a full month before becoming pregnant and continue to take folic acid daily during pregnancy. If a woman finds she is pregnant and has not been taking folic acid, it is best to start taking folic acid immediately and continue to do so thereafter. Folic acid is available in most multivitamins and is sold separately in folic acid tablets.

- Don't smoke cigarettes, drink alcohol or use illegal drugs. According to the March of Dimes, babies born to mothers who smoke cigarettes are more likely to be born premature and low birth weight. They are also more likely to be born with cardiovascular, orofacial, gastrointestinal, and musculoskeletal birth defects. There is no amount of alcohol that is safe to drink during pregnancy. When a pregnant woman drinks, the alcohol in her system passes from mother to baby through the placenta and umbilical cord. Drinking too much can cause fetal alcohol syndrome, which is a serious condition involving growth deficiencies; facial abnormalities; central nervous system impairment; behavioral disorder; and intellectual disabilities. Use of street drugs such as amphetamines and ecstasy are also associated with cleft lip; cleft palate; and club foot, as well as reduced head size; and intellectual disabilities.

- While there are certain hereditary and genetic factors that cannot be reduced, this lists illustrates there are many environmental factors that public health, new mothers to be and health care providers can address together to assist in reducing birth defect occurrences in infants born in Tennessee.

Glossary of Terms

Agenesis Absence of part(s) of the body. Lack of development or failure to develop part(s) of the body.

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.

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.

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.

Aniridia The complete absence of the iris of the eye or a defect of the iris.

Anophthalmia A developmental defect characterized by complete absence of the eyes, or by the presence of vestigial eyes.

Anotia A congenital absence of one or both ears.

Aortic valve stenosis A cardiac anomaly characterized by a narrowing or stricture of the aortic valve.

Aplasia Absence of a tissue or organ due to lack of cell proliferation.

Atresia Absence or closure of a normal opening.

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.

Biliary atresia A congenital absence or underdevelopment of one or more of the ducts in the biliary tract.

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.

Chromosome abnormalities A major group of genetic diseases in which alterations of chromosome number or structure occur and are observable by microscope.

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.

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.

Coarctation of the aorta Localized narrowing of the aorta. This condition can vary from mild to severe.

Common truncus arteriosus A congenital heart defect in which the common arterial trunk fails to divide into pulmonary artery and aorta.

Confidence interval (95%) The interval that contains the true prevalence (which can only be estimated) 95% of the time.

Congenital Existing at or dating from birth although the defect may not be recognized at the time of birth.

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).

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.

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.

Dysgenesis Anomalous or disorganized formation of an organ.

Dysplasia Disorganized cell structure or arrangement within a tissue or organ.

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 350 grams or more, or, in absence of weight, of 20 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.

Microphthalmia The congenital abnormal smallness of one or both eyes. Can occur in the presence of other ocular defects.

Microtia A small or maldeveloped external ear and atretic or stenotic external auditory canal.

Multifactorial A term used to describe characteristics or diseases that are caused by a combination of multiple genetic and environmental factors.

Multiple congenital anomaly Term used to describe the presence of more than one anomaly at birth.

Mutagen Substance that is known to cause a mutation.

Mutations Alterations in the sequence of DNA.

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.

Neonatal (newborn) period The first 28 days following delivery of a live-born infant.

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.

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.

Omphalocele The protrusion of intestines into the umbilicus. The defect is usually closed surgically soon after birth.

Patau Syndrome See Trisomy 13

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.

Periconceptual At or around the time of conception.

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.

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.

Pulmonary artery anomaly Abnormality in the formation of the pulmonary artery such as stenosis or atresia.

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.

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.

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.

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.

Renal agenesis or dysgenesis The failure, or deviation, of embryonic development of the kidney.

Spina bifida An incomplete closure of the vertebral spine (usually posterior) through which spinal cord tissue or membranes (meninges) covering the spine herniated.

Stenosis A narrowing or constriction the diameter of a bodily passage or orifice.

Stenosis or atresia of the small intestine A narrowing or incomplete formation of the small intestine obstructing movement through the digestive tract.

Syndrome A pattern of multiple primary malformations or defects all due to a single underlying cause (for example, Down syndrome).

Teratogen A substance in the environment that can cause a birth defect.

Term infant An infant born after 37 complete weeks and before 42 complete weeks of gestation.

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.

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.
Tricuspid valve atresia or stenosis	A congenital cardiac condition characterized by the absence or constriction of the tricuspid valve.
Trisomy	A chromosomal abnormality characterized by one 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	See Down Syndrome.
Ventricular Septal Defect	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.