Iowa Registry for Congenital and Inherited Disorders

2010 Report

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Dear members of the Legislature, health care professionals, and concerned citizens of Iowa:

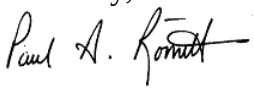
We are happy to provide you with the 2010 report of the Iowa Registry for Congenital and Inherited Disorders (IRCID). The IRCID continues to be a national leader in surveillance of congenital and inherited disorders and serves as a model program for other states. For 2010, the National Birth Defects Prevention Network selected the IRCID for their State Leadership Award, which honors the outstanding contributions or leadership by a state program in the development or expansion of birth defects surveillance or its use in the promotion of prevention services.

The IRCID continues to conduct active, statewide surveillance for birth defects, stillbirths, muscular dystrophy, and newborn screening disorders, and is also a key partner with the Iowa Center of Excellence for Birth Defects Research and Prevention. The Center is a collaborative enterprise between the College of Public Health, Carver College of Medicine, College of Pharmacy, and Center for Health Effects of Environmental Contamination at The University of Iowa, and the Iowa Department of Public Health.

Additionally, the IRCID is a key partner with the Iowa site for the Muscular Dystrophy Surveillance, Tracking, and Research Network, a collaborative enterprise between the College of Public Health and Carver College of Medicine at The University of Iowa along with the Muscular Dystrophy Association of Iowa, and the Iowa Department of Public Health.

The surveillance and research efforts of the IRCID and its partners provide a valuable resource for the state of Iowa. While taking care to preserve the privacy of families affected by these disorders, the IRCID provides important information to state policy makers and public health professionals. We are pleased to perform this important work on behalf of the citizens of Iowa.

Sincerely,



Paul A. Romitti, Ph.D.
Director and Associate Professor of Epidemiology

In the United States, the Centers for Disease Control and Prevention (CDC) recognize three types of surveillance systems; each is rated differently for completeness of patient ascertainment:

- Vital Records: Use of birth and fetal death certificates provided by the state's Department of Health (Rating: Poor)
- Passive Reporting: Use of medical reports submitted by staff from hospitals, clinics, or other facilities (Rating: Fair to Good)
- Active System: Use of trained personnel who systematically review records in hospitals, clinics, or other facilities (Rating: Excellent)

The IRCID conducts active surveillance to identify information about congenital and inherited disorders that occur in Iowa and to Iowa residents. The IRCID has collected information for over 49121 children with various birth defects. This information has been used by health care providers and educators to provide treatment and support services. It is also used by researchers to study risk factors for birth defects and to evaluate treatments for birth defects. The IRCID also conducts surveillance for Duchenne/Becker muscular dystrophy and has identified over 126 children with this neuromuscular disease. In addition, the IRCID is collaborating with the Metropolitan Atlanta Congenital Defects Program to develop approaches to active surveillance for stillbirths and also newborn screening disorders.

Surveillance for Birth Defects

The term "defect" refers to abnormal development related to body structure, body function, and metabolism, or an error in body chemistry. Typically a defect is present at birth (congenital), but a recognizable defect may be diagnosed during pregnancy (prenatal) or following birth (postnatal).

The IRCID has traditionally focused on structural birth defects, which typically involve a body part that is missing or malformed. Examples include heart defects, spina bifida, and cleft lip and palate. Starting with 2003 deliveries, the IRCID adopted the recommendations of the National Birth Defects Prevention Network (NBDPN) to focus on a core set of 45 defects (see Table 1). Prior to this change, the IRCID included many 'minor' conditions, so this change represents a reduction in the number of conditions that it monitors.

Table 1
Prevalence for birth defects in Iowa, 2003-2007 deliveries

Condition	Total	Prevalence Rate[†]
Brain/Spinal Cord		
Anencephalus	58	2.94
Encephalocele	18	0.91
Hydrocephalus without spina bifida	201	10.19
Microcephalus	194	9.84
Spina bifida without anencephalus	92	4.67
Eye		
Aniridia	1	0.05
Anophthalmia/microphthalmia	54	2.74
Congenital cataract	52	2.64
Ear		
Anotia/microtia	38	1.93
Heart		
Aortic valve stenosis	67	3.40
Atrial septal defect	612	31.03
Coarctation of aorta	96	4.87
Common truncus	17	0.86
Ebstein's anomaly	21	1.06
Endocardial cushion defect	147	7.45
Hypoplastic left heart syndrome	45	2.28
Patent ductus arteriosus	553	28.04
Pulmonary valve atresia and stenosis	209	10.60
Tetralogy of Fallot	86	4.36
Transposition of great arteries	68	3.45
Tricuspid valve atresia and stenosis	32	1.62
Ventricular septal defect	1014	51.42

[†] Prevalence per 10,000 live births.
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Table 1 (continued from previous page)

Condition	Total	Prevalence Rate[†]
Oral/Facial		
Choanal atresia	34	1.72
Cleft lip with and without cleft palate	224	11.36
Cleft palate without cleft lip	149	7.56
Digestive		
Biliary atresia	10	.51
Esophageal atresia / tracheoesophageal fistula	35	1.77
Hirshsprung's disease (congenital megacolon)	34	1.72
Pyloric stenosis	566	28.70
Rectal and large intestinal atresia/stenosis	104	5.27
Genital/Urinary		
Bladder exstrophy	10	0.51
Hypospadias and Epispadias [*]	193	[**]19.08
Obstructive genitourinary defect	493	25.00
Renal agenesis/hypoplasia	150	7.61
Muscle/Skeletal		
Congenital hip dislocation	157	7.96
Diaphragmatic hernia	20	1.01
Gastroschisis	94	4.87
Omphalocele	51	2.59
Reduction deformity, lower limbs	40	2.03
Reduction deformity, upper limbs	88	4.46
Syndromes		
Down syndrome (Trisomy 21)	337	17.09
Edwards syndrome (Trisomy 18)	51	2.59
Patau syndrome (Trisomy 13)	35	1.77
Other		
Amniotic bands	20	1.01
Fetus or newborn affected by maternal alcohol use	9	0.46

[†] Prevalence rates per 10,000 live births.
[*] Includes epispadias and/or second or third degree hypospadias. Excludes hypospadias NOS and first degree hypospadias.
[**] Prevalence per 10,000 male live births.

Birth Defects Research

Approximately 1 in 33 newborns are affected by a major birth defect, making such conditions disturbingly common. These conditions come with personal and monetary costs, both for the families of these children and for society. Nearly 20% of all infant deaths are caused by birth defects. Hospitalizations associated with such conditions are longer than hospitalizations for other conditions. More than $8 billion is required to provide lifetime care for the children born with birth defects each year.

Because the causes of up to 70% of birth defects are unknown, research is a critical part of any strategy to prevent these conditions. For this reason, in 1996 the United States Congress directed the CDC to establish regional "centers of excellence" in birth defect research and prevention. Furthermore, interest in fostering collaboration among state birth defect programs led to the formation of the National Birth Defects Prevention Network in 1998.

National Birth Defects Prevention Network

The National Birth Defects Prevention Network (NBDPN) is a nationwide association of birth defect programs and individuals. The IRCID is an active member of the NBDPN and participates in many of its projects. For example, the NBDPN provides a set of guidelines to help birth defect registries around the country organize their work in a consistent manner. The NBDPN also provides educational materials to birth defect abstractors, as well as informational resources to promote Birth Defects Prevention Month each January. Another goal of the NBDPN is to encourage scientific collaboration among birth defect programs. The IRCID is currently participating in NBDPN projects for biliary atresia, neural tube defects, pyloric stenosis, and ventral wall defects.

<u>2010 NBDPN Publications Using IRCID Data</u>

National Birth Defects Prevention Network (NBDPN). (2010) Selected Birth Defects Data from Population-based Birth Defects Surveillance Programs in the United States, 2003-2007. *Birth Defects Res A Clin Mol Teratol* 88:1062-1174.

Parker SE, Mai CT, Canfield MA, Rickard R, Wang Y, Meyer RE, Anderson P, Mason C, Collins JS, Kirby RS, and Correa A, for the National Birth Defects Prevention Network. (2010) Updated national birth prevalence estimates for selected birth defects in the United States, 2004-2006. *Birth Defects Res A Clin Mol Teratol* 88(12): 1008-16.

Iowa Center of Excellence for Birth Defects Research and Prevention

The Iowa Center of Excellence for Birth Defects Research and Prevention was one of eight charter centers established by the CDC to study genetic and environmental (broadly defined) risk factors for birth defects. Iowa Center investigators participate in local (state-wide) projects as well as the National Birth Defects Prevention Study (NBDPS). The NBDPS is a population-based study that investigates genetic and environmental risk factors for over 30 major birth

defects. As a partner with the Iowa Center, the IRCID identifies children with NBDPS-eligible birth defects and secures permission from mothers and guardians to share information with researchers. Women with a pregnancy affected by one or more of the defects and women with an unaffected pregnancy are interviewed about their health, diet, and lifestyle during their pregnancies. Biologic samples are also collected from each family to study genetic factors that may contribute to these birth defects. Presently, over 35,000 interviews have been completed nationwide, and biologic samples have been collected from more than 21,000 families.

Over 200 research projects are currently underway nation-wide as part of the NBDPS. Some of them examine risk factors such as maternal nutrition. Others examine gene and environment interactions. Still others examine maternal behavior during pregnancy. For example, the Iowa Center recently led a project that examined the role of maternal caffeine consumption during pregnancy and selected caffeine metabolism gene on the development of neural tube defects. The Iowa Center also led a project that examined maternal exposure to cigarette smoking and alcohol during pregnancy and congenital diaphragmatic hernia

The research performed by Iowa investigators has the potential to positively affect the lives of Iowans. Current studies by Iowa investigators are focused on the relationships between birth defects and agricultural chemicals, cigarette smoking, alcohol consumption, medications, and compounds in drinking water.

2010 Iowa Center Publications Using IRCID Data
(Names listed in bold designate Iowa investigators)

Austin AA, Druschel CM, **Tyler M**, **Romitti PA**, West I, Robbins JM, Burnett W, **Damiano P.** (2010) Interdisciplinary craniofacial teams compared with individual providers: is orofacial cleft care more comprehensive and do parents perceive better outcomes? *Cleft Palate Craniofac J* 47:1-8.

Damiano P, Tyler M, **Romitti PA**, Druschel C, Austin A, Burnett W, Robbins J. (2010) Primary care physician experience with children with oral clefts in three states. *Birth Defects Res Part A Clin Mol Teratol* 88:1050-1056.

Kancherla V, **Romitti PA, Caspers KM**, Morcuende JA, **Puzhankara S**. Epidemiology of congenital idiopathic equinovarus in Iowa, 1997-2005. (2010) *Am J Med Genet* 152A:1695-1700.

Robbins JM, **Damiano PC**, Druschel CM, Hobbs CA, **Romitti PA**, Austin AA, **Tyler M**, Reading JA, Burnett W. (2010) Prenatal diagnosis of orofacial clefts: association with maternal satisfaction, team care and treatment outcomes. *Cleft Palate Craniofac* J 47:476-81.

Romitti PA, Watanabe-Galloway S, **Budelier WT**, **Lynch CF, Puzhankara S, Wong-Gibbons D**, Hoppin JA, Alavanja M. (2010) Identification of live births of Iowa participants in the Agricultural Health Study: a record linkage approach. *Arch Environ Occup Health* 65:154-62.

Shin M, Besser L, Siffel C, Kucik JE, Shaw GM, Lu C, Correa A, and the Congenital Anomaly Multistate Prevalence and Survival Collaborative. (2010) Prevalence of Spina Bifida Among Children and Adolescents in 10 Regions in the United States. *Pediatrics* 126:274-279.

2010 NBDPS Publications Using IRCID Data

(Names listed in bold designate Iowa investigators)

Alwan S, Reefhuis J, Botto LD, Rasmussen SA, Correa A, Friedman JM, and the National Birth Defects Prevention Study. (2010) Maternal use of bupropion and risk for congenital heart defects. *Am J Obstet Gynecol* 203:52 e.1-6.

Alwan S, Reefhuis J, Rasmussen SA, Friedman JM, and the National Birth Defects Prevention Study. (2010) Patterns of antidepressant medication use among pregnant women in a United States population. *J of Clin Pharmacol* 51:264-270.

Anderka M, **Romitti PA**, **Sun L**, Druschel CM, Carmichael SL, Shaw GM, Hobbs CA, and the National Birth Defects Prevention Study. (2010) Patterns of tobacco exposure before and during pregnancy. *Acta Obstetricia et Gynecologica Scandinavica* 89:505-514.

Boulet S, Rasmussen S, Honein M and the National Birth Defects Prevention Study. (2010) Maternal body mass index as a risk factor for craniosynostosis. *Am J Med Genet A* 152A:2895-7.

Broussard CS, Louik CA, Honein MA, Mitchell AA, and the National Birth Defects Prevention Study. (2010) Herbal use before and during pregnancy. *Am J Obstet Gynecol* 202(5):443e1-6.

Carmichael S, Rasmussen S, Lammer E, Chen M, Shaw G and the National Birth Defects Prevention Study. (2010) Craniosynostosis and nutrient intake during pregnancy. *Birth Defects Res A Clin Mol Teratol* 88(12): 1032-1039.

Carter TC, Olney RS, Mitchell AA, **Romitti PA**, Bell EM, Druschel CM and the National Birth Defects Prevention Study. (2011) Maternal self-reported genital tract infections during pregnancy and the risk of selected birth defects. *Birth Defects Res A Clin Mol Teratol* 91(2):108-116.

Caspers K, Oltean C, **Romitti P**, **Sun L**, Pober B, Rasmussen S, Yang W, Druschel C; and the National Birth Defects Prevention Study. (2010) Maternal periconceptional exposure to cigarette smoking and alcohol consumption and congenital diaphragmatic hernia. *Birth Defects Res Part A Clin Mol Teratol* 88:1040-1049.

Dott M, Reefhuis J, Hogue CJ, Rasmussen SA. (2010) Association between pregnancy intention and reproductive-health related behaviors before and after pregnancy recognition, National Birth Defects Prevention Study, 1997-2002. *Matern Child Health J* 14 (3):373-81.

Duwe KN, Reefhuis J, Honein MA, Schieve LA, Rasmussen SA. (2010) Epidemiology of fertility treatment use among US women with liveborn infants, 1997-2004. *J Womens Health* 19(3):407-16.

Feldkamp ML, Meyer RE, Krikov S, Botto LD. (2010) Acetaminophen use in pregnancy and risk for birth defects: Findings from the National Birth Defects Prevention Study. *Am J Obstet Gynecol* 115(1):109-15.

Fisk Green R, Devine O, Crider KS, Olney RS, Archer N, Olshan AF, Shapira SK, and the National Birth Defects Prevention Study. (2010) Association of paternal age and risk for major congenital anomalies from the National Birth Defects Prevention Study, 1997-2004. *Annals of Epi* 20(3): 241-9.

Gilboa SM, Correa A, Botto LD, Rasmussen SA, Waller DK, Hobbs CA, Cleves MA, Riehle-Colarusso RJ, and the National Birth Defects Preventions Study. (2010) Association between prepregnancy body mass index and congenital heart defects. *Am J Obstet Gynecol* 202:51.e1-10.

Griesenbeck J, Brender J, Sharkey J, Steck M, Huber J, Rene A, McDonald T, **Romitti P**, Canfield M, Langlois P, Suarez L, and the National Birth Defect Prevention Study. (2010) Maternal characteristics associated with the dietary intake of nitrates, nitrites, and nitrosamines in U.S. women of child-bearing age: a cross-sectional study. *Environ Health* 9:10.

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Hashmi SS, Galloway MS, Waller DK, Langlois P, Hech JT and the National Birth Defects Prevention Study. (2010) Maternal fever during early pregnancy and the risk of oral clefts. *Birth Defects Res Part A Clin Mol Teratol* 88(3):186-194.

Herdt-Losavio ML, Lin S, Chapman BR, Hooiveld M, Olshan A, Liu X, DePersis RD, Zhu J, Druschel CM and the National Birth Defects Prevention Study. (2010) Maternal occupation and the risk of birth defects: An overview from the National Birth Defects Prevention Study. *Occup Environ med* 67(1):58-66.

Lupo PJ, Symanski E, Waller DK, Chan W, Canfield MA, Langlois PH, Mitchell LE, and the National Birth Defects Prevention Study. (2010) Polytomous logistic regression as a tool for exploring heterogeneity across birth defect subtypes: An example using anencephaly and spina bifida. *Birth Defects Res A Clin Mol Teratol* 88(8):701-705.

Ma C, Carmichael SL, Scheuerle AE, Canfield MA, Shaw GM, and the National Birth Defects Prevention Study. (2010) Association of microtia with maternal obesity and periconceptional folic acid use. *Birth Defects Res A Clin Mol Teratol* 152A(11):2756-2761.

Miller EA, Rasmussen SA, Siega-Riz AM, Fri‘ as JL, Honein MA, and the National Birth Defects Prevention Study. Risk factors for non-syndromic holoprosencephaly in the National Brith Defects Prevention Study. *Am J Med Genet Part C Semin med Genet* 154C:62-72.

Prakalapakorn SG, Rasmussen SA, Lambert SR, Honein MA, and the National Birth Defects Prevention Study. (2010) Assessment of risk factors for infantile catarats using a case-control study, National Birth Defects Prevention Study, 2000-2004. *Opthalmology* 117(8):1500-1505.

Reefhuis J, Honein M, Schieve L, Rasmussen S, and the National Birth Defects Prevention Study. (2010) Use of clomiphene citrate and birth defects, National Birth Defects Prevention Study, 1997-2005. *Hum Reprod* 26(2):451-7.

Sanchez-Lara PA, Carmichael SL, Graham JM, Lammer EJ, Shaw GM, MA C, Rasmussen SA. (2010) Fetal constraint as a potential risk factor for craniosynostosis. *Am J Med Gen* 152(A):394-400.

Schmidt RJ, **Romitti PA**, **Burns TL, Murray JC**, Browne ML, Druschel CM, Olney RS, and the National Birth Defects Prevention Study. (2010) Caffeine, selected metabolic gene variants, and risk of neural tube defects. *Birth Defects Res Part A Clin Mol Teratol* 88:560-569.

Shaw GM, Carmichael SL, Yang W, Lammer EJ. Periconceptional nutrient intake and risks of conotruncal heart defects. *Birth Defects Res A Clin Mol Teratol* 88:144-51.

Suarez L, Ramadhani T, Felkner M, Canfield MA, Brender JD, **Romitti PA**, **Sun L**. (2011) Maternal smoking, passive tobacco smoke, and neural tube defects. *Birth Defects Res A Clin Mol Teratol* 91(1):29-33.

Tinker S, Reefhuis J, Dellinger A, Jamieson D, and the National Birth Defects Prevention Study. (2010) Epidemiology of maternal injuries during pregnancy in a population-based study, 1997-2005. *J Womens Health* 19(12):2211-8.

van Gelder MMHJ, Reefhuis J, Caton A, Werler M, Druschel C, Roeleveld N. (2010) Characteristics of pregnant illicit drug users and associations between cannabis use and perinatal outcome in a population-based study. *Drug Alcohol Depend* 109(1-3):243-247.

Waller DK, Lockwood GT, Gallaway MS, Canfield MA,, Scheuerle A, Hernandez-Diaz S, Louik C, Correa A, and the National Birth Defects Prevention Study. (2010) Use of oral contraceptives in pregnancy and major structural birth defects in offspring. *Epidem* 21(2):232-239.

Muscular Dystrophy Research

Muscular dystrophy refers to a group of genetic diseases that cause progressive muscle weakness. The most common form of muscular dystrophy affecting children is Duchenne/Becker muscular dystrophy (DBMD). Duchenne muscular dystrophy is the name that historically refers to the most severe form of this disorder. DBMD usually presents with weakness in early

childhood. Weakness is progressive and children lose the ability to walk in late childhood. In the severe form, death occurs in young adulthood.

DBMD is caused by mutations in the dystrophin gene on the X chromosome. Approximately 1 in 3,500 boys have DBMD. Girls rarely have the disease, but they can be carriers of the gene mutation. Approximately one-third of boys with Duchenne muscular dystrophy did not inherit the disorder.

The Muscular Dystrophy Surveillance Tracking and Research Network

MD STARnet, the Muscular Dystrophy Surveillance, Tracking and Research Network, is a program currently active in six states. Its goal is to identify all people with childhood-onset Duchenne/Becker muscular dystrophies (DBMD). On behalf of the MD STARnet, the IRCID is undertaking surveillance of Iowans born since 1982 with DBMD. This surveillance consists of identification and ongoing medical chart review.

<u>2010 MD STARnet Publications Using IRCID Data</u>

Matthews DJ, James KA, Miller LA, Pandya S, Campbell KA, Ciafaloni E, **Mathews KD**, Miller TM, Cunniff C, Meaney FJ, Druschel CM, **Romitti PA**, Fox DJ. (2010) Use of corticosteroids in a Population-Based Cohort of Boys with Duchenne and Becker Muscular Dystrophy. *J Child Neuro* 25:1319-24.

Mathews KD, Cunniff C, Ciafaloni E, Miller T, Matthews D, Cwik V, Druschel CM, Miller L, Meaney FJ, **Romitti PA**, and the MD STARnet group. (2010) MD STARnet: case definition in surveillance for childhood-onset Duchenne/Becker muscular dystrophy. *J Child Neurol* 25:1098-1102.

Romitti P, **Puzhankara S,** Zamba G, **Nabukera S,** James K, Andrews J, Fox D, Cunniff C, Ciafaloni E, Druschel C, **Mathews K,** Matthews D, Miller L, Pandya S, Au S, Scollon S, Adams M, Street N, and the Muscular Dystrophy Surveillance, Tracking, and Research Network (MD STARnet). (2010) Population-based prevalence of Duchenne/Becker muscular dystrophy (DBMD). *Am J Epidemiol* 171(11 Suppl): S10.

Acknowledgements

We gratefully acknowledge the assistance of the following collaborating Iowa agencies and organizations:

The University of Iowa
- Members of the internal advisory committee for the Iowa Registry for Congenital and Inherited Disorders
- Center for Health Effects of Environmental Contamination
- College of Liberal Arts
- Carver College of Medicine
- College of Nursing
- College of Public Health
- Craniofacial Anomalies Research Center
- Governmental Relations Office
- Hygienic Laboratory
- Iowa Cancer Registry

Iowa Department of Public Health and the members of the Center for Congenital and Inherited Disorders Advisory Committee
Iowa Regional Genetic Consultation Service
Iowa Board of Regents
March of Dimes Birth Defects Foundation
KID Coalition
ASK Resource Center

Registry surveillance activities are funded by:
State of Iowa through a special appropriation to the Board of Regents
State of Iowa through a fee on issuance of birth certificates
Centers for Disease Control and Prevention

Registry research activities are funded by:
Centers for Disease Control and Prevention
National Institutes of Health

Registry educational activities are funded by:
Centers for Disease Control and Prevention
National Institutes of Health

Development and publication of this report was supported by funds appropriated by the Iowa General Assembly to the State Board of Regents.

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The Iowa Registry for Congenital and Inherited Disorders is a collaborative program of the University of Iowa's College of Public Health and the Iowa Department of Public Health.