



CHILDREN'S MINNESOTA FETAL MEDICINE:

# DRAMATICALLY CHANGING LIVES BEFORE BIRTH

Children's Minnesota has long held a responsibility to meet the unmet needs in our community. We know that fragile babies with complex health needs deserve a chance to thrive, and this belief has driven us to provide a revolutionary approach to fetal care. Through pioneering advances in fetal medicine, we can identify and treat disabling or life threatening conditions and diseases before a baby is born, such as congenital heart defects, fetal tumors, and genetic and neurological disorders, dramatically improving a child's lifetime of health.

We are at a defining moment in both fetal clinical care and research where advances in fetal medicine not only vastly improve care of unborn babies - they save lives.

- Open fetal surgery interventions for congenital anomalies such as spina bifida are proving that these babies have better outcomes and experience fewer complications than babies who have corrective surgery after birth.
- Imaging and physician knowledge have enhanced diagnosis and treatments, creating greater access to early fetal monitoring and lifesaving treatment plans.
- Gene therapy and fetal research offer an extraordinary future potential to eradicate disease and change the face of health care.

The future has never looked so promising for Children's fetal care and for the mothers and unborn babies we serve.

**ANNUAL IMPACT OF HIGH RISK PREGNANCIES IN THE U.S.:**

**4 MILLION**

babies are born each year<sup>i</sup>

**1 in 10**

pregnancies defined as high-risk<sup>ii</sup>

**6 in 1,000**

infants die<sup>iii</sup>

**"WE SEE HOPE FOR A LOT OF PREGNANCIES WHERE OTHER PEOPLE SEE NONE."**

-Dr. Brad Feltis, Surgical Director of the Midwest Fetal Care Center

## THE NEED FOR ADVANCEMENT

Fetal medicine is at the pioneering edge of pediatric health care. Babies still in the womb with serious illnesses and conditions once faced a lifetime of struggle and chronic issues. Now, if treated early, they have the hope of productive lives, with the burden of chronic illness reduced or fully eliminated.

## FUTURE REDUCTIONS IN LIFETIME COST OF CARE WILL BE TIED TO ADVANCES IN FETAL MEDICINE

We have come far in a short time, filling an unmet need in our community with Children's fetal medicine program. And this is only the beginning.

We can revolutionize fetal medicine for the families in our region and around the world. Our work aims to preserve lives through early detection and fetal interventions. It holds potential one day to eliminate genetic diseases through groundbreaking research in gene therapy. Wiping out genetic diseases will have an immeasurable impact on our nation's health care costs.

**BIRTH DEFECTS AFFECT 3% OF BABIES BORN IN THE UNITED STATES EACH YEAR.<sup>iv</sup>**

**1 in 5**

infant deaths is caused by birth defects<sup>v</sup>

**1 in 100**

babies has a congenital heart defect; 25 percent will need surgery or advanced care to survive.

**OVER 95%**

of congenital cardiac defects can be detected in utero. Currently only 30 percent of heart disease is diagnosed prenatally.

<sup>i</sup>National Center for Health Statistics. Centers for Disease Control. Page last reviewed. July 20, 2015. Page last updated Feb. 25, 2016 <http://www.cdc.gov/nchs/fastats/births.htm>

<sup>ii</sup>Centers for Disease Control. Preterm Birth. Page last reviewed: Dec. 2, 2015. Page last updated: Dec. 4, 2015 <http://www.cdc.gov/reproductivehealth/maternalinfanthealth/pretermbirth.htm>

<sup>iii</sup>Deaths: Final Data for 2013. National Vital Statistics Reports. Feb. 16, 2016: 64(2). [http://www.cdc.gov/nchs/data/nvsr/nvsr64/nvsr64\\_02.pdf](http://www.cdc.gov/nchs/data/nvsr/nvsr64/nvsr64_02.pdf)

<sup>iv</sup>CDC. Birth Defects. Reviewed: Feb. 29, 2016. Updated: Sept. 21, 2016. Accessed Sept 23, 2016. <http://www.cdc.gov/ncbddd/birthdefects/data.html>

<sup>v</sup>CDC. Birth Defects. Reviewed: Feb. 29, 2016. Updated: Sept. 21, 2016. Accessed Sept 23, 2016. <http://www.cdc.gov/ncbddd/birthdefects/data.html>



## CHILDREN'S MINNESOTA FETAL MEDICINE:

# TRANSFORMING THE OBSTETRIC, FETAL AND NEWBORN CARE MODEL

Children's Minnesota fetal medicine program started with the support of spirited providers and generous donors that allowed us to identify and fill an unmet need for fetal care in our community. Philanthropic support has provided crucial components of the program including:

- A state-of-the-art clinic and ultrasound equipment
- The opportunity for gene therapy and fetal research to occur
- The dedicated time for surgeon and research directors to commit their expertise

Today, our passionate team provides comprehensive patient care from prenatal diagnosis and counseling through treatment and long-term follow-up for hundreds of babies in the region.

Children's unites the nation's best mom and baby experts to work together as partners to further advance fetal medicine.

## THE MOTHER BABY CENTER:

The Mother Baby Center is a joint partnership between Children's Minnesota and Allina Health, bringing together the finest in fetal, neonatal, obstetrics, perinatology and labor & delivery services. By establishing The Mother Baby Center model, Children's Minnesota is able to address the acute and underlying causes of complications, and improve the health and lives of moms and babies.

- Between the two health systems, we deliver nearly one in three babies and treat nearly two in three babies in the Twin Cities.
- Our expertise, size, access, training programs and outcomes are unmatched in this region. This allows us the opportunity and responsibility to conduct research with a larger base of patient data.
- We offer specialists in cardiology, neurosurgery, pediatric surgery, genetics, obstetrics/perinatology, radiology, nursing and neonatal medicine.
- Our team coordinates all aspects of care from diagnosis to postoperative recovery and long-term follow-up.
- Our concierge care model puts patients and families first, driving exceptional outcomes and an unparalleled care experience.



## HISTORY OF THE MIDWEST FETAL CARE CENTER:

The center was established in 2008 as a partnership between Children's Minnesota, Abbott Northwestern Hospital and Minnesota Perinatal Physicians, along with Pediatric Surgical Associates and other consulting subspecialists for the diagnosis, consultation and treatment of fetuses with developmental abnormalities. The center's clinic opened in 2016 and was made possible through the generous support of philanthropic partners.

# TRANSFORMING THE OBSTETRIC, FETAL AND NEWBORN CARE MODEL

## THE MIDWEST FETAL CARE CENTER:

The future is bright for the relatively new field of fetal surgery, in which the demand is high and growing. For babies who need fetal surgery, the Midwest Fetal Care Center has among the highest survival rates and the lowest rates of post-operative complications. We are:

- The first and largest advanced fetal care program in the Upper Midwest and one of only a few in the nation.
- Housed in a 6,700-square-foot, state-of-the-art facility that has helped to improve the diagnostic process and management of pregnancies impacted by fetal anomalies and enabled in utero intervention when appropriate.
- The only active fetal program in the region performing open surgeries which allow repair of myelomeningocele (spina bifida).

## FETAL CARDIOLOGY WITH THE CHILDREN'S HEART CLINIC:

Because congenital heart defects represent a large percentage of fetal medicine needs, in utero diagnosis and treatment are key to improving outcomes after birth. That's why Children's pediatric cardiologists partner with fetal medicine experts to assist in the diagnosis and management of fetal congenital heart defects. Highlights of this partnership include:

- Developing our region's only **Fetal Cardiology Diagnostic Network**, a program that allows local physicians to transmit fetal heart ultrasound images to specialists at Children's Minnesota who can diagnose babies' congenital heart malformations early in the mother's pregnancy and then develop the baby's care plan.
- Diagnosing early congenital heart defects through advancements in **Fetal Echocardiography**, which is performed from the maternal abdomen as early as 16 weeks gestation to term.

## GENE THERAPY RESEARCH WITH THE MAYO CLINIC:

Through ground-breaking gene therapy research with the Mayo Clinic, we have the potential to eradicate certain diseases in unborn babies. Our research group recently published results of a promising gene therapy treatment to correct inborn errors of liver metabolism. Gene therapy permanently corrected diseased liver cells in a large animal model and is currently being vetted with the Food and Drug Administration (FDA) for human trials.

## OPEN FETAL SURGERY:

Our open fetal surgery program now qualifies us as a truly advanced fetal center. Children's is also developing a long-term infant-to-adult follow-up and evaluation program to provide the highest level of ongoing care for our patients with chronic health conditions.

### CHILDREN'S MINNESOTA FETAL SURGERY:

Our fetal surgeons have trained with world-renowned experts in fetal surgery to care for babies who have potentially life-threatening conditions. Fetal surgery (any surgical procedure performed on the fetus or placenta during gestation):

#### May be minimally invasive

- Ultrasound guided
- Fetoscopic (example: fetoscopic laser ablation therapy for twin-to-twin transfusion syndrome (TTTS) )

#### May be open

- Ex utero intrapartum treatment
- Hysterotomy



## CHILDREN'S MINNESOTA FETAL MEDICINE:

# OUR FETAL CARE IMPACT

More than 1,000 children per year are born in Minnesota with congenital disorders – a number that is rising. The need for an advanced fetal care program in our region of this caliber cannot be understated.

Children's Minnesota's growth of new patients in the program reflects an increasingly complex and diverse mix of patient needs beyond previous years' projections, including:

**+50 %**

Congenital Diaphragmatic Hernia

**+4 %**

Congenital Pulmonary Airway Malformation

**+36 %**

Twin-to-Twin Transfusion Syndrome

Children's treated on average about five new patients each clinic day at the Midwest Fetal Care Center in 2016. Projections for 2017 new patient and surgery growth are estimated at 5 percent and 15 percent, respectively. Overall, the Children's fetal medicine program is forecasting 5 percent annual growth over the next five years.

CONDITIONS TREATED AT FETAL CENTERS	
CHEST ABNORMALITIES	Congenital Diaphragmatic Hernia (CDH), Congenital Cystic Adenomatoid Malformation, Bronchopulmonary Sequestrations, Pleural Effusions, Pulmonary Agenesis
TWIN PROBLEMS	Twin-to-Twin Transfusion Syndrome (TTTS), Twin-Reversed Arterial Perfusion Sequence, Anomalies in Monochorionic Twins, Conjoined Twins
FETAL TUMORS	Cervical Teratoma, Mediastinal Teratoma, Sacrococcygeal Teratoma, Lymphangioma, Neuroblastoma
GENITOURINARY PROBLEMS	Bladder Outlet Obstruction, Bladder Exstrophy, Bilateral Ureteral Obstruction, Cloaca, Cloaca Exstrophy
NEUROLOGIC PROBLEMS	Myelomeningocele, Encephalocele
CONGENITAL HEART DISEASE	Aortic Stenosis, Complete Heart Block, Hypoplastic Left Heart Syndrome (HLHS), Pulmonary Atresia with Intact Ventricular Septum
AMNIOTIC DISORDERS	Amniotic Band Syndrome

## OUR FETAL CARE IMPACT

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### CLINICAL OUTCOMES

Critical to measuring the impact of fetal medicine is the ability to measure the short- and long-term clinical outcomes of mothers and their babies facing high-risk pregnancies. Children's Minnesota has some of the nation's lowest rates of post-operative complications, and the lowest rate of surgical complications in premature babies. Our successful outcomes derive from quality research, high-volume experience, superior training, and the identification and use of evidence-based practices. This success includes:

## 1<sup>st</sup> IN REGION

to establish a comprehensive fetoscopic laser ablation program for TTTS with outcomes consistent with national norms and neuro-cognitive outcomes that are improved over national norms

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## 84%

survival rate for CDH patients on extracorporeal membrane oxygenation, compared to 55 percent national average

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## 90%

survival rate for complex cardiac surgeries, including HLHS, compared with 83 percent national average

Our fetal specialists have been published in peer-reviewed medical journals. Members of our multidisciplinary care team regularly generate national research abstracts related to the clinical protocols/algorithms we develop. The Midwest Fetal Care Center is also part of the North American Fetal Therapy Network, an association of medical centers funded by the National Institutes of Health with the goal of fostering collaborate research in fetal medicine.



## CHILDREN'S MINNESOTA FETAL MEDICINE:

# OUR VISION: MORE HEALTHY BABIES

Birth defects are more common than most people realize. Our vision is to give more babies the best possible opportunity for a full and healthy life. Before delivery, we will use the most advanced surgical and treatment procedures that blend ground-breaking medical advancements, leading research, advanced screening techniques, and improved outreach and access. By taking an evidence-based, multidisciplinary approach to patient care that extends from prenatal diagnosis and counseling through treatment and long-term follow-up, we will realize short-term and lifetime financial savings to our health care system.

***“A RARE FETAL DIAGNOSIS HAD THROWN US INTO UNIMAGINABLE ANGUISH, BUT THE STAFF AT CHILDREN’S GAVE US COMFORT AND HOPE. MOST IMPORTANT, CHILDREN’S WAS ABLE TO PROVIDE LIFESAVING TREATMENT TO OUR UNBORN TWINS. TODAY THEY ARE HAPPY, THRIVING TWO-YEAR-OLDS.”***

*—Mother of boys with twin-to-twin transfusion syndrome*

### TO ACHIEVE OUR VISION, WE WILL:

- Expand our mother/baby fetal care innovations, treating spina bifida, muscular dystrophy and cystic fibrosis while the baby is still in the womb.
- Expand fetal cardiology program and services.
- Establish early fetal echo capabilities to enhance knowledge and technical skills for earlier detection, enabling valuable parental counseling and the parents’ ability to make informed pregnancy decisions.
- Recruit national clinical leaders and emerging clinicians and researchers to define the future of maternal fetal medicine.
- Contribute to developing one of the first in utero gene therapy and transplantation programs in the country.
- Adopt preemptive genomic testing as our standard of care so we can proactively understand, detect and manage diseases.
- Integrate the latest personal technology to monitor pregnant mothers and newborns.
- Develop community partnerships to better address social, behavioral and environmental challenges facing mothers, babies and families.

The demonstrated need for fetal diagnosis and complex fetal procedures, the advances in science and technology that make such early treatment possible, and generous community philanthropic support prove that now is the right time to take Children’s Minnesota fetal medicine to the next level.





## CHILDREN'S MINNESOTA FETAL MEDICINE: THE IMPACT OF PHILANTHROPY

Children's Minnesota is recognized as one of the most advanced fetal care centers in the country, thanks to transformational philanthropic contributions that have enabled us to come a long way in a short time. Today, we are right at the edge of groundbreaking interventions and research that have the potential to not only save lives, but eliminate diseases. Additional community funding is imperative to continue advancing the extraordinary developments occurring in the field of fetal therapy.

Working together, our community can bring the life-changing innovations in fetal science to families not only in our area, but around the world.

### GIVING OPPORTUNITIES

Early and generous gifts to fetal care at Children's have sparked phenomenal philanthropic momentum. The community, through Children's Foundation, the state-of-the-art Michael and Ann Ciresi Midwest Fetal Care Clinic and the clinical and research programs. Additionally, Children's is expanding The Mother Baby Center offerings and facilities beyond Minneapolis to increase access for maternal and fetal care need in our region.

Philanthropic support will fast-track advancements in research, staffing and program expansions, including:

- Expanding our open fetal surgery program;
- Accelerating gene therapy research to clinical trials;
- Adding to our multidisciplinary care team;
- Adopting pre-emptive genomic testing as our standard of care so we can proactively detect and manage diseases earlier; and
- Advancing our fetal cardiology and early fetal radiology programs.

***"THE USE OF ULTRASONOGRAPHY HAS REVOLUTIONIZED PRENATAL CARE. BUT DESPITE PERSISTENT ATTEMPTS TO IMPROVE CARDIAC EVALUATION IN UTERO, THE PRENATAL DETECTION RATE OF MAJOR HEART DEFECTS STILL HAS A LONG WAY TO GO. WE CAN DO BETTER."***

*Kirsten B. Dummer, MD, Fetal Cardiology  
at Children's Minnesota*

# THE IMPACT OF PHILANTHROPY

## RESEARCH HIGHLIGHT: GENE THERAPY FOR INBORN ERRORS OF METABOLISM

The philanthropic commitment to Children’s basic science research program, in partnership with Mayo Clinic and others, has and is expected to continue to result in ground-breaking research in gene therapy. Children’s fetal care researcher, Dr. Joseph Lillegard’s initial research efforts are focused on correcting inborn errors of metabolism of the liver - a common group of diseases of the liver affecting 1-in-1,200 live births.

In the fall of 2015, Dr. Lillegard and his group presented research advancements to both the Plenary session for the European Society for Gene and Cell Therapy in Helsinki, Finland, and the American Society of Liver Diseases in San Francisco, demonstrating the first ever large animal pre-clinical proof of concept for gene therapy to durably correct and treat the phenotype related to Tyrosinemia, one of the inborn errors of metabolism.

- This work was published in the prestigious research journal *Science Translational Medicine*.
- The next step in this effort is to open a trial with the Center for Biologics Evaluation and Research (CBER), a center within the Food and Drug Administration, studying the efficacy of treating in-born errors of metabolism of the liver using this unique gene therapy approach.
- Dr. Lillegard has also formed a partnership with a distinguished group of researchers studying phenylketonuria (PKU) at Oregon Health and Science University – this is the next inborn error of metabolism his work will be applied to.
- Ultimately, it is the belief of his group that this gene therapy approach will be applicable to all inborn errors of metabolism of the liver, which will significantly change the field.

As testing for these and other genetic diseases has become increasingly, we can rapidly move toward targeting, treating and correcting these problems before the children are even born.

## GIFT OPPORTUNITIES: \$22.5M FETAL INITIATIVE

	DESCRIPTION	PROGRAM	CAPITAL
FETAL SURGICAL PROGRAMS TOTAL \$4,000,000	Further Fetoscopic / Open Surgery Capabilities	\$1,000,000	
	Surgeon Recruitment, On-boarding and Training	\$500,000	
	Endowed Chair: Fetal Surgery	\$2,500,000	
FETAL RESEARCH TOTAL \$12,000,000	Gene Therapy Research and Support	\$8,800,000	
	Research to Advance Fetal Treatment	\$500,000	\$200,000
	Endowed Chair: Fetal Research	\$2,500,000	
MULTIDISCIPLINARY CLINIC TEAM TOTAL \$5,500,000	Fetal Cardiology Network - FUNDED	\$760,000	\$200,000
	Fetal Radiology Program	\$540,000	\$1,000,000
	Fetal Genetics Lead and Counselors	\$500,000	
	Endowed Chair: Fetal Cardiology	\$2,500,000	
INNOVATION TOTAL \$1,000,000	Patient Education / Website and Dissemination	\$250,000	
	Expand Regionally via Care Technology	\$750,000	
<b>TOTALS</b>		<b>\$21,100,000</b>	<b>\$1,400,000</b>