Division Introduction

The Pediatric Cardiology Division provides comprehensive care for children with heart disease, conducts seminal research, and oversees a nationally recognized training program.

Under the direction of Gerald Greil, M.D., Ph.D., the Division provides services at Children’s Medical Center Dallas and Children’s Medical Center Plano in:

- Outpatient clinics (~12,000 visits/year)
- A 22-bed inpatient telemetry floor dedicated to cardiac patients
- A 32-bed dedicated Cardiac Intensive Care Unit
- Two catheterization laboratories for diagnostic and interventional procedures, including catheter ablation
- A 1.5T cardiac MRI scanner fully dedicated to Pediatric Cardiac Imaging with and without general anesthesia. The close proximity of this scanner to the cardiac catheterization laboratory allows combined MRI – cardiac catheterization procedures (XMRI).
- All imaging facilities are in close proximity to the OR allowing intra- and perioperative assessment of surgical and cardiac catheterization procedures.
- An echocardiography suite, including special areas for fetal echocardiography, as well as a complete non-invasive monitoring laboratory
- Outreach services are available at multiple sites throughout North Texas

Faculty

The Division has 25 pediatric cardiologists, each with a special area of expertise, including critical care medicine, interventional catheterization, electrophysiology, advanced imaging including echocardiography and fetal echocardiography, cardiac Magnetic Resonance Imaging (MRI) and Computed Tomography (CT), fetal cardiology, cardiac transplantation, heart failure, prevention, and adults with congenital heart disease.

Honors / Awards

Promotions

- Colin Kane, Associate Professor
- Poonam Thankavel, Associate Professor

Best Pediatric Specialists in Dallas, D Magazine

- Vivian Dimas
- Lynn Mahony
- Claudio Ramaciotti
- Thomas Zellers

Texas Super Doctors, Texas Monthly Magazine

- Vivian Dimas
- Adrian Dyer
- Lynn Mahony
- Alan Nugent
- Claudio Ramaciotti
- William Scott
- Poonam Thankavel
- Surendranath Veeram Reddy
- Thomas Zellers
Alan Nugent

- Charles S. Kleinman Scientific Scholarship Award Winner, Pediatric and Adult Interventional Cardiac Symposium
- Highest ranking abstract from Australia, American College Cardiology Annual Scientific Session

Animesh Tandon

- Clinical Stipend, International Society for Magnetic Resonance in Medicine

Surendranath Veeram Reddy

- Charles S. Kleinman Scientific Scholarship Award Winner, Pediatric and Adult Interventional Cardiac Symposium

Ilana Zeltser

- Alpha Omega Alpha Honor Medical Society, UT Southwestern Medical Center

Invited Lectures

Bibhuti Das

- American Transplant Congress Meeting, Chicago, IL, March 2017
  - “High Titer De Novo Donor-Specific HLA Alloantibodies and Cardiac Allograft Vasculopathy after Pediatric Heart Transplantation”
- ISHLT 37th Annual Meeting and Scientific Sessions, San Diego, CA, April 2017
  - “Reverse Remodeling after Placement of Pulsatile and Continuous-flow Ventricular Assist Device in Pediatric Heart Failure Patients with Idiopathic Dilated Cardiomyopathy”
  - “Use of Two Dimensional Speckle Tracking Echocardiography for the Detection of Acute Rejection in Pediatric Heart Transplant Recipients: A Prospective Study”

Vivian Dimas

- 7th World Congress of Pediatric Cardiology and Cardiac Surgery, Barcelona, Spain, June 2017
  - “Transcatheter Ventricular Assist Devices”

Gerald Greil

- Society for Cardiovascular Magnetic Resonance 20th Annual Scientific Sessions, Washington, DC, February 2017
  - “Clinical Utility of MRI in Imaging of Coronary Vessels in Adults and Pediatrics”
  - Moderator, “Advanced Techniques in Congenital CMR: Ready for Wide Clinical Use?”
- 51st Annual Association for European Paediatric and Congenital Cardiology Meeting, Lyon, France, March 2017
  - “Aortic Coarctation: Morphology Predicting Outcomes in Adulthood”
  - Moderator, “3D Printing of Congenital Heart Disease”
  - “Coronary Evaluation – Are CT, MRI and Catheterization Complementary?”
  - Moderator, “Imaging Right Ventricle-Pulmonary Artery – Unit in Volume and Pressure Overload”
Tarique Hussain

- 51st Annual Association for European Paediatric and Congenital Cardiology Meeting, Lyon, France, March 2017
  - “XMR and Pulmonary Vascular Resistance”
- Catheter Interventions in Congenital and Structural Heart Disease Meeting, Frankfurt, Germany, June 2017
  - “Groping in the Dark or Light at the End of the Tunnel”
  - “XMR and Hybrid Cath-MRI: The Modern Approach?”

Richard Kirk

- International Society for Heart & Lung Transplantation, San Diego, CA, April 2017
  - “Infant with End-Organ Dysfunction – Patient Selection and Optimization Prior to VAD Implantation”
  - “Managing the RV after LVAD Placement”
- 4th International Conference on Cardiomyopathy in Children, Bethesda, MD, May 2017
  - “Continuous Donor Perfusion for Heart Preservation”
- International Pediatric Transplant Association, Barcelona, Spain, May 2017
  - “Donation after Circulatory Death (DCD). Is it an Option for Children?”

Lynn Mahony

- Visiting Professor, Children’s Mercy Hospital, Kansas City, MO, October 2017

Alan Nugent

- Live Cases Presenter, Pediatric and Adult Interventional Cardiac Symposium, Miami, FL, January 2017
- Moderator, Case Competition, Society for Cardiovascular Angiography & Interventions, New Orleans, LA, May 2017
  - “Between a Rock and a Hard Case”
- CSI-UCSF – Catheter Interventions in Structural, Valvular and Congenital Heart Disease, Atrial Fibrillation and Heart Failure, San Francisco, CA, September 2017
  - “New and Upcoming Technologies – Novel Bioresorbable Materials for Use in Interventional Cardiology”

William Scott

- Texas Medical Association, Austin, TX, January 2017
  - “Sports Pre-participation ECG Screening Controversies”

David Sutcliffe

- Intermacs 11th Annual Meeting, Atlanta, GA, March 2017
  - “Does Small BSA Lead to Small Events?”
- ISHLT 37th Annual Meeting and Scientific Sessions, San Diego, CA, April 2017
  - “Post-Transplant Outcomes in Pediatric VAD Patients: A Pedimacs-PHTS Linkage Study”
Conference Presentations

Batsis M, Greil GF, Tandon A, Hussain T.

Poster, American College of Cardiology’s 66th Annual Scientific Sessions, Washington, DC, March 2017
“Mitral valve phase contrast imaging is a more reproducible method of determining cardiac rest periods for whole-heart coronary magnetic resonance angiography in congenital heart disease than 4 chamber cine”


Poster, Cardiology 2017: Children’s Hospital of Philadelphia, Orlando, FL, February 2017
“Critical evaluation of diagnostic evaluation prior to the Glenn procedure in the current era”

Jamison R, Mahony L, McKinney J, Hicks P.

Poster, Pediatric Academic Societies Meeting, San Francisco, CA, May 2017
“Matters of the Heart: Evaluation of a New Online Ambulatory Cardiology Curriculum for Residents”

Moye DM, Hussain T, Botnar RM, Tandon A, Greil GF, Dyer AK, Henningsson M.

ePoster, International Society for Magnetic Resonance in Medicine (ISMRM) 25th Annual Meeting, Honolulu, HI, April 2017
“Dual-phase whole-heart imaging using image navigation in congenital heart disease”

Tandon A, Hallac R, Byrne N, Velasco Forte MDLN, Greil GF, Hussain T.

Poster, SCMR 20th Annual Scientific Sessions, Washington, DC, February 2017
“Accurate 3D prints for RVOT interventions: a quantitative study”

Tandon A, Hussain T, Tran A, Botnar RM, Greil GF, Henningsson M.

ePoster, International Society for Magnetic Resonance in Medicine (ISMRM) 25th Annual Meeting, Honolulu, HI, April 2017
“Aortic vessel wall imaging using 3D phase sensitive inversion recovery in children and young adults”

Education and Training

The Division is dedicated to the training of medical students, residents, and fellows.

Medical Students

- Third-Year Pediatric Rotations:
  - Cardiology inpatient rotations with three medical students throughout the year
  - Pediatric Cardiology Clinic Days
- Fourth-Year Electives in Pediatric Cardiology:
  - Cardiac Outpatient Clinic Rotation
  - Cardiac Intensive Care Unit Rotation
  - Cardiac Imaging Rotation (MRI, CT, echocardiography)
Resident

The Division of Pediatric Cardiology plays a major role in the training of pediatric residents. Training occurs at many levels.

- **Inpatient Training:**
  - Three interns and one senior resident typically participate on the cardiology inpatient service, caring for patients on a 22-bed cardiology floor with the supervision of the attending cardiologist
  - An elective is available for residents to rotate in the Cardiac Intensive Care Unit

- **Outpatient Training:**
  - One or two second- or third-year residents are typically training in the Cardiology Outpatient Clinic under the supervision of the attending cardiologists

Fellows

The Pediatric Cardiology fellowship currently accepts two trainees per year in the categorical program. In addition to the standard three-year fellowship program, up to three qualified fellows a year are offered an additional fourth-year training programs in either cardiac critical care, interventional cardiology, advanced cardiac imaging, electrophysiology, heart transplantation or cardiac MRI. The structure of these experiences depends on the interests and skills of the individual fellow. Categorical fellows rotate through cardiac outpatient, inpatient, critical care, preventive cardiology, adult congenital heart disease, cardiac catheterization, electrophysiology, echocardiography, MRI and cardiac transplantation. They also spend up to one year participating in clinical, translational, or basic science research. The program provides fellows the training, tools, and philosophy necessary for advancing the field of pediatric cardiology within their areas of choice. All pediatric cardiology faculty members are actively involved in the fellows’ training.

Research Activities

Members of the Division of Pediatric Cardiology are engaged in multiple research projects to advance the care of children with heart disease.

Basic Science

An exciting new area of investigation is the development of biodegradable stents for use in the cardiovascular system. Current research is directed at an evaluation of the tissue response to these materials in animals. Cardiopulmonary bypass is known to have adverse effects on neurologic development, but a clear understanding of the mechanisms is lacking. Using a mouse model of bypass, investigation is underway to evaluate biomarkers of injury.

Another new area of investigation is to optimize cardiovascular support therapy for pediatric patients with end stage heart failure. Currently the only ventricular assist devices available require surgical placement. Researchers are investigating in an animal model the feasibility of a catheter delivered devise. One additional animal research area is the optimization of technologies for fetal intervention.

In close cooperation with the Department of Radiology faculty have access to the Advanced Imaging Research Center at UT Southwestern. This gives staff members access to novel cardiovascular research technology to contribute to existing research as well as opportunity to design their individual research projects.

Clinical Sciences

The Pediatric Cardiology Division participates in multiple multicenter trials. In interventional catheterization, current trials are assessing various devices, including the Amplatzer and Helex occluders, and management of coarctation, including the placement of stents. It is anticipated that a recently completed multicenter trial of athletic screening processes will be used for a broader national evaluation.
The Division is contributing to a quality initiative to assess the care of patients with hypoplastic left heart syndrome. A multicenter effort is also underway to evaluate the use of ventricular assist devices in the pediatric population.

Collaborative studies within the Department of Pediatrics include protocols to evaluate stroke, migraine, and complications of sickle cell disease and childhood cancer.

Ongoing areas of research interest include epidemiologic studies of congenital heart disease, particularly within the state of Texas, natural history studies of patent ductus arteriosus in preterm neonates; evaluation of renal function with heart catheterization, markers for cardiac transplant rejection, development of new techniques for pediatric cardiovascular MRI; 3D printing and modeling of congenital heart disease; and using cutting-edge wearable sensors, combined with innovative big data techniques, to improve monitoring of children with heart disease while at home.

**Clinical Activities**

The Pediatric Cardiology division offers a comprehensive program of specialized care at the Heart Center at Children’s Health℠ for children with congenital and acquired heart diseases, and children who have grown into adults with congenital heart disease. The Heart Center’s team of professionals includes cardiologists, cardiac surgeons, cardiac intensivists, neonatologists, and cardiac anesthesiologists. In addition to providing the highest quality clinical and surgical care, our faculty members are committed to improving the health of children everywhere by sharing innovations and research.

**Inpatient Services**

Inpatient service is divided between the cardiac intensive care unit and the cardiology inpatient floor, on which all beds have telemetry capability with central monitoring. The inpatient floor functions as a “step-down” unit with the capacity to manage higher acuity patients, including those with temporary pacemakers and vasoactive infusions. There are usually 20 patients in the cardiac intensive care unit and 20 patients on the cardiology floor. New consultations average three to five per day.

**Outpatient Services**

Approximately 12,000 cardiology outpatients are seen each year at the Heart Center and regional outreach clinics. Subspecialty cardiology clinics, including heart transplantation, heart failure, arrhythmia, pacemaker, preventive cardiology, and young adult congenital heart disease, are held on a weekly or monthly basis.

**Preventive Cardiology Clinic**

A preventive cardiology clinic serves children with hyperlipidemia and hypercholesterolemia and children with metabolic syndrome (i.e. obesity, insulin resistance, increased triglycerides, decreased high density lipoprotein, and hypertension). A team of physicians, dietitians, and nurses provides comprehensive physical assessments and dietary evaluations for patients and their families, with the development of individualized programs, including:

- Diet
- Life style modification
- Treatments, including natural as well as prescription medications

**Pediatric Echocardiography Laboratory**

The pediatric echocardiography laboratory at Children’s Health is Intersocietal Accreditation Commission (IAC) accredited for pediatric transthoracic, transesophageal, and fetal echocardiography. Six dedicated sub-specialty trained physicians staff the laboratory and provide coverage 24/7. The team consists of highly trained pediatric sonographers who perform
approximately 11,000 studies a year and provides direct services for four primary hospitals and two outpatient sites. In addition, we provide support services for tele-echocardiography at three additional hospitals and four outreach clinics.

The laboratory offers the latest technology including fetal echocardiography, stress imaging, 3 dimensional and strain imaging and provides imaging support for the cardiac operating rooms, ECMO cannulation, and catheterization laboratory.

The laboratory has a strong track record of academic endeavors, including research on congenital coronary artery imaging, identification of rejection in transplanted hearts, and evaluation of single ventricle palliation. We have many successful research collaborations with other divisions in pediatrics including neonatology, hematology/ oncology and neurology. We have recently participated in a multi-center National Institute of Health (NIH) funded study to determine normal values for pediatric echocardiography.

**Fetal Heart Program**

The fetal heart program is Joint Commission Disease Specific Certified. We performed more than five hundred fetal echocardiograms and consultations in 2017. The program expertly coordinates prenatal testing and delivery planning to ensure critical congenital heart conditions receive the care they need at precisely the right time. Comprehensive multidisciplinary consultations may include an imaging cardiologist, electrophysiology cardiologist and nurse, cardiothoracic surgeon, social work, neurodevelopmental specialist, and introduction to our “safe at home” program for interstage single ventricle monitoring program. We also participate in multi-institutional studies investigating rare congenital heart disease that can be detected in utero.

**2017 Patient Statistics**

The following numbers for 2017 include patient visits for Children’s Dallas and Plano, as well as our outreach clinics in Abilene, Odessa and Tyler, and Telemedine which is handled through the Outreach Group.

### Surgical Procedures

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac Operations</td>
<td>519</td>
</tr>
<tr>
<td>ACHD Operations</td>
<td>30</td>
</tr>
<tr>
<td>Heart Transplant</td>
<td>18</td>
</tr>
</tbody>
</table>

### Diagnostic Testing and Cardiac Imaging

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrocardiograms</td>
<td>16,684</td>
</tr>
<tr>
<td>ECHO</td>
<td>11,741</td>
</tr>
<tr>
<td>Holters</td>
<td>998</td>
</tr>
<tr>
<td>Fetal ECHO</td>
<td>514</td>
</tr>
<tr>
<td>Cardiac MRIs</td>
<td>497</td>
</tr>
<tr>
<td>Stress Tests</td>
<td>168</td>
</tr>
</tbody>
</table>

### Cardiac Catheterization Procedures

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interventional Cardiac Caths</td>
<td>617</td>
</tr>
<tr>
<td>Biopsy Cardiac Caths</td>
<td>135</td>
</tr>
<tr>
<td>Diagnostic Cases</td>
<td>164</td>
</tr>
<tr>
<td>EP Studies &amp; Ablation Procedures</td>
<td>171</td>
</tr>
<tr>
<td>Pacemaker &amp; Defibrillator Implants</td>
<td>26</td>
</tr>
</tbody>
</table>

### Outpatient Clinic Patient Encounters

<table>
<thead>
<tr>
<th>Location</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dallas</td>
<td>9,108</td>
</tr>
<tr>
<td>Plano</td>
<td>2,462</td>
</tr>
<tr>
<td>Outreach</td>
<td>1,267</td>
</tr>
<tr>
<td>Presbyterian-Dallas</td>
<td>106</td>
</tr>
</tbody>
</table>
Current Grant Support

Ryan Butts

Grantor: American Heart Association Mentored Clinical Research Program
Title of Project: Effect of Carvedilol on Exercise Performance in Fontan Patients
Role: Principal Investigator
Dates: 07/2016 - 07/2018

Gerald Greil

Grantor: Children’s Clinical Research Advisory Council (Children’s Health)
Title of Project: 3D Printing of Patient Specific Congenital Heart Defects and Comparisons to Conventional Imaging Methods
Role: Co-Investigator
Dates: 02/2016 – 02/2018
Grantor: Association of European Cardiology (AEPC)
Title of Project: 3D printing of congenital heart disease: hands-on imaging from fetal development to long term follow up
Role: Co-Investigator
Dates: 02/2016 – 02/2017
Grantor: NIHR
Title of Project: MRI-augmented guidance for X-ray fluoroscopic pediatric cardiovascular interventions.
Role: Principal Investigator
Dates: 01/2015 – 01/2017
Grantor: Moss Foundation
Title of Project: Radiation-Free Cardiac Catheterization using MRI guidance.
Role: Co-Investigator
Dates: 09/2017 to 03/2019
Grantor: Siemens, USA
Title of Project: Biplane Overlay of Cross-Sectional Imaging onto Cardiac Catheterization.
Role: Co-Investigator
Dates: 02/2019 to 08/2020

Tarique Hussain

Grantor: NuMED for Children, LLC
Title of Project: Modified CP Stent with variable cell dimensions
Role: Principal Investigator
Dates: 02/2016 – ongoing
Grantor: Children’s Clinical Research Advisory Council
Title of Project: 3D Printing of Patient Specific Congenital Heart Defects and Comparisons to Conventional Imaging Methods
Role: Principal Investigator/Scientific Mentor
Dates: 02/2016 – 02/2018
Grantor: Action Medical Research
Title of Project: Improving surgical decisions in hypoplastic left heart syndrome (HLHS) through computational cardiac models
Role: Co-Investigator
Dates: 09/2015 – 02/2019

Grantor: BHF PG/15/104/31913
Title of Project: How accurate are our clinical measures of aortic stiffness? A combined in vitro, in silico and in vivo study
Role: Co-Investigator
Dates: 02/2016 – 02/2019

Grantor: Association of European Cardiology
Title of Project: 3D printing of congenital heart disease: hands-on imaging from fetal development to long term follow up
Role: Co-Investigator
Dates: 02/2016 – 02/2017

Grantor: Texas Neurofibromatosis Foundation Grant
Title of Project: Cardiovascular abnormalities in pediatric patients with neurofibromatosis
Role: Co-Investigator
Dates: 06/2016 to 06/2018

Grantor: Moss Foundation
Title of Project: Radiation-Free Cardiac Catheterization using MRI guidance.
Role: Principal Investigator
Dates: 09/2017 to 03/2019

Grantor: Siemens, USA
Title of Project: Biplane Overlay of Cross-Sectional Imaging onto Cardiac Catheterization.
Role: Principal Investigator
Dates: 02/2019 to 08/2020

Richard Kirk
Grantor: International Society of Transplantation
Title of Project: International Pediatric Heart Failure Registry
Role: Co-Investigator
Dates: 2015 – 2018

Lynn Mahony
Grantor: National Heart, Lung and Blood Institute
Title of Project: Pediatric Heart Disease Research Network
Role: Steering Committee Chair
Dates: 2017 – 2018

Grantor: Cincinnati Children’s Hospital
Title of Project: Quality of Life Assessment in the Pediatric Cardiac Population: Testing the Pediatric Cardiac Quality of Life Inventory
Role: Principle Investigator
Dates: 2005 – ongoing
Alan Nugent

**Grantor:** NIH  
**Title of Project:** Development of Large Diameter Biodegradable Stents for Congenital Heart Disease  
**Role:** Principal Investigator  
**Dates:** 07/2015 – 06/2017

Animesh Tandon

**Grantor:** Thrasher Foundation  
**Title of Project:** Predictive analytics to prevent adverse events in interstage single ventricle heart disease  
**Role:** Principal Investigator  
**Dates:** 02/2016 – 01/2018

**Grantor:** Children’s Clinical Research Advisory Committee (CCRAC)  
**Title of Project:** 3D Printing of Patient-Specific Congenital Heart Defects and Comparisons to Conventional Imaging Methods  
**Role:** Principal Investigator  
**Dates:** 02/2016 – 01/2018

**Grantor:** UT Southwestern Center for Translational Medicine Service Package Grant  
**Title of Project:** Cardiac Magnetic Resonance Imaging for Patients with High Cardiometabolic Risk Factors  
**Role:** Principal Investigator  
**Dates:** 11/2016 – 01/2017

**Grantor:** Texas Neurofibromatosis Foundation Grant  
**Title of Project:** Cardiovascular abnormalities in pediatric patients with neurofibromatosis type 1  
**Role:** Co-Investigator  
**Dates:** 05/2016 – 05/2017

Surendranath Veeram Reddy

**Grantor:** Children’s Clinical Research Advisory Committee (CCRAC)  
**Title of Project:** 3D Printing of Patient-Specific Congenital Heart Defects and Comparisons to Conventional Imaging Methods  
**Role:** Co-Investigator  
**Dates:** 02/2016 – 02/2018

**Grantor:** Moss Foundation  
**Title of Project:** Radiation-Free Cardiac Catheterization using MRI guidance.  
**Role:** Co-Investigator  
**Dates:** 09/2017 to 03/2019

Ilana Zeltser

**Grantor:** NIH / Children’s Hospital of Philadelphia  
**Title of Project:** Hypertrophic Cardiomyopathy in Children: Age Specific Risk Stratification for Sudden Death  
**Role:** Co-Investigator  
**Dates:** 06/2014 – 06/2019
Peer-Reviewed Publications


**Book Sections**

