

HEART INSTITUTE CONTINUES TO GROW, BUILD NEW PROGRAMS

Le Bonheur Children's Heart Institute continues to grow under the leadership of Executive Co-director Jeffrey A. Towbin, MD, who was recruited in early 2015.

Towbin, an expert in cardiomyopathies, spent much of his career at Cincinnati Children's Hospital Medical Center and Texas Children's Hospital prior to moving to Memphis.

In the past year, Towbin has focused on recruiting specialized cardiologists and expanding programs within the Heart Institute to care for the changing needs of children with congenital heart defects.

"We have the surgical and medical teams in place to look beyond patient survival – now, it's about lifestyle and giving children and adults with congenital heart defects and heart muscle diseases a great quality of life," said Towbin.

To build new programs, the Heart Institute expects to recruit 25 cardiologists in the next five years. Recruits since February, when Towbin joined Le Bonheur, include:

Interventional Cardiologist

Thomas Fagan, MD, moved to Memphis from Children's Hospital Colorado in Denver where he was director of Cardiac Interventional Catheterization and director of the Advanced Cardiac Interventional Fellowship. Towbin quickly sold him on his vision for the Heart Institute. Fagan, who became the medical director of the Catheterization Lab at Le Bonheur in August, says he was attracted to the "whole push to take things to the next level."

"I know Jeff can build a program, and it became enticing

– the thought of coming to help build and move treatments and the science forward," Fagan said.

Fagan is taking the reins from former Catheterization Lab Medical Director Rush Waller, MD. Waller, the new

DESTINATION PROGRAMS

The Heart Institute will expand destination programs in the next five years

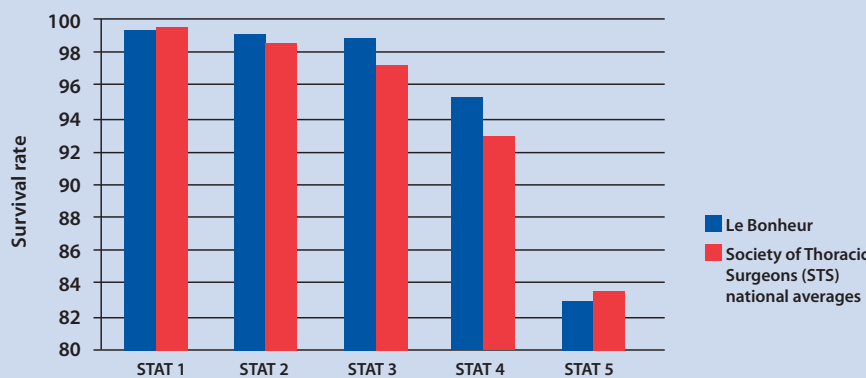
- Mechanical Circulatory Support
- Cardiomyopathy/Heart Failure
- Cardiovascular Genetics
- Adult Congenital Heart Disease
- Cardio-Oncology
- Heart Transplantation
- Neurodevelopment
- Single Ventricle Service
- Sports Cardiology
- Obesity

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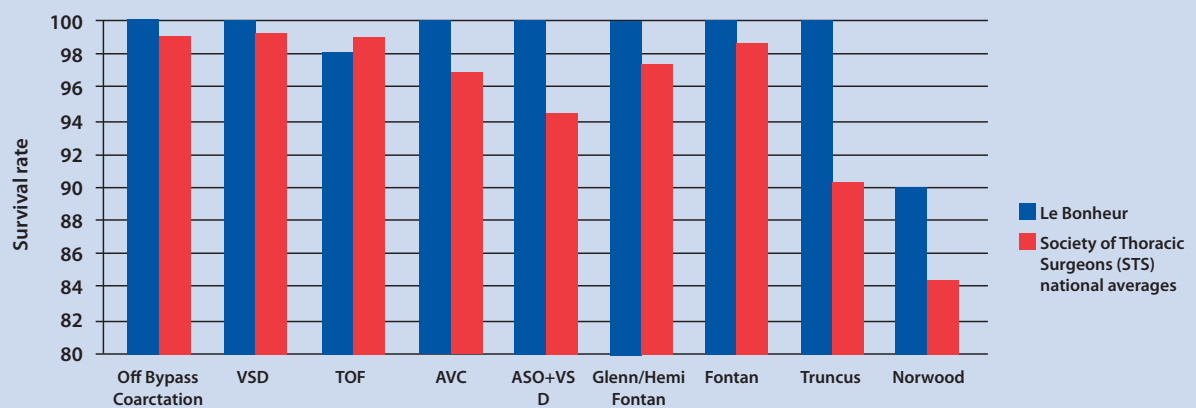
2015 HEART INSTITUTE SURGICAL OUTCOMES

Le Bonheur's Heart Institute measures quality using data compiled by the Society of Thoracic Surgeons, or STS. STS collects data from other top pediatric heart programs in the country and publishes that information twice a year. The average survival rates for the majority of heart surgeries at Le Bonheur are higher than the national average – especially in the most complex procedures, like the Norwood.

Operative Survival by STAT Category, Jan. 2011 - Dec. 2014



Survival Rate by Procedure, 4 Years
Jan. 2011 - Dec. 2014



Referrals: 866-870-5570

www.lebonheur.org/heart

A pediatric partner of The University of Tennessee Health Science Center/College of Medicine and St. Jude Children's Research Hospital



Meet the Leadership Team

The Heart Institute at Le Bonheur Children's Hospital uses the combined expertise of an advanced pediatric cardiac team to provide specialized care for children with congenital heart disease. Pediatric cardiologists, pediatric cardiothoracic surgeons, cardiac intensivists, pediatric intensivists and anesthesiologists make up the Heart Institute. Advanced practice nurses, perfusionists, cardiac nurses, respiratory therapists and lab and imaging technicians are specially trained in pediatric cardiology care.

Leaders of the Heart Institute include:



Christopher Knott-Craig, MD, executive co-director of the Heart Institute, medical director of Cardiovascular Surgery

Christopher Knott-Craig, MD, graduated from the University of Cape Town in South Africa and completed training in cardiac surgery at the Groote Schuur Hospital in South Africa. He is board certified by the South African Medical & Dental Council in cardiothoracic surgery. Knott-Craig also serves as professor and chief of pediatric cardiac surgery at the University of Tennessee Health Science Center (UTHSC) School of Medicine. His areas of special focus include neonatal/infant cardiac surgery, Ebstein's anomaly, Ross Procedure, minimally invasive valve surgery, cardiopulmonary bypass, ambulatory thoracic surgery, hyperhidrosis and pediatric congenital heart disease.



Jeffrey Towbin, MD, executive co-director of the Heart Institute, medical director of Pediatric Cardiology

Jeffrey Towbin, MD, studied at the University of Cincinnati College of Medicine and completed his fellowship in pediatric cardiology at Texas Children's Hospital/Baylor College of Medicine. He is board certified by the American Board of Pediatrics with a pediatric cardiology subspecialty. Towbin serves as professor and chief of Pediatric Cardiology at UTHSC School of Medicine and vice chair of Strategic Advancement for Le Bonheur. He serves as chief of Cardiology for St. Jude Children's Research Hospital and holds the St. Jude Chair of Pediatric Cardiology at Le Bonheur. His areas of special focus include diagnostic and therapeutic advances for cardiomyopathies, heart failure, heart transplantation and cardiovascular genetics.



Umar Boston, MD, surgical director of Heart Transplant and Mechanical Circulatory Support, surgical director of Adult Congenital Heart Disease Program

Umar Boston, MD, received his medical training at Howard University School of Medicine and general surgery and cardiothoracic/thoracic surgical training at Mayo Clinic. He earned his pediatric cardiac surgical residency at Stollery Children's Hospital at the University of Alberta. His research focus includes advancing VAD support systems in children with end-stage heart failure, preservation techniques for increasing the pediatric donor heart pool and application of regenerative tissues to congenital heart surgery. At UTHSC, Boston serves as an associate professor.



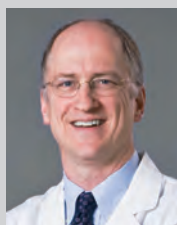
Thomas Fagan, MD, medical director of the Cardiac Catheterization Lab

Thomas Fagan, MD, studied at St. Louis University School of Medicine and earned his pediatric cardiology training at Baylor College of Medicine. Fagan is board certified by the American Board of Pediatrics and the Sub-board of Pediatric Cardiology. Fagan was the director of Cardiac Interventional Catheterization, director of Catheterization Innovation and Research, director of Advanced Cardiac Interventional Fellowship and director of Pediatric Cardiac Catheterization Laboratory at the University of Colorado Denver School of Medicine, Denver – Children's Hospital Colorado. He also serves as a professor at UTHSC.



Vijay Joshi, MD, medical co-director of Heart Institute, medical director of Non-Invasive Cardiology

Vijay Joshi, MD, attended medical school at the University of Vermont and completed a fellowship in pediatric cardiology at Children's Hospital of Philadelphia. Board certified by the American Board of Pediatrics with a cardiology subspecialty, Joshi is also an associate professor at UTHSC. His patient care emphasis is on general cardiology with focus on fetal cardiology, advanced echocardiography, cardiac MRI and exercise testing.



B. Rush Waller, MD, medical co-director of Heart Institute, medical director of Adult Congenital Heart Disease Program

B. Rush Waller, MD, studied at UTHSC and completed fellowships in pediatric cardiology and pediatric interventional cardiology at the Medical University of South Carolina. Waller is an associate professor at UTHSC and is board certified by the American Board of Pediatrics with a cardiology subspecialty and is board certified in Adult Congenital Heart Disease medicine. His areas of focus include interventional pediatric cardiology, including therapeutic catheterizations for critically ill neonates, critically ill preoperative patients and complex cases of adults with congenital heart disease and transcatheter closure of intracardiac shunts.



Glenn Wetzel, MD, PhD, medical director of Pediatric Electrophysiology, director of Fellowship Program

Glenn Wetzel, MD, PhD, completed fellowship training in pediatric cardiology at University of California at Los Angeles. He is board certified by the American Board of Pediatrics and has a cardiology subspecialty. Wetzel is also a professor at UTHSC. His special interests include pediatric electrophysiology (arrhythmias), radiofrequency ablation and cryoablation, cardiomyopathy, pediatric pacemakers and internal defibrillator devices (ICDs).

Paris Walker Rogers: 26 weeks, interventional patent ductus arteriosus closure

At 1 pound, 9 ounces at 25 weeks gestation, Paris Walker Rogers was born with a patent ductus arteriosus that caused her oxygen saturation to stay dangerously low.

Paris' parents, Marquita and Edward, worried she was too small for a PDA ligation, or surgical repair. Cardiac Interventionalist Shyam Sathanandam, MD, proposed repairing the PDA with a transcatheter technique. At 2.03 kilograms (kg), Paris was half the size of many babies who undergo the procedure.

"Small preemie babies have tiny blood vessels which makes the trans-catheter device closure of

PDA a challenging technique," Shyam said.

Because the procedure is performed in the cath lab, preemies benefit from the

less invasive procedure, which often shortens their length of stay in the hospital.

Today, Paris is a healthy, typical 15-month-old with no lasting effects of her early days in the hospital.

"We are so thankful for Dr. Shyam and the entire Le Bonheur staff. We believe this surgery saved her life," said Marquita. "Her little body was just so fragile, I don't believe she would have survived a more invasive surgery."

To date, Shyam and his team have performed 17 PDA closures on children who weigh less than 2.5 kgs, eight of whom are between 1-1.5kg.



medical director of the institute's Adult Congenital Heart Disease program, is working to build a robust program that supports the ongoing and complex needs of adults living with congenital heart disease. He is leading the program with Cardiologist Ryan Jones, MD, and **Umar Boston, MD**, the hospital's new surgical director of Heart Transplant and Mechanical Circulatory Support and surgical director of the Adult Congenital Heart Defect program.

Boston comes to Le Bonheur from Washington University in St. Louis and St. Louis Children's Hospital, where he served as a pediatric cardiothoracic surgeon. His expertise is in heart transplantation, mechanical circulatory support, adult congenital heart disease and neonatal/childhood cardiac surgery.

Finally, **Daniel Stromberg, MD**, was recruited to join Le Bonheur's Cardiac Intensive Care Unit in December 2015. He most recently served as director of the Congenital Heart Surgery Unit at Medical City Children's Hospital in Dallas.

The Heart Institute has also added new research scientists,



Waller earns ACHD board certification

Rush Waller, MD, medical director of Le Bonheur's Adult Congenital Heart Disease program, is one of the first pediatric cardiologists to be board certified in Adult Congenital Heart Disease (ACHD) medicine after passing the first-ever ACHD board exam.

Waller is working to build a robust program that supports the ongoing and complex needs of adults living with congenital heart disease.

through Le Bonheur's Children's Foundation Research Institute. The investigators are studying gene discovery and the mechanisms of cardiomyopathies, arrhythmias, sudden cardiac death, vascular disorders and congenital heart disease – as well as viral causes of myocarditis, cardiomyopathies, transplant rejection and transplant coronary disease.

Towbin pioneered the concept of pathway-focused candidate gene analysis using his "final common pathway hypothesis," and calls his work in understanding how heart muscle turns into cardiomyopathy his most important research to date.

Towbin plans to grow the research program to focus more on personalized medicine for congenital heart disease and cardiomyopathies.

In addition to expanding research and destination programs, Le Bonheur will also develop its transplant program.

William Gomez: *Hypertrophic cardiomyopathy*

At 6 years old, William Gomez already has a medical history longer than most adults: NICU stay at birth; formal diagnosis of hypertrophic cardiomyopathy at 22 months of age; cardiac arrest at age 4. His parents, Rich and Anne Gomez of San Pedro, Calif., spent hours researching options for their son, as they grew to understand the complexity of his disease.

They would eventually hear a more official diagnosis: Hypertrophic/restrictive cardiomyopathy form of biventricular non-compaction cardiomyopathy with systolic and diastolic dysfunction and LV dilation. William's team of cardiologists is scattered across the country – pieced together to care for his complex and rare condition: an electrophysiologist, general pediatric cardiologist and even, for a time, a specialist in adult and adolescent cardiomyopathy.

William needed something more, they decided. They asked



other parents who are members of his Children's Cardiomyopathy Foundation listserv for advice.

"I kept hearing the name of Dr. Towbin over and over again," Rich said. "This is the guy we have got to go see. I called and talked to his nurse. In an hour, he called me back and talked to me for 40 minutes. The next thing you know, we have an appointment in Memphis."

The Gomez family was immediately impressed with their interaction with Towbin and with his expertise in William's condition. They were reassured that the trip across the country was a good decision.

Since that call, the Gomez family has visited Memphis and Towbin. William continues on a drug therapy aimed at improving the relaxation of the heart and improving its efficiency with the goal of not requiring heart transplantation and preventing sudden life-threatening events.

Pediatric Heart Update is a publication of the Heart Institute at Le Bonheur Children's Hospital

Chris Knott-Craig, MD, Co-Director, Heart Institute
Jeffrey A. Towbin, MD, Co-Director, Heart Institute

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| Mohammed Alsheikh-Ali, MD | Kelvin Lee, MD |
| Alex Arevalo, MD | Ronak Naik, MD |
| Jean Ballweg, MD | Ranjit Philip, MD |
| Umar Boston, MD | Shyam Sathanandam, MD |
| John Edney, MD | Andreas Schwingshackl, MD |
| Thomas Fagan, MD | Samir Shah, MD |
| Jason Johnson, MD | Daniel Stromberg, MD |
| Ryan Jones, MD | B. Rush Waller, MD |
| Vijay Joshi, MD | Glenn Wetzel, MD, PhD |
| Dai Kimura, MD | Adam Willis, MD, PhD |
| Nagendra S. Kodali, MD | Thomas Yohannan, MD |
| TK Susheel Kumar, MD | |



Le Bonheur Heart Institute Publications and Presentations: 2014-2015

Publications

2015
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Towbin, Jeffrey A. "Modern Genetic Medicine in Pediatric EP Mini-Course". Chair: Heart Rhythm Society 2015, Mini-Course on Risk Stratification in Three Arrhythmia Substrates". Boston, Mass. May 2015.
Towbin, Jeffrey A. "Final Common Pathways of Pediatric Cardiomyopathies and Overlapping Phenotypes." 35th International Society of Heart Research North American Meeting: Heart Failure- 21st Century Research and Therapeutics, Seattle, Wa. June 2015.
Towbin, Jeffrey A. "Genetic and Mechanistic Final Common Pathways of Cardiomyopathies". Keynote Lecture, 51st Annual Meeting of the Japanese Society of Pediatric Cardiology and Cardiac Surgery, Tokyo, Japan, July 2015.
Towbin, Jeffrey A. "Cardiomyopathy Genetics and Mechanisms: Overlapping Final Common Pathways". Featured Plenary Session Lecture, China Heart Congress 2015, Beijing, China, August 2015.
Towbin, Jeffrey A. "Noncompaction Cardiomyopathies". 2015 Children's Hospital of Fudan University Workshop for Heart Development and Congenital Heart Disease, Shanghai, China, August 2015.
Towbin, Jeffrey A. "Genetics of heart failure/cardiomyopathies". The Saban Research Institute Seminar Series, Children's Hospital of Los Angeles, Los Angeles, Calif. September 2015.
Towbin, Jeffrey A. "Cardiac-oncology: a new paradigm". Cardiology Grand Rounds, Children's Hospital of Los Angeles, Los Angeles, Calif. September 2015.
Towbin, Jeffrey A. "Cardio-Oncology in Children and Young Adults", Leukemia, Lymphoma and Bone Marrow Transplant Conference, St. Jude Children's Research Hospital, Memphis, Tenn. September 2015.
Towbin, Jeffrey A. "Born This Way: The Role of Genetic Testing in Cardiomyopathy- Dilated Cardiomyopathy Groups and Beyond", 19th Annual Heart Failure Society of America, Washington, D.C. 2015.
Towbin, Jeffrey A. "Outcomes With Early Biventricular Assist Device in Pediatric Heart Failure: A Single Center Experience of 31 Patients" Society of Thoracic Surgeons 51st Annual Meeting, San Diego, CA, Jan 25, 2015
Boston, Umar. Improved Transplant Survival in Failed Fontan Patients With Preserved Ventricular Function in the Current Era. ISHLT 25th Annual Meeting, Nice, France, 2015

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Figueroa M, Holloway R, Shah S. Implementation of a pediatric cardiac arrest algorithm leads to early recognition of need for extracorporeal life support and improved outcomes" Poster presentation: 10th International Pediatric Cardiac Intensive Care Society (PCICS) Conference in Miami Beach, Florida, December 2014
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Knott-Craig CJ. Tricuspid Valve Repair in Neonatal Ebstein's Malformation. *Oral Presentation*.
Knott-Craig C., Kumar T. S., Figueroa M., Joshi V. M. What is the Best Surgical Option for Symptomatic Neonates With Ebstein's Anomaly and Pulmonary Atresia? Oral Presentation. *Society of Thoracic Surgeons 50th Annual Meeting*, January 25-29, 2014, Orlando, FL.
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Book Chapters

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