

MEMORIAL HERMANN HEART & VASCULAR

ANNUAL REPORT 2023



MEMORIAL[®]
HERMANN
Heart & Vascular



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Introduction

Welcome to the 2023 annual report for the Memorial Hermann Heart & Vascular program. This report highlights the program's accomplishments over the past year*, and gives a glimpse into its evolution since Memorial Hermann Health System began offering cardiovascular services more than 40 years ago.

What began as a small contingent of cardiologists and heart surgeons now encompasses a world-class program dedicated to advancing comprehensive cardiovascular care, where innovation and quality intersect and are guided by pioneering physicians committed to enhancing patients' lives.

Since its inception, Memorial Hermann Heart & Vascular has invested in bringing together affiliated physicians who are leaders in their respective specialties, establishing a technologically advanced care model and infrastructure, educating the next generation of physicians, leveraging new technology and conducting visionary research to find new and better ways of treating heart and vascular anomalies, conditions and diseases.

Through these investments, Memorial Hermann Heart & Vascular has achieved a reputation for excellence and continues to lead exciting innovations in cardiovascular care. Memorial Hermann Heart & Vascular shapes industry best practices by creating forums for professional collaboration, such as the Houston Aortic Symposium and Houston Shock Symposium held annually each Spring.

One of the largest not-for-profit health systems in the nation, Memorial Hermann is an integrated organization comprising more than 29,000 employees and 250 care delivery sites, including the country's busiest Level I trauma center, an academic medical center affiliated with UTHealth Houston and numerous specialty programs and services. It serves people throughout the Greater Houston area and beyond and reinvests into the community.

We invite you to read through this report to discover how Memorial Hermann Heart & Vascular is bringing together innovation and quality to advance cardiovascular care.

SERVICE LINE ADMINISTRATION LEADERS

Kyle Price
Senior Vice President, Service Lines
Memorial Hermann Health System

Amy Harberg
Vice President
Heart & Vascular Service Line
Memorial Hermann Health System

PHYSICIANS GOVERNANCE COUNCIL LEADERS

Anthony Estrera, MD, FACS
Professor and Chair for the
Department of Cardiothoracic
and Vascular Surgery
UTHealth Houston Heart & Vascular
Chief of Cardiac Surgery,
Director of the Cardiovascular
Intensive Care Unit
Memorial Hermann Heart &
Vascular Institute at Memorial
Hermann-Texas Medical Center

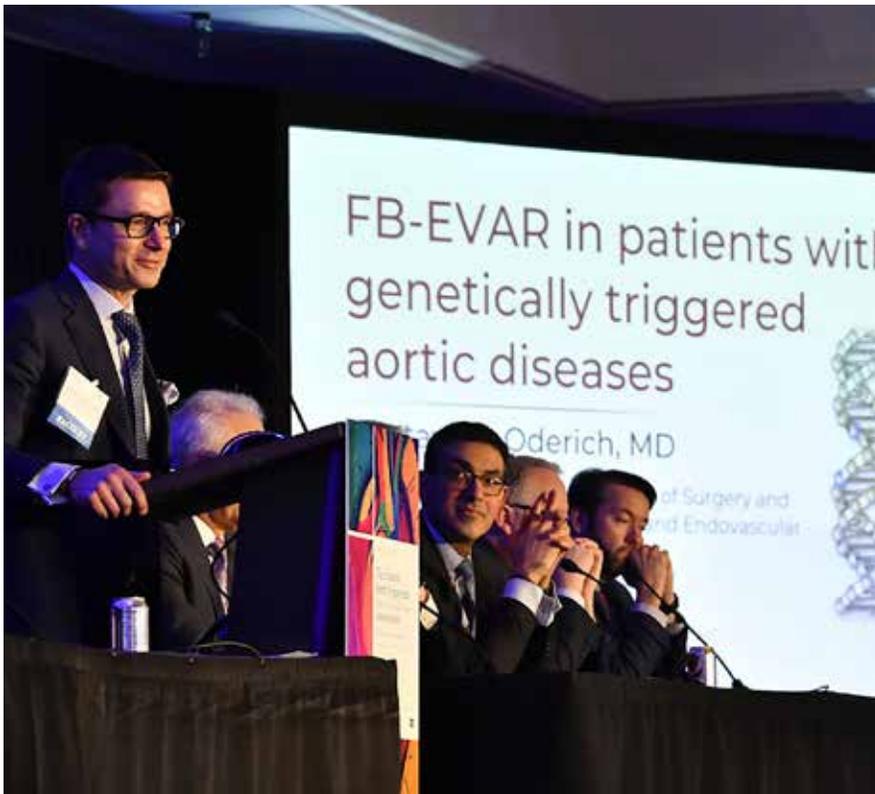
Igor Gregoric, MD, FACC
Professor, Center for Advanced
Cardiopulmonary Therapies
and Transplantation
UTHealth Houston Heart & Vascular
Chief of Surgery, Center for
Advanced Heart Failure
Memorial Hermann Heart &
Vascular Institute at Memorial
Hermann-Texas Medical Center

Biswajit Kar, MD
Professor, Center for Advanced
Cardiopulmonary Therapies
and Transplantation
UTHealth Houston Heart & Vascular
Chief of Medicine, Center
for Advanced Heart Failure
Memorial Hermann Heart &
Vascular Institute at Memorial
Hermann-Texas Medical Center

* Reporting period is 7/1/21 - 6/30/22, unless otherwise stated.

Aortic Surgery

A leading center for aortic care in the United States and worldwide, the Memorial Hermann Heart & Vascular Aortic Center of Excellence is ground zero for device development research and care innovation related to the aorta.



Gustavo Oderich, MD, FACS, presents at The Houston Aortic Symposium. The 2023 Symposium: Frontiers in Cardiovascular Disease, the Fifteenth in the Series presented and discussed diagnosis and treatment paradigms for aortic and structural heart diseases, including medical, endovascular, surgical and hybrid options. Session topics included Structural Heart, Aortic Root/BAV, Ascending Aorta, Transverse Arch, Aorta: Get with the Guidelines, Aortic Dissection, AAA/Physiology/Pathology and DTAA/TAAA.

ADVANCES IN AORTIC CARE

Since the early days of aortic reconstruction, Memorial Hermann has been the epicenter of many advances in aortic surgery, research and care. Groundbreaking work has since been achieved at our hospitals by our affiliated physicians and caregivers, resulting in advancements in the repair of aortic dissections, aneurysms and stenosis and has significantly improved outcomes. Our program focuses on regular multidisciplinary team discussions about each case to ensure that patients with aortic aneurysms and other aortic conditions receive coordinated, evidence-based care to achieve those positive outcomes.

Additionally, Memorial Hermann-Texas Medical Center (TMC) is now **one of only eight** centers in the United States testing fenestrated and branched stents to repair aortic aneurysms. These stents are custom-made to fit each patient's anatomy and put in place endovascularly by principal investigator Gustavo Oderich, MD, FACS, professor and chief of vascular and endovascular surgery and program director for the Advanced Endovascular Aortic Program at McGovern Medical School at UTHealth Houston, and director of the Aortic Center of Excellence at Memorial Hermann Heart & Vascular Institute at Memorial Hermann-Texas Medical Center. Procedures take place in Memorial Hermann's state-of-the-art hybrid operating rooms, equipped with the GE Allia™ platform that allows real-time imaging and visualization of critical vascular structures during aortic surgery.

The aneurysm research is aided by pre-procedure planning involving an advanced simulation lab that captures data on fluoroscopy time, radiation exposure and total operating time based on various levels of experience. The research is also bolstered by access to IOPS®, a novel surgical positioning system that reduces the need for contrast and minimizes prolonged exposure to radiation for patients, physicians and OR staff.

Research is also being conducted on cerebral and spinal cord protection during complex open aortic arch repair procedures. Moreover, our affiliated providers are testing the efficacy of local analgesia during sternotomies and thoracotomies and have confirmed that cryoablation of the intercostal



RESEARCH AND TECHNOLOGY
 “Our hybrid operating room is second to none and provides access to unique technology. We have a number of research projects that we integrate into our clinical practices. One such area is radiation exposure reduction. We are also working on research with sensors akin to GPS for catheters, wires and devices. This coupled with technology, such as 3D print models of patients’ vascular anatomies, and equipment, such as virtual reality lenses, allows physicians to have a four-dimensional view. This has implications to many specialties.” Gustavo Oderich, MD, FACS



We’re leading research about the genetic components of aortic disease and successfully treating complex cases to give patients restored health and hope for more fulfilled lives.”

nerve is effective in managing pain for open descending thoracic and thoracoabdominal aortic repairs.

This body of research has been shared in more than 200 peer-reviewed publications and published in major subspecialty journals and general medical journals, such as the *Journal of Vascular Surgery*, the *Journal of Cardiovascular and Thoracic Surgery*, the *New England Journal of Medicine*, *Lancet* and *Nature Genetics*.

IDENTIFYING THE GENETIC LINK

Through genetic research being conducted by McGovern Medical School at UTHealth Houston, specific genes related to aortic

dissections have been identified. From this research, families with histories of aortic dissection are undergoing genetic testing to determine if they have the gene that predisposes people to this life-threatening condition. If the gene is identified, surgeons affiliated with Memorial Hermann are performing aortic root replacement surgery to minimize the risk of a dissection. Research has led to aorta screening protocols and to education about treatment options to prevent death.

AORTIC CARE FOR WOMEN

Understanding that more women die from cardiovascular disease than from all cancers combined, the unique Women’s Vascular

– **ANTHONY ESTRERA, MD, FACS**
 Professor and Chair for the Department of Cardiothoracic and Vascular Surgery
 UTHealth Houston Heart & Vascular
 Chief of Cardiac Surgery,
 Director of the Cardiovascular Intensive Care Unit
 Memorial Hermann Heart & Vascular Institute at Memorial Hermann-Texas Medical Center





Gustavo Oderich, MD, FACS, and his team perform a simulation of endovascular aortic repair (EVAR) using a 3D print model of the aorta connected into a cardiopulmonary bypass machine to simulate flow. The EVAR was performed using an intraoperative position system (IOPS), which is akin to GPS, instead of fluoroscopy, and used a newer generation IOPS. This simulation process allowed the team to capture data on fluoroscopy time, radiation exposure and total operating time based on various levels of experience.

SPECIALIZED ADVANCED PRACTICE PROVIDERS

The Aortic Center of Excellence at the Memorial Hermann Heart & Vascular Institute at Memorial Hermann-TMC is supported by advanced practice providers who complete formal, high-acuity training to care for patients with aortic conditions. The six-month program, taught by senior advanced practice providers who dedicate 300-400 hours of teaching, includes education and clinical practice scenarios specific to aortic surgery.

These specially trained nurse practitioners and physician assistants have earned industry recognition for their evidence-based practice and sharing research, quality improvement projects and best practices in aortic surgery care strategies at the Houston Aortic Symposium and at other national conferences. They also lead diagnostic utilization and optimization programs and collaborate with the University of Rotterdam in the Netherlands for cardiovascular intensive care training.

FY22 VOLUMES

Thoracic Endovascular Aortic Repair (TEVAR)	306
Total Open Thoracic	229
Endovascular Aneurysm Repair (EVAR)	154
Total Open Abdominal (AAA)	55

Source: Inpatient and outpatient volumes, July 1, 2021 - June 30, 2022
Source: Memorial Hermann internal data

and Cardiac Health Interdisciplinary Center, formed in 2018, has been leading a multidisciplinary approach to managing women’s cardiovascular health.

The collaboration among multiple specialists, including vascular surgeons, cardiac surgeons, cardiologists, neurologists, genetic counselors, pulmonologists and maternal-fetal medicine physicians, has led to innovative research through UTHHealth Houston on women’s distinctive cardiovascular risks and how pregnancy can magnify those risks. Through this collaborative group, women have been monitored throughout pregnancy, delivery and postpartum to ensure the best outcomes, especially when aortic conditions are present. The Center hopes to educate the public about the particular risks women face, address the disparities of care that exist for them and work toward a multicenter research initiative and care protocols in the U.S. and worldwide. **(See Research on Page 30).**

Combined, these factors, along with significant volumes and positive outcomes, have led Memorial Hermann to be recognized by *U.S. News & World Report* as “high performing” in abdominal aortic aneurysm repair.

Cardiovascular Imaging

With a focus on innovation to improve cardiovascular care, Memorial Hermann goes beyond conventional imaging, such as X-ray, nuclear studies, MRI, CT and ECHO, employing advanced imaging technology at its hospitals and imaging centers throughout Greater Houston.

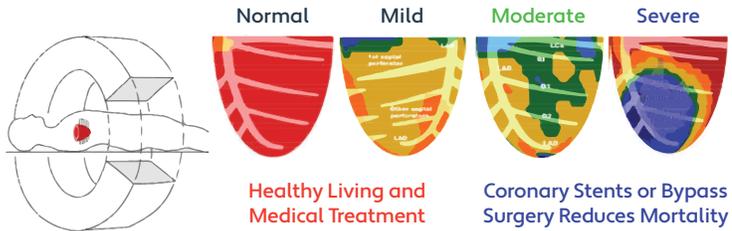
ADVANCED IMAGING TECHNOLOGY

Over the past five years, we have made substantial upgrades to our imaging capabilities, equipping our 32 cardiac catheterization labs and other imaging sites with the latest generation of low-radiation imaging technology. These upgrades have reduced radiation exposure to our patients and our providers, resulting in a median dose of radiation that is 12 times lower than has been cited in studies involving typical EVAR procedures, according to GE. Moreover, the upgrades have greatly improved image acquisition. Our investment of more than \$35 million supports our robust endovascular program and demonstrates our strong commitment to the health and safety of patients and staff.

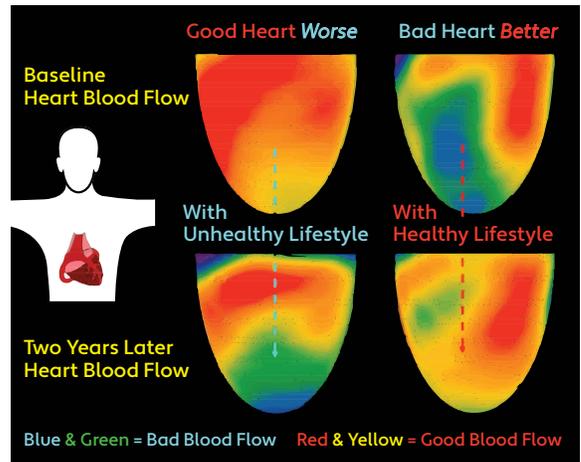
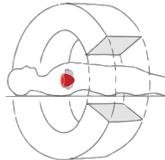
We've also invested in an intraoperative positioning system, or IOPS®, which aids in properly positioning patients to attain high-quality 3D images while reducing radiation exposure during endovascular procedures. And with our ability to simulate procedures before they happen with our simulation lab, we're able to account for radiation exposure and total operating time and make appropriate adjustments to ensure optimum outcomes for patients while reducing radiation.

We're also using 4-D intracardiac echo (ICE) devices, delivered into the heart chambers through catheters, to provide radiation-free, high-quality visualization of blood flow and valves inside the heart.

Memorial Hermann-TMC was the first medical institution in the world to use an ultra-high definition (UHD) imaging system to visualize blood vessels, less than 4 mm in diameter, in real time at a resolution



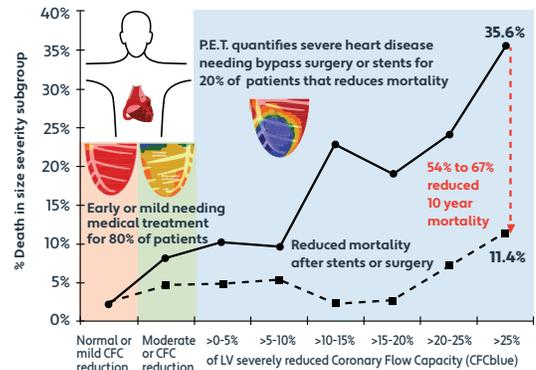
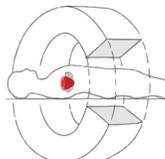
P.E.T. Scanner



Cardiac positron emission tomography (P.E.T.) identifies early or mild coronary heart disease for preventive treatment or guides stents and bypass surgery that improves survival for severe coronary heart disease.



P.E.T. Scanner





ADVANCED AND INTERVENTIONAL ECHOCARDIOGRAPHY

Physicians at Memorial Hermann use imaging such as Trasesophageal Echocardiography (TEE) to collect clear images of the heart and its valves, including three-dimensional evaluations that are key to deciding suitability and guide complex cardiac interventions.

of 76 m. In one case, UHD helped diagnose stent fractures and avulsion that were not apparent with standard imaging even at high magnification. UHD also enables the deployment of stents with a high degree of precision during complex interventions. This advanced imaging tool will lead our clinical teams into a new era of vascular treatments.

A number of Memorial Hermann ECHO labs are accredited by the Intersocietal Accreditation Commission, demonstrating our commitment to providing quality care, maintaining patient safety and improving patient outcomes.

CARDIAC PET

Memorial Hermann offers cardiac positron emission tomography (PET) imaging at the Weatherhead PET Imaging Center. The Weatherhead is the leading cardiac PET center in the U.S. and is where this type of heart imaging was first developed in 1979 by the physicians who continue to advance its use today. For more than four decades, the work conducted with cardiac PET at Memorial Hermann has been transforming cardiovascular care

by providing non-invasive alternatives to cardiac catheterization that determine the presence and severity of coronary heart disease and aid in treatment planning.

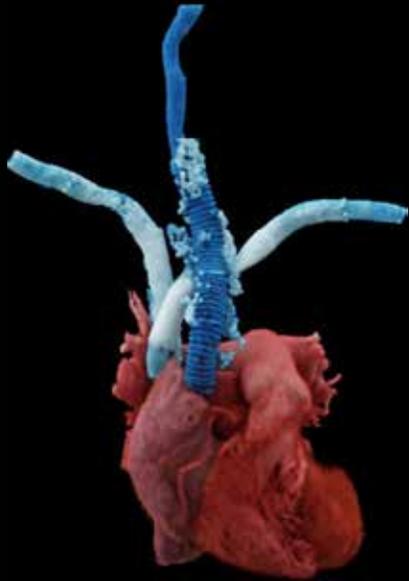
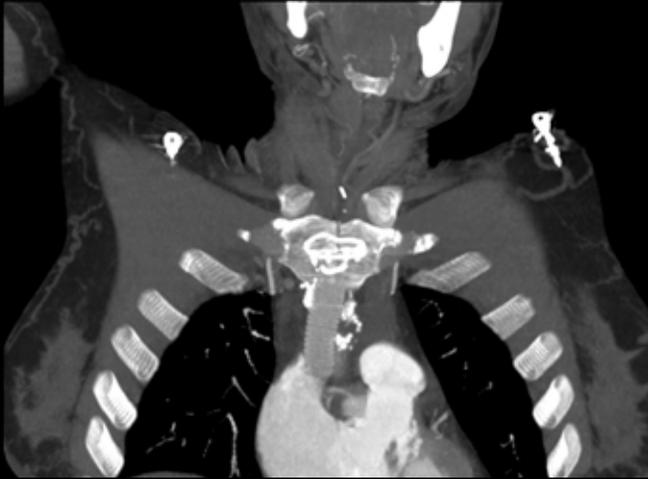
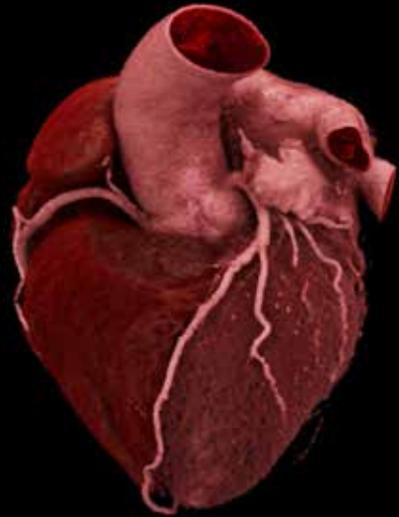
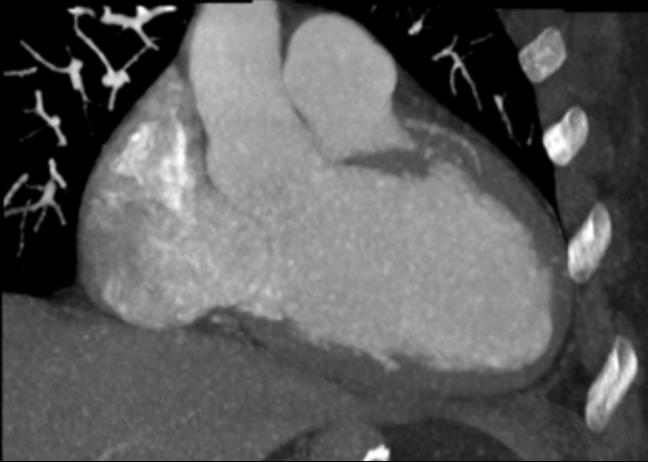
The Weatherhead PET Imaging Center uses specialized software within its cardiac PET scanners to measure coronary blood flow and reveal calcium deposits from atherosclerosis. The precise measurement of blood flow in the heart that is offered by PET technology can differentiate early mild coronary heart disease from severe disease. In this way, PET helps guide clinical decisions, such as determining the need for stents, bypass surgery or transplants to minimize the risk of a heart attack or mortality. PET studies are also being used to aid physicians with monitoring the reversal of coronary artery disease in patients who follow diet, exercise and medication regimens. In fact, UTHealth Houston and Memorial Hermann are leading important research, the results of which are due out in 2023, that uses PET imaging to identify patients who would benefit from lifestyle changes and medical treatment of mild coronary heart disease to prevent heart attack or mortality. **(See Research on Page 30).**

CENTER FOR ADVANCED IMAGING PROCESSING

Additionally, Memorial Hermann has established a Center for Advanced Imaging Processing. This innovative digital solution, centrally located at Memorial Hermann-TMC, brings together the industry's leading technology providers into a single cloud-based platform that enhances visualization of cardiovascular imaging, allows for accurate measuring and facilitates three-dimensional modeling and printing to aid in procedural planning and achieving positive patient outcomes.

Memorial Hermann is committed to offering the most advanced cardiovascular imaging for diagnosis, procedural planning and treatment for simple to complex cardiovascular diseases and conditions.

(Right) Images illustrate the difference between a traditional image and one with advanced processing from the Memorial Hermann Center for Advanced Imaging Processing (CAIP).



Standard 3D
No Filter
GIR: Base # GIR
Segmented
8 of 19 at 14.4 sec

Cardiac Surgery

Memorial Hermann's comprehensive cardiac surgery program, bolstered by a multidisciplinary team of affiliated physicians, offers a complete spectrum of surgical options—from minimally invasive and robotic approaches to traditional open surgery—to accommodate patients' needs and to achieve successful outcomes with quality, safety and innovation at the forefront.

MINIMALLY INVASIVE CARDIAC SURGERY

Our affiliated cardiologists, electro-physiologists, cardiothoracic and vascular surgeons are experienced and skilled at evaluating patients through the lens of what surgical approach will provide the best possible outcomes and patient experience. Often, a minimally invasive approach to even complex cases can be achieved, and we equip our affiliated cardiac surgeons with the latest tools and technology available to encourage innovation.

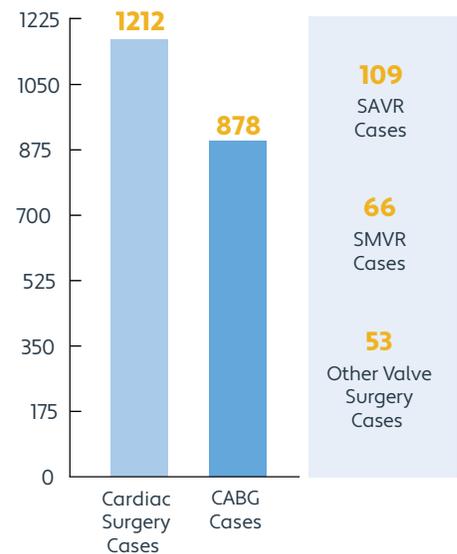
ROBOTIC CARDIAC SURGERY

Memorial Hermann is among a small number of health systems that offer patients the option of undergoing minimally invasive robotic cardiac surgery. That's, in part, because less than 5% of cardiac surgeons have been trained to use the surgical robot to perform heart surgery. Yet at Memorial Hermann, we're using robotic cardiac surgery to successfully perform CABGs, valve repairs, valve replacements, septal myectomies, cardiac tissue ablations, heart defect repairs, tumor resections and placement of leads for pacemakers. The robot's dexterity and responsiveness to the surgeon's hand movements, along with the optimized 3-D visualization of cardiovascular structures, allows for a more precise surgical technique. Data in robotic cardiac surgery shows improved outcomes and fewer complications than traditional open surgery.

TRADITIONAL OPEN SURGERY

While Memorial Hermann has embraced and adopted new technology that allows for minimally invasive procedures when appropriate, our affiliated surgeons continue to excel with traditional surgical approaches, including open-heart surgery for coronary bypasses, stenting, valve repair and replacement, and tumor resection.

FY22 VOLUMES



Source: Inpatient and outpatient volumes, July 1, 2021 - June 30, 2022
Source: Memorial Hermann internal data

COMMITMENT TO QUALITY AND SAFETY

Memorial Hermann participates in the Society of Thoracic Surgeons Adult Cardiac Surgery Database (ACSD), the premier clinical outcomes registry for adult cardiac surgery. Through our participation, we have demonstrated our commitment to quality and improved outcomes.

Those outcomes drove our recognition by *U.S. News & World Report* in 2022 as "high performing" for coronary artery bypass grafts (CABGs) and aortic valve surgery. Additionally, Healthgrades ranked Memorial Hermann Memorial City Medical Center No. 3 in Texas for cardiac surgery and honored the hospital with the Cardiac Surgery Excellence Award™ for its superior clinical outcomes in heart bypass surgery and heart valve surgery.



Almost everything that can be done in heart surgery can be done robotically, especially as the robotic tools and our surgical techniques get better.”

– **DANNY RAMZY, MD, PHD**, professor and chief and director of robotics for cardiac surgery at UTHouston and chief of cardiac surgery and medical and surgical director of the Memorial Hermann Heart & Vascular Institute at Memorial Hermann Memorial City Medical Center

Coronary Artery Disease

Interventional cardiologists affiliated with Memorial Hermann are experts in performing cutting-edge, catheter-based procedures to treat the spectrum of atherosclerotic heart disease in all age groups. Many of these interventionalists are nationally and internationally recognized for their use of new and emerging techniques to improve patient outcomes.

At Memorial Hermann, we offer the full gamut of percutaneous options for patients with coronary artery disease, from state-of-the-art STEMI care and routine angioplasty to complex coronary interventions in patients with chronic total occlusions (CTO), inoperable coronary artery disease (CAD), left ventricular failure and multivessel involvement. Our experts have the tools to maximize the chances of successful revascularization without compromising patient safety.

STEMI CARE

Physicians affiliated with Memorial Hermann have a long history of leading STEMI research and care in Texas and nationally. The Pre-hospital Administration of Thrombolytic Therapy With Urgent Culprit Artery Revascularization (PATCAR) clinical trials, which studied the pre-hospital use of reduced dose thrombolytics followed by emergent heart catheterization, including stenting of the problematic coronary artery was conceived and led by James J. McCarthy, MD, executive vice president and chief physician executive of Memorial Hermann Health System, and Richard Smalling, MD, PhD, professor of cardiovascular medicine and director of the cardiology division in the department of internal medicine at McGovern Medical School at UTHealth Houston, and director of interventional cardiovascular medicine at Memorial Hermann Heart & Vascular Institute at Memorial Hermann-TMC. The results of this study laid the groundwork for contemporary STEMI management, such as shortened time from symptom onset to restoring blood flow in the heart attack related artery, which dramatically reduced heart damage and improved survival.

Since then, we have continued to innovate and employ techniques that improve STEMI patient outcomes. A key area of focus is reducing time to definitive care. We work closely with our EMS partners to ensure that pre-hospital EKGs are interpreted in real time, and shared with our activated STEMI response teams while patients are en route to the ER. We have also implemented systemwide processes to enable STEMI patients arriving by Memorial Hermann Life Flight® or EMS to be taken directly to the cath lab, bypassing the ER altogether.

CORONARY REVASCULARIZATION IN COMPLEX HIGH-RISK INDICATED PATIENTS (CHIP)

Symptomatic patients with complex multivessel coronary artery disease who are not candidates for coronary artery bypass graft (CABG) surgery now have percutaneous options to achieve coronary revascularization. Dedicated interventional cardiologists within the Memorial Hermann system routinely perform CHIP procedures, which allow them to treat high surgical risk patients with CAD with advanced technologies, such as atherectomy, laser and lithotripsy, in addition to angioplasty and stent implantation.

Many patients with complex CAD have left ventricular failure which further adds to the risk of any intervention. Our facilities are equipped with the latest mechanical support devices, enabling our interventional cardiologists to perform these CHIP procedures safely. The use of innovative technologies and techniques allows many of our patients to achieve

(Right) Abhijeet Dhoble, MD, and Richard Smalling, MD, PhD, perform an advanced structural heart procedure replacing a diseased mitral valve without open heart surgery.



1,030
STEMI Volume*

* Inpatient cases with STEMI diagnosis, excludes N-STEMI

2,697
PCI Procedures

3.78%
PCI In-Hospital Mortality Rate vs. US registry percentage

72.75 min.
Median Door-to-Balloon Time vs. national average

8.70%
All AMI In-Hospital Mortality Rate vs. national average

97.2 %
Door-to-Balloon Times for Non-Transfer < 90 minutes vs. national percentage

3,014
Chest pain MI

Source: Inpatient and outpatient volumes, July 1, 2021 - June 30, 2022
Source: Memorial Hermann internal data



CTO IN ACTION

Memorial Hermann affiliated heart specialists are known throughout the Southeast Texas region for taking on complex cases other hospitals turn away. Salman Arain, MD, is an internationally known pioneer in CTOs and has developed a number of new techniques which restore the functionality of the smallest blood vessels, including those in the hand. Amazingly, with his help, patients who have lost the use of their hands can return to normal activities. Such was the case with a 56-year-old man from Corpus Christi, Texas, who was told by multiple local cardiologists and surgeons that nothing could be done for his potentially career-ending symptoms. Diagnosed with CAD at a young age, the patient underwent CABG at 46 years of age. When he began experiencing chest pains, an angiogram indicated two or three grafts were patent and showed an area that was not supplied by graft or native vessel. Preparing to apply for disability and sell his business, the man was told about the CTO program at Memorial Hermann. He underwent successful revascularization of the proximal left anterior descending (LAD) artery and was able to regain his quality of life and maintain his business and his livelihood.

the degree of revascularization needed to recover their cardiovascular function and improve their symptoms of angina or congestive heart failure. Most patients experience a marked improvement in their quality of life and are able to resume their usual activities without a prolonged interruption.

CHRONIC TOTAL OCCLUSION INTERVENTION

A CTO is defined as a coronary artery that has been completely blocked for at least three months, often much longer. CTOs are common and are found in approximately 20% of patients diagnosed with CAD during angiography. While symptomatic patients with a CTO benefit from revascularization, until recently, CABG was the only option for such individuals. However, technological advances have made it possible to treat many CTOs using catheter-based interventions with high success and low complication rates.

The Memorial Hermann CTO program is the fastest growing CTO program in South Texas. Salman Arain, MD, associate professor of interventional cardiology at McGovern Medical School at UTHealth Houston, and colleagues perform over **200 interventions in patients with CTOs each year** using the latest tools and technologies. Many referrals come from cardiologists in the Greater Houston area as well as the surrounding states. Each patient is evaluated by a team of experts to determine the best course of treatment for the CTO. Most patients can go home within 24 hours of the CTO PCI.

Patients who benefit the most from CTO intervention are those who have lifestyle-limiting symptoms despite optimal medical therapy. CTO PCI is the preferred option in patients who do not have enough disease to qualify for coronary bypass, or patients in whom bypass grafts have failed. For patients in the latter category, percutaneous revascularization is often a safer and more durable solution than treating the diseased graft or performing re-do bypass surgery.

Heart Failure and Transplants

Since the first heart transplant performed at Memorial Hermann-TMC in 2012, Memorial Hermann has established a fast growing heart and lung transplant program and is working to create a comprehensive heart failure program to serve the people of Greater Houston.

MULTIDISCIPLINARY TEAM

We bring together a multidisciplinary team of more than 50 board-certified affiliated physicians who specialize in cardiothoracic surgery, advanced heart failure, mechanical assist devices, video-assisted surgery, high-risk coronary intervention, as well as heart and lung transplantation. The program is co-directed by a cardiothoracic and vascular surgeon and an interventional cardiologist who also serve as professors and department chiefs at UTHealth Houston with more than 50 years of combined experience.

TRANSPLANTS

Our transplant team has performed more than 350 heart and lung transplants over the past 10 years and has achieved one-year transplant survival rates that are better than the national average of 90%. We partner with LifeGift, Greater Houston's organ procurement organization, to receive donor hearts and lungs. Our transplant physicians, cardiologists and pulmonary specialists collaborate daily to determine the safest and most effective type of treatment, tailored to each patient's needs. Many patients who received their transplants at another facility—even outside of Houston—trust us with their long-term transplant monitoring and care (shown in our data as volumes of procedures versus transplant patients).

MECHANICAL CIRCULATORY SUPPORT

When transplants are not yet available or are not indicated, our affiliated physicians turn to their experience with mechanical circulatory support for bridge-to-transplant or destination therapy. Patients often are transported



to Memorial Hermann-TMC after they start ECMO therapy at a Memorial Hermann hospital or at other community hospitals in the Greater Houston area. Our team has placed more than 550 left ventricular assist devices and has attained 5-year survival rates well above those reported by the Interagency Registry for Mechanically Assisted Circulatory Support (INTERMACS). The Joint Commission has certified our use of ventricular assist devices, validating our commitment to quality and acknowledging our significant volumes in this area.

These volumes are possible because of Memorial Hermann Life Flight, the only air ambulance service equipped to transport cardiogenic shock patients and patients who need extracorporeal membrane oxygenation (ECMO) from a 150-mile radius to Memorial Hermann-TMC for care.

The Center for Advanced Heart Failure has helped to extend the lives of more than 900 patients by performing 355 heart transplants and implanting 561 left ventricular assist devices (LVAD) to date.



Total synchronization happens. I think that's what translates into good results and good outcomes."

– BISWAJIT KAR, MD,
Professor, Center for Advanced Cardiopulmonary Therapies and Transplantation UTHealth Houston Heart & Vascular, Chief of Medicine, Center for Advanced Heart Failure Memorial Hermann Heart & Vascular Institute at Memorial Hermann-Texas Medical Center



Offering therapies for patients in advanced stages of heart and lung disease, the Center for Advanced Heart Failure has served the Greater Houston Area for over 10 years.



The annual Houston Shock Symposium brings multi-specialty experts together to share and advance knowledge, expertise, and vision to save lives and reduce shock's unacceptable high mortality rate. A panel of national and international faculty discuss issues surrounding cardiogenic shock in this prestigious two-day symposium hosted by UTHealth Houston Heart & Vascular and Memorial Hermann.

As a result of our experience and infrastructure, we are among the top ECMO centers in the country. In fact, the Extracorporeal Life Support Organization (ELSO) has awarded Memorial Hermann its Platinum Award for demonstrating excellence in patient care by following evidence-based practice and achieving the highest quality measures, processes and organizational structure and for showcasing distinction in training, education, collaboration and communication among caregivers.

ADVANCED HEART FAILURE MANAGEMENT

Our comprehensive heart failure management program takes a multi-pronged approach that encompasses inpatient and outpatient services. As with our transplant program, the Center for Advanced Heart Failure convenes a collaboration of providers, including cardiologists, cardiothoracic surgeons, primary care physicians, nurses, pharmacists, substance abuse therapists, dietitians, physical therapists, inpatient navigators, case managers and community resources, to help heart failure patients receive the care that best suits their needs and improves their overall health and quality of life. We are following evidence-based practice across the continuum of care to ensure that all treatment options, from medication

management to cardiac rehabilitation to mechanical circulatory support to transplantation, are considered through a multidisciplinary lens and are standardized throughout Memorial Hermann.

Our INTERMACS scores reveal that even the sickest patients have better outcomes than less sick patients at other facilities in Texas and throughout the U.S.

HOUSTON SHOCK SYMPOSIUM

To further demonstrate our leadership in heart failure management and transplantation, Memorial Hermann sponsors the annual Houston Shock Symposium, along with UTHealth Houston, to share and advance knowledge among physicians, nurses and clinical support staff to reduce the high mortality rate of cardiogenic shock and save lives.

PIONEERING RESEARCH

Our affiliated physician leaders have published more than 400 articles of research and given hundreds of international presentations about advanced heart failure and transplantation. The team also participates in clinical trials to test the latest in medical and surgical treatment options for patients with heart failure or who have mechanical circulatory support devices. **(See Research on Page 30).**



Transplant Expertise

93.26%

One-year survival rate for orthotopic heart transplantation, well above the national average of 89.07%

>180 patients

Our outpatient team closely follows more than 180 patients with surgical LVADS, performing invasive and non-invasive organization studies.

54.7%

Our 5-year survival rate is well above the 43% survival rate reported by INTERMACS.

Source: Memorial Hermann Center for Advanced Heart Failure.

Pictured: Manish Patel, MD.

Heart Rhythm Disorders

Cardiac electrophysiology (EP) is one of the fastest growing fields in medicine today, and Memorial Hermann's EP Program is at the forefront, translating breakthrough research into advanced care at the bedside, creating care teams with other specialists to provide comprehensive integrated care, driving treatments for the most complex rhythm conditions, and creating an education platform for the next generation of technical/clinical specialists.

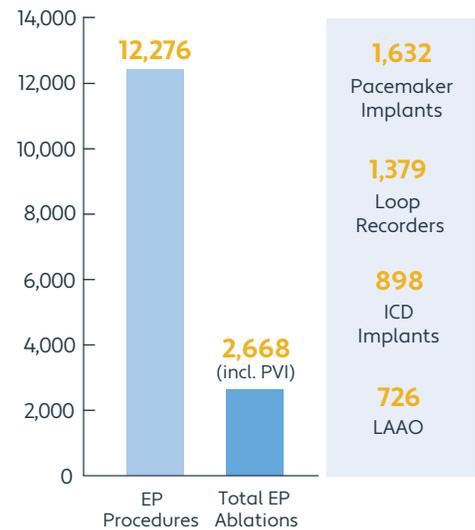
In 2011, Memorial Hermann and UTHealth Houston established the first and only organized high-volume lead extraction center in Houston, through which our affiliated physicians perform laser, mechanical and femoral extractions. To date, the center has performed over 1,000 lead extraction procedures and removed over 2,000 leads—some as old as 25 years, achieving a 97.3 percent complete success extraction rate.

TRANSLATING RESEARCH INTO ADVANCED CARE AT THE BEDSIDE

Since implanting the first subcutaneous implantable cardioverter defibrillator (S-ICD) in 2014, affiliated specialists at Memorial Hermann have continued to innovate in the use of heart rhythm devices. We were the first in Texas to implant a dual chamber leadless pacemaker; the first in Texas and the second in the U.S. to implant Abbott's left atrial appendage occlusion (LAAO) device following FDA approval for commercial use; and the first in the U.S. to use the Amplatzer™ Steerable catheter during an LAAO procedure.

Our teams have access to the latest technologies and devices, including sophisticated mapping platforms and catheters, steerable catheters for use during LAAO procedures and computer modeling programs.

2022 VOLUMES



Source: Inpatient and outpatient volumes, July 1, 2021 - June 30, 2022
Source: Memorial Hermann internal data





In March 2023, Memorial Hermann opened a new state-of-the-art EP facility on the Memorial Hermann-TMC campus, doubling the size of our current footprint. Three new cath labs and a hybrid OR, all dedicated to EP, will feature the latest equipment for mapping and diagnostic and interventional procedures, including lead extraction and LAAO procedures. Patients are cared for by specialized, dedicated EP staff.

Pictured: Ramesh Hariharan, MD, MRCP (UK), FACC, FHRS

COLLABORATING TO PROVIDE COMPREHENSIVE, INTEGRATED CARE

EP specialists at Memorial Hermann work hand in hand with heart failure specialists, interventional cardiologists, cardiologists, neurologists, gastroenterologists and other specialists to treat all forms of arrhythmia, including atrial fibrillation (AFib), atrial flutter and ventricular tachycardia (VT). And, we are one of the highest volume centers in the U.S. for the treatment and intervention of LAAO for stroke prevention.

TREATING THE MOST COMPLEX RHYTHM CONDITIONS

Our affiliated physicians continue to advance techniques and technologies for cardiac ablation and lead extractions. At the Memorial Hermann Heart & Vascular Institute at Memorial Hermann-TMC, VT ablations and complex arrhythmias are treated in patients in cardiogenic shock, and arrhythmia management and device implants are performed in cardiac transplant patients.

EDUCATING THE NEXT GENERATION OF TECHNICAL AND CLINICAL SPECIALISTS

In 2018, Memorial Hermann, in partnership with McGovern Medical School at UTHealth Houston, established a new educational program for aspiring technical/clinical specialists in the fields of cardiac rhythm management (CRM), electrophysiology and structural heart disease. At the time, the program was only the third such school in the U.S. and the only one affiliated with a hospital.

The program trains participants in the use of virtually all of the leading cardiac electrophysiology devices, including pacemakers, defibrillators and cardiac resynchronization devices, as well as in the use of lead extraction and heart mapping systems. To date, we have trained over 75 individuals, 97% of whom have been placed in the industry.

Five Memorial Hermann facilities offer LAAO procedures, with three identified as high-volume and two as very-high volume performers.

* Source: LAAO Registry™ Q2 2022 Published Report Data

Thoracic Surgery

The Memorial Hermann Heart & Vascular program offers a complete range of thoracic services, from diagnostic procedures to innovative, minimally invasive surgical options designed to improve outcomes for patients with diseases of the chest, airway and esophagus.

Our nationally recognized team of affiliated surgeons has specialized expertise in esophageal resections for both benign and malignant disease, colon interposition for total esophageal replacement, bronchial sleeve resections and related bronchoplasty procedures, and tracheal sleeve resections. The team performs both open and minimally invasive pulmonary resections, including video-assisted thoracoscopic surgery (VATS) and robotic procedures.

DIAGNOSING AND TREATING ESOPHAGEAL DISORDERS

The Memorial Hermann Esophageal Disease Center, in partnership with McGovern Medical School at UTHealth Houston, provides streamlined care for patients with conditions affecting the upper GI tract, including gastroesophageal reflux disease (GERD), swallowing disorders, such as achalasia, hiatal hernia and cancers of the esophagus or stomach.

One of the first of its kind in the region, the Center is equipped with the most advanced tools for making an accurate diagnosis. A multidisciplinary team of gastroenterologists, radiologists, pathologists and surgeons collaborate to discuss complicated cases, develop plans of care and ensure patients receive the best care possible. When surgery is necessary, the team uses minimally invasive laparoscopic procedures that prevent reflux disease and result in faster recovery and earlier return to daily activities.

MULTIDISCIPLINARY LUNG CANCER PROGRAM

The dedicated Memorial Hermann lung cancer team employs a multidisciplinary approach to lung cancer patient care. Cases are reviewed by a multidisciplinary tumor board, comprised of radiation oncologists, medical oncologists, pulmonologists, interventional

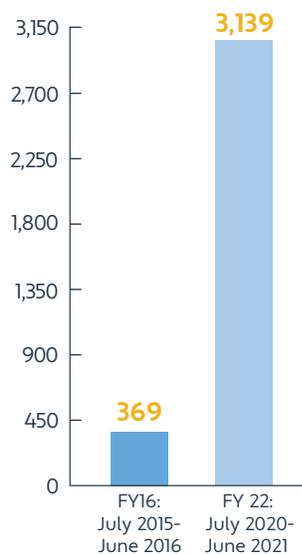
20 | At Memorial Hermann, our journey and commitment to quality of care is unwavering. We continually challenge ourselves to improve and our Pre-Operative Risk Assessment (PORA) process implementation journey is no exception. This process utilizes the STS risk calculation to bring together multi-disciplinary teams and patients to optimize outcomes. Our teams focus on goals such as ventilation and daily patient goals. Continual electronic health record (EHR) optimization ensures documentation and patient care elements are met via templates, checklists, physician alters and dashboards to monitor real-time progress and identify opportunities.



Pictured this page and next:
Philip Rascoe, MD, FACS



LOW-DOSE CT LUNG CANCER SCREENING GROWTH



Source: Memorial Hermann internal data

pulmonologists, thoracic surgeons and Oncology Nurse Navigators, whose members discuss treatment options and create individualized treatment plans. In addition, the multidisciplinary team works together to coordinate each patient's care and to provide access to a wide array of support resources.

The team utilizes the latest technologies, including advanced navigational techniques and endobronchial ultrasound (EBUS) for lung cancer diagnosis and staging. If surgery is required, surgical options for early-stage lung cancer include video-assisted and robotic-assisted thoracoscopic lobectomies and segmentectomies, which generally enable faster recovery and fewer complications.

THORACIC CONDITIONS TREATED

Swallowing Problems

- GERD
- Hiatal Hernia
- Barrett's Esophagus
- Reflex-Related Adult-Onset Asthma
- Peptic Esophageal Stricture
- Previous Failed Antireflux Surgery

Esophageal Motility Disorders

- Achalasia
- Scleroderma
- Diffuse Esophageal Spasm
- Nutcracker Esophagus
- Hypertensive Lower Esophageal Sphincter
- Eosinophilic Esophagitis

Other Esophageal Diseases

- Tracheoesophageal Fistula
- Zenker's Diverticulum
- Schatzki's Ring

Cancers in the Chest

- Esophageal Cancer
- Lung Cancer

TREATMENTS FOR THORACIC CONDITIONS

- Lung Cancer Surgery
- Lung Transplant
- VATS
- Esophageal Cancer Surgery
- Heller Myotomy (laparoscopic esophagomyotomy)
- Laparoscopic Antireflux Surgery
- Pulmonary Resection
- Esophageal Resection
- Colon Interposition
- Bronchial Sleeve Resection
- Bronchioplastic Procedures
- Tracheal Sleeve Resection

Valve & Structural Heart

Memorial Hermann has been at the cutting-edge of structural heart innovation—locally, nationally and internationally, pioneering minimally invasive solutions to prevent or cure heart disease, in the highest acuity patients.

Memorial Hermann participates in national registries to support its commitment to high quality standards, including the American College of Cardiology's National Cardiovascular Data Registries (NCDR®): CathPCI Registry®, Chest Pain - MI Registry™, STS/ACC TVT Registry™ and LAAO Registry™.

Additionally, Memorial Hermann participates in the Vizient® Clinical Data Base (CDB) and The Society for Vascular Surgery Vascular Quality Initiative® (VQI®).

The structural heart program at Memorial Hermann is known for breaking new ground in minimally invasive treatments for patients with valve disease, congenital heart disease and cardiac abnormalities. What sets us apart is our breadth of capability and our depth of experience. We have a reputation for taking on the toughest cases.

TRANSCATHETER AORTIC VALVE REPLACEMENT (TAVR)

Since performing the first commercial TAVR in Texas and one of the first in the country in 2011, Memorial Hermann has become one of the highest-volume TAVR programs in the U.S.

Memorial Hermann-TMC participated in the PARTNER II and PARTNER III clinical trials, which evaluated percutaneous options for aortic valve replacement for patients with severe aortic stenosis, across all risk cohorts. We also participated in the Sentinel Study, which led to FDA

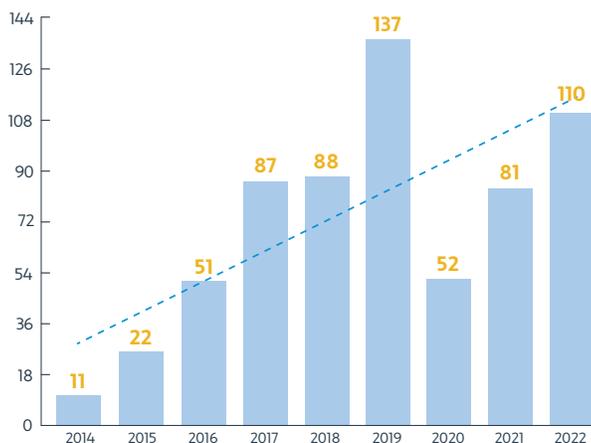
approval of the first cerebral embolic protection device for use during TAVR to protect against stroke.

MITRAL VALVE REPAIR AND REPLACEMENT

Memorial Hermann-TMC continues to be one of the highest-volume percutaneous mitral valve repair/replacement centers in the U.S. Our program has long been instrumental in the testing and implementation of new valvular devices.

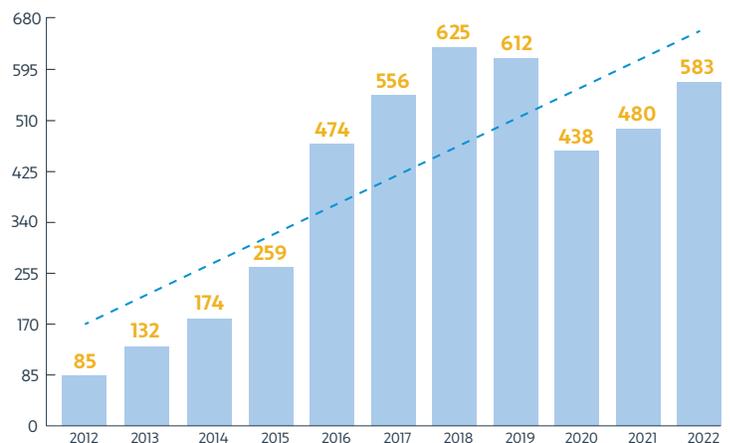
- We were the fifth center in the U.S. and the first in Texas to implant the MitraClip device in a patient with severe mitral regurgitation (MR) with a team led by Richard Smalling, MD, PhD. We were one of the top enrolling sites in the Endovascular Valve Edge-to-Edge Repair Study - EVEREST I study, which led to FDA approval of the device for patients with degenerative MR.
- We participated in the Cardiovascular Outcomes Assessment of the MitraClip Percutaneous Therapy for Heart

MITRAL LEAFLET CLIP PROCEDURE GROWTH



Source: Memorial Hermann internal data

TAVR VOLUME GROWTH



Source: Memorial Hermann internal data

Failure Patients With Functional Mitral Regurgitation (COAPT) trials, which led to the approval of the first percutaneous option for mitral valve repair in patients with functional MR.

LEFT ATRIAL APPENDAGE PROCEDURES

Memorial Hermann has one of the busiest left atrial appendage programs in Houston, performing over 600 left atrial appendage occlusion (LAO) procedures each year.

Our program is a leader and top enroller in the Amplatzer™ Amulet™ LAO vs. NOAC (CATALYST) trial, evaluating the safety and effectiveness of the Amulet LAO compared to NOAC therapy in patients with non-valvular AFib at increased risk for ischemic stroke and who are recommended for long-term NOAC therapy. We were the site of the first randomized implantation of the device in the world. Today, we are the top Amplatzer™ Amulet™ LAO implanter in the country.

Vizient National Peer Comparison Dashboard Mortality Index Rankings

Specialties	National Rank
Vascular Surgery	#7
Cardiology	#10
Cardiac Surgery	#11
Thoracic Surgery	#11
Cardiac Surgery, Cardiology, Thoracic Surgery, Transplant Services, Vascular Surgery combined	#11
Heart and Lung Transplant; VAD	#12

Source: Vizient Peer Comparison Dashboard: Mortality Index Rank-Memorial Hermann Tableau Server; July 2021- September 2022

SAYING “YES” WHEN OTHERS SAY “NO.”

The Memorial Hermann Heart & Vascular program frequently takes on highly complex cases other hospitals turn away. Such was the case with two pregnant women with complex heart conditions, both of whom were advised elsewhere to terminate their pregnancies and to undergo lifesaving open heart surgeries.

In 2018, surgeons at Memorial Hermann performed a successful TAVR on a 31-year-old expectant mother with congenital kidney problems and a failing transplanted aortic valve. Just prior, the same team performed a successful transcatheter patent foramen ovale (PFO) closure on another pregnant patient. In both cases, the team took extra precautions, avoiding X-ray imaging around the uterus and only briefly thinning the patient’s blood. Because of the surgical team’s vast experience and expertise, the lives of both women and their unborn children were spared, and both babies were born healthy.

HEART-BRAIN PROGRAM OFFERS ‘CLOSED-LOOP’ CONTINUUM OF CARE TO PATIENTS WITH PFO-ASSOCIATED STROKE

Patients with suspected PFO-related strokes can receive multidisciplinary care through the Heart-Brain Program at UHealth Houston. Before the program was established in 2018, patients with PFO-associated ischemic stroke were referred for PFO closure in one of two ways. Now, patients at Memorial Hermann-TMC and other hospitals in the Houston area are directed to a single clinical setting in an effort to expedite the appropriate workup and improve shared decision-making about PFO closure among neurologists, cardiologists and patients. The clinical team includes an interventional cardiologist, a stroke neurologist, neurology and cardiology fellows, and advanced practice research coordinators.

An internal study, which compared outcomes in patients sent to the Heart-Brain Program versus patients undergoing routine care from February 2017 to July 2020, found that the Heart-Brain group required fewer clinic visits from stroke to closure decision. Fewer visits can reduce costs, save time and improve overall quality of care for patients.

LEADER IN STRUCTURAL HEART RESEARCH

The Structural Heart Program at Memorial Hermann has access to all pivotal structural heart studies underway.

Mitral Studies

- CLASP IID/F
- REPAIR MR
- APOLLO
- SUMMIT
- ENCIRCLE

Aortic Studies

- Progress AS
- ACURATE IDE
- SMART
- ALLIANCE

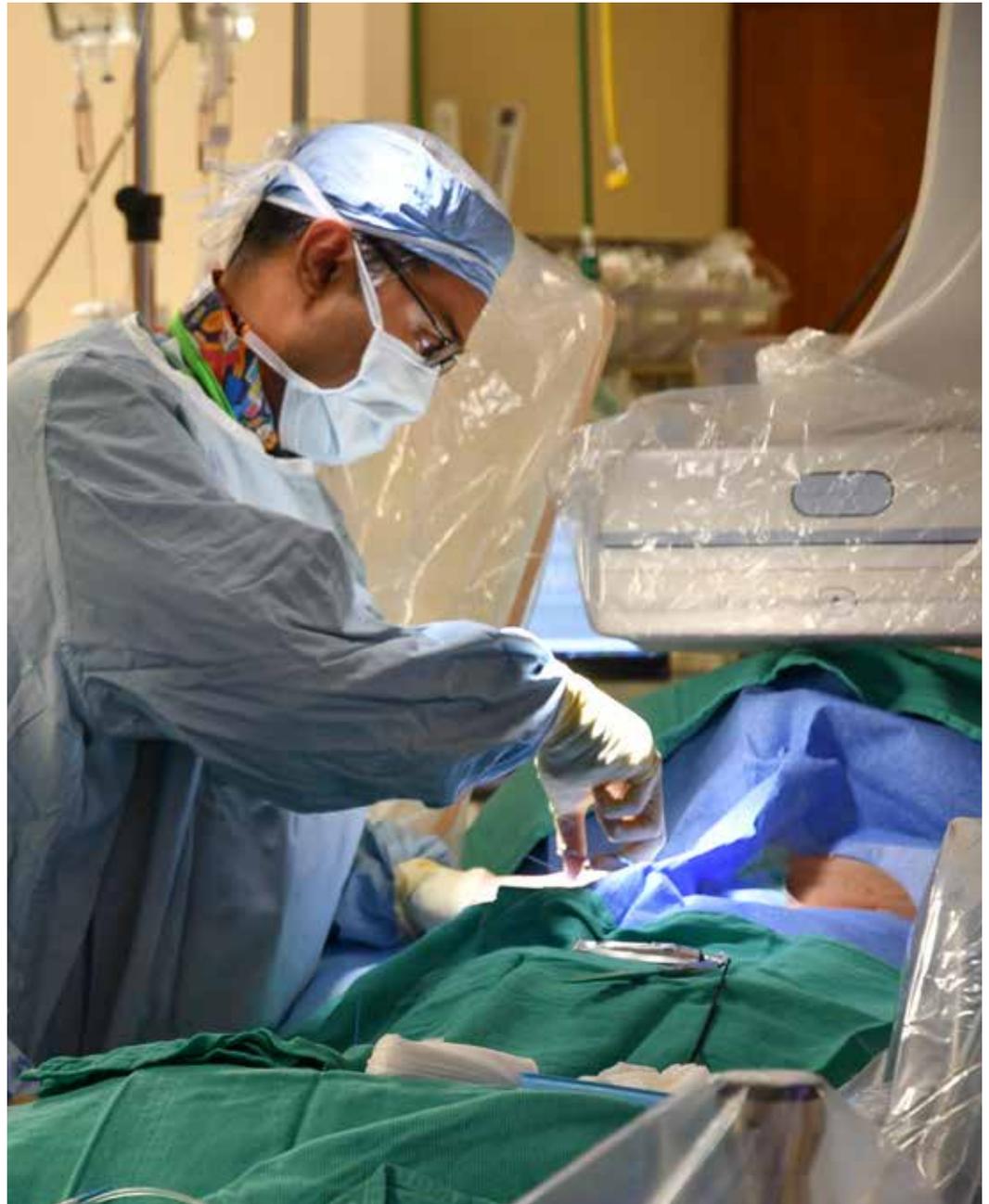
Tricuspid

- Triscend
- CLASP TR

Abhijeet Dhoble, MD, performs a PFO closure at Memorial Hermann-TMC.

Memorial Hermann-TMC and Memorial Hermann Memorial City Medical Center are high volume TAVR procedure facilities by NCDR® standards.

* Source: TVT Q2 2022
Published Report Data



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COIL EMBOLIZATION FOR SEPTAL ABLATION

The first septal ablation in a patient with hypertrophic obstructive cardiomyopathy (HOCM) utilizing Micro-coil embolization, rather than alcohol septal ablation, was performed in 2005 by Richard Smalling, MD, PhD, at Memorial Hermann-TMC. The microcoil embolization technique results in less need for new permanent pacemakers (<5% versus 30-40%), immediate reduction of symptoms rather than delayed improvement, and dramatically less procedural-induced chest pain compared to alcohol septal ablation.

STRUCTURAL HEART ACROSS THE SYSTEM

Memorial Hermann has taken a thoughtful and methodical approach to provide advanced structural heart care throughout the Greater Houston area. We are proud to offer:

- TAVR at 5 facilities
- LAAO at 5 facilities
- TEER at 3 facilities

PFO REPAIR

Memorial Hermann is a pioneer in the treatment of cryptogenic stroke. One of our physicians served as one of the two cardiologists on the steering committee of the Randomized Evaluation of Recurrent Stroke Comparing PFO Closure to Established Current Standard of Care Treatment (RESPECT) trial, the largest randomized trial of PFO closure in cryptogenic stroke.

The Heart & Vascular Institute at Memorial Hermann-TMC was one of the two highest-enrolling sites in the trial, the results of which led to FDA approval of the Amplatzer™ PFO occluder, the first device approved for the treatment of cryptogenic stroke. In addition, we were the first in the world to implant the Talisman™ PFO device and are currently enrolling patients in a clinical trial to collect additional information on the safety and effectiveness of the device.

Vascular Disease

With a team of affiliated physicians with a passion for clinical practice, research and education, Memorial Hermann offers a full complement of care throughout Greater Houston to treat patients with common and complex venous and arterial disease. Care options include medical management and mechanical thrombolytic devices, along with advanced open surgery and minimally invasive endovascular treatment options, to restore blood flow and lives.

The collaboration between our affiliated cardiologists, cardiac surgeons, vascular radiologists and vascular surgeons across Memorial Hermann and during the process of evaluating patients, planning treatment, performing cases and post-surgical follow-up ensures that patients receive the highest-quality care and best opportunity for positive outcomes. Our vascular disease program addresses peripheral vascular disease, carotid artery stenosis, aneurysms and malformations that require interventions and revascularization.

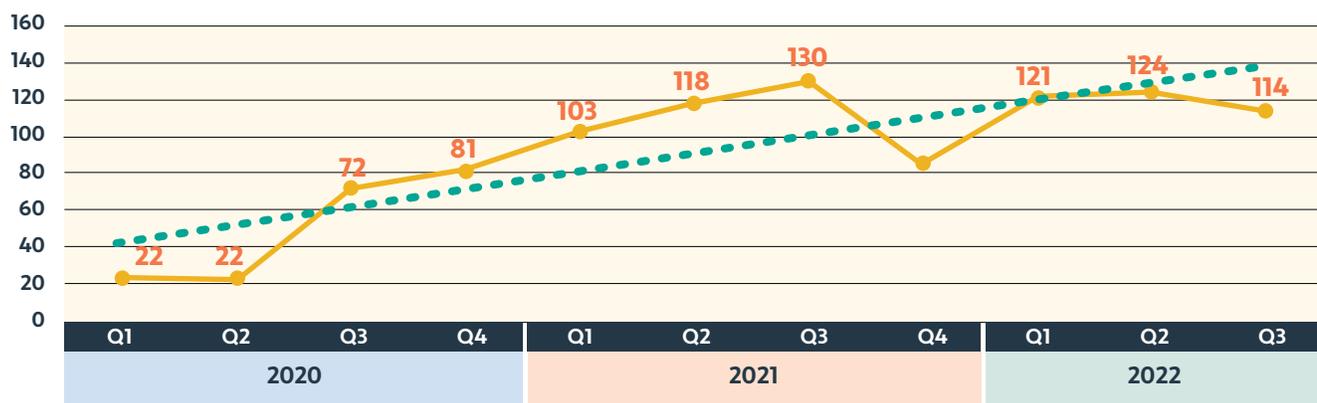
ADVANCED CARE OPTIONS

In addition to performing complex open procedures, such as thoracoabdominal aneurysm (TAAA) repair, our affiliated specialists also perform advanced endovascular procedures to treat blocked arteries and veins. These procedures include

transcarotid artery revascularization (TCAR), which reduces the risk of intraoperative stroke. And for more than four years, Memorial Hermann has been offering mechanical thrombolytic devices to remove blood clots endovascularly. These devices have led to improved patient outcomes, including reduced complications, for the treatment of DVTs and PEs. Patients who undergo procedures with these devices are often able to bypass the ICU and IMU, reducing length of stay. They also have significantly fewer instances of needing repeat procedures as compared with other management techniques, such as with thrombolytics alone. Memorial Hermann has also become an international training site for physicians who travel to Houston to learn how to manage complex critical limb ischemia cases to minimize the need for amputation.

Growth in Mechanical Thrombectomy Procedures

Across the System, Memorial Hermann continues on a positive trajectory in mechanical thrombectomy growth, reaching nearly 1,000 in less than two years.



Source: Memorial Hermann: Cases Across the IDN, Inari Medical, September 2022

TRAINING NEXT-GENERATION VASCULAR SURGEONS

Partnering with McGovern Medical School at UTHealth Houston, Memorial Hermann is developing an endovascular training program that will offer a pathway for the next generation of vascular surgeons to learn from and work alongside our experienced surgeons.



Pictured: Gustavo Oderich, MD, FACS, Naveed Saqib, MD, FACS, and team.

LATEST VASCULAR TECHNOLOGY

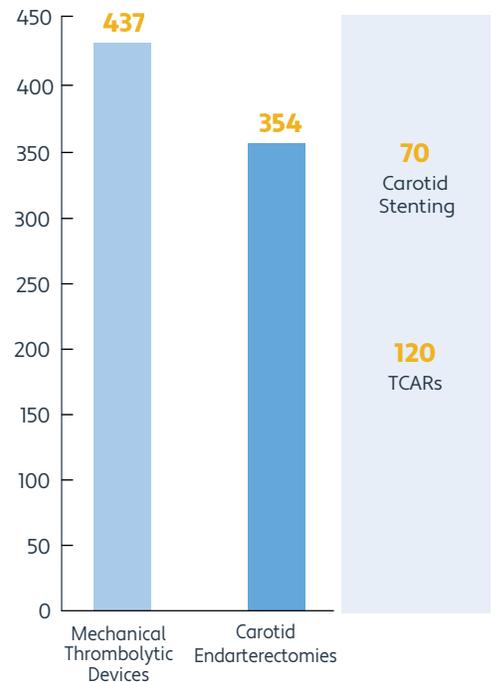
Responding to the trend toward minimally invasive endovascular procedures, our hospitals throughout Greater Houston have invested in endovascular suites and hybrid operating rooms, equipped with the latest imaging technology, to help surgeons clearly visualize vascular structures in real time. A novel surgical positioning system, IOPS®, in use at Memorial Hermann-TMC reduces the need for contrast. This minimizes prolonged exposure to radiation.

Additionally, a simulation lab allows for pre-procedure planning and is being used to capture data on fluoroscopy time, radiation exposure and total operating time based on various levels of experience. Ultimately, the simulation enhances patient and staff safety from reduced radiation and improves outcomes.

TRACKING OUTCOMES

Since 2017, Memorial Hermann has proudly participated in the Vascular Quality Initiative with an aim of improving the quality, safety, effectiveness and cost of vascular care offered at our hospitals. We subject our cases and outcomes to expert scrutiny so that we can adapt our clinical practice and teach others how to elevate the standard of vascular care and improve efficiency. We also collaborate internally on a weekly basis to review complications, adjust pathways appropriately and keep our entire clinical team abreast of the

FY22 VOLUMES

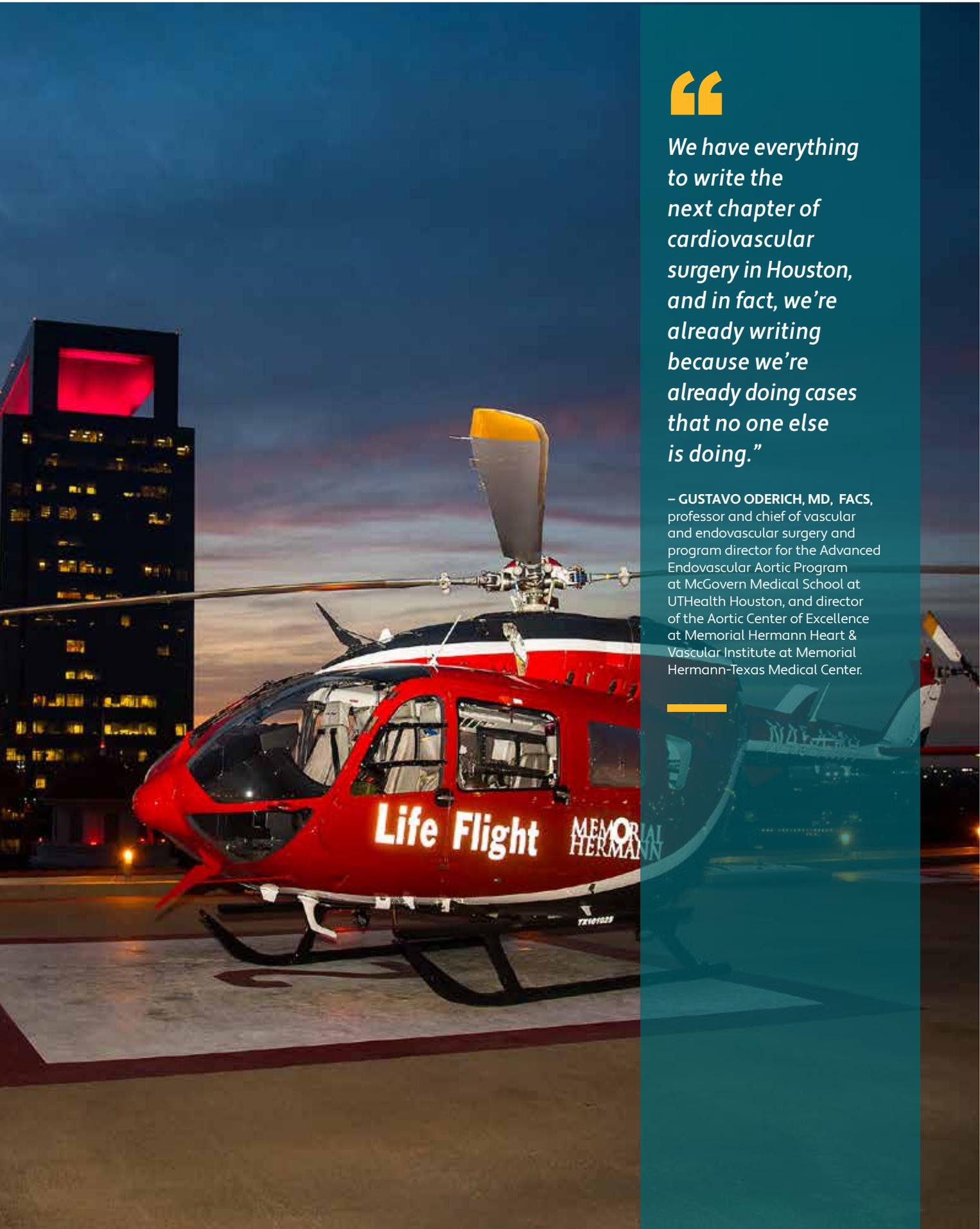


* Source: Memorial Hermann internal data.

Since program inception, Memorial Hermann has completed over 500 TCAR procedures.

latest evidence-based care and practice. With this philosophy, we've established a culture that is motivated toward excellence and attracts other great clinicians.

The sum contribution of skilled physicians and research, advanced surgical tools and imaging technology, along with participation in accreditation programs and quality initiatives, has positioned Memorial Hermann as a leader in vascular surgery.



“

We have everything to write the next chapter of cardiovascular surgery in Houston, and in fact, we're already writing because we're already doing cases that no one else is doing.”

— GUSTAVO ODERICH, MD, FACS, professor and chief of vascular and endovascular surgery and program director for the Advanced Endovascular Aortic Program at McGovern Medical School at UTHealth Houston, and director of the Aortic Center of Excellence at Memorial Hermann Heart & Vascular Institute at Memorial Hermann-Texas Medical Center.

Cardiac and Pulmonary Rehabilitation

Memorial Hermann offers cardiac rehabilitation at six locations across the Houston area and offers pulmonary rehabilitation at Memorial Hermann-TMC. Patients recovering from heart disease who participate in cardiac and pulmonary rehabilitation show marked improvement in their physical and mental functioning and are able to enjoy a better quality of life.



Memorial Hermann's cardiac and pulmonary rehabilitation programs are certified by the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR).

CARDIAC REHABILITATION

Memorial Hermann's 12-week cardiac rehabilitation program is a phased, multidimensional, medically supervised program designed to help patients recover as quickly as possible from heart disease. With a comprehensive focus on exercise, education and lifestyle changes (including nutrition and smoking cessation), the program is designed to improve our patients' overall physical and mental health.

FY22 TOTAL ANNUAL VISITS

Cardiac Rehabilitation
25,150
Pulmonary Rehabilitation
2,800

Source: Memorial Hermann Internal Data, July 1, 2021 - June 30, 2022

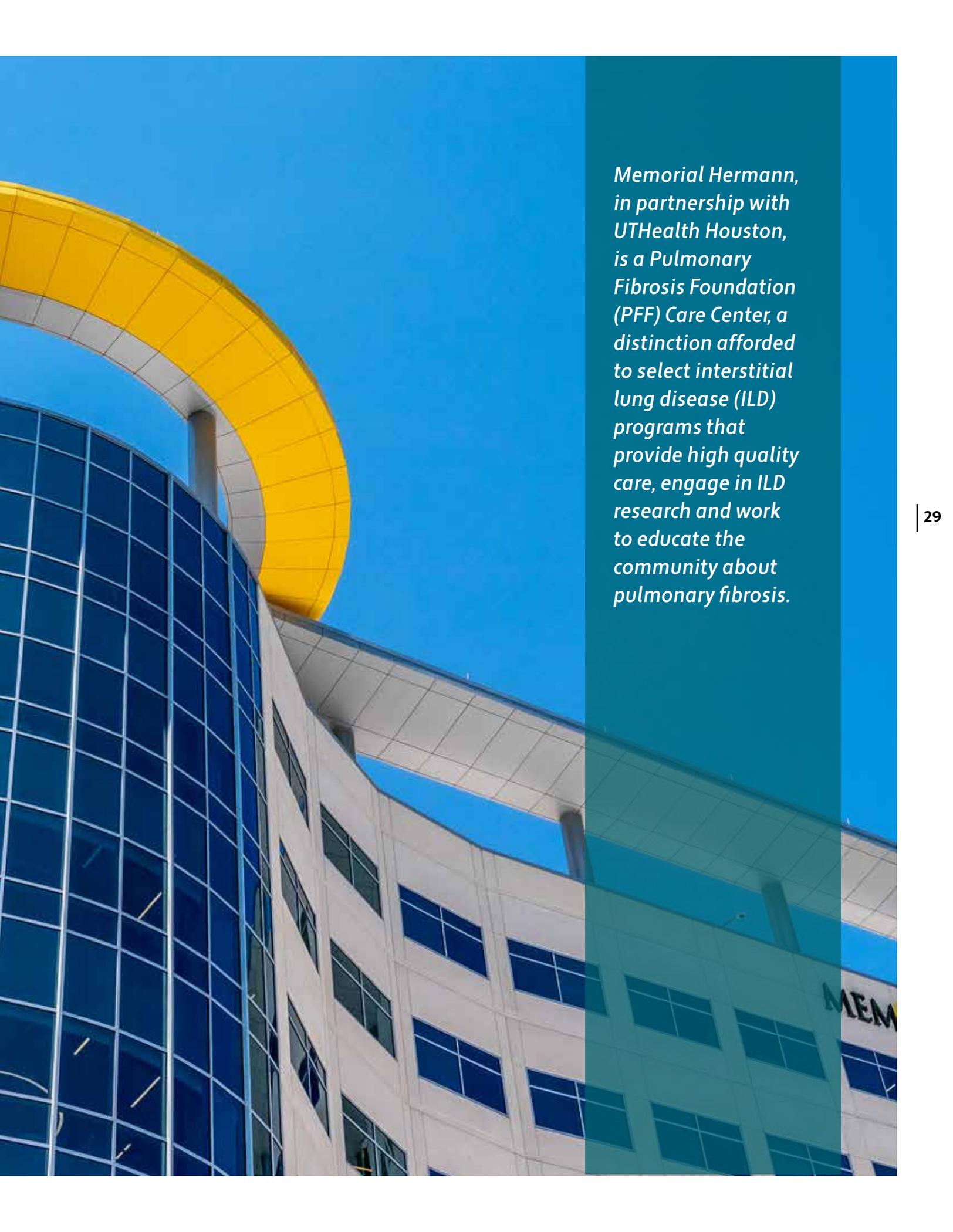
PULMONARY REHABILITATION

Pulmonary rehabilitation is an integral part of the comprehensive range of lung treatments offered at Memorial Hermann, including complicated lung surgery, advanced mechanical ventilation support, lung transplant and ECMO support.

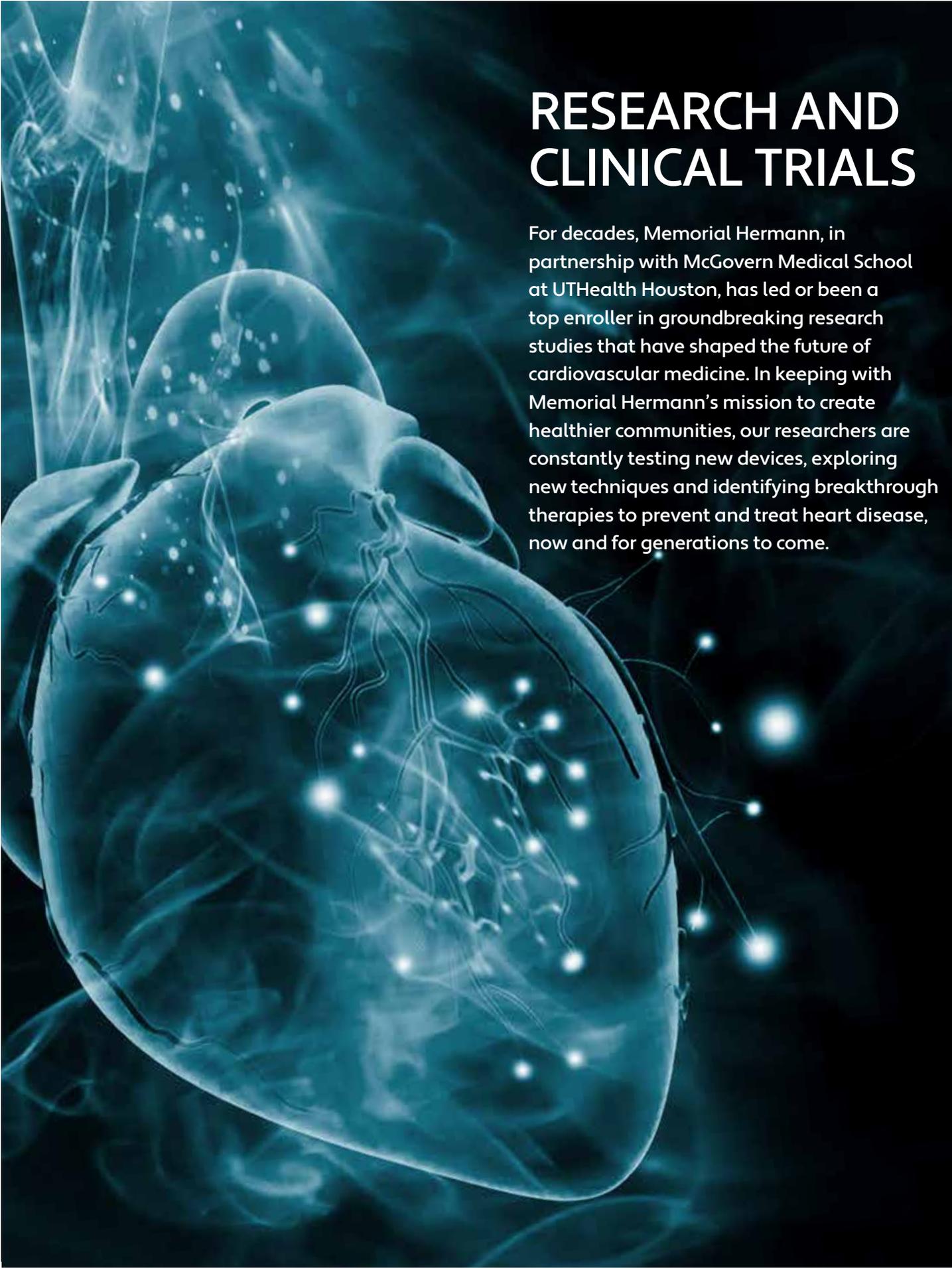
The 12-week pulmonary rehabilitation program at Memorial Hermann features a comprehensive combination of exercise, education, counseling and meditation. The pulmonary rehabilitation team, comprised of affiliated physicians, registered nurses, respiratory therapists, exercise specialists, occupational therapists, pharmacists and dietitians, creates a customized rehabilitation program to match each patient's specific needs and goals.

In 2021, we incorporated a meditation program into pulmonary rehabilitation to reduce patients' anxiety and stress levels and lower their generalized anxiety disorder (GAD) scores. Patient feedback has been very positive.

Since its inception in 2017, the program has shown remarkable growth. In our fiscal year 2022, our volume of annual pulmonary rehabilitation visits nearly doubled, to 2,800 visits.



Memorial Hermann, in partnership with UTHHealth Houston, is a Pulmonary Fibrosis Foundation (PFF) Care Center, a distinction afforded to select interstitial lung disease (ILD) programs that provide high quality care, engage in ILD research and work to educate the community about pulmonary fibrosis.



RESEARCH AND CLINICAL TRIALS

For decades, Memorial Hermann, in partnership with McGovern Medical School at UTHealth Houston, has led or been a top enroller in groundbreaking research studies that have shaped the future of cardiovascular medicine. In keeping with Memorial Hermann's mission to create healthier communities, our researchers are constantly testing new devices, exploring new techniques and identifying breakthrough therapies to prevent and treat heart disease, now and for generations to come.

Here is a sampling of active research studies performed at Memorial Hermann.

CARDIOVASCULAR SURGERY

ARISE: Evaluation of the GORE Ascending Stent Graft
Study to evaluate the GORE® TAG thoracic branch endoprosthesis (TBE Device) in the treatment of lesions of the aortic arch and descending thoracic aorta.
NCT0277528, Principal Investigator: Estrera, Anthony

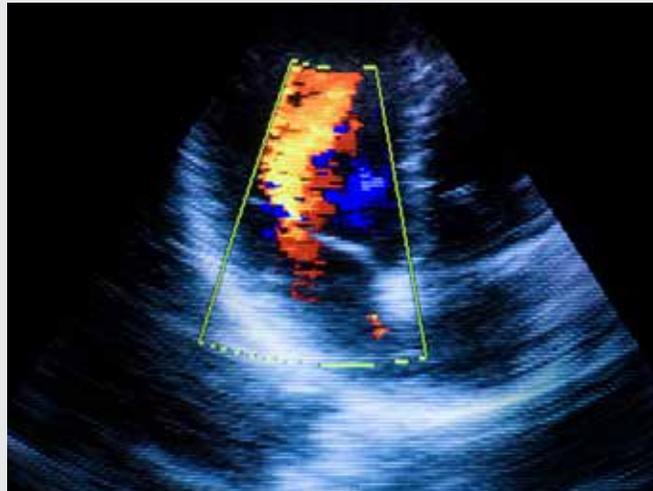
TAMBE: GORE EXCLUDER Thoracoabdominal Branch Endoprosthesis in the Treatment of Type IV Thoracoabdominal Aortic Aneurysms
Study to assess the initial feasibility of the GORE EXCLUDER® thoracoabdominal branch endoprosthesis (TAMBE) device in the treatment of aortic aneurysms involving the visceral branch vessels.
NCT02528500, Principal Investigator: Saqib, Naveed

CRYOICE: Intercostal Nerve Cryoablation for Postoperative Pain Management
Prospective single-blinded, controlled randomized clinical trial with two-armed parallel-group sequential design. The primary objective of the study is to prove the feasibility of intercostal nerve cryoablation in postoperative pain control both in magnitude and duration in patients undergoing thoracoabdominal incisions for the descending or thoracoabdominal aortic aneurysm repair.
NCT03972397, Principal Investigator: Estrera, Anthony

Fenestrated and Branched Endovascular Aortic Repair After Failed Zenith Dissection Endovascular System for Type B Aortic Dissection: An International Multicenter Registry
Study to assess the safety and effectiveness of the Zenith® Fenestrated+ Endovascular Graft (ZFEN+) in combination with the BeGraft Balloon-Expandable FEVAR Bridging Stent Graft System (BGUS) for the treatment of patients with aortic aneurysms involving one or more of the major visceral arteries.
NCT04875429, Principal Investigator: Oderich, Gustavo

ADVANCED HEART FAILURE

PREVENT II: Prevention of Non-Surgical Bleeding by Management of HeartMate II Patients Without Antiplatelet Therapy
Prospective, multicenter, randomized, double-blind placebo-controlled study of subjects receiving the HeartMate™ II LVAD as per the current FDA approved indications for use.
NCT02836652, Principal Investigator: Nathan, Sriram



GALACTIC-HF: Registrational Study with Omecamtiv Mecarbil (AMG 423) to Treat Chronic Heart Failure With Reduced Ejection Fraction
A double-blind, randomized, placebo-controlled, multicenter study to assess the efficacy and safety of Omecamtiv Mecarbil on mortality and morbidity in subjects with chronic heart failure with reduced ejection fraction (GALACTIC-HF).
NCT02929329, Principal Investigator: Nathan, Sriram

The ARIES HeartMate 3 Pump IDE Study
Prospective, randomized, double-blinded, placebo-controlled clinical investigation of advanced heart failure patients treated with the HeartMate 3 with two different antithrombotic regimens: vitamin K antagonist with aspirin versus vitamin K antagonist with placebo.
NCT04069156, Principal Investigator: Gregoric, Igor

ANTHEM-HFrEF Pivotal Study
A multicenter randomized controlled clinical trial to evaluate autonomic regulation therapy with the VITARIA® system in patients with symptomatic heart failure and reduced ejection fraction.
NCT03425422, Principal Investigator: Jumean, Marwan

RELIEVE-HF: Reducing Lung Congestion Symptoms in Advanced Heart Failure
Study to provide reasonable assurance of safety and effectiveness of the V-Wave® Interatrial Shunt System by improving meaningful clinical outcomes in patients with New York Heart Association (NYHA) functional Class II, Class III or ambulatory Class IV heart failure, irrespective of left ventricular ejection fraction, who at baseline are treated with guideline-directed drug and device therapies.
NCT03499236, Principal Investigator: Kumar, Sachin

PROTECT IV: Impella®-Supported PCI in High-Risk Patients With Complex Coronary Artery Disease and Reduced Left Ventricular Function

Study to assess if using the Impella CP (or Impella 2.5) device during high-risk PCI in patients with reduced left-sided heart function will result in an improvement in symptoms, heart function and health after a heart procedure compared to the current standard of care.

NCT04763200, Principal Investigator: Kumar, Sachin

SAFE-MCS: Safe Surveillance of PCI Under Mechanical Circulatory Support With the Saranas® Early Bird® Bleed Monitoring System

Study to establish the safety of complex high-risk Percutaneous Coronary Intervention (PCI) using Mechanical Circulatory Support (MCS) and surveillance with the Saranas Early Bird Bleed Monitoring System (EBBMS).

NCT05077657, Principal Investigator: Kar, Biswajit

VALVE AND STRUCTURAL HEART**Triscend II Pivotal Study**

This study is evaluating a new heart valve (EVOQUE System) to replace the tricuspid valve and if this is a safe and effective treatment for patients with severe or greater tricuspid regurgitation.

NCT04482062, Principal Investigator: Dhoble, Abhijeet

Edwards PASCAL Transcatheter Valve Replacement System Pivotal Clinical Trial - CLASP II TR

This study is evaluating the Edwards PASCAL System to repair the tricuspid valve and see if this is a safe and effective treatment for patients with severe or greater tricuspid regurgitation. The study will compare this group of patients to a group of patients who receive optimal medical therapy alone.

NCT04097145, Principal Investigators: Dhoble, Abhijeet; Kar, Biswajit

ACURATE IDE Study: Safety and Efficacy of the ACURATE Valve for Transcatheter Aortic Valve Replacement

This study is looking at a new heart valve, the ACURATE IDE valve, used during a TAVR procedure, compared to other FDA approved TAVR valves.

NCT03735667, Principal Investigator: Dhoble, Abhijeet

Amplatzer™ PFO Occluder and Amplatzer™ Talisman™ PFO Occluder Post-Approval Study “PFO PAS”

The purpose of this research study is to collect additional information on the safety and effectiveness of the commercially approved Amplatzer™ Talisman™

PFO Occluder device. This study is enrolling patients who have had a stroke from an unknown cause and also have a patent foramen ovale (PFO).

NCT03309332, Principal Investigator: Smalling, Richard

ENCIRCLE: The ENCIRCLE Trial

Study to establish the safety and effectiveness of the SAPIEN M3 System in subjects with symptomatic, at least 3+ mitral regurgitation for whom commercially available surgical or transcatheter treatment options are deemed unsuitable.

NCT04153292, Principal Investigator: Kar, Biswajit

SUMMIT: Clinical Trial to Evaluate the Safety and Effectiveness of Using the Tendyne Mitral Valve System for the Treatment of Symptomatic Mitral Regurgitation

A prospective, controlled, multicenter clinical investigation of the Tendyne™ Mitral Valve System for the treatment of eligible subjects with symptomatic, severe mitral regurgitation.

NCT03433274, Principal Investigator: Basra, Sukhdeep

APOLLO: Transcatheter Mitral Valve Replacement With the Medtronic Intrepid Transcatheter Mitral Valve Replacement (TMVR) System in Patients With Severe Symptomatic Mitral Regurgitation

Study to evaluate the Intrepid™ TMVR System.

NCT03242642, Principal Investigator: Smalling, Richard

PROGRESS: Management of Moderate Aortic Stenosis by Clinical Surveillance or TAVR

Study to establish the safety and effectiveness of the Edwards SAPIEN 3/SAPIEN 3 Ultra transcatheter heart valve in subjects with moderate, calcific aortic stenosis.

NCT04889872, Principal Investigator: Kar, Biswajit

CLASP IID/IIF: Edwards PASCAL CLASP IID/IIF Pivotal Clinical Trial

Study to establish the safety and effectiveness of the Edwards PASCAL transcatheter valve repair system in patients with degenerative mitral regurgitation who have been determined to be at prohibitive risk for mitral valve surgery by the heart team, and in patients with functional mitral regurgitation on guideline directed medical therapy (GDMT).

NCT03706833, Principal Investigator: Dhoble, Abhijeet

REPAIR MR: MitraClip REPAIR MR Study

Randomized controlled trial (RCT) to compare the clinical outcome of MitraClip™ device versus surgical repair in patients with severe primary MR who are at moderate surgical risk and whose mitral valve

has been determined to be suitable for correction by MV repair surgery by the cardiac surgeon on the local site heart team.

NCT04198870, Principal Investigator: Smalling, Richard

ELECTROPHYSIOLOGY

Leadless II IDE Study (Phase II): A Safety and Effectiveness Trial for a Leadless Pacemaker System

This study will evaluate the safety and effectiveness of the Leadless Pacemaker system, which does not have pacemaker leads. Patients will have the leadless pacemaker system implanted into their heart to help with the abnormal heart rhythm.

NCT04559945, Principal Investigator: Hariharan, Ramesh

FLExAbility Sensor Enabled Substrate Targeted Ablation for the Reduction of VT Study (LESS-VT Trial)

This study will evaluate the FlexAbility™ Sensor Enabled (SE) Ablation Catheter System for patients who have had episodes of Ventricular Tachycardia.

NCT03490201, Principal Investigator: Hariharan, Ramesh

Amplatzer™ Amulet™ LAAO vs. NOAC (Catalyst Trial)

This study is evaluating the safety and effectiveness of the Amplatzer™ Amulet™ Left Atrial Appendage Occluder (Amulet Device) compared to non-vitamin K antagonist oral anticoagulants (NOACs) for stroke risk reduction. This study will see if the Amulet device compares to NOAC therapy in preventing stroke.

NCT04226547, Principal Investigator: Dhoble, Abhijeet

Cardiac Resynchronization Therapy in Previously Untreatable and High Risk Upgrade Patients (SOLVE-CRT Trial)

This study will test a new way to pace the left side of the heart without using pacing leads, using the WISE CRT System. The study will evaluate the safety and effectiveness of this system.

NCT02922036, Principal Investigator: Sharma, Saumya

TactiFlex AFIDE: Safety and Effectiveness of TactiFlex Ablation Catheter, Sensor Enabled (TactiFlex SE) for the Treatment of Drug Refractory, Symptomatic, Paroxysmal Atrial Fibrillation

Clinical investigation intended to demonstrate the safety and effectiveness of the TactiFlex™ Ablation Catheter, Sensor Enabled™ (TactiFlex SE) for treating drug-refractory, symptomatic paroxysmal atrial fibrillation. Sponsor: Abbott Medical Devices.

NCT04356040, Principal Investigator: Hariharan, Ramesh

CARDIOVASCULAR IMAGING

Century Trial, a Randomized Lifestyle Modification Study for Management of Stable Coronary Artery Disease

Single center Phase III randomized study to test the hypothesis that a combined image-treatment regimen of PET plus a comprehensive program of lifestyle modification and lipid-lowering drugs will result in an improved cardiovascular risk score when compared to current standard optimal medical therapy, potentially resulting in a lower rate of death, non-fatal myocardial infarction (MI) and revascularization procedures during long term follow-up when compared with the current standard of care. The recently completed primary five-year follow-up is to be presented in 2023. The ongoing 10-year follow-up continues.

NCT00756379, Principal Investigator: Gould, K Lance

Coronary Blood Flow PET Study

Volunteers with risk factors or patients denied by their insurance companies can receive two research PET scans within a short period to provide clinical answers while improving our imaging protocols, validating our new scanners, and understanding test repeatability. Patients who undergo PCI or CABG can return for a second scan to understand the improvement after the procedure and establish a new baseline for future comparisons.

Principal Investigator: Gould, K Lance

CARDIOVASCULAR GENETICS

MAC:H-TAD: Montalcino Aortic Consortium: Precision Medicine for Heritable Thoracic Aortic Disease

The Montalcino Aortic Consortium (MAC) will provide the infrastructure to assemble large cohorts of patients with Heritable Thoracic Aortic Disease (H-TAD) with and without mutations in known H-TAD genes, define the phenotype associated with these genes, determine genetic and environmental modifiers of H-TAD, as well as rapidly and efficiently identify novel genes.

NCT04005976, Principal Investigator: Milewicz, Dianna

SCIENTIFIC JOURNAL PUBLICATIONS

For a list of current scientific journal publications by affiliated academic physician partners, please visit:

med.uth.edu/cvs/research

med.uth.edu/cahf/education/research

med.uth.edu/internalmedicine/cardiovascular-medicine/research



Awards and Accolades



Memorial Hermann Memorial City Medical Center and Memorial Hermann The Woodlands Medical Center have been recognized for achieving meritorious outcomes for surgical patient care by the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP®). The recognition program commends a select group of hospitals deemed meritorious for outstanding composite quality scores in eight surgical care outcome areas, calculated from risk-adjusted data from the July 2022 ACS NSQIP Semiannual Report, which presents data from the 2021 calendar year.



Memorial Hermann-TMC was awarded by Healthgrades with America's 100 Best Hospitals for Coronary Intervention™ and ranked No. 2 in Texas for coronary intervention in 2022.

Memorial Hermann Memorial City was honored with the Healthgrades Cardiac Surgery Excellence Award™ for its superior clinical outcomes in heart bypass surgery and heart valve surgery. It was also recognized as No. 3 in Texas for cardiac surgery in 2022.



Memorial Hermann has earned the CardioSmart Cath PCI 4-Star ranking for five sites reporting to National Cardiovascular Data Registry (NCDR) PCI registry.

Affiliated interventional cardiologist with UTHealth Houston Heart & Vascular, H. Vernon "Skip" Anderson, MD, FACC, serves as an integral resource for the American College of Cardiology's NCDR data analytics efforts.



Memorial Hermann-TMC has earned Chest Pain Center Accreditation with Primary PCI by the American College of Cardiology (ACC).



Memorial Hermann Memorial City is recognized by Boston Scientific as a top enroller in the CHAMPION – Atrial Fibrillation Trial, ranking No. 5 globally.



The Society of Thoracic Surgeons



Affiliated cardiovascular surgeon Anthony Estrera, MD, FACS was appointed to the Board of Directors of the Society of Thoracic Surgeons (STS) for 2022-2025.



Memorial Hermann Greater Heights Hospital has been named a Center of Excellence in Vascular and Endovascular Surgery (COEVES) by the Surgical Review Corporation. A community-based hospital, Memorial Hermann Greater Heights cares for a high volume of patients who undergo vascular surgery or endovascular procedures with low rates of mortality, morbidity and repeat cases. The hospital is equipped with an OR dedicated to cardiovascular surgery and a hybrid room in which EVARs, TAVRs and TCARs are performed regularly.



Affiliated vascular surgeons, Sheila Coogan, MD, and Rana Afifi, MD, serve as the medical director and associate medical director, respectively, for the Society for Vascular Surgery® Vascular Quality Initiative® (SVS VQI). Comprised of vascular surgeons, cardiologists, radiologists and other specialists nationwide who perform vascular procedures collected in the VQI Registries, participants meet biannually to discuss initiatives for improving quality of vascular care and connecting the next generation of vascular professionals with the tools and data needed to enhance clinical quality and patient outcomes.

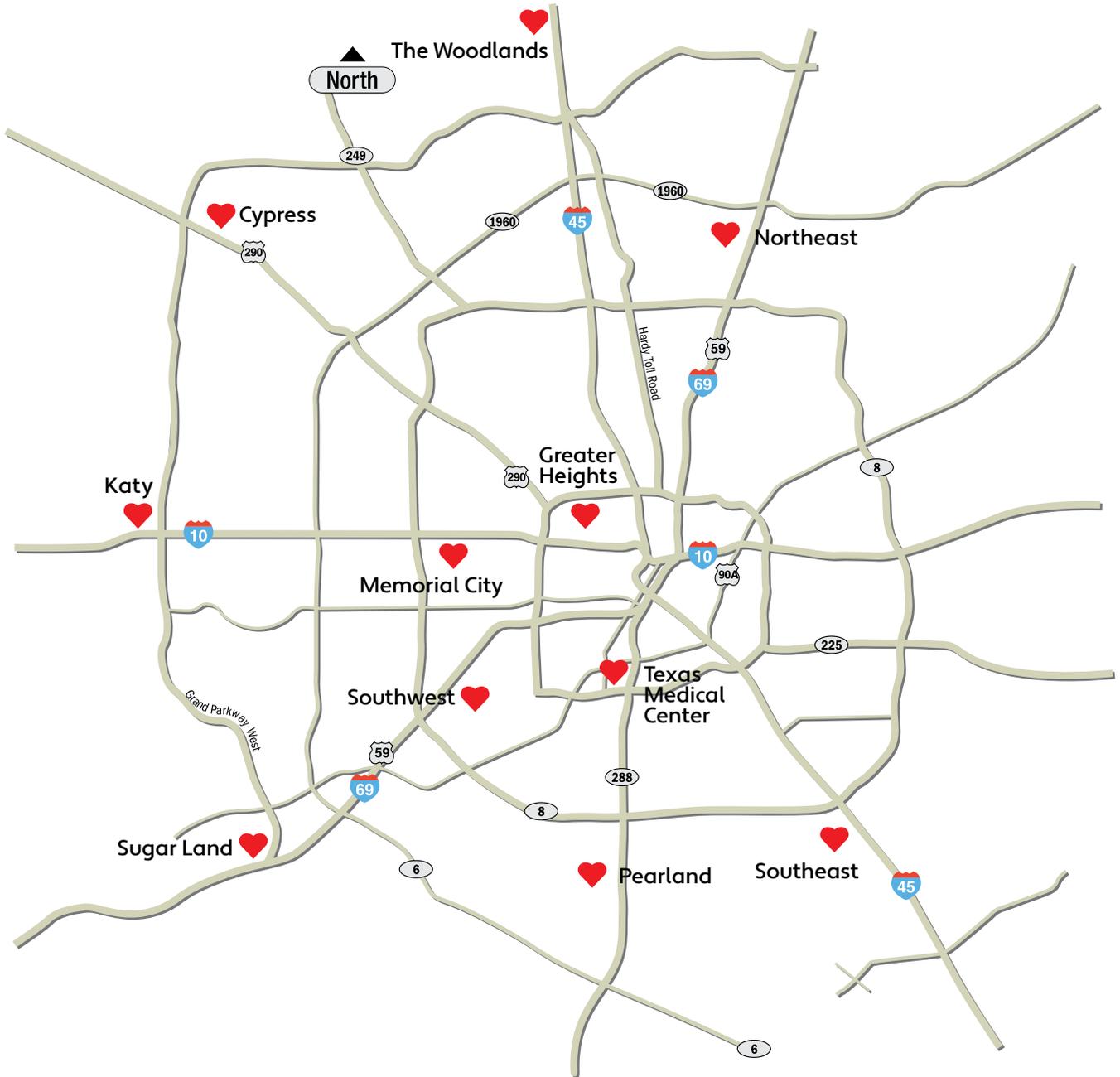


All Memorial Hermann acute care hospitals are STEMI-receiving facilities, and Chest Pain certified by the Joint Commission.



The Center for Advanced Heart Failure was designated as a Platinum Level Center of Excellence for Life Support (ECMO) September 2020 – 2023.

HEART PROGRAM LOCATIONS



For more information, please visit memorialhermann.org/heart
or email HeartandVascular@memorialhermann.org



Watch the ABOUT US video:

<https://memorialhermann.org/services/specialties/heart-and-vascular/about>

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