



SANGER

HEART & VASCULAR
INSTITUTE

2018 Outcomes and Innovation



Atrium Health
Sanger Heart & Vascular Institute

The choice for advanced cardiovascular care

For more than 50 years, Sanger Heart & Vascular Institute has delivered world-class care across a broad range of heart and vascular conditions.

Today, that commitment to patients and the breakthroughs that help them live longer continues to thrive. In this report, explore our broad range of specialties and see how our outcomes and clinical innovators place us among the nation's leaders.

Need to refer a patient? We offer lifesaving care at Carolinas Medical Center, part of Atrium Health, in Charlotte, NC, and at more than 25 other locations in North and South Carolina. We work together closely with referring physicians throughout the treatment process until we can transition each patient back for ongoing care. **Call 877-999-7484.**

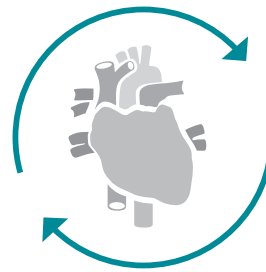
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ONE NETWORK CONNECTED BY EXCELLENCE

When it comes to comprehensive cardiac care, Sanger Heart & Vascular Institute offers the broadest range of treatments possible. From minimally invasive surgery to the latest in interventional cardiology, we care for the most complex cases – with the quality and compassion you expect from a pioneer.

TOP IN HEART TRANSPLANT Three-year survival rate



96.15%
Carolinas
Medical Center
85.22%
Nationally

Adult only, unadjusted
Scientific Registry of Transplant Recipients, published Jan. 2019

MORE EXPERIENCE IN MORE PLACES



100+
physicians



75+
advanced care
practitioners



25+
locations in
the Carolinas

265,000
total visits

Adult ambulatory patient visits for 2018

TAVR

289

procedures
2018

0.4%

in-hospital
mortality rate
(unadjusted)

Rolling 4-quarter data
ending Q3 2018*

*STS/ACC TVT Registry™ 2018 Q3 Report, March 2019

PUTTING PATIENTS AND FAMILIES FIRST

93rd
PERCENTILE

inpatient HCAHPS overall rating

Press Ganey National Database, 2018

ISOLATED CABG

0.7%

30-day mortality rate
(unadjusted)

Rolling-year data ending Dec. 2018

Internal dashboard using Society of Thoracic
Surgeons Registry Data, Feb. 2019

ACUTE CORONARY SYNDROME

Speed and coordination are the hallmarks of exceptional acute cardiac care.

That's why Sanger's STEMI program is proud to be a national leader in treatment response times for patients who present with myocardial infarction symptoms. Thousands of patients with coronary artery disease are treated by our expert interventional cardiologists each year using the latest percutaneous coronary interventions (PCIs).

Our door-to-balloon times for patients presenting to PCI centers are consistently nine minutes faster than the national median.

Plus, our nine J. Lee Garvey, Jr. chest pain centers help make up the region's largest chest pain network, which offers cardiac catheterization around the clock at three of our facilities.

In addition, our care teams provide a supportive navigator program for our patients and families, helping them coordinate resources and the transition to post-acute care.



PERFORMANCE AT THE MOST CRITICAL MOMENTS

DOOR-TO-BALLOON TIMES

51 minutes
D2B

Registry benchmarks

50th percentile: 60 minutes
75th percentile: 54 minutes

*NCDR CathPCI Registry®, 2018 Q3 (Oct. 2017–Sept. 2018)
Median time to immediate PCI for non-transfer STEMI patients*



97.4%

patients \leq 90 minutes

Registry benchmarks

50th percentile: 94.67%
75th percentile: 98.16%

Combined facilities (Carolinas Medical Center,
Carolinas HealthCare System NorthEast,
Atrium Health Pineville)

*NCDR CathPCI Registry®,
2018 Q3 (Oct. 2017–Sept. 2018)*

PCI OUTCOMES AND VOLUMES

1.48

in-hospital mortality rate
(risk-adjusted)

Registry benchmarks

50th percentile: 2.07
75th percentile: 1.53

*NCDR CathPCI Registry®, 2018 Q1
Apr. 2017–March 2018), Aug. 2018*

2,744

PCI procedures

2,127

patients with
radial access

Mortality rate for internal volume-weighted average of all PCI patients for Carolinas Medical Center, Carolinas HealthCare System NorthEast, Atrium Health Pineville and Atrium Health Union

NCDR CathPCI Registry®, 2018 Q3 (Oct. 2017–Sept. 2018)

AREAS OF SPECIALTY

- Percutaneous coronary intervention
 - Acute ST elevation myocardial infarction (STEMI)
 - Acute coronary syndromes, including unstable angina and non-ST elevation myocardial infarction (NSTEMI)
 - Stable angina
- Chronic total occlusion

CARDIAC ELECTROPHYSIOLOGY

With one of the largest networks in the country, the Advanced Heart Rhythm Program at Sanger offers world-class arrhythmia care close to home.

Our dedicated Center for Atrial Fibrillation offers a vertically integrated and comprehensive approach to the treatment of atrial fibrillation. We provide traditional treatment and an array of ablation procedures including radiofrequency, cryoablation and hybrid ablation (a minimally invasive surgical approach combined with catheter-based ablation).

We have more than 1,380 patients in our atrial fibrillation ablation registry since January 2013. In addition, we implant left atrial appendage occlusion devices in patients unable to take oral anticoagulants. We focus on limiting radiation exposure with our low-fluoro or fluoroless techniques incorporating advanced three-dimensional mapping technologies.

Our multidisciplinary team includes cardiac electrophysiologists, cardiac electrophysiology specialists, advanced care providers, cardiothoracic surgeons, imaging cardiologists, cardiac anesthesiologists, sleep medicine specialists and anti-coagulation specialists. Our team works seamlessly to achieve superior outcomes.

Our complex cardiac device program includes the use of leadless pacing and the largest volume His-bundle pacing program in the Carolinas. With a focus on safety, our cardiac device infection rate is one of the best in the country at 0.3 percent. Our electrophysiologists and cardiac surgeons collaborate as national leaders in the field of lead management, using laser, mechanical and femoral-snare techniques to enable patients to safely undergo lead extraction. We have served more than 370 patients and safely removed 651 leads with a zero percent in-lab mortality rate since 2013.

Our expertise in device-based heart failure diagnostics and device-based follow-up care has helped make Sanger a training facility for practitioner teams from across the globe who consult with our Cardiac Rhythm Device Management Center of Excellence on an ongoing basis. Using a population health-based approach, we follow just under 11,000 patients using remote monitoring capabilities.

CLINICAL EXCELLENCE BY THE NUMBERS

713

ICD procedures

April 2017–March 2018

*NCDR-ICD Q1 2018
Outcomes Report, Feb. 2019*

83

**ablations for
ventricular arrhythmia**

June 2017–May 2018

Internal data, Feb. 2019

80

**lead extraction
procedures**

April 2017–March 2018

Internal data, Feb. 2019



Internal data, Feb. 2019

DEVICE MANAGEMENT ENCOUNTERS

42,137

total encounters

Jan.–Dec. 2018

55%

remote encounters

Jan.–Dec. 2018

For all cardiovascular electronic implantable devices (CEIDs): pacemakers, implantable cardioverter-defibrillators (ICDs), implantable/insertable loop recorders (ILRs) and cardiac resynchronization therapy devices (CRTs).

SHVI PaceArt Optima Database, Feb. 2019

AREAS OF SPECIALTY

- Ablation
 - Atrial fibrillation
 - Atrial flutter
 - Supraventricular tachycardia
 - Ventricular tachycardia
 - Wolff-Parkinson-White syndrome
- Complex lead and device extraction
- Devices
 - Cardiac pacemakers
 - Implantable cardiac defibrillators (ICDs)
 - Cardiac resynchronization therapy (CRT-P, CRT-D)
 - Subcutaneous ICDs (SICDs)
 - Left atrial appendage occlusion devices
 - Leadless pacing and His-bundle pacing

HEART FAILURE & TRANSPLANT

Sanger is proud to count itself among the national leaders in advanced heart failure care.

While our goal is to diagnose and treat heart failure early to prevent progression, if transplantation is needed, our team of specialists offers the broadest range of advanced therapies and mechanical circulatory support available to help patients achieve best-in-class outcomes.

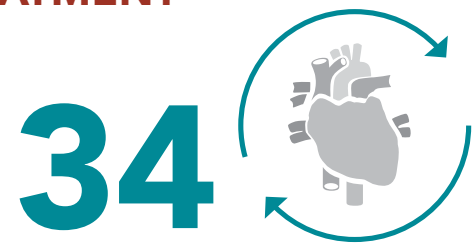
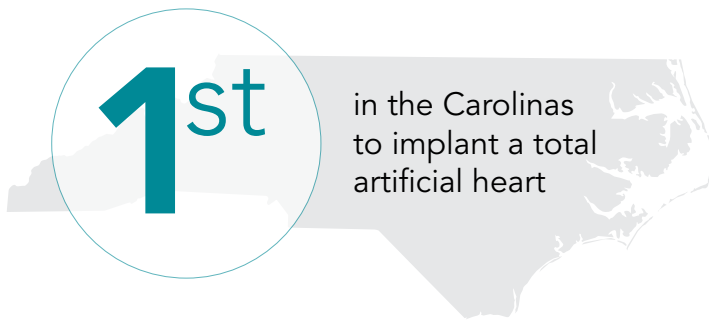
As evidence of our continued commitment to innovation, Sanger's award-winning Heart Success program has been designed to

treat even the most complex cases. Led by multidisciplinary teams of physicians, geneticists, dietitians, pharmacists, patient navigators, social workers, specially trained nurses and advanced care practitioners, we're highly experienced in managing high-risk patients. We also offer a virtual component of the Heart Success program that makes advanced care available to patients who live far from our facilities.

AREAS OF SPECIALTY

- Heart transplant
- Advanced heart failure
- Pulmonary hypertension – only facility in region to provide specialized care
- Hypertrophic cardiomyopathy – one of a few dedicated clinics nationwide
- Septal myectomy
- Ventricular assist device (VAD)
- Total artificial heart implant
- Cardio-oncology

LEADING THE WAY IN HEART FAILURE TREATMENT

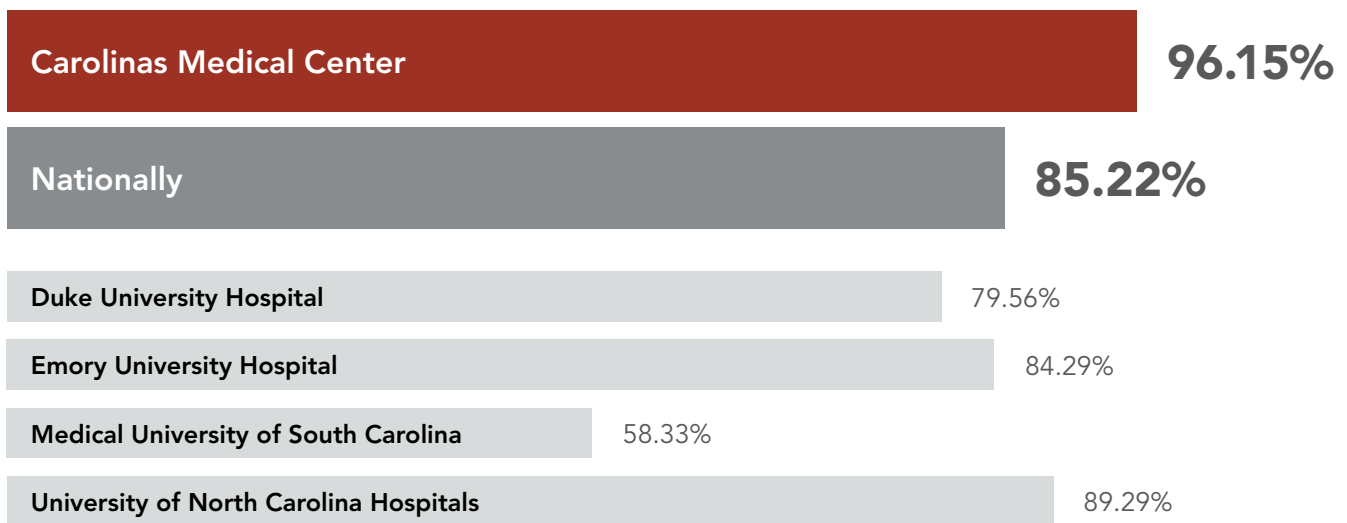


heart transplants

2018 (annualized)

TransChart, Feb. 2019

THREE-YEAR PATIENT SURVIVAL



Unadjusted data for adult transplants from July 2017–Dec. 2017
Scientific Registry of Transplant Recipients, published Jan. 2019

VAD IMPLANTS

37

implants

2018

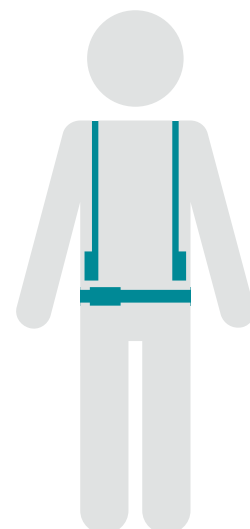
TransChart, Feb. 2019

363

total implants since inception of the program

June 2006–Dec. 2018

Intermacs, Feb. 2019



CARDIAC SURGERY

One team. A unified network of hospitals.
The full spectrum of the latest surgical treatments.

Our expertise in cardiothoracic surgery is built upon extensive capabilities and trailblazing pioneers, like Joseph T. McGinn, MD, who developed the pre-eminent technique in minimally invasive coronary artery bypass grafting (CABG). Our 30-day readmission and mortality rates for isolated CABG are consistently lower than the national benchmark.

While quaternary-level-care patients are treated at Carolinas Medical Center, tertiary-level care is offered at Atrium Health Pineville and Carolinas HealthCare System NorthEast.



EXPERIENCE WHERE IT COUNTS

1,086

cardiac surgeries

Dec. 2017–Dec. 2018

Internal dashboard using Society of Thoracic Surgeons Registry Data, Feb. 2019



656

total CABG procedures

**+ 552 isolated CABG
104 combined CABG**

Dec. 2017–Dec. 2018

Internal dashboard using Society of Thoracic Surgeons Registry Data, Feb. 2019

ISOLATED CABG QUALITY METRICS

(Rolling-year data ending Dec. 2018)

8.5%

**30-day observed
readmission rate**

**STS benchmark
10.2%**

0.8%

**30-day operative
mortality rate**

(risk-adjusted)

**STS benchmark
2.4%**

*Carolinas Medical Center, Carolinas HealthCare System NorthEast, Atrium Health Pineville
Internal dashboard using Society of Thoracic Surgeons Registry Data, Feb. 2019*

AREAS OF SPECIALTY

- Minimally invasive mitral valve repair
- Complex thoracic aortic surgery
- Minimally invasive coronary bypass surgery
- Heart transplant and mechanical support

VALVE & STRUCTURAL HEART DISEASE

Sanger's Center for Advanced Heart Valve Therapies has grown into one of the country's most experienced leaders in treating complex structural heart and valve conditions.

Our high-volume program provides patients with a different level of expert care, built on thousands of surgical and catheter-based interventions:

- As one of the first regional providers of transcatheter aortic valve replacement (TAVR) outside of clinical trials, we are committed to advancing this less invasive technology.
- We are the most experienced mitral program in the Carolinas, having performed hundreds of transcatheter mitral valve repairs since its FDA approval in 2013. We are one of the only centers in the Southeast to perform balloon mitral valvuloplasty for mitral stenosis.
- Sanger performs the highest number of transcatheter closures of patent foramen ovale and paravalvular leak in the Carolinas.

- In 2018, we implanted more WATCHMAN devices for left atrial appendage closure than any other center in the Carolinas. We were also the first program in the Southeast to implant this technology and continue to pioneer the use of cardiac CT for procedural planning.

From offering a multidisciplinary surgical valve program to serving as a national teaching site for treatment efficiencies, we are focused on a patient-centered approach to each disease process to achieve excellent outcomes. Our survival rates for TAVR and mitral valve repair beat the national average, and we often perform in the top decile in published outcomes for the STS/ACC TVT Registry™.

AREAS OF SPECIALTY

- Valve surgery, including open heart and minimally invasive, to repair or replace the mitral, aortic, tricuspid or pulmonary valve
- Transcatheter aortic valve replacement (TAVR)
- Transcatheter mitral valve repair
- Transcatheter closure of paravalvular leaks
- Transcatheter closure of the left atrial appendage

MAKING THE MOST OF TRANSCATHETER INNOVATIONS

TAVR

873
procedures

since inception
of program in 2012

289
procedures

2018

0.4%
in-hospital
mortality rate
(unadjusted)

Rolling 4-quarter data
ending Q3 2018

*STS/ACC TVT Registry™
2018 Q3 Report, published in March 2019*

ISOLATED AORTIC VALVE REPLACEMENT (AVR)

1.0%
3-year
mortality rate
(risk-adjusted)

Benchmark*: 1.9%

*Internal dashboard using Society
of Thoracic Surgeons Registry Data
Jan. 2016–Dec. 2018, April 2019*

Mitral Valve

59
mitral leaflet
clip procedures

0.0%
30-day observed
mortality rate
(unadjusted)

Rolling 4-quarter data
ending Q3 2018

*STS/ACC TVT Registry™
2018 Q3 Report, published in March 2019*

ISOLATED MITRAL VALVE REPAIR

0.0%
3-year
mortality rate
(risk-adjusted)

Benchmark*: 1.0%

*Internal dashboard using Society
of Thoracic Surgeons Registry Data
Jan. 2016–Dec. 2018, April 2019*

**All STS benchmark data come from Data Analysis
reports of the Society of Thoracic Surgeons
Registry published in Feb. 2019.*

Left Atrial Appendage Occlusion (LAAO)

67
procedures

0.0%
complication
rate

Jan.–Dec. 2018

*NCDR-2018 Q4 LAAO
Outcomes Report, Feb. 2019*



367

valve surgeries
Dec. 2017–Dec. 2018

Cedaron Report, Feb. 2019

AORTIC DISEASE

With some of the most skilled teams in the world, our Center for Aortic Disease rivals any other major program in performing high-quality, complex aortic surgeries.

Led by John R. Frederick, MD, and Frank R. Arko III, MD, our aortic team is highly experienced in traditional open procedures and minimally invasive endovascular repair techniques to address transections, dissections, aneurysms and penetrating aortic ulcers.

Our program is an international resource for referring physicians looking for the most innovative treatments for their patients. Under Dr. Arko, we became the first in the world to implant a branched stent graft specifically designed for branch vessel repair of a thoracic aortic aneurysm. Since that time, we've built a group of world-class specialists at the forefront of several new aortic techniques. For example:

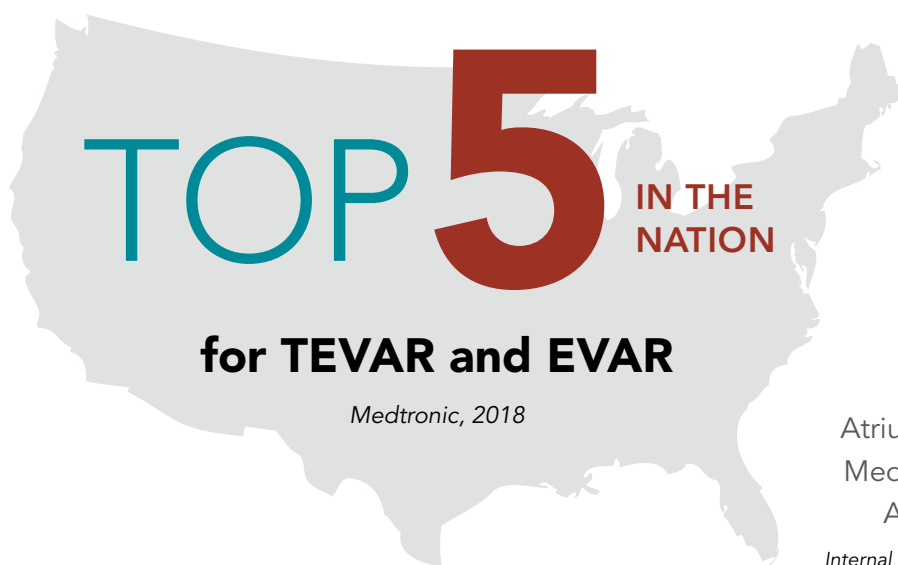
- Dr. Arko became the first surgeon in the Southeast to implant a new novel thoracic stent graft
- We're one of two centers in the US with access to two arch branched stent grafts for minimally invasive treatments.
- We were second in the world to implant a new type of thoracic stent graft after FDA approval – and first to use it for an acute aortic dissection.
- We were the first to champion endovascular suture aneurysm repair, particularly for short neck indications.

We also have deep expertise in some of the most complex open surgeries, including aortic root replacement and ascending aortic replacement. For aortic arch reconstruction, we have significant experience in complicated circulation management. We also offer aortic valve repair, which can be a better, more durable option for patients under 60. Sanger's aortic repair patients have a less than 1 percent risk of mortality, stroke, renal failure or postoperative moderate to severe aortic insufficiency.

Our program continues to push treatment boundaries. We are the only program in the region that participated in the Mona LSA clinical trial, and we continue to help lead research for the Gore and VALIANT trials.

For patients with a ruptured abdominal aortic aneurysm or an aortic dissection, we've developed rapid-response Code Rupture and Code Dissection programs to quickly assess patients while simultaneously coordinating our medical teams to be on standby in our hybrid operating room. It's one more way we set ourselves apart in saving lives.

EXPERTISE THAT GOES ABOVE AND BEYOND



430

TEVAR procedures

494

EVAR procedures

Atrium Health Mercy, a facility of Carolinas Medical Center; Atrium Health Cleveland; Atrium Health Pineville (2015–2018)

Internal billing data for Oct. 2015–Aug. 2018, reported Feb. 2019



**All STS benchmark data come from Data Analysis reports of the Society of Thoracic Surgeons Registry published in Feb. 2019.*

ELECTIVE EVAR

0.0%

**in-hospital
mortality rate**

July 2017–July 2018

*Internal report M2S/ENDOAAA,
March 2019*

AREAS OF SPECIALTY

- Aortic dissection repair
- Aortic root aneurysm repair
- Thoracic endovascular aortic repair (TEVAR/EVAR)
- Abdominal aortic aneurysm repair
- Thoracoabdominal aortic aneurysm repair
- Complex aortic arch reconstruction
- Code Rupture
- Code Dissection

VASCULAR DISEASE

Our growing vascular program – including internationally recognized venous disease experts – provides complete vascular care across the continuum.

Sanger performs more than 2,600 vascular procedures annually, making us one of the highest-volume programs in the region – and we continue to add more physicians across Atrium Health to bring world-class care closer to our patients. Specializing in vascular imaging, vascular medicine and vascular surgery, our collaborative team develops the best treatment plan for each patient.

Our Venous and Lymphatic Program has a dedicated staff of physicians and nurses – as well as an accredited lab and specialized ultrasound capabilities – to manage the increasing population of venous diseases, from deep vein thrombosis to superficial varicose veins. We were the nation's second-leading enroller in the ABRE venous study and the first in the world to implant the self-expanding stent for deep venous disease.

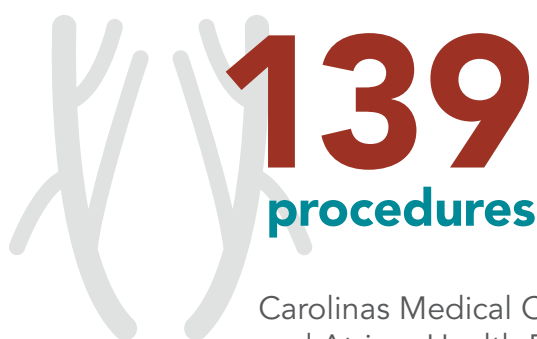
We offer comprehensive care of carotid artery disease, including medical management, carotid endarterectomy and carotid stenting. In addition, we are the only center in the Western Carolinas to offer transcatheter revascularization (TCAR) as part of the Roadster 2 Study and Vascular Quality Initiative®, and have been recognized as a center of excellence for TCAR. Atrium Health has been designated a comprehensive stroke center, and we are heavily involved in providing care as part of this center.

Limb Salvage Program

Our limb salvage program uses the latest techniques and technologies – including endovascular technology and revascularization solutions – to save limbs for patients with peripheral vascular problems or ischemia. Since we launched this program in 2012, we have saved 150 percent more limbs, often for patients who have been referred for amputation.

EXPERIENCED IN TREATING COMPLEXITY

CAROTID ENDARTERECTOMY



Carolinas Medical Center
and Atrium Health Pineville

0.6%

in-hospital mortality rate

0.0%

MI complication rate

2.2%

stroke complication rate

2018

Internal report M2S/CEA Module, March 2019

CRITICAL LIMB ISCHEMIA

143

procedures

July 2017–July 2018

Internal report M2S/PVI Module, March 2019

19,813

noninvasive vascular
lab ultrasound studies

2,620

OR and invasive
vascular lab procedures

2018

Internal data, March 2019

LOWER EXTREMITY PERCUTANEOUS INTERVENTIONS

244

procedures

July 2017–July 2018

Internal report M2S/PVI Module, March 2019

AREAS OF SPECIALTY

- Carotid endarterectomy (CEA)
- Complex venous
 - Iliac vein angioplasty and stent
 - Saphenous vein ablation
 - Phlebectomy
 - Sclerotherapy
- Endarterectomy
- Chronic critical limb ischemia
- Transcatheter closure of paravalvular leaks
- Transcatheter closure of the left atrial appendage
- Limb salvage

THORACIC SURGERY

Our thoracic surgery program brings state-of-the-art techniques – including robot-assisted surgery – to treat a broad spectrum of chest-related diseases.

With decades of thoracic surgery experience, our growing team is deeply committed to delivering the best in patient care. We work closely with the medical oncologists at Atrium Health's Levine Cancer Institute, along with a network of pulmonologists and radiation oncologists, to design treatment plans that employ the most effective and least invasive approaches available.

In addition to offering video-assisted thoracoscopic surgery (VATS) for lung cancer treatment, we're the most experienced provider of robot-assisted thoracic surgery in the greater Charlotte area.

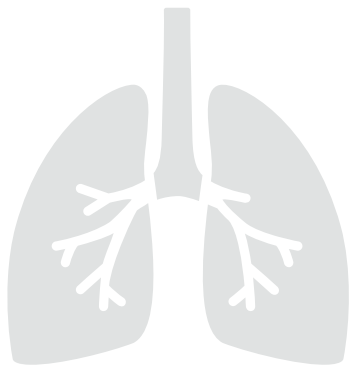
To help identify lung cancer patients early on, we offer one of the nation's largest cancer screening programs. Since implementing an EHR-based health maintenance alert system, we have screened 3,200 patients throughout Atrium Health.

We're also experienced in diagnosing and treating several other complex thoracic conditions. For example:

- We provide tertiary-level care for complex re-operative gastroesophageal reflux and esophageal disease.
- We are building a multidisciplinary program in pleural effusion – including pulmonary, thoracic surgery and interventional radiology – that can deliver new surgical and catheter-based drainage treatment options.
- We treat a broad range of thoracic tumors, including mediastinal and thymic.

To improve our patients' care and experience, we have implemented an ambitious enhanced recovery after surgery (ERAS) program for thoracic surgery patients to reduce length of stay and speed up recovery. To make it as easy as possible for patients to receive the care they need, we have streamlined our referral process with physicians using tools such as telemedicine and navigator programs.

WHERE QUALITY AND TECHNOLOGY MEET



312

major thoracic surgeries

Jan.–Dec. 2018

1.5%

PULMONARY LOBECTOMIES

30-day mortality rate
(unadjusted)

Benchmark: 1.2%

Jan.–Dec. 2018

Internal dashboard using Society of Thoracic Surgeons Registry Data, March 2019

3,200

LDCT lung cancer screening scans

Aug. 2017–Dec. 2018

Internal data, March 2019

ROBOT-ASSISTED SURGERY

1.1%

30-day mortality rate
(unadjusted)



1.1%

30-day readmission rate

Jan.–Dec. 2018

Internal dashboard using Society of Thoracic Surgeons Registry Data, March 2019

AREAS OF SPECIALTY

- Lung cancer
 - Robot-assisted surgery
 - VATS
- Esophageal cancer
- Pulmonary lobectomy
- Myasthenia gravis
- Barrett’s esophagus
- Thoracic tumors
 - Mediastinal
 - Chest wall
 - Endobronchial
 - Thymic
- Gastroesophageal reflux disease (GERD)
- Pleural effusion
- Tracheal stenosis

ADULT CONGENITAL HEART DISEASE

For the growing population of adults with congenital heart defects, Sanger offers one of the largest comprehensive adult congenital heart disease (ACHD) programs in the Southeast.

Each patient works with our ACHD experts to develop a comprehensive care plan that addresses medications, lifestyle modifications and potential surgical interventions, including imaging and cardiac catheterization of adults with congenital heart diseases as well as advanced procedures such as percutaneous pulmonary valve replacement.

Our team has completed hundreds of ACHD-related surgeries in just the past eight years. During that time, Sanger specialists have worked with referring physicians to plan surgical and interventional treatments across a patient's complete journey from evaluation to follow-up.

**GROWING
IN EXPERTISE**

1,107

**adult congenital heart
disease clinical visits**

Carolinas Medical Center, 2014–2018



121%

increase

from 2014–2018

Internal data, Feb. 2019

2.1% **adult congenital heart surgery
in-hospital mortality rate**

STS Congenital Database (July 2014–June 2018), March 2019

347 **adult congenital heart surgeries**

Cardio Access Database (2010–2018)

AREAS OF SPECIALTY

- Congenital heart surgery
 - Pulmonary valve replacement
 - Aortic valve and root repair / replacement
 - Tricuspid valve repair or replacement
 - Fontan revision
- Cardiac electrophysiology
- Interventional catheterization
 - Atrial and ventricular septal defect (ASD, VSD) closure
 - Patent foramen ovale (PFO) closure
- Percutaneous pulmonary and tricuspid valve replacement
- Aortic and pulmonary stenting
- Patent ductus arteriosus closure
- Coronary fistula occlusion

CARDIOVASCULAR IMAGING

Equipped with the latest technologies, our cardiac imaging specialists work hand in hand with providers across Sanger, all focused on advancing patient outcomes.

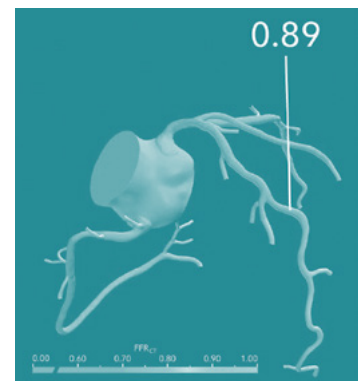
Our imaging specialists are in the operating room to evaluate the quality of a cardiac repair. They collaborate with heart failure specialists to assess left ventricular functioning or with oncologists to detect chemotherapy-related cardiac changes. For us, imaging is integral to comprehensive cardiac care.

We are one of the few heart centers in the region to offer fractional flow reserve CT (FFRCT) technology, a groundbreaking diagnostic test that enables clinicians to identify significant coronary artery disease without a diagnostic catheterization. This non-invasive technology greatly reduces unnecessary invasive testing, saving healthcare costs while improving the patient experience.

AT THE FOREFRONT OF TECHNOLOGY

305

**FFRCT
procedures**



1,266

cardiac MRI scans

3,728

cardiac CT scans

FY 2018, Encompass, Feb. 2019

AREAS OF SPECIALTY

- Transthoracic and transesophageal 3D imaging
- Cardiac computed tomography angiography (CTA)
- Cardiac magnetic resonance imaging (MRI)
- Myocardial perfusion imaging for viability and ischemia
- Cardio-oncology

INNOVATION, RESEARCH & CLINICAL TRIALS

At Sanger, innovation takes many forms, but they all have one central goal: to improve the treatment of cardiovascular disease.

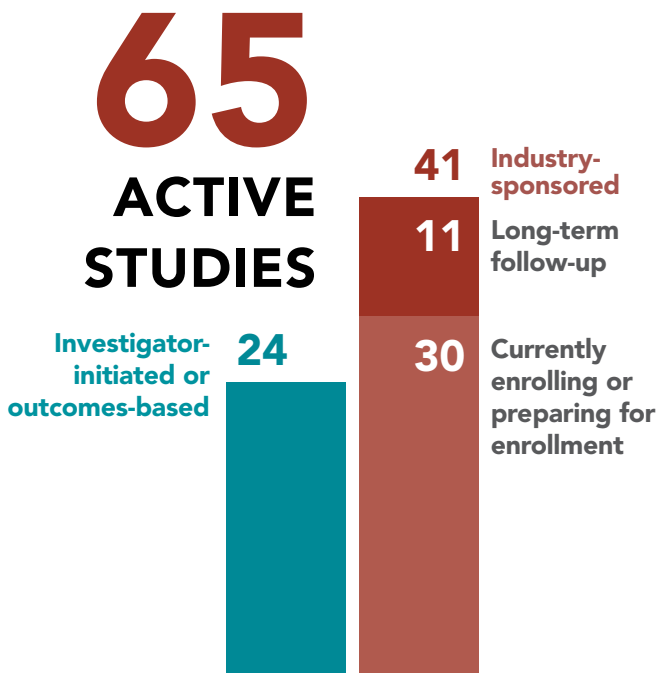
With leadership roles in top clinical trials across multiple disciplines, Sanger has broadened and deepened its research over the past decade. Many of our physicians take part in pioneering clinical studies, from the COAPT study that evaluated the first transcatheter mitral valve repair therapy device for heart failure patients with moderate to severe functional mitral regurgitation, to the PARTNER III trial that is assessing TAVR in low surgical risk populations. Our physicians also serve in leadership investigator roles for trials such as the Galactic-HF heart failure trial, the Gore TAG thoracic branch endoprosthesis device trial, the ASSURED Gore Cardioform

ASD occluder trial, the ABRE iliofemoral venous stents trial and the EARLY TAVR study, in which we enrolled the first patient in the world.

Innovation also comes in the shape of clinical protocols. In conjunction with the Department of Emergency Medicine and Pulmonary & Critical Care, Sanger helped create the Code Pulmonary Embolism (PE) program, which takes a multidisciplinary approach to the diagnosis and treatment of severe forms of PE. Co-created by Dan Troha, MD, and Glen Fandetti, MD, in 2014, the program is now active at 16 Atrium Health sites, has treated over 1,600 patients and serves as a national leader in PE care.



ACTIVE IN CLINICAL RESEARCH



750
enrolled research patients

Internal data, 2018

SELECTED TRIAL INVOLVEMENT

We've taken leadership roles in some of the major trials that may improve cardiovascular treatment worldwide.

- **ABRE** study utilizing iliofemoral venous stents
- **Accurate Neo** trial assessing a novel TAVR device
- **ADVANCE** registry for fractional flow reserve CT (FFRCT)
- **ASAP Too** study for WATCHMAN left atrial appendage closure
- **ASSURED** trial for atrial septal defects
- **COAPT** transcatheter mitral valve repair in secondary MR
- **EARLY TAVR** study comparing TAVR to clinical surveillance for severe aortic stenosis (now a continued access registry)
- **Galactic-HF** chronic heart failure trial
- **Gore TAG** for evaluation of thoracic branch endoprosthesis device
- **HeartMate 3** Left Ventricular Assist System (LVAS) and Continued Access study
- **MAVERICK** study to improve symptoms or activity level of patients with Non-obstructive Hypertrophic Cardiomyopathy (nHCM)
- **Mona LSA** early feasibility study for descending thoracic aneurysms
- **PARTNER III** study of TAVR in low surgical risk populations
- **PASCAL** trial assessing a novel percutaneous mitral valve repair technology
- **REDUCE** study for atrial septal defects (ASDs) closure (cardioform septal occluder)
- **SAPIEN 3** transcatheter heart valve study
- **SUMMIT** mitral valve replacement system for the treatment of symptomatic mitral regurgitation
- **Tendyne** study for transcatheter mitral valve replacement technology

VALUE-BASED CARE

The highest caliber of cardiac care, wherever patients receive it. That's how Sanger brings greater value to healthcare.

Our broad, integrated network in the Carolinas allows us to deliver coordinated care across geographies and disciplines in a way that emphasizes quality and efficiency.

Whether we're providing virtual follow-up to a heart failure patient in one city or cardiac rehabilitation in another, all of our subspecialties work with the same processes and goals, and our facilities operate at the highest quality standards, with providers who have participated in standardized training and educational efforts. That's how we've dramatically lowered retesting and readmission rates, increased our patient satisfaction ratings and held down the cost of care.

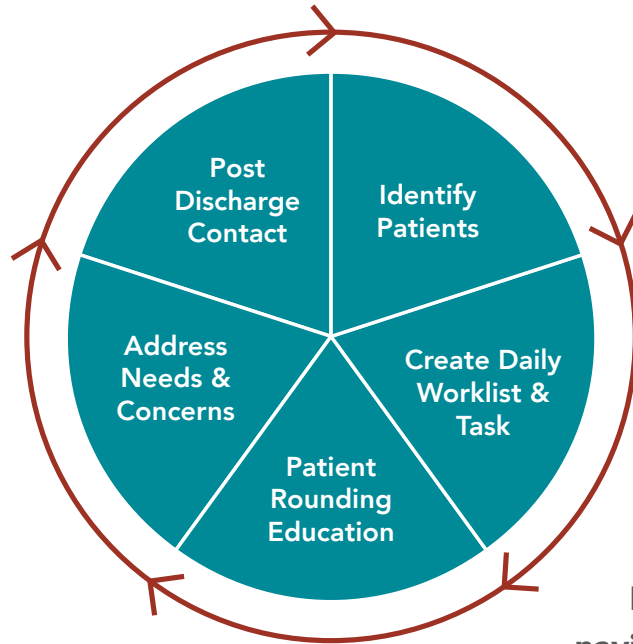
Our Heart Care Navigation Team supports patients and families, improving guideline-based care, the patient experience, clinical outcomes and continuity across the care continuum.

We've instituted care pathways – for example, in acute myocardial infarction (AMI), atrial fibrillation and chest pain – that help us reduce variability in treatment and achieve more reliable outcomes. Where external benchmarks do not exist for some procedures – for example, in device management – we've developed our own internal quality measures to track our outcomes.

Overall, by keeping equipment costs under control, establishing medication protocols and stressing evidence-based practice, we've made healthcare delivery more standardized, more efficient and even more in line with patients' diverse needs.

CREATING MORE VALUE IN HEALTHCARE

NAVIGATION TEAM OPTIMIZES HEART CARE



Nurse navigator workflow

5 CARDIAC REHABILITATION FACILITIES

89,000+

total visits

2018

Internal data, Feb. 2019



HEART SUCCESS

455

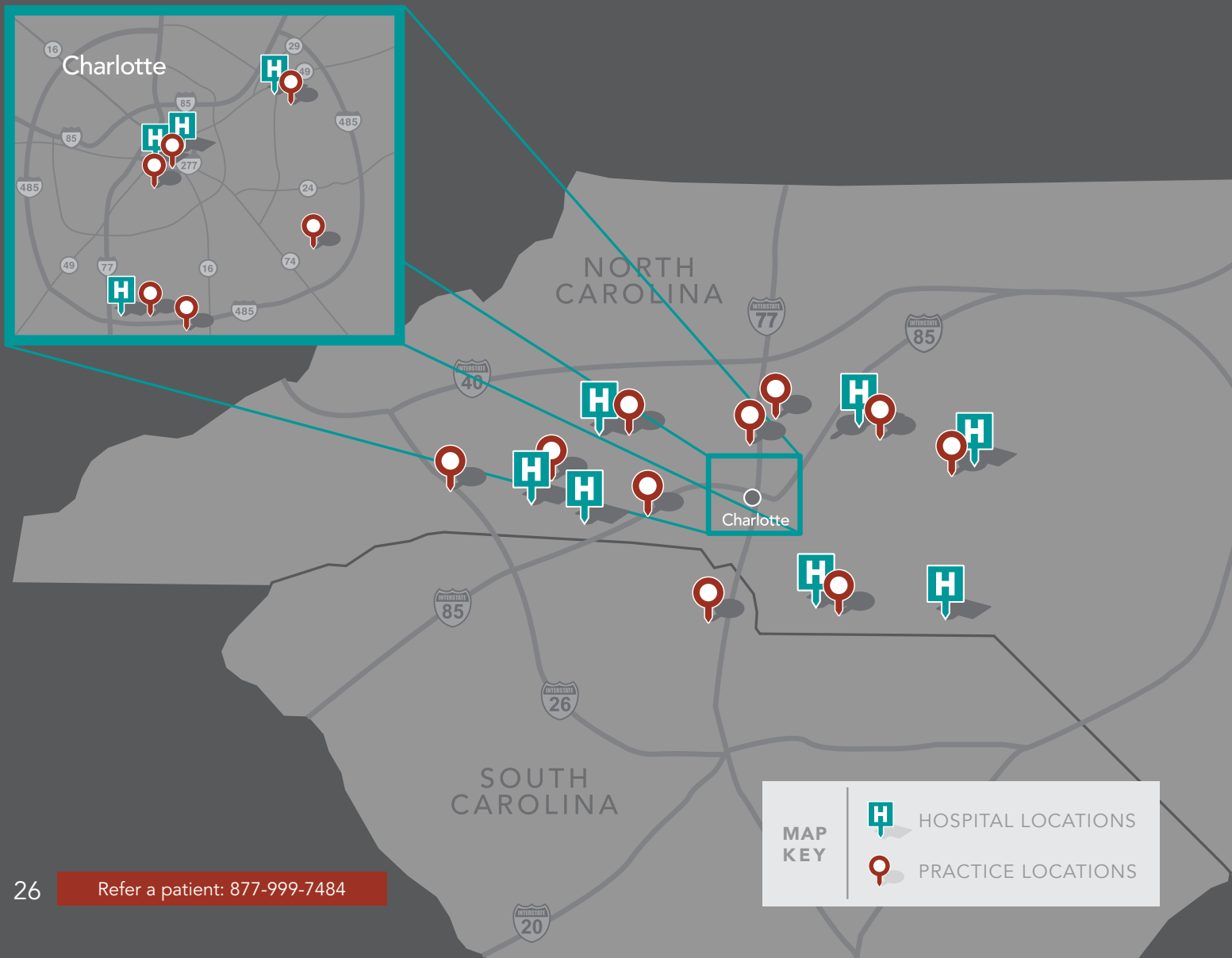
virtual visits

Internal data, Q1-Q4 2018

A NETWORK DESIGNED FOR BETTER CARE

Sanger Heart & Vascular Institute acts as one coordinated network, seamlessly delivering the specialty care your patients need.

At any one of our more than 25 locations across the Carolinas, patients receive more than just conveniently located expert care. They gain access to internationally recognized physicians, emerging technologies and lifesaving research that can't be found anywhere else in the region.





MAKE A REFERRAL

Collaboration and patient-centered care are at the heart of our provider referral process.

When you refer your patients to Sanger Heart & Vascular Institute, we'll work together closely until we can transition each patient back to you for ongoing care post-treatment. And no matter where you're located – in the Carolinas or beyond – we'll find the right specialist for your most complex cases.

Our Global Healthcare Services program makes it easy for patients coming from all over the world. We coordinate medical appointments, travel needs and any other arrangements so patients and their families can focus on their treatment.

To make a referral to any Sanger Heart & Vascular Institute location, contact a referral coordinator at

877-999-SHVI (7484)

Our representatives are available
24 hours a day, seven days a week.



Atrium Health
Sanger Heart & Vascular Institute

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