



Heart and Vascular

Affiliate Program Offerings



171 Ashley Avenue | Charleston, SC 29425 | MUSChealth.org

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ABOUT MUSC

The Medical University of South Carolina (MUSC) is dedicated to the pursuit of changing what's possible in health care. Nationally recognized for its innovation, patient- and family-centered care, and quality outcomes, this integrated health care system is accessible through a robust health system network, clinical affiliations and a nationally recognized telehealth network. MUSC experiences more than one million patient encounters annually, and its specialized care teams consistently rank among the best in the country. MUSC delivers transformational care shaped by world-class clinicians, health scientists, and educators who provide leading-edge care while developing the next generation of innovative health care leaders.

MUSC AT A GLANCE

- South Carolina's only comprehensive academic medical center
 - › Over 16,000 team members
 - › \$2.6 billion annual operating budget
- Oldest medical school in the South; founded in 1824
 - › Six colleges with 3,000 students in all areas of health professions. Colleges include Dental Medicine, Graduate Studies, Health Professions, Medicine, Nursing, and Pharmacy
- Member of the prestigious National Institutes of Health (NIH) Consortium, which includes only the 60 best biomedical research institutions in the U.S.
- South Carolina's most comprehensive clinical enterprise offerings:
 - › 1,428-bed health system and 100 outreach locations
 - › 1+ million patient encounters per year
 - › One of only two National Centers for Excellence in Telehealth in the United States
 - › Hollings Cancer Center, one of only 70-National Cancer Institute NCI-Designated Cancer Centers in the U.S.

- › South Carolina's only solid organ transplant program (kidney, liver, heart)
- › Extracorporeal Life Support Center
- › SC's only nationally ranked children's hospital; that will open two new facilities in 2019
- › MUSC surgeons perform nearly 10,000 pediatric surgeries annually
- › Only pediatric Level 1 trauma center in the state; 25,000 visits annually to the emergency room
- › South Carolina's only Pediatric Burn Center
- › Advanced pediatric heart center with a 99% survival rate for complex surgeries

MUSC HEALTH BY THE NUMBERS

50,745

Annual Surgical Cases

1,428

Combined number of patient beds

58,028

Annual Patient Admissions

Average Daily Census

209,085

Annual Emergency Room Visits

926

inpatients/day

1.6 Million

Annual Outpatient Visits

1,500+

Total Medical Staff

675+

Total Physicians in Training

MUSC'S AFFILIATIONS PROGRAM

To honor MUSC Health's mission of preserving and optimizing human life in South Carolina and beyond through education, research and patient care, the vision for the MUSC Affiliations Program states:

We extend MUSC Health's mission through the establishment of meaningful relationships locally, regionally and statewide.

KEY TENETS

At MUSC, we believe that the following tenets drive a successful affiliation:

- **Health care is best provided locally.** To ensure that this is possible, we will work with Affiliates to capitalize on their strengths and grow their clinical capabilities.
- For care that cannot be provided locally, we commit to timely patient access **and** timely, personal communication with referring physicians, supported by technology where appropriate.
- Physician-to-physician relationships are essential to any affiliate relationship. They will be prioritized through regular communication and collaboration.
- Affiliate relationships will be coordinated by a single resource—a relationship manager—and the Integrated Center of Clinical Excellence (ICCE) Chiefs, MUSC's physician service line leaders, will be accountable for the delivery of clinical services in their respective areas.
- Affiliation agreements will contain clearly defined and documented benefits and requirements to ensure that alignment and accountability are established on both ends.

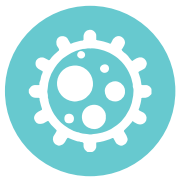
BENEFITS OF PARTNERING WITH MUSC

MUSC provides opportunities for health care organizations to better serve their local communities and keep care in South Carolina, including the following:

- Support in the continual enhancement of clinical care and supplemental services for the community
- Assurance of continuity of care for patients that require tertiary or quaternary services
- VIP/expedited access to hospitals, clinics and health care providers throughout the MUSC system
- Greater leverage for contract negotiation and purchasing agreements (participation in a group purchasing organization [GPO])
- Guidance to enhance growth and operations of the program(s)
- Utilization of cobranding to leverage the recognition and reputation of MUSC within the community
- Access to educational and graduate medical education (GME) opportunities
- Support with physician and provider recruitment
- Support for population health initiatives, including clinically integrated networks (CINs), accountable care organizations (ACOs), etc.
- Physician-to-physician relationships
- Access to electronic health record resources, including MUSC's Epic CareLink platform

MUSC HEALTH AFFILIATE PROGRAM OFFERINGS

Based upon extensive market research and years of conversations with current and prospective affiliate partners, we have refined and tailored specific program offerings. These clinical offerings include the following areas:



Cancer



Heart &
Vascular



Pediatrics



Neurosciences



Hospital based



Telehealth



GME

AFFILIATE PARTNER MODEL

Affiliate partners invariably have unique combinations of strengths, capabilities and resources. Our goal is to design a program with our partners that capitalizes on strengths and utilizes resources in the community to deliver the highest value in a community heart and vascular program. To this end, MUSC has developed two different partnership models to support the various needs of our Affiliates: **Consultative Services** and **Comprehensive Services**. Irrespective of the package chosen, every Affiliate organization will have a dedicated team focused on supporting the Affiliate's unique needs.

Each dedicated team will consist of a Relationship Manager, the Chief Medical Officer (CMO) for the Affiliate Network, the respective ICCE Physician Chief, a Telehealth Liaison and other administrative and clinical personnel, as appropriate. The MUSC Health Heart & Vascular ICCE (H&V ICCE) is a physician-led, disease-specific organizational agency within MUSC charged to oversee multispecialty, multisite inpatient and outpatient strategy, quality, clinical operations and financial performance for all heart and vascular medical and surgical diseases and conditions. Typical roles/responsibilities for each of these individuals are outlined in the right column.

- **Relationship Manager:** serves as the day-to-day MUSC Affiliations Contact, often coming on-site to meet with key stakeholders at the Affiliate organization and helping to coordinate and communicate between the two entities
- **ICCE Chief:** works closely with the Affiliate organization's Chief Physician/Chair of Department (or equivalent role) on clinical delivery components (strategy, staffing, clinical programs, quality and safety, network building, clinical operations)
- **CMO of Affiliate Network:** partners with the Affiliate organization's Chief Medical Officer/Chief Quality Officer (or equivalent role) on all quality-related services
- **Telehealth Liaison:** works with the Affiliate organization to identify telehealth opportunities and implement MUSC telehealth programs at the Affiliate organization; acts as the day-to-day contact for all telehealth services and coordinates between the Affiliate organization and MUSC Health's Center for Telehealth

MUSC'S HEART & VASCULAR ICCE AND CLINICAL PROGRAMS

OVERVIEW

The MUSC H&V ICCE integrates all the multidisciplinary components of cardiovascular care, research and education at the Medical University of South Carolina, current affiliates and current clinical outreach sites. The H&V ICCE subsumes all the inpatient, outpatient, and procedure and imaging suite clinical facilities, units, sites and clinical faculties of the Divisions of Cardiology, Cardiac Surgery and Vascular Surgery, trainees, clinical researchers, nursing colleagues and dedicated hospital administrative staff. The principal responsibility of the ICCE is to develop, execute and oversee 1) clinical strategy, 2) quality and 3) financial performance for all cardiovascular diseases and conditions. Dedicated MUSC Health administrative, strategy, financial, informatics and marketing personnel support the H&V ICCE clinicians in this work and provide collaborative stewardship of all clinical sites, programs and activities. The H&V ICCE also has stewardship over the research and training missions, working in close collaboration with the Departments of Medicine and Surgery and the College of Medicine to design and oversee basic and translational cardiovascular research and physician and staff education activities and programs.

As part of South Carolina's only comprehensive academic health science center, we at MUSC Heart & Vascular strive to enhance the quality and breadth of clinical services, research, teaching and other specialty services available to patients, families, communities, providers and hospitals across South Carolina and beyond. We aim to provide an interprofessional environment for learning, discovery and healing through the education of health care professionals and biomedical scientists, research in the health sciences, and the provision of comprehensive health care. In all that we do, we embrace the five core values of MUSC Health: compassion, respect, innovation, collaboration and integrity.

MUSC H&V ICCE Programs by the Numbers

The H&V ICCE is a key strategic focus for MUSC Health and is the recipient of deep investment by MUSC Health for facilities, clinical personnel and programs. As a result, our growth has been rapid in the past several years, particularly in hospital-based procedure volumes and tertiary and quaternary differentiated clinical programs.

39,101

patients served statewide

900+
vascular surgeries
per year

600+
cardiac surgical
cases per year

28,568

outpatient visits

150
transaortic valve
replacements
(TAVR) per year

3,000+

cardiac catheterizations
per year

1,000+

percutaneous coronary
interventions per year

16,000

echocardiograms
per year

4,022

cardiovascular hospital
discharges

6,511

new outpatient visits

3,000

hospital observation
patients per year

38 cardiologists

24 cardiovascular
fellows

7 Ph.D.
scientists

4 cardiac
surgeons

5
vascular
surgeons

QUALITY AND AWARDS

The MUSC Health Heart & Vascular Team has received an assortment of awards and accreditations, including the following:

- Blue Distinction Center in Cardiac Care by Blue Cross Blue Shield, in recognition of MUSC's expertise and efficiency in delivering heart and vascular care
- One of just a few hospitals nationwide to achieve multiple American Heart Association recognitions
 - › Gold Plus - Get With The Guidelines (heart failure)
 - › Mission: Lifeline Gold Award (heart attack)
 - › Target: Heart Failure Honor Roll
- Preferred Hospital in SC award for the 18th year in a row
- Ranked in top terciles nationally in cardiology and cardiac surgery mortality among 128 Vizient-ranked hospitals
- South Carolina's preferred institution for heart care, according to the National Research Corporation
- Nationally accredited Chest Pain Center
- AD Center of Excellence
- One of Becker's "Top 100" Heart Hospitals
- Center of Excellence in Left Ventricular Assist Device



LEADERSHIP

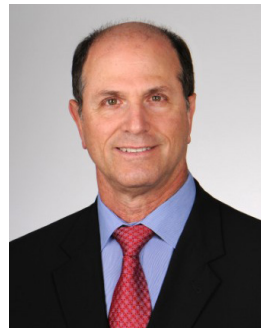
MUSC Health Heart & Vascular is led by a team of renowned physicians, researchers and administrators who have trained and served in prominent positions at some of the country's top heart and vascular centers and academic medical institutions. Listed below are the clinical and administrative leaders that support the program



Thomas Di Salvo, M.D., MBA
Chief, Heart & Vascular ICCE



Ravi Veeraswamy, M.D.
Chief of Vascular Surgery



Marc Katz, M.D., MPH
Chief of Cardiac Surgery



Stephen Vinciguerra, MBA
Administrator, Heart &
Vascular ICCE



Leah Ramos
Director of Cardiovascular
H&V ICCE Nursing


TREATMENT PROGRAMS

MUSC Health Heart & Vascular offers more heart disease specialists and treatment options than those at any hospital in the state. With a comprehensive suite of services, we are able to diagnose and treat the full spectrum of heart and vascular conditions for all patients, from infants to adults. The following centers and programs are included in MUSC Health's H&V ICCE. See the Appendix for a comprehensive description of these treatment programs.

- Cardiac Surgery
- Electrophysiology
- Arrhythmia Center
- Cardio-Oncology
- Congenital Heart Program
- Structural Valve Center
- Vascular Surgery
- Advanced Heart Failure
- Cardiac & Pulmonary Rehabilitation
- Cardiothoracic Anesthesiology
- Heart Health Program
- Interventional Cardiology
- Aortic Disease Center
- Cardiovascular Genetics
- Chest Pain Center
- Preventive Cardiology

SERVICE OFFERINGS

High-level details of each partnership model are included in the matrix below. More detailed descriptions of the specific service offerings included can be found in the subsequent pages.

H&V Service Offerings	H&V Service Line Affiliation Partnership Model	
	Consultative Services Model	Comprehensive Services Model
Price*	\$60,000 per quarter*	\$60,000 per quarter*
Branding	H&V Brand MUSC Health Affiliate	System Brand 
Quality Oversight	✓	✓
Peer Review	✓	✓
External Registries	✓	✓
Clinical Access	✓	✓
Additional Value-Added Services	✓	✓
Consultative Offering Options – at Additional Cost		
Clinical Program Review	✓	✓
Departmental Support Services	✓	✓
Clinical Staffing Options – at Additional Cost		
Advanced Heart Failure Clinic	✓	✓
Electrophysiology Studies/Clinic	✓	✓
Catheterization Lab	✓	✓
Cardiac Surgery	N/A	✓
Shared Equity/Joint Venture	N/A	✓

*This price represents the base Affiliation quarterly fees. Any additional fees and expenses related to optional service elements are excluded. The final fee structure will be dependent upon the services selected and will be delineated as a component of the Affiliation agreement.

CONSULTATIVE SERVICES MODEL

MUSC created the Consultative Services Model to serve the needs of Affiliate organizations who have their own programs and clinical staff but wish to have MUSC help provide quality program oversight and program support.

BRANDING OPPORTUNITIES

MUSC Health is excited to share our brand with those who broaden our commitment to high-quality, patient-centered care. The extent of the opportunity within this model is limited and is pursuant upon MUSC oversight and management of a comprehensive quality program. MUSC Health will work with affiliate organizations to understand branding requests and assist with determining the most appropriate usage.

QUALITY OVERSIGHT

Quality and safety are paramount to ensuring the highest levels of patient care and best possible outcomes across the entire continuum of care. To ensure that our Affiliates and their patients experience the highest possible quality and safest possible heart and vascular care, MUSC offers the following services:

For our Cancer Affiliates, MUSC will provide the following Oncology-specific quality offerings:

Programmatic Quality Oversight & QAPI Program

In today's health care environment, a robust quality program is essential for health care delivery systems in order to ensure safe, timely, efficient, effective, equitable, and patient-centered care. Outcomes bespeak themselves in any hospital or health care system. In addition, health care payment models are moving rapidly from fee-for-service to value-based payments, making high quality and safe care prerequisites for successful financial performance. To this end, MUSC will work collaboratively with the Affiliate organization to develop a comprehensive quality and safety program customized to the Affiliate's specific needs.

After exploration and learning about the Affiliate's current quality and safety systems and programs, MUSC will partner with the Affiliate to develop and implement key deliverables, provided via a robust Quality Assurance and Performance Improvement (QAPI) program—a systematic, comprehensive, data-driven, multidisciplinary approach to drive tangible improvements in safety and quality across the health care system and continuum. The QAPI program will be based upon two core guiding principles: 1) a high-reliability system and process improvement and 2) a just culture. Upon the foundations of high reliability and just culture, we will assist in designing and building team-based, multidisciplinary, sustainable cultures of safety. We will provide templates and best practices for core QAPI components, including quality and safety management dashboards, quality and safety key performance indicators (KPIs), quality and safety data collection and registries, peer review, event reporting, morbidity and mortality conferences, and root cause analyses. Our experienced team will advise the Affiliate regarding credentialing, accreditation and center-of-excellence designation, including magnet nursing and distinction-based designations provided by payors and professional organizations.

CONSULTATIVE SERVICES MODEL (continued)

Peer Review

Peer review is a vital part of a holistic QAPI approach. Accordingly, we will partner with Affiliates to develop and implement real-time, rigorous, and just peer review systems and processes. Depending on the resources and capabilities of our Affiliates, we are prepared to provide a spectrum of services, ranging from “training the trainer,” with the aim of deployment of fully autonomous Affiliate program peer-to-peer review over a defined timeline, to direct peer-to-peer review oversight and execution by Affiliate and MUSC personnel. We will provide peer-to-peer review services for all levels of providers, including technicians, nurses and physicians. We will also provide equivalent peer-to-peer review for focused clinical programs, e.g., electrophysiology, image interpretation, cardiac catheterization, interventional cardiology and surgical services.

Internal & External Data Repositories & Registries

Internal and external data repositories and registries are also important for a robust QAPI approach. We will help our Affiliates devise and execute data collection, abstraction and recording according to their needs for both internal and external data repositories and registries. Our team has in-depth experience with all common cardiovascular data registries and can help advise and guide our Affiliates on best practices in data abstraction, registry completion and clinical documentation designed for registry fulfillment.

Evidence-Based Pathways & Protocols

Our Affiliates will have full access to all evidence-based care pathways and protocols developed by the H&V ICCE. In addition, Affiliates will be provided full access to appropriate MUSC H&V ICCE faculty and staff and the MUSC Value Institute, which has been responsible for implementing pathways at MUSC for many years. These teams can serve on a consultative basis to provide insight into specific pathways and provide guidance

on the challenge of operationalizing pathways in the electronic medical record (EMR). Finally, we can provide our Affiliates with access to Epic “super-users,” who include both full-time Epic programmers and physician end-users with experience and expertise in Epic.

CLINICAL ACCESS

Providing timely clinical access for both outpatients and inpatients is crucial for ensuring the highest level of patient care. To ensure that our Affiliates can improve clinical access to provide timely care, MUSC will partner with our Affiliates to design and implement best practices.

Expedited Admission, Patient Transfers & Scheduling

At MUSC, we believe that the best care is provided locally. However, when an Affiliate provider wishes to have a patient seen by an MUSC specialist in Charleston or desires to have a quick consult with a heart and vascular subspecialist, we want the process to be efficient and easy to navigate. To this end, MUSC has established a specialized team that will take calls and help expedite any Affiliate consult requests.

In addition, we will provide consultative assistance with best practices in staffing outpatient practices and phone centers, centralized clinical scheduling and inpatient throughput.

ADDITIONAL VALUE-ADDED SERVICES

Access to Advanced Diagnostic & Therapeutic Services & Testing

MUSC Health offers a rich and extensive menu of clinical program and laboratory test options to support the common and uncommon diagnostic needs of Affiliate partners. We field focused multidisciplinary programs, for example, with national expertise in inherited and acquired cardiomyopathies (e.g., familial, genetic,

inflammatory, and toxic), hypertrophic cardiomyopathy, cardiac sarcoidosis, cardiac amyloidosis, adult congenital heart disease, cardiovascular diseases of pregnancy, advanced cardiac electrophysiology, advanced structural heart disease, advanced ischemic heart disease and cardiopulmonary exercise testing. Our Affiliates will have expedited and full access to these specialized clinical programs and services.

In addition, MUSC Health team members are experts in a variety of specialties in more traditional laboratory medicine, including but not limited to:

- | | |
|----------------------|------------------------|
| ■ Clinical Chemistry | ■ Immunology |
| ■ Cytogenetics | ■ Microbiology |
| ■ Flow Cytometry | ■ Molecular Genetics |
| ■ Clinical Genomics | ■ Molecular Pathology |
| ■ Hematology | ■ Toxicology |
| ■ HLA | ■ Transfusion Medicine |

Beyond access to these advanced testing services, MUSC Health offers consultative services to help Affiliates understand the diagnostic needs of their community and develop their own specialized clinical, laboratory and pathology programs. Additionally, Affiliate partners have access to our team of physician experts in these areas for primary diagnostics and secondary consultations for complex cases, which can be accommodated through our telehealth platform.

Advanced Imaging

The MUSC Health H&V ICCE offers multimodality cardiac imaging, including nuclear cardiology, echocardiography, cardiac CT scanning, cardiac MRI, and positron emission tomography. We offer a complete menu of all currently available cardiovascular imaging options.

Clinical Trials

Clinical trials are the foundation for advancement in heart and vascular treatments. As an academic medical center, MUSC Health is part of several national networks of clinical trials, which provides access to hundreds of trials across the United States. This opens access to treatment options that are not available anywhere else in the state and assures patients that they are getting the most up-to-date, appropriate treatments, ensuring the best chance of long-term survival.

CONSULTATIVE OFFERINGS

Clinical Program Review

As a component of the relationship, MUSC will partner with the Affiliate to conduct a thorough programmatic review of heart and vascular team-specific clinical and operational workflows and processes, staffing models, support service capabilities and quality outcomes. The work will commence early in the relationship and can take place as a multiday on-site visit. The on-site review will be followed up with a detailed report outlining opportunities for optimization and MUSC best-practice recommendations. We will then establish defined goals in each programmatic area to optimize improvements and will initiate quarterly check-ins to help drive progress and instill accountability.

Departmental Support Services

MUSC wishes its Affiliates to be as successful as possible and is pleased to offer additional departmental consulting services upon request, as described above. These may include but are not limited to projects related to service line development, CON support and revenue cycle optimization. Similar to the Clinical Program Review, these detailed assessments will consist of on-site review sessions, with a complete follow-up report identifying opportunities for optimization and MUSC best-practice recommendations.

COMPREHENSIVE SERVICES MODEL

MUSC created the Comprehensive Services Model to serve the needs of Affiliate organizations who need complete operational and clinical support to serve their heart and vascular patient populations. Think of this offering as “On-Site MUSC” in the local community. To accomplish this, MUSC will offer all the services of the Consultative Services Model and also provide the staff, equipment and processes to manage and operationalize your community heart and vascular program.

BRANDING OPPORTUNITIES

At MUSC Health, we have invested in building South Carolina’s most nationally recognized health system brand. We believe that even greater brand value can be achieved by working collaboratively with the best strategic partners to improve safety scores, quality ratings, patient perception and awareness. Leveraging strong brand names through cobranding brings greater value to both parties.

STAFFING

Finding highly trained heart and vascular staff is challenging—even more so if the community is small or the Affiliate’s heart and vascular program is still nascent. MUSC is prepared to provide appropriate staffing for our Affiliate’s programmatic needs, as follows.

Provider Staffing

Regardless of whether the Affiliate needs to have one additional surgeon to help with demand and balance the call rotation or needs to secure a complete heart and vascular provider team, MUSC is ready to meet the needs for each program (catheterization lab, electrophysiology lab, cardiac surgery, and advanced heart failure program).

Programmatic Staffing & Recruiting

MUSC appreciates the importance of staff recruitment and retention and has established a designated team within our H&V ICCE who will partner with Affiliates to understand job requirements, staffing counts, necessary credentials, etc., and will create a plan to fill the gap—be it deploying MUSC resources as interim staff, placing MUSC staff on-site, or partnering to create a dynamic recruiting and onboarding program.

TREATMENT PROGRAMS

Cardiac Surgery

MUSC Health's specialized heart surgery team is the only one in the state with the experience and expertise to perform complex surgical procedures. The MUSC Health surgical team works together to treat both transcatheter and open surgical procedures in state-of-the-art, dedicated hybrid operating rooms. MUSC Health is the only medical center in South Carolina with the experience to perform lifesaving heart transplants for patients with advanced heart failure. The MUSC Health H&V ICCE is able to provide the following:

- Coronary artery disease treatment, including robotic surgical revascularization
- Heart valve disease treatment, including robotic mitral valve repair
- Transcatheter aortic valve replacement
- High-risk revascularization and/or valve replacement for heart failure
- Mechanical circulatory support, including use of ECMO, Impella, Centrimag, HeartWare, and other devices

Vascular Surgery

The vascular disease experts at the MUSC Health H&V ICCE expertly perform a full range of procedures to treat vascular disease. The MUSC Health vascular team has deep expertise in performing minimally invasive procedures that speed the patient's recovery and result in less pain and infection risk. MUSC Health provides patients with the latest treatments for vascular diseases, including:

- Carotid artery disease
- Aortic disease
- Abdominal aortic aneurysm
- Peripheral vascular disease
- Venous disease

Interventional Cardiology

Interventional cardiology has vastly expanded and is becoming increasingly complex and specialized. MUSC Health H&V specialists are experts in catheter-based treatments of structural heart disease. MUSC Health offers interventional cardiology for the following diseases:

- Acute and chronic coronary heart disease
- Structural heart disease
- Acute and chronic pulmonary thromboembolic disease
- Percutaneous circulatory support
- Complex hemodynamic assessment

Electrophysiology

MUSC Health cardiac electrophysiologists specialize in the diagnosis of cardiac arrhythmias. Our physicians offer expertise in the following:

- Noncomplex and complex supraventricular tachycardia ablation (atrial fibrillation, atrial flutter, atrial tachycardia, re-entrant tachycardia, AV nodal ablation)
- Noncomplex and complex ventricular tachycardia (VT) ablation (premature ventricular contractions [PVCs], VT, sarcoid VT, ARC)
- Pacemaker implantation (including leadless devices and complex pacing modalities)
- Implantable cardioverter-defibrillator (ICD) implantation
- Cardiac resynchronization therapy
- Implantable loop recorder
- Cardiovascular genetics for familial disorders

TREATMENT PROGRAMS (continued)

Advanced Heart Failure

MUSC Health's H&V ICCE provides a complete range of heart failure treatments. Our heart failure experts have the necessary skills and training to offer treatment options not found elsewhere. The advanced treatment options include:

- Mechanical circulatory support (ventricular assist devices [VADs])
- Heart transplants
- CardioMEMS for heart failure surveillance
- Hypertrophic cardiomyopathy
- Peripartum cardiomyopathy
- Alcohol septal ablation for hypertrophic cardiomyopathy
- Heart valve surgery
- Transcatheter aortic valve replacement (TAVR)
- Familial cardiomyopathy

Aortic Center

Aortic disease specialists at the MUSC Health H&V ICCE offer comprehensive treatments, including minimally invasive procedures for complex aneurysms to help patients have a faster recovery, reduced risk of infection, and less pain. These minimally invasive aortic disease treatment options include:

- Endovascular aneurysm repair (EVAR)
- Fenestrated endovascular aneurysm repair (FEVAR)
- Thoracic endovascular aneurysm repair (TEVAR)

Arrhythmia Center

The Frank P. Tourville Sr. Arrhythmia Treatment Center at MUSC Health is the only center in South Carolina with doctors who have the expertise to provide a comprehensive range of arrhythmia treatment options, including the use of Watchman and Lariat devices.

Cardiac and Pulmonary Rehabilitation

The cardiac rehab program at MUSC Health is one of the most established and extensive programs in South Carolina. Cardiac rehabilitation is a crucial step in the recovery process following a cardiac event. Patients who participate in MUSC Health's cardiac rehabilitation program benefit from specially trained cardiac rehabilitation teams that collaborate with each patient's doctors to create the most specialized plan of treatment.

Cardiovascular Genetics

The MUSC Health H&V ICCE provides a formal program in genetic screening and diagnosis of cardiomyopathies, heart rhythm disorders, aortic diseases and lipid disorders.

Cardio-Oncology

Treatment for an underlying cancer can be toxic to many organ systems. MUSC's cardio-oncology program allows pretreatment evaluation of patients at risk for cardiac toxicity of cancer treatments. Cardiologists work with a multidisciplinary team that includes referring oncologists, hematologists and primary care physicians to make recommendations regarding therapy to minimize risk to the patient and mitigate long-term cardiac sequelae of chemotherapy and other cancer treatments.

Cardiothoracic Anesthesiology

The experienced cardiac anesthesia specialists of the MUSC Health H&V ICCE are all proficient in the use of transesophageal echocardiography for a range of complex heart procedures. As part of a coordinated team across heart and vascular programs, MUSC Health Cardiac Anesthesia adds another layer of excellence in clinical care and patient safety.

Chest Pain Center

MUSC Health's Chest Pain Center treats and provides evaluations and diagnosis for patients who are experiencing chest pain symptoms. Patients are fast tracked upon arrival for immediate care, which offers the best chance for identification of serious problems and minimizes the time to intervention. The Chest Pain Center is accredited by the Joint Commission and offers world-class cardiovascular specialists and the most advanced technology among South Carolina heart centers. The MUSC Health Chest Pain Center puts time and unmatched expertise on the patient's side.

Congenital Heart Program

As the only Adult Congenital Heart Association (ACHA) ACHD Accredited Comprehensive Care Center in the Southeast and one of only a dozen centers in the country with the ACHA's seal of approval, MUSC Health offers comprehensive services and specialized lifelong care for children and adults born with heart defects. The medical experts in MUSC Health's Adult Congenital Heart Disease Program work hand in hand with pediatric heart specialists to ensure that patients receive the highest quality of care.

Heart Health Program

The Seinsheimer Cardiovascular Health Program offers programs and services designed to help patients enjoy a longer, healthier life. This program helps patients take steps to prevent and manage many of the risk factors for heart disease, including obesity, smoking, high cholesterol, high blood pressure, and diabetes. Seinsheimer Cardiovascular Health Program patients benefit from comprehensive diagnostic screening tools, a supportive team and helpful resources, such as nutrition services, tobacco treatment programs, supervised exercise programs and more.

Preventive Cardiology

The MUSC Health H&V ICCE provides comprehensive, integrated preventive care for patients referred with heart disease risk factors and for patients with established coronary heart disease. We have physicians that specialize in the evaluation, diagnosis and management of patients with complex lipid abnormalities and in the early detection of subclinical atherosclerosis and coronary calcification. The MUSC Health H&V ICCE team can run genetic diagnostics, treat patients with novel therapies and introduce patients to clinical trials. Through the Seinsheimer Cardiovascular Health Program, patients receive holistic lifelong prevention planning and lifestyle counseling.

Structural Valve Center

At MUSC Health's Structural Heart & Valve Center, patients have access to the most innovative heart valve repair and replacement options available. In addition to traditional open-heart surgical procedures to repair or replace faulty heart valves, we also offer the following minimally invasive catheter-based treatment options: TAVR, MitraClip, and robotic mitral valve repair.

RESEARCH & CLINICAL TRIALS

MUSC Health Heart & Vascular has a robust basic and translational clinical research program with an annual budget of approximately \$24 million. The clinical program currently includes more than 40 ongoing trials in cardiac arrhythmia, congestive heart failure, coronary intervention and heart transplant. The Division of Cardiology Basic Research Program receives more than \$2 million annually in extramural funding, and total clinical grant funding exceeds \$6.3 million annually.

The basic research program has focused programs for the following:

- Novel therapies in acute ischemic heart disease
- Nanoparticle drug delivery systems in acute ischemia/reperfusion injury
- Drug discovery in cardiac fibrosis (e.g., novel caveolin scaffolding protein)
- Role of monocytes and fibroblasts in collagen deposition and fibrosis in heart failure
- Basic mechanisms of conjoint neurodegenerative disease (Alzheimer's disease) and heart failure
- Novel molecular mechanisms of mitral valve prolapse
- Role of immunomodulation and T cell function in cardiac fibrosis and remodeling following cardiac surgery

Researchers in the Division of Cardiothoracic Surgery are conducting numerous studies focusing on several key cardiovascular diseases, including thoracic aortic aneurysms, myocardial infarction and ischemia reperfusion, nonischemic dilated cardiomyopathy, pressure overload hypertrophy, arrhythmias, and the development of pulmonary arteriovenous malformations. MUSC has partnered with the VA Health Administration in support of cardiovascular research for three decades, with shared space, core lab facilities, and shared

personnel. Many division faculty members serve as principal investigators on national and international multicenter clinical trials and publish dozens of peer-reviewed articles each year. In addition to the Division of Cardiothoracic Research, MUSC Health H&V consists of the following research programs:

- The Gazes Research Institute and Foundation: provides an endowment for support of basic research
- Tourville Electrophysiology Research Center and Foundation: provides an expendable gift for electrophysiology research development
- Christie Family Heart-Brain Center: one of very few of its kind in the world, this endowed center supports clinical care in autonomic dysfunction diagnostics and in basic and translational research in conjoint mechanisms operative in Alzheimer's disease and heart failure; it is a collaboration between the Division of Cardiology and the Department of Neurosciences.
- Cardiac Surgery Laboratory: an endowed laboratory dedicated to further research on diseases and conditions of the aorta and on cardiac surgery

FACULTY

Each of MUSC Health's Heart & Vascular physicians has a specialized area of cardiac expertise, such as heart failure, valvular problems, arrhythmias or interventional and surgical procedures. Our physicians work as a team, integrating specific expertise when needed, to provide the most advanced and effective treatments for each patient's individual health needs.

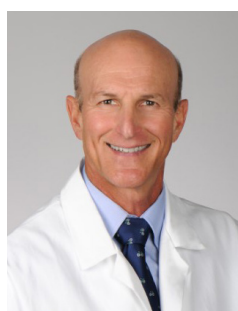
In addition to the H&V Leadership listed on page 7, the Heart & Vascular Care Team includes the following:



Carlee Clark, M.D.
Cardiac Anesthesia
(Anesthesia ICCE Chief)



David Gregg, M.D.
Cardiac Imaging
(echocardiography)



Sheldon Litwin, M.D.
Cardiac Imaging
(echocardiography)



Lucian Lozonschi, M.D.
Director of Surgical
Heart Failure & Cardiac
Transplantation



Pamela Morris, M.D.
Prevention



Chris Nielsen, M.D.
Interventional Cardiology



Eric Powers, M.D., FACC
Quality



Joseph Schoepf, M.D.
Cardiac Imaging
(Cardiac CT)



Daniel Steinberg, M.D.
Interventional Cardiology



Ryan Tedford, M.D.
Heart Failure



Jeff Winterfield, M.D.
Electrophysiology



Sanford Zeigler, M.D.
Cardiothoracic Surgery
& Medical Director of
Cardiovascular ICU



Michael Zile, M.D.
Gazes Research Institute

LEADERSHIP & FACULTY BIOS

Carlee Clark, M.D.

Dr. Clark graduated from Miami University (Ohio) and the Ohio State College of Medicine and completed residency and fellowship training in anesthesia critical care at the Columbia University College of Physicians and Surgeons. Dr. Clark is the Anesthesia ICCE Chief at MUSC. Dr. Clark became an American Board of Anesthesiology Oral Board Examiner in 2015.

Thomas Di Salvo, M.D., MBA

Dr. Di Salvo graduated from Harvard College and the University of Cincinnati College of Medicine and completed internal medicine and chief residency training at Johns Hopkins University and general clinical cardiology and advanced heart failure fellowship training at Massachusetts General Hospital, Harvard Medical School. He also completed an MPH at the Harvard School of Public Health and an MBA at the Owens School of Management, Vanderbilt University. He is currently Director of the Division of Cardiology and Chief of the H&V ICCE.

David (Daley) Gregg, M.D.

Dr. Gregg graduated from Middlebury College and the Columbia University College of Physicians and Surgeons and completed an internal medicine residency at Duke University and a cardiology fellowship at the University of California, San Francisco. Dr. Gregg is a nationally known expert in adult congenital heart disease and is Director of the Adult Congenital Heart Disease Program and Director of the Adult Congenital Heart Disease Fellowship Program.

Brian Houston, M.D.

Dr. Houston graduated from Milsap College and the Emory University School of Medicine and completed internal medicine training, a chief residency, and general clinical cardiology and advanced heart failure fellowships at Johns Hopkins University. He is Director of the Mechanical Circulatory Support Program. Dr. Houston was a finalist for the American Heart Association's Young Clinician Award in 2015.

Daniel Judge, M.D.

Judge graduated from the College of the Holy Cross and the University of Pennsylvania School of Medicine and completed internal medicine, general clinical cardiology, and advanced heart failure training at Johns Hopkins University. He is an internationally known cardiovascular geneticist and is currently Director of Cardiovascular Genetics and Director of the Cardiovascular Fellowship Program.

Marc Katz, M.D., MPH

Dr. Katz graduated from Adelphi University and Tulane Medical School and completed general surgery and cardiothoracic surgery training at the Medical College of Virginia. He is currently the Fred Crawford Professor of Surgery, Chief of the Division of Cardiothoracic Surgery, and Associate Chief of the H&V ICCE. Dr. Katz performed the first combined heart-kidney transplant in the eastern United States.

Sheldon Litwin, M.D.

Dr. Litwin graduated from Colorado College and the Washington University School of Medicine and completed internal medicine training at the University of Arizona and a cardiology fellowship at Beth Israel Hospital, Harvard Medical School. He is an expert in multimodality cardiac imaging and is Co-Director of the Multi-Modality Cardiac Imaging Program along with Dr. Joseph Schoepf.

Lucian Lozonschi, M.D.

Dr. Lozonschi graduated from the G. T. Popa University and School of Medicine and Pharmacy and completed general surgical training at the Mt. Sinai and Albert Einstein College of Medicine and cardiothoracic surgery training at the Ohio State University. He is currently the Edna Sutton Professor of Advanced Heart Failure Surgery and Director of Advanced Heart Failure Surgery at MUSC.

Pamela Morris, M.D.

Dr. Morris graduated from Wellesley College and Duke University School of Medicine and completed internal medicine and cardiology fellowships at Duke University. She is currently Director of Preventive Cardiology and Co-Chair of the ACC.19 Annual Scientific Meeting.

Eric Powers, M.D., FACC

Dr. Powers graduated from Cornell University and Harvard Medical School and completed internal medicine and cardiology training at the Massachusetts General Hospital, Harvard Medical School. Dr. Powers has over 35 years of experience as an interventional cardiologist and cardiac catheterization laboratory director, including work as the director of catheterization laboratories at Presbyterian Hospital (Columbia University College of Physicians and Surgeons) and the University of Virginia. He is currently Director of Quality for the H&V ICCE. Dr. Powers has been named one of America's Top Doctors and one of the Best Doctors in America.

Joseph Schoepf, M.D.

Dr. Schoepf graduated from the Ludwig Maximilians University of Munich University and School of Medicine and completed residency in diagnostic and interventional radiology at the Klinikum Grosshadern, Ludwig Maximilians University of Munich. He is currently Co-Director of the Multi-Modality Cardiac Imaging Program at MUSC, along with Dr. Litwin. Dr. Schoepf has been named one of the top 10 cardiovascular imagers worldwide by Medical Imaging Magazine and is listed among the Best Doctors in America.

Daniel Steinberg, M.D.

Dr. Steinberg graduated from Emory University and the New Jersey Medical School and completed internal medicine training at Georgetown University and general clinical cardiology and interventional cardiology fellowships at the Washington Heart Center. He is a national expert in coronary and structural heart disease catheter-based interventions and is Co-Director of the Structural Heart Program along with Dr. Marc Katz.

LEADERSHIP & FACULTY BIOS (continued)

Ryan Tedford, M.D.

Dr. Tedford graduated from the University of Texas and the UTSW Medical School and completed internal medicine training, a chief residency, and general clinical cardiology and advanced heart failure fellowships at Johns Hopkins University. He is an expert in right ventricular failure and pulmonary hypertension and is Director of the Advanced Heart Failure Program and Director of the Advanced Heart Failure Fellowship Program. Dr. Tedford was elected as a Fellow of the American Heart Association in 2016.

Ravi Veeraswam, M.D.

Dr. Veeraswamy graduated from Johns Hopkins University and the Johns Hopkins School of Medicine and completed a residency in general surgery and a fellowship in vascular surgery at Barnes-Jewish Hospital and the Washington University School of Medicine. He is currently Director of the Division of Vascular Surgery and Associate Chief of the H&V ICCE.

Stephen Vinciguerra, MBA

Dr. Vinciguerra graduated from Temple University and completed an MBA at The Citadel, Charleston, SC. He is currently Administrator of the Division of Cardiology and Administrator of the MUSC H&V ICCE.

Jeff Winterfield, M.D.

Dr. Winterfield graduated from Amherst College and the UTSW Medical School and completed internal medicine training at UTSW and general clinical cardiology and electrophysiology training at the Brigham and Women's Hospital, Harvard Medical School. He is a national expert in ventricular tachycardia ablation and is Director of the Electrophysiology Section.

Chris Nielsen graduated from Wake Forest College of Medicine and completed internal medicine, general clinical cardiology, and interventional cardiology training at the Medical University of South Carolina. He is an interventional cardiologist and is currently Director of the Cardiac Catheterization Laboratory.

Sanford Zeigler, M.D.

Dr. Zeigler graduated from The University of the South and the Medical University of South Carolina and completed general and cardiothoracic surgical training at Stanford University Hospitals. He is currently Co-Director of the Aortic Program and Co-Director of the Cardiovascular Intensive Care Unit.

Michael Zile, M.D.

Dr. Zile graduated from the Rush College of Medicine and completed internal medicine training at Presbyterian-St. Luke's Hospital in Chicago, a general clinical cardiology fellowship at Tufts University, and a cardiology research fellowship at the West Roxbury VA Hospital in Boston. He is the Ezra Daniels Professor of Medicine at MUSC and is Director of Translational Research and a world-renowned heart failure investigator.



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