



University of Iowa Heart and Vascular Center

2017 ACCOMPLISHMENTS REPORT

**Physician Referral and Consult Line:
800-322-8442**

uihc.org/heart



**UNIVERSITY OF IOWA
HEART AND
VASCULAR CENTER**

University of Iowa Health Care

2,200

OR/ASC procedures

40,000+

outpatient visits

40,000+

procedures

67,000+

imaging and diagnostic tests



Executive Summary



PHILLIP A. HORWITZ, MD



W. JOHN SHARP, MD

On behalf of University of Iowa Heart and Vascular Center, it is our privilege to share with you this report that outlines our services and provides an overview of our notable accomplishments. In this document you will find summaries of our programs in clinical care, research discovery, and medical education and training.

Across UI Heart and Vascular Center, our teams of physicians, surgeons, nurses, pharmacists, allied health care professionals, and others are committed to providing excellence in cardiac, vascular, and thoracic specialties. We focus on care delivery, research, and education that is unique to Iowa and the region.

With a research enterprise that is a hallmark of University of Iowa Health Care—one of the nation's leading academic medical centers—we are positioned at the forefront of basic science investigations, clinical trials, and new therapies that lead to better understanding and better treatment. We take pride in not only practicing medicine but advancing it.

A handwritten signature in black ink, appearing to read "P.A. Horwitz".

Phillip A. Horwitz, MD
Executive Director,
UI Heart and Vascular Center

A handwritten signature in black ink, appearing to read "W. John Sharp".

W. John Sharp, MD
Co-Director
UI Heart and Vascular Center

Cardiac Imaging Program

University of Iowa Heart and Vascular Center offers comprehensive cardiovascular imaging, including 3D echocardiography, computer tomography (CT) angiography and PET, CT with fluoroscopy, electron beam (EBCT) for evaluating coronary calcium deposits, and magnetic resonance imaging.

Echocardiography

The Echocardiography Laboratory performed more than 13,000 echocardiograms for inpatients and outpatients in the past year. The UI Echo Lab is one of only a handful of labs that is accredited through the Intersocietal Accreditation Commission (IAC).

Cardiac Computed Tomography (Cardiac CT)

We are one of the first centers in the country to install a Siemens FORCE CT Imaging System, which offers decreased radiation dose exposure, shorter exam times, and elimination of sedation in some cases. In the coming year, we will begin fractional flow reserve CT (FFR-CT) scans to determine the severity of coronary stenosis in some patients without the need to perform more invasive procedures.

Cardiovascular Magnetic Resonance Imaging (CMRI)

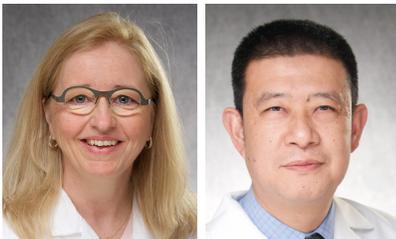
A leader in advanced cardiac imaging, our Cardiac MRI Program offers accurate diagnosis of noninvasive cardiomyopathies, without the need for biopsy or invasive procedures, along with accurate assessment of myocardial viability for ischemic cardiomyopathy. With the addition of Mahi Ashwath, MBBS, FACC, FASE, UI Heart and Vascular Center now offers MRI stress perfusion imaging to detect the extent of cardiac ischemia, along with function and viability. All scans are performed using contrast agents with the least likelihood of causing nephrogenic systemic fibrosis (NSF), making patient safety a high priority.

In addition, UI Heart and Vascular Center recently expanded its services by offering combined cardiac MRI with thoracic MRA, which requires the expertise of a top-notch interdisciplinary team. The expert faculty is also certified to perform MRIs on patients with MRI conditional devices, including implantable cardioverter defibrillators (ICDs) and pacemakers.

With the addition of another two Siemens Aera scanners, UI Heart and Vascular Center will build on its tradition of investing in top-of-the-line equipment to provide the best diagnostic information to physicians. With T1 and T2 mapping capabilities, the Aera scanner offers improved detection of myocardial edema, interstitial fibrosis and inflammation. A leader in the field of CMR, Dr. Ashwath plans to expand the center's CMRI research program and participation in multicenter studies. ///



MAHI ASHWATH, MBBS, FACC, FASE,
MEDICAL DIRECTOR OF CARDIAC MRI



KIMBERLY
DELCOUR, DO,
INTERIM MEDICAL
DIRECTOR OF
CARDIAC CT

KAN LIU, MD, PHD,
FACC, FASE,
MEDICAL DIRECTOR
OF CARDIAC
ECHOCARDIOGRAPHY

The UI Electrophysiology Program expanded faculty and innovative treatment offerings to become the most advanced arrhythmia management program in the region.

Electrophysiology Program

Under the direction of Michael Giudici, MD, the program includes seven other faculty members—Steven Bailin, MD; Rick Hopson, MD; Alex Mazur, MD; Steven Mickelson, MD; Troy Rhodes, MD, PhD; Denice Hodgson Zingman, MD; and Samuel Johnston, MD—and has expanded the service line’s offsite ambulatory consultation services

to nine locations throughout southeastern Iowa and western Illinois.

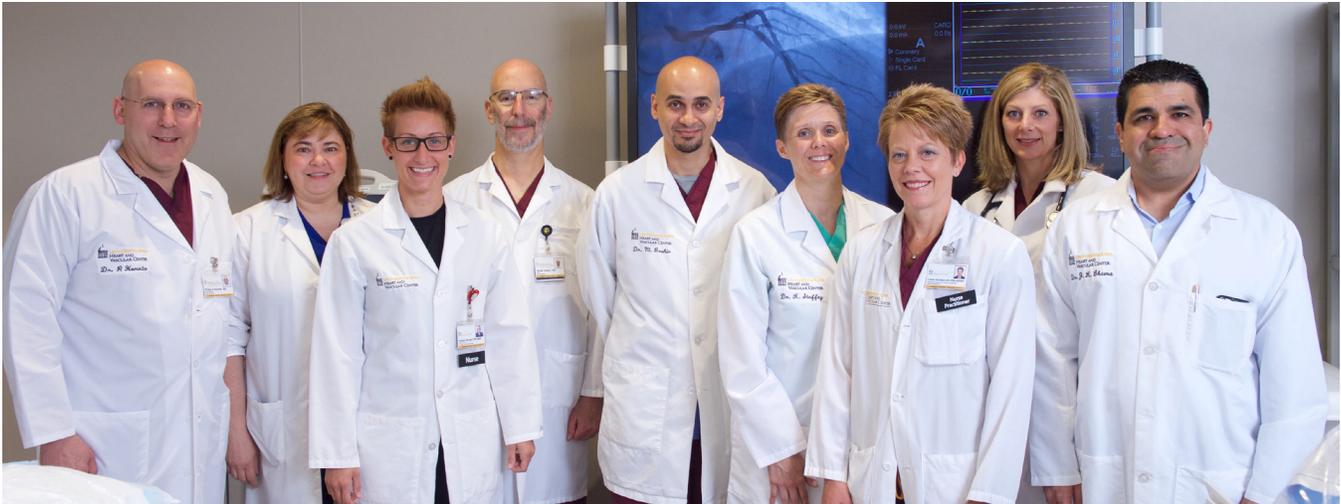
The Electrophysiology Program provides a full array of advanced device therapies, including radiofrequency and cryoablation, advanced mapping with three state-of-the-art systems, epicardial

VT ablation, and lead extraction. UI Heart and Vascular Center is one of only two centers in Iowa to offer the revolutionary Watchman™ atrial appendage occlusion device for stroke prevention, and it is the only center in the region with the procedural expertise to offer female patients the option of sub-mammary device implantation.

UI electrophysiology faculty participated and/or directed a myriad of device and procedure trials in the past year, including a genetic atrial fibrillation study, a new laser balloon catheter, bundle of HIS pacing, CRT trials, the latest MADIT trials, and the MADIT S-ICD trial. They are also the only group in the region to offer an outpatient temporary pacemaker implantation for patients to experience the technology before permanent implant--the pacemaker “test drive.” ///



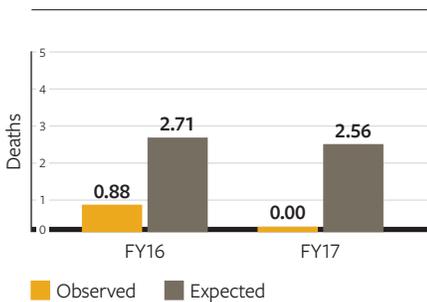
MICHAEL C. GIUDICI, MD, MEDICAL DIRECTOR OF ELECTROPHYSIOLOGY



MEMBERS OF THE TAVR TEAM

Structural Heart Disease Program

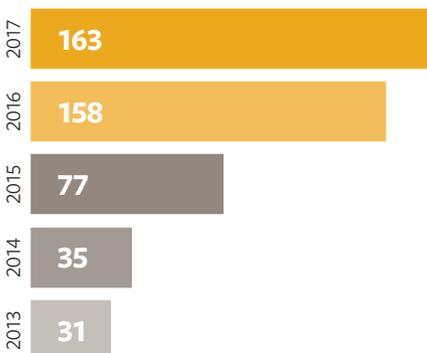
UI Health Care Transcatheter Aortic Valve Replacement Inpatient Mortality Rate



Source: Vizient Clinical Data Base/Resource Manager used by permission of Vizient. All rights reserved.

See page 11 for a detailed description of the Vizient database.

UI Health Care TAVR and MitraClip Procedures



Source: University of Iowa Health Care data

The Structural Heart Disease Program, led by Phillip Horwitz, MD, medical director, and Mohammad Bashir, MBBS, surgical director, provides a comprehensive array of advanced diagnostic modalities. Other members of the program include James Rossen, MD, Sid Panaich, MBBS, Jay K. Bhamra, MD, and Sharon Larson, DO. Cardiac imaging support is provided by Kimberly Staffey, MD, and Ramzi El Accaoui, MD.

The Structural Heart Disease Program’s therapeutic offerings include a full range of interventional and transcatheter options such as transcatheter aortic valve replacement (TAVR), transcatheter mitral valve repair (MitraClip™), atrial-septal defect (ASD) catheter repair, repair of paravalvular leaks, and repair of patent foramen ovale (PFO). In the past year, the UI Structural Heart Disease Program added left atrial appendage occlusion (LAAO) procedures utilizing the revolutionary Watchman™ device as an alternative to long-term anticoagulation for stroke prevention in atrial fibrillation patients.

The largest area of growth for the UI Structural Heart Disease Program was in TAVR procedures. The UI TAVR program continues to demonstrate outcomes that far exceed national averages. UI Heart and Vascular Center offers the widest range of TAVR treatment options in Iowa, and it is the only Iowa center currently enrolling patients in the PARTNER 3 trial. The goal of the trial is to establish the safety and effectiveness of the Edwards SAPIEN 3 transcatheter heart valve in low-surgical-risk patients with severe calcific aortic stenosis.

The structural heart team members also are enrolling patients in the REFLECT Trial, a randomized evaluation of the TriGuard embolic deflection device to reduce the risk of stroke after transcatheter aortic valve implantation. ///



UI Heart and Vascular Center’s Mechanical Circulatory Support Program is certified by the Joint Commission through achieving quality performance standards. In the past three years, the program has demonstrated significant growth with a near doubling of LVAD implant volume and a significant reduction in surgical complication rates such as bleeding and pump thrombosis.

Advanced Heart Failure, Mechanical Circulatory Support, and Heart Transplant Program

As the only cardiac transplant program in Iowa, the UI Advanced Heart Failure and Transplant Program includes a physician team of heart failure cardiologists (Paulino Alvarez, MD; Alex Briasoulis, MD; and Linda Cadaret, MD) and heart surgeons (Jay K. Bhama, MD, surgical director; Mohammad Bashir, MBBS; Sharon Larson, DO; and Ali Nasr, MD). The program served patients from 67 of 99 counties in Iowa as well as 11 counties in western Illinois.

A model of the multidisciplinary team approach in the arena of patient evaluation, management, and clinical research, the program includes not only clinical support through physicians, surgeons, and advanced practice nursing personnel but also a dedicated PharmD, social workers, and a quality-management team. Under the surgical leadership of Dr. Bhama, the program continued to experience stable volumes of heart transplants this past year. Most important, the program’s multidisciplinary approach has resulted in survival rates above the national averages.

The Mechanical Circulatory Support (MCS) Program, which is led by surgical director Dr. Bhama and the heart failure cardiology team, has seen advances in LVAD clinical management, including prevention of right ventricular failure (RVF) and implementation of minimally invasive LVAD and RVAD treatment options. In addition, Dr. Bhama directed the team’s participation in the MOMENTUM 3 clinical trial, investigating the novel Heartmate 3 LVAD. The University of Iowa was the only study site in the state for this trial, which evaluates a fully magnetically levitated centrifugal pump that is associated with better early outcomes than the traditional axial pumps and other centrifugal pumps.

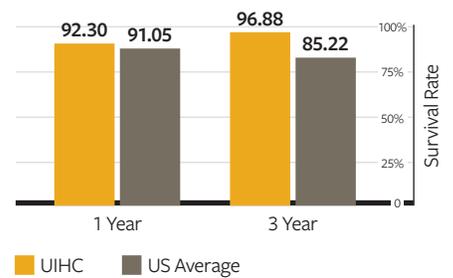
In the past three years, the MCS Program has demonstrated significant growth with a near doubling of LVAD implant volume and a significant reduction in surgical complication rates such as bleeding and pump thrombosis. ///



HEART FAILURE CARDIOLOGIST PAULINO ALVAREZ, MD (LEFT), AND AMANDA YEAST, RN (RIGHT)

UI Health Care Adult Heart Post-Transplant

1-Year and 3-Year Survival Rate



Source: Scientific Registry of Transplant Recipients (SRTR) Jan 2018.

UI Health Care LVAD Implants



Source: University of Iowa Health Care data



LINDA CADARET, MD, MEDICAL DIRECTOR FOR PULMONARY HYPERTENSION

Pulmonary Hypertension Program

The state of Iowa's only comprehensive pulmonary hypertension center is under the direction of cardiologist, Linda Cadaret, MD, and supported by her colleagues, cardiologists Paulino Alvarez, MD, and Alexandros Briasoulis, MD, PhD, and pulmonologist, Alicia Gerke, MD.

Designated as a Center of Comprehensive Care by the prestigious Pulmonary Hypertension Association, the UI program provides 24/7, multidisciplinary disease management. The program is one of only 26 in the country to have received this designation. The Pulmonary Hypertension Center of Comprehensive Care designation is awarded when a program demonstrates a dedication to appropriately and comprehensively manage pulmonary hypertension patients. Linking care centers through a national network increases collaboration in the PH community and fosters clinical quality improvement and investigative partnerships.

The Pulmonary Hypertension Program follows the tiered international treatment algorithm: baseline pharmacotherapy and supportive measures, initial therapy with PH-approved drugs, and combination therapy and endovascular procedures.

Research is a key component of the program at Iowa, with 10 active industry-sponsored clinical trials currently being conducted. In the coming year, researchers will participate in a new trial to evaluate a novel pharmaceutical designed to treat diastolic dysfunction.

In addition, the program will remain on the forefront of new treatment options by being one of the first centers to offer an implantable treprostinil infusion pump for patients with worsening symptoms who have exhausted other therapies. ///

In the coming year, the Cardiovascular Genetics Program plans to seek recognition from the Hypertrophic Cardiomyopathy Association as a Center of Excellence.

Cardiovascular Genetics Program

The UI Cardiovascular Genetics Program is the only program in Iowa offering multidisciplinary genetic services, including genetic testing, state-of-the-art cardiovascular diagnostic imaging, consultation with genetic cardiologists and genetic counselors, and access to clinical trials. Comprehensive genetic counseling is a cornerstone of the program, with trained staff working with patients and families to address the myriad of issues confronting those coping with genetic disorders.

The largest patient groups are hypertrophic cardiomyopathy (HCM), which comprised the largest number of new patients, followed by patients with cardiac complications secondary to various muscular dystrophies and in patients following cardiac arrest, and family members of those patients with sudden cardiac death.

In addition to clinical management and comprehensive counseling, innovative basic science and translational research is an important dimension of the Cardiovascular Genetics Program. In collaboration with other researchers at Exemplar Genetics and MyoKardia, the program established the world's first porcine model for the study of hypertrophic cardiomyopathy in 2015.

In the past year, Ferhaan Ahmad, MD, PhD, program director, began enrollment for two National Institutes of Health (NIH)-sponsored observational studies: LIVE-HCM and LIVE-LQTS, which are designed to study how lifestyle and exercise impact the well-being of individuals with HCM and long QT syndrome (LQTS). The program also participates in multicenter industry-funded trials, known as LIBERTY-HCM, EXPLORER-HCM, and MAVERICK-HCM, to determine the effect of novel medications on exercise capacity and symptoms in patients with HCM, and an internally funded study aimed at identifying new genetic causes of inherited heart disease. ///



FERHAAN AHMAD, MD, PHD, PROGRAM DIRECTOR



MICHAEL MUELLERLEILE, MD, DIRECTOR OF CARDIAC REHABILITATION

Lipid Management and Cardiac Rehabilitation Services

The UI Lipid Clinic offers evaluation and advanced treatment management for patients at high risk for cardiovascular disease. This population includes patients with difficult-to-manage hyperlipidemia and those with familial hypercholesterolemia (FH), severe hypertriglyceridemia, and statin intolerance.

The Lipid Clinic is one of only a handful of sites in Iowa offering PCSK9 inhibitors to lower cholesterol in patients with FH and clinical atherosclerotic cardiovascular disease. The unique

services offered by the Lipid Clinic team also include a dedicated pharmacist who reviews and monitors all medications to minimize side effects and drug interactions and manage costs.

In the past year, the Lipid Clinic relocated to the Iowa River Landing facility in Coralville, Iowa, which houses other outpatient cardiovascular services, including cardiac rehabilitation and imaging. The Cardiac Rehabilitation Program offers a comprehensive prevention program as well as inpatient and outpatient (phase II) rehabilitation.

The Cardiac Rehabilitation Program accommodates patients with a variety of conditions, including stable chronic heart failure and the rehabilitation needs of transcatheter aortic valve replacement (TAVR) patients. ///

Adult Cardiac Surgery Program



The Adult Cardiac Surgery Program is led by Jay K. Bhama, MD. Other faculty members include Mohammad Bashir, MBBS; Sharon Larson, DO; and Ali Nasr, MD.

Along with providing surgical leadership roles for Mechanical Circulatory Support, the Heart Transplant Program, and ECMO, the program is one of the busiest

in Iowa, offering a wide range of services, many of which are unique to the UI program. The program offers standard and minimally invasive approaches to the surgical management of diseases of the heart, including the coronary arteries, heart valves (aortic, mitral, tricuspid, and pulmonary), and thoracic great vessels.

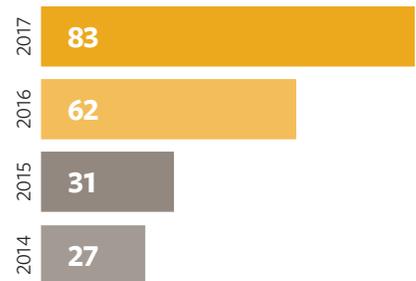
An area of significant growth within Adult Cardiac Surgery has been the mitral valve surgery program, which has developed significantly in breadth and depth within the past two years. The volume of mitral valve surgical procedures has nearly tripled during this time with a significant increase in the proportion of patients undergoing valve repair versus replacement. There also has been a significant increase in the surgical management of co-existing tricuspid valve disease and atrial fibrillation. The program, which has placed significant emphasis on multidisciplinary patient care management, has been certified as a Valve Repair and Replacement Program by the Joint Commission Disease Specific Certification since 2011. Furthermore, Mohammad Bashir, MBBS, and Jay K. Bhama, MD, have developed minimally invasive approaches for mitral valve repair and replacement.



JAY K. BHAMA, MD,
SECTION CHIEF OF ADULT CARDIAC
SURGERY FOR THE DIVISION OF
CARDIOTHORACIC SURGERY



UI Health Care Surgical Mitral Valve Case Volume



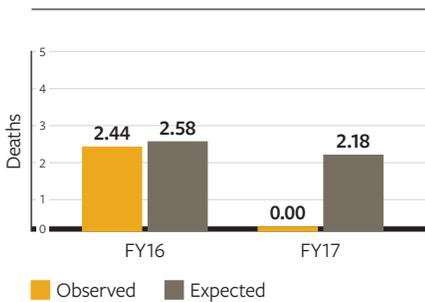
Source: University of Iowa Health Care data



SHARON BETH LARSON, DO, CARDIOTHORACIC SURGEON

UI Health Care CABG Surgery Procedure

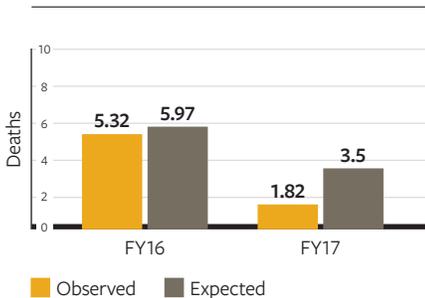
Inpatient Mortality Rate



Source: Vizient Clinical Data Base/Resource Manager used by permission of Vizient. All rights reserved.

UI Health Care Valve Repair

Patient Mortality Rate



Source: Vizient Clinical Data Base/Resource Manager used by permission of Vizient. All rights reserved.

Robotic Coronary Artery Bypass Program

The Robotic Coronary Artery Bypass Program offers the opportunity for patients to have the benefit of surgical revascularization without the invasiveness of a sternotomy, allowing for a faster recovery and lower complication rate. Video-assisted thoracoscopic surgery (VATS) has been used to develop therapies for epicardial pacing lead placement and transmyocardial laser revascularization (TMR), which helps patients to avoid a larger thoracotomy incision. A variety of minimally invasive approaches for valve repair or replacement have been developed to offer sternal sparing approaches for mitral, aortic, and tricuspid valve disease. Jay K. Bhamra, MD, and Mohammad Bashir, MBBS, both offer these minimally invasive surgical approaches for valvular heart disease. ///

Vizient is a comparative database with discharge data from more than 300 hospitals. Vizient allows an organization to compare its clinical outcome performance with that of other hospitals. The Vizient risk models provide expected values for mortality for each discharge, allowing an organization to see not only what its performance was but also whether that performance was better or worse than expected based on the patients' available information in the format of an observed-to-expected (O/E) ratio (index value). An index value above 1.0 indicates an observed mortality higher than the Vizient expected value.

Vizient defines inpatient mortality as any patient who expires (discharge status codes 20, 41 or 42 expired XYZ) during the inpatient hospital stay. When measuring observed mortality in aggregation, Vizient represents mortality as the percentage of deaths over total inpatient discharges for a given time period.

Thoracic Surgery Program

The Thoracic Surgery Program demonstrated growth in many areas in the past year under the direction of Kalpaj Parekh, MBBS. To address the growing need for advanced diagnostic and therapeutic thoracic surgical services, Parekh and John Keech, MD, were joined by thoracic surgeon Evgeny Arshava, MD. The UI Thoracic Surgery Program offers a full spectrum of open, thoracoscopic (video-assisted), laparoscopic, and robotic surgical approaches for diseases of the airway, lung, chest wall, mediastinum, diaphragm, and esophagus. As part of the only National Cancer Institute (NCI)-designated comprehensive cancer center in the state, the Thoracic Surgery Program demonstrates an overall length of stay that is nearly half the national average and also offers access to the latest clinical trials.

In addition to advanced thoracic repairs, the program is the largest volume provider in the state for complex thoracic-esophageal repairs. In conjunction with Gastroenterology and General Surgery, the Thoracic Surgery Program is one of a select group of providers nationwide who perform the pioneering achalasia repair option, the per-oral endoscopic myotomy (POEM) procedure. The program has demonstrated a body of success with the procedure that allows their surgeons to routinely offer POEM for patients who have had a prior myotomy but have had symptoms return over time. Unlike prior treatments, the POEM procedure is unique in that it is well-suited for recurrent symptoms from achalasia. Dr. Keech presented the outstanding UI outcomes for the procedure at the annual Society of Thoracic Surgery Meeting in Phoenix, Arizona. ///



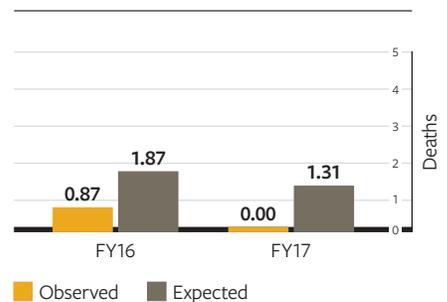
EVGENY ARSHAVA, MD, CARDIOTHORACIC SURGEON



JOHN KEECH, MD, CARDIOTHORACIC SURGEON, AT LEFT, AND KALPAJ PAREKH, MBBS, DIVISION DIRECTOR OF CARDIOTHORACIC SURGERY AND SECTION CHIEF OF THORACIC SURGERY

UI Health Care Lobectomy

Inpatient Mortality Rate



Source: Vizient Clinical Data Base/Resource Manager used by permission of Vizient. All rights reserved.

See page 11 for a detailed description of the Vizient database.



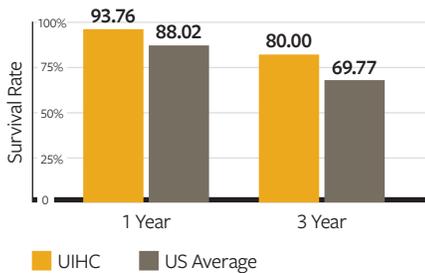
SUCCESS RATE

in relieving symptoms of achalasia, concordant with or better than all recent studies on the effectiveness of POEM.

*We perform this operation on people between the ages of 20 and 88.

Lung Transplant Program

UI Health Care Adult Lung Post-Transplant 1-Year and 3-Year Survival Rate



Source: Scientific Registry of Transplant Recipients (SRTR)
Jan 2018.

The Lung Transplant Program continues to delivery exceptional patient outcomes under the medical direction of Julia Klesney-Tait, MD, PhD, and surgical direction of Kalpaj Parekh, MBBS. The program has been Medicare-approved since 2009.

Through a multidisciplinary approach, the program has shorter organ wait times than the national average and maintains a median hospitalization time post-transplant of 12 days, which is significantly less than the regional and national average of 14 to 17 days.

Our Lung Transplant Program has a robust research portfolio that includes NIH-sponsored research projects investigating neutrophil function in lung, lung stem cell biology, animal models of cystic fibrosis, and lung imaging. ///



JULIA KLESNEY-TAIT, MD, PHD,
MEDICAL DIRECTOR,
PULMONOLOGIST



KALPAJ PAREKH, MBBS,
SURGICAL DIRECTOR,
CARDIOTHORACIC
SURGEON



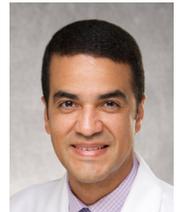
EVGENY ARSHAVA, MD,
CARDIOTHORACIC
SURGEON



MICHAEL
EBERLEIN, MD, PHD,
PULMONOLOGIST



JOHN KEECH, MD, FACS,
CARDIOTHORACIC
SURGEON



TAHUANTY
PENA, MD, MS,
PULMONOLOGIST

Extracorporeal Membrane Oxygenation (ECMO) Program



In the past year, the UI Heart and Vascular Center ECMO program again received a Center of Excellence designation from the Extracorporeal Life Support Organization (ELSO), an international accrediting body. The University of Iowa is the only center in Iowa to achieve gold-level designation.

The robust program, which treats adult, pediatric, and neonate patients, saw growth in all aspects: volume, number of transports, and use of ECMO support as a bridge to recovery and cardiopulmonary rescue.

To better serve patients in rural areas, the program added an ECMO transport system, or sled, for use in ambulances and fixed-wing aircraft, making it one of only a few medical centers in the Midwest with this capability.

UI Heart and Vascular Center also offers one of the premier ECMO training programs in the country, featuring both didactic instruction and simulation training. Offered quarterly, these courses, which follow ELSO guidelines for training and continuing education, attract more than 100 people from around the globe annually. The team includes cardiothoracic surgeons, cardiologists, pulmonary and critical care physicians and nurses, perfusionists, respiratory therapists, and support staff who work 24/7, 365 days per year. ///



UNIVERSITY OF IOWA STEAD FAMILY CHILDREN'S HOSPITAL, PHOTO CREDIT: NIGEL YOUNG, FOSTER AND PARTNERS

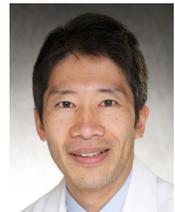
Pediatric Cardiothoracic Surgery Program

Marco Ricci, MD, MBA, leads the UI Pediatric Cardiothoracic Surgery Program and is joined by Yuki Nakamura, MD. The Pediatric Cardiothoracic Surgery Program at University of Iowa Stead Family Children's Hospital offers the most comprehensive treatment options available in Iowa, including the state's only pediatric heart transplant program. UI Stead Family Children's Hospital surgeons offer hypoplastic left heart repair, transposition of the great vessels repair, tricuspid atresia repair, and many other procedures to treat complex congenital and acquired heart and lung diseases.

In the past year, the new, 14-story UI Stead Family Children's Hospital opened with state-of-the-art pediatric operating rooms and a 14-bed pediatric cardiac intensive care unit (PCICU). Every room in the new PCICU is equipped with booms that feature surgical lights to allow surgeons to perform in-room procedures without moving critically ill patients. ///



MARCO RICCI, MD, MBA,
DIRECTOR OF PEDIATRIC
CARDIOTHORACIC
SURGERY



YUKI NAKAMURA, MD,
CARDIOTHORACIC
SURGEON

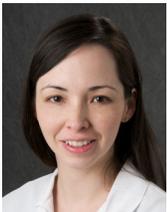
Vascular Surgery Program



W. JOHN SHARP, MD



TIM KRESOWIK, MD



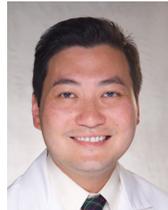
RACHAEL NICHOLSON, MD



MELHELM SHARAFUDDIN, MD



BRIAN MILLER, MD



JUN XU, MD, MA



MAEN HOSN, MD

Under the leadership of W. John Sharp, MD, director of vascular surgery and vice chair in the Department of Surgery, the Vascular Surgery Program saw the opening of a new dedicated vein center as well as the expansion of treatment options for complex arterial vascular disease. Sharp is joined by faculty members Maen Hosn, MD, Tim Kresowik, MD, Brian Miller, MD, Rachael Nicholson, MD, Melhem Sharafuddin, MD, and Jun Xu, MD, MA.

The opening of the UI Vein Center at Iowa River Landing in Coralville, Iowa, greatly expanded peripheral venous services by offering the most advanced and comprehensive diagnosis and treatment of venous disorders in the state. The UI Vein Center performs sclerotherapy, venous ulcer treatment, catheter-directed venous ablation procedures, and venous stenting and reconstruction.

In the complex vascular repair arena, led by Melhem Sharafuddin, MD, UI Heart and Vascular Center was the first center in the nation to receive Joint Commission disease-specific certification for aortic aneurysms, and it remains one of the few centers in the Midwest that provides round-the-clock access to treatment for complex aortic disease.

UI Vascular Surgery faculty also serve the Iowa City Veterans Affairs Health Care System, with primary surgical presence being provided by UI vascular surgeons. New facilities are expected to provide a basis for growth in endovascular aortic aneurysm repair, carotid stenting, angiograms, and angioplasty.

The vascular surgery team continues its active limb salvage work for chronic limb ischemia, with both endovascular approaches such as drug-coated balloon and directional atherectomy as well as traditional bypass approaches to limb salvage.



UI vascular surgeons continue to be recognized for their expertise and leadership within their field. Dr. Nicholson was elected councilor for the Midwestern Vascular Surgical Society (MVSS). Melhelm Sharafuddin, MD, was an invited faculty member of MVSS's "Advanced Peripheral Artery Disease Intervention Course for Vascular Surgeons. ///

UI Heart and Vascular Center Outpatient Clinic

Last year, UI Heart and Vascular Center opened a state-of-the-art outpatient clinic at UI Hospitals and Clinics. For the first time, all heart, thoracic, and vascular ambulatory services within the hospital are co-located, enhancing interdisciplinary collaboration, teamwork, and research.

The new 30,000-square-foot space, which currently serves approximately 23,000 ambulatory clinic visits annually, offers increased exam space, minor procedure rooms, a combined vascular and echocardiography lab, and state-of-the-art patient education and conference facilities. With 27 exam rooms, three minor procedure rooms, and 10 imaging suites, the clinic allows UI Heart and Vascular Center to offer enhanced care, including exercise stress testing, nuclear cardiology procedures, transthoracic and transesophageal echocardiography, minor vascular procedures, transplant biopsies, and a host of other diagnostic and therapeutic procedures.

To streamline care and maximize patient privacy, the clinic incorporates onstage and offstage design principles. Evidence-based design was utilized to maximize efficiency, as were Blue Zone principles aimed to create a healthy working environment. Sophisticated audiovisual capabilities will be instrumental in helping staff provide superior patient education, especially for heart transplant and ventricular assist device patients. ///



STAFF MEMBERS GATHER FOR RIBBON CUTTING CEREMONY, CELEBRATING THE OPENING OF THE HEART AND VASCULAR CENTER OUTPATIENT CLINIC.

Offsite Clinics and Services

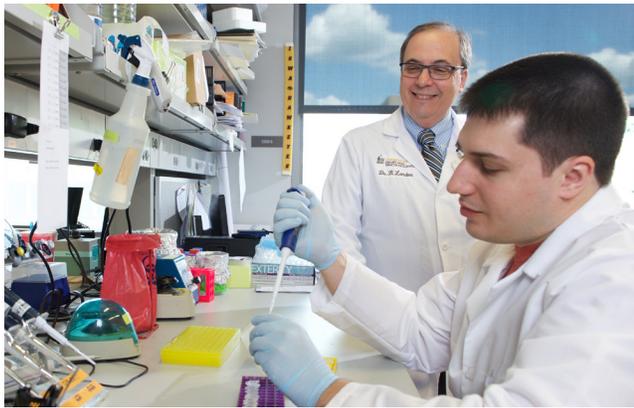
UI Heart and Vascular Center has a long history of providing outpatient services throughout eastern and southeastern Iowa. In the past year, the center has significantly expanded its ambulatory cardiology and vascular services footprint by formally integrating an area cardiology practice—Iowa City Heart Center—into UI Heart and Vascular Center at the Iowa River Landing outpatient facility in Coralville, Iowa. ///



Outreach Clinic Services

- General Cardiology
- Electrophysiology
- Heart Failure
- Pulmonary Hypertension
- Vascular

Research and Publications



BARRY LONDON, MD, PHD,
CARDIOVASCULAR MEDICINE DIVISION DIRECTOR

A Giant Among NIH Grants

The University of Iowa's Francois M. Abboud Cardiovascular Research Center (ACRC), one of the premier research centers of its type in the Midwest, pioneered the use of multidisciplinary teams throughout biomedical science. At the same time, it has the distinction of being awarded one of the longest continuously funded NIH Institutional Research Fellowship Training Grants, establishing it as a premier training ground for generations of PhD scientists and physician-scientists.

The UI Division of Cardiology received \$9,945,060 in research funding in the past fiscal year, much of it for work conducted at the ACRC; the total number of active grants is 135. Under the leadership of director Barry London, MD, PhD, who also serves as editor-in-chief of the prestigious *Journal of the American Heart Association*, researchers perform basic science and translational research aimed at increasing understanding of cardiovascular disease and stroke.

The center's namesake and founder, Francois M. Abboud, MD, is internationally known within the cardiology community. Funded by the National Heart, Lung, and Blood Institute since 1971, Abboud's program project grant is the nation's longest continuously funded grant under the direction of the same principal investigator. ///

Multidisciplinary Research Inquiries

In the past year, cardiologists from the ACRC collaborated with pulmonologists to research the relationship between heart failure and cystic fibrosis (CF); pilot research has begun using CF model pigs, also developed at Iowa. Later in the year, a human study designed to evaluate the effect of cardiac stress tests on CF carriers has begun. The ACRC has also expanded its ability to perform population-based modeling with the addition of faculty members skilled in that arena.

Faculty members also are engaged in several significant clinical trials, including participation in the DREAM Trial. This trial will evaluate the efficacy and safety of a single trans-endocardial delivery of human bone marrow-derived allogenic mesenchymal precursor cells for patients with chronic heart failure.

UI Heart and Vascular researchers also are participating in the ADAPTABLE Trial, a multicenter clinical trial sponsored by the Patient-Centered Outcomes Research Institute (PCORI). The trial will assess the long-term effectiveness of low dose (81 mg) or high dose (325 mg) aspirin therapy in patients with established coronary artery disease. Also, UI Heart and Vascular Center is the only site in Iowa participating in the CREST-2 (Carotid Revascularization Endarterectomy versus Stenting) Trial. ///

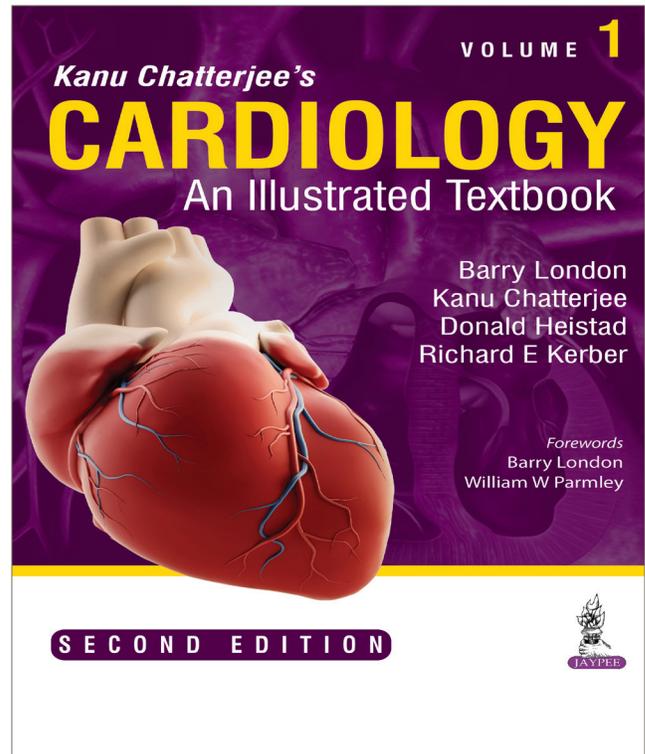
Landmark Textbook Edited by UI Experts

University of Iowa cardiology, vascular surgery, and cardiothoracic surgery faculty have a national and international reputation as clinicians, scientists, and authors, with manuscripts published in multiple peer-reviewed publications.

Several faculty also served as editors of the second edition of the seminal work by Kanu Chatterjee, MD, titled, *Cardiology: An Illustrated Textbook*, which is to be released in the coming year by Jaypee Brothers Medical Publishers (P) Ltd.

London, director of the Division of Cardiovascular Medicine and director of the Abboud Cardiovascular Research Center; the late Dr. Chatterjee; and the late Richard E. Kerber, MD, edited the two-volume textbook, along with Donald Heistad, MD, professor of internal medicine and cardiologist in the Division of Cardiovascular Medicine.

The expanded work is composed of 112 chapters across 15 sections and spans 2,200 pages that provide step-by-step diagnosis and treatment options. The development of PCSK9 inhibitors for hyperlipidemia, transcatheter aortic valve replacement (TAVR) for aortic stenosis and aortic insufficiency, and induced pluripotent stem cells for personalized medicine are some of the new topics covered in this edition. The University of Iowa is proud of its tradition of educating tomorrow's physicians. ///



A Banner Year for Scholarly Publishing

The past year has been an outstanding one for ACRC faculty members, who have had papers published in numerous scientific journals, including *Circulation Research*, *JCI Insight*, *Journal of the American College of Cardiology*, *Nature Medicine*, *Nature Communications*, *Nature Cell Biology*, and *Proceedings of the National Academy of Sciences*. Researchers also made presentations at major scientific meetings, including the American College of Cardiology, the American Heart Association, the American Society of Echocardiography, Gordon Research conferences, and the Heart Rhythm Society. ///



SAKET GIROTRA, MBBS (RIGHT),
ASSISTANT PROFESSOR OF INTERNAL MEDICINE

Research Spotlight: Saket Girotra, MBBS

Saket Girotra, MBBS, assistant professor of internal medicine and an interventional cardiologist in the Division of Cardiovascular Medicine, is recognized as a national leader in outcomes research related to both in-hospital and out-of-hospital cardiac arrest. He was the lead author of a study published in the prestigious journal *Circulation* titled, “Regional Variation in Out-of-Hospital Cardiac Arrest Survival in the United States” (April 14, 2016), which examined variation in cardiac arrest outcomes for out-of-hospital events.

The study examined data from the Cardiac Arrest Registry to Enhance Survival (CARES) for nearly 100,000 patients in 132 counties across the United States. Rates of survival to discharge and rates of survival with functional recovery have been known to vary widely. Analysis of study data found that a substantial proportion of the variation was due to differences in bystander response across communities.

In addition, Girotra was one of the authors of a separate study published in *Circulation* titled, “Hospital Variation in Time to Epinephrine for Non-Shockable In-Hospital Cardiac Arrest,” (Dec. 1, 2016). This study analyzed the extent of hospital variation in delayed epinephrine administration and its impact on hospital-level outcomes for adult patients with in-hospital cardiac arrest due to a non-shockable rhythm. Analysis concluded that hospitals

with high rates of delayed epinephrine administration had lower rates of overall survival for in-hospital cardiac arrest due to non-shockable rhythm. Further studies are needed to determine if improving hospital performance on this metric will lead to improved outcomes in this patient population.

Girotra will begin another study using data from the GWTG-Resuscitation Registry in the coming year. ///



STEVEN MICKELSEN, MD, ASSISTANT PROFESSOR OF INTERNAL MEDICINE

Research Spotlight: Steven Mickelsen, MD

As principal investigator for the Laboratory of Integrated Cardio-Neuro-Electrophysiology at the University of Iowa, Steven Mickelsen, MD, assistant professor and an electrophysiologist in the Division of Cardiovascular Medicine, combines his knowledge of cardiology and technology to develop new medical devices and treatments. His work focuses on the use of pulsed electric field therapies in minimally invasive procedures. The target of Mickelsen’s current work is to achieve a successful transvenous sympathectomy that could replace a left stellate ganglionectomy, potentially providing a lower-risk treatment for patients with ventricular tachycardia and ventricular fibrillation.

Mickelsen has done extensive work related to catheter ablation refinements, including decreasing procedure time, radiation exposure, and subsequent costs. ///

Research Spotlight: Melhem Sharafuddin, MD

Melhem Sharafuddin, MD, provides expertise in pursuit of innovative therapies and translational research. He was the first in the area to offer fenestrated stent-graft technology and became a national leader in the continued evolution of physician-modified fenestrated aortic endografts.



MELHELM SHARAFUDDIN, MD,
CLINICAL PROFESSOR OF
VASCULAR SURGERY

Under the direction of Sharafuddin, multiple clinical trials are under way related to vascular repair procedures and technology—including IDE (investigational device exemption) trials in the areas of peripheral vascular disease and aortic aneurysm.

The University of Iowa is the only site in Iowa participating in the CREST-2 (Carotid Revascularization Endarterectomy versus Stenting) Trial and its companion trial, CREST-H, which is evaluating hemodynamics of carotid disease.

Funded by NIH's National Institute of Neurological Disorders and Stroke, the CREST-2 Trial was designed to compare three different methods of stroke prevention for patients with carotid artery disease: intensive medical management, intensive medical management in combination with a carotid endarterectomy, or intensive medical management in combination with carotid artery stenting. ///

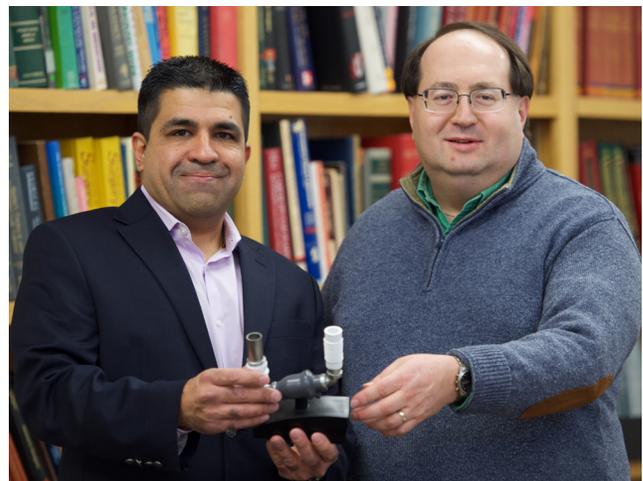
Research Spotlight: Jay K. Bhama and Albert Ratner

The Bhama-Ratner Artificial Heart and Mechanical Circulatory Sciences Advancement (BRAHMA) Lab is a novel research endeavor to design and implement devices involved in artificial heart and mechanical circulatory support technology. The lab was developed by Jay K. Bhama, MD, who serves as the medical director, and Albert Ratner, PhD, who serves as the engineering director.

Currently supported by the Department of Surgery, the lab focuses on applying a newly designed flow-regulating valve to common health care applications that involve mechanical circulation of blood—such as LVADs, ECMO, cardiopulmonary bypass, and hemodialysis. By converting these typically continuous flow devices to pulsatile devices using this innovative valve technology, the group hopes to optimize clinical efficiency and efficacy of these therapies.

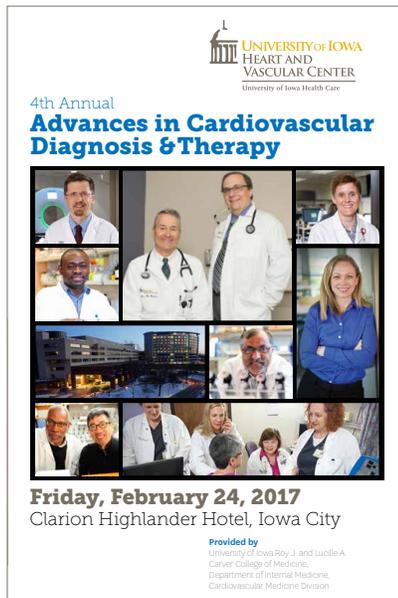
In addition, the lab is actively working to reconfigure and design current LVAD technology by introducing wireless energy transfer options that will reduce the size of or eliminate current components that patients must carry with them while on device support, thereby improving safety and quality of life for patients.

Other projects include the design of a novel, miniature, highly portable ECMO device for use by civilian and military first-responders as well as development of an innovative, sensor-driven, implantable drug delivery device for use in the treatment of diabetes and heart failure. As one of only a handful of similarly collaborative medical/engineering labs in the country, the BRAHMA Lab offers a unique environment for innovation by bringing engineering and medical/surgical expertise to a common location. ///



JAY K. BHAMA, MD, SURGICAL DIRECTOR (LEFT),
AND ALBERT RATNER, PHD, ENGINEERING DIRECTOR (RIGHT)

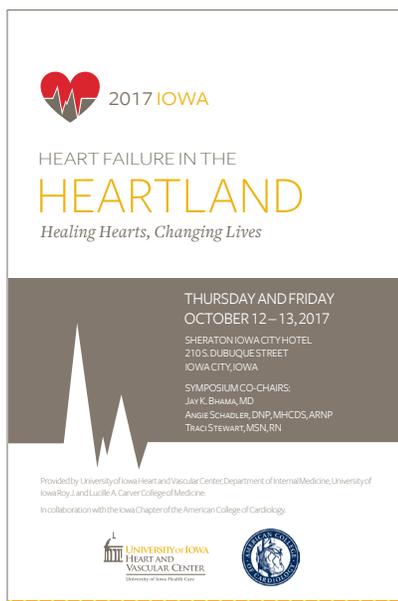
Education



4th Annual
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Diagnosis & Therapy**

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Carver College of Medicine,
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Provided by University of Iowa Heart and Vascular Center, Department of Internal Medicine, University of Iowa Roy J. and Lucille A. Carver College of Medicine.
In collaboration with the Iowa Chapter of the American College of Cardiology.

The University of Iowa has a long history of serving as a superior training ground for tomorrow's physicians. The highly regarded Cardiovascular Medicine Fellowship Training Program, under the direction of Paul Lindower, MD, clinical professor and non-invasive cardiologist in the Division of Cardiovascular Medicine, is certified by the Accreditation Council for Graduate Medical Education (ACGME). One of the largest physician subspecialty fellowship programs at Iowa, it provides 24 training fellowships that include general cardiology, two in interventional cardiology, two in electrophysiology, and one in heart failure.

Additionally, the Department of Surgery has a nationally renowned fellowship training program. The Division of Vascular Surgery trains one vascular fellow per year in an ACGME-accredited program. The Division of Cardiothoracic Surgery training program is the second-oldest training program in the country. The division trains three fellows per year and has recently embarked on an integrated thoracic residency program. This is a six-year residency that combines three years of general surgery (and designated cardiac and thoracic rotations), and three years that include both combined cardiac and thoracic training as well as individual subspecialty focus. Trainees from the UI cardiothoracic training program provide excellent care around the country and are national leaders and pioneers in innovation.

Cardiology and vascular fellows treat patients at both UI Hospitals and Clinics and the Iowa City Veterans Affairs Medical Center. Collectively, the remarkable group of current cardiology fellows had more than 40 journal publications in the past year and presented at national and international meetings.

UI Heart and Vascular Center also produces nationally recognized continuing medical education conferences each year for primary care providers, cardiologists, and other health care professionals. The annual daylong events are titled, "Advances in Cardiovascular Diagnosis and Therapy," and "Heart Failure in the Heartland." Both CME-accredited conferences feature presentations from UI non-invasive cardiologists, interventionalists, electrophysiologists, heart failure specialists, vascular surgeons, and cardiac surgeons. ///

In Memoriam: Richard Kerber (1939-2016)

Richard E. Kerber, MD, left a lasting legacy for his patients, students, colleagues, and the entire cardiovascular community when he died on November 8, 2016.

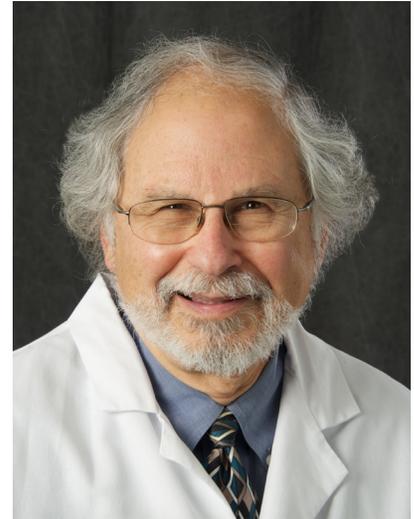
A professor of cardiovascular medicine at UI Hospitals and Clinics since 1971, Dr. Kerber was known for his pioneering research in echocardiography and in cardiac resuscitation. He served as associate director (1983-2008) interim director of the Division of Cardiology (2009-2012) and led its fellowship program for 17 years.

Educated at Columbia University, New York University, and Bellevue Hospital, Dr. Kerber's medical training was interrupted by the Vietnam War. Serving in the army from July 1967 –June 1968, he regularly flew on dangerous helicopter "Medevac" missions to rescue the wounded in the midst of a firefight. For this he was awarded the Bronze Star "for meritorious action against hostile forces."

He returned to finish his training at Stanford University. Recruited by the University of Iowa as an echocardiographer in 1971, a time when that imaging technique was first being used, he continued to do important research, heading the Echocardiography Laboratory and serving as president of the American Society of Echocardiography. In his memory, the ASE has established the Annual Richard E. Kerber Memorial Lecture in Ethics/Humanitarian Care.

Cardiopulmonary resuscitation was a new strategy when Dr. Kerber arrived in Iowa. He established the CPR training program for the entire faculty and staff of the UI Hospitals and Clinics in 1971 and led it for 36 years. Inspired by what he was seeing in clinical practice, he pursued pioneering research in cardiac defibrillation and resuscitation throughout his career. His research was instrumental in developing many of the improvements seen in current defibrillation practices. Concerned about the public health implications of this knowledge, he led the AHA's first Task Force on the Future of CPR (1990) and continued to serve on national and international committees that regularly updated the AHA's resuscitation guidelines. He lobbied fiercely and effectively to get AEDs in airports and other public places. He treasured his secondary appointment in Emergency Medicine.

Dr. Kerber's scholarship included 250 articles, two books, and more than 330 abstracts. Among his many awards was the American Heart Association's Scientific Councils' 2001 Distinguished Achievement Award. ///



IN MEMORIAM: RICHARD E. KERBER, MD

UI Heart and Vascular Center Outpatient Clinic Locations

University of Iowa Hospitals and Clinics
200 Hawkins Drive
Iowa City, IA 52242

Iowa River Landing
105 East 9th Street
Coralville, IA 52241

Clinton
915 13th Avenue North
Clinton, IA 52732

Davenport
1236 East Rusholme Street
Davenport, IA 52803

Des Moines
1215 Pleasant Street
Des Moines, IA 50309

Dubuque
1000 Langworthy Avenue
Dubuque, IA 52001

Fairfield
2000 South Main Street
Fairfield, IA 52556

Fort Madison
5445 Avenue O
Fort Madison, IA 52627

Keosauqua
304 Franklin Street
Keosauqua, IA 52565

Mount Pleasant
407 S. White Street
Mount Pleasant, IA 52641

Muscatine
3465 Mulberry Avenue
Muscatine, IA 52761

Sigourney
23019 Highway 149
Sigourney, IA 52591

Sterling
101 E. Miller Road
Sterling, IL 61081

Washington
414 East Polk Street
Washington, IA 52353

West Burlington
1401 West Agency Road
West Burlington, IA 52655