

CARDIAC SURGERY

AT THE UNIVERSITY OF MICHIGAN



ADULT AND PEDIATRIC

CARDIAC SURGERY

OUTCOMES AND CLINICAL

ACTIVITY REPORT 2009 DATA



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From the Head of the Section of Cardiac Surgery

It is again a pleasure and with extreme pride that University of Michigan Health System, our Mott children's Hospital and the Cardiovascular Center (CVC) present our outcomes over the last 5 years for adult and pediatric cardiac surgery. The University of Michigan is a great academic medical center and our patients are treated for critical and complex problems. Our new CVC is a leader in collaborative care for cardiovascular diseases with specialists in cardiovascular medicine, cardiac surgery, interventional radiology, vascular surgery, critical care, and cardiac anesthesia. Patients are referred to us for the finest care whether it is for complex heart disease or more common cardiac care – because there is nothing routine about cardiac care.

In the last 5 years our surgeons have performed nearly 10,000 operations involving the heart and great vessels with a mortality rate well below national figures.

We are proud to be recognized by *U.S. News & World Report* for our accomplishments being ranked 11th this year in Adult Cardiac Surgery and Cardiovascular care and we are equally proud that the Congenital Heart Program is rated 4th in the nation.

Edward L. Bove, M.D.
Helen and Marvin Kirsh Professor of Surgery • Head, Section of Cardiac Surgery



Integrated Care

Our surgeons have focused on the treatment and repair of complex cardiac problems from neonates to the geriatric patient population. Multidisciplinary care involves experts from cardiac surgery, cardiology, radiology, and vascular surgery to define and create the most appropriate treatment plan for the patient.

Specialty clinics at the University of Michigan Cardiovascular Center include:

- Adult Congenital Program
- Pediatric Congenital Program
- Aortic Diseases Program
- Ischemic Heart Disease Program
- End Stage Heart Failure and Transplant Program
- Center for Circulatory Support
- Aortic Valve Program
- Mitral Valve Program
- Arrhythmia Program
- Pulmonary Thromboendarterectomy Program / Pulmonary Hypertension.

Adult Specialties

The University of Michigan Health System was among 4,861 facilities evaluated by *U.S. News & World Report* in compiling the 2010-11 edition of America's Best Hospitals. Only 174 were ranked in one or more of 16 adult specialties. The University of Michigan Health System was ranked as #11 Best Hospital in Adult Heart and Heart Surgery.

Pediatric Specialties

The University of Michigan Health System was among 62 facilities ranked in one or more of the 10 pediatric specialties in the 2010-11 edition of *U.S. News & World Report* Best Children's Hospitals and was ranked the #4 Best Children's Hospital in Pediatric Heart and Heart Surgery.

Patient and Family Centered Care

At the heart of the U-M Cardiovascular Center lies the belief that providing the ideal care experience stems from a partnership between patients, their families, physicians and staff. As a result, the CVC has created a Patient and Family Centered Care Program, to provide a platform for patients and families (Advisors) to share their personal experiences and provide input on how the CVC can improve care for future patients and family members.

The University of Michigan Cardiovascular Center



The University of Michigan Cardiovascular Center (CVC)

The U-M CVC provides care for patients with a wide spectrum of cardiovascular diseases. This five-story interdisciplinary facility includes clinics, diagnostic laboratories, operating rooms, intensive care units, and all the support services essential for a 21st century medical enterprise.

The U-M CVC is a nationally recognized leader in the diagnosis and treatment of heart and vascular diseases. And while we are known for our ability to handle the most advanced cases, we would really like to keep yours from becoming advanced in the first place. The team of doctors and researchers who discover new medical treatments are the same ones who work with you to make sure you get the most appropriate treatment.

- The University of Michigan Cardiovascular Center is ranked among the most prestigious hospitals in the U.S. for heart, vascular and stroke care.
- We offer nationally-known programs in heart failure, heart transplant, stroke, children's heart disease, valve surgery, implanted heart-assist devices, heart rhythm disorders, preventive heart care, and vascular medicine and surgery.
- Our team approach ensures patients are exposed to specialists in their condition, leading to an early, accurate diagnosis and comprehensive care – from treatment to follow-up.
- Our surgeons and interventional specialists perform the most complex procedures on a daily basis.
- Heart patients seeking a second opinion are placed on the "Fast Track." Appointments for interventional cardiology can often

be arranged within
24 hours by calling
1.888.287.1082.





- Our convenient toll-free number, 1.888.287.1082 gives you access to our full range of services, and offers the chance to ask questions about cardiovascular care.
- Our state-of-the-art facility includes hybrid operating rooms with fluoroscopy for endovascular procedures, as well as new operating rooms, interventional procedure suites and 48 additional inpatient beds.
- Our clinical research means our scientists and physicians work together to provide the most advanced care, and our patients have access to innovative and appropriate new treatment options.



U-M Survival Flight

Survival Flight air and ambulance service is able to handle emergent cases at any time. They are equipped to transport patients from all Michigan counties and can fly anywhere in the United States. They have dedicated staff and equipment to transport patients on intra-aortic balloon pumps and heart assist devices. They also transport patients on ECMO and have a dedicated helicopter for organ procurement.





Advanced Care

The section of Cardiac Surgery at The University of Michigan is led by Dr. Edward L. Bove and includes 4 faculty whose focus is congenital heart disease and 7 faculty whose focus is adult cardiac surgery. Our basic science research efforts are focused on cardiac myocytes and contractile proteins.

As part of our teaching mission, we have a residency in cardiac and thoracic surgery which was the 1st formal residency in the U.S., having been started in 1928. We recently established a 1-year residency in congenital heart surgery as well.

Care teams in our offices and inpatient units include clinicians from many disciplines as well as clinical care coordinating nurses, Physician Assistants, and Nurse Practitioners who collaborate to create the highest level of care for our patients.

From the Head of the Division of Adult Cardiac Surgery

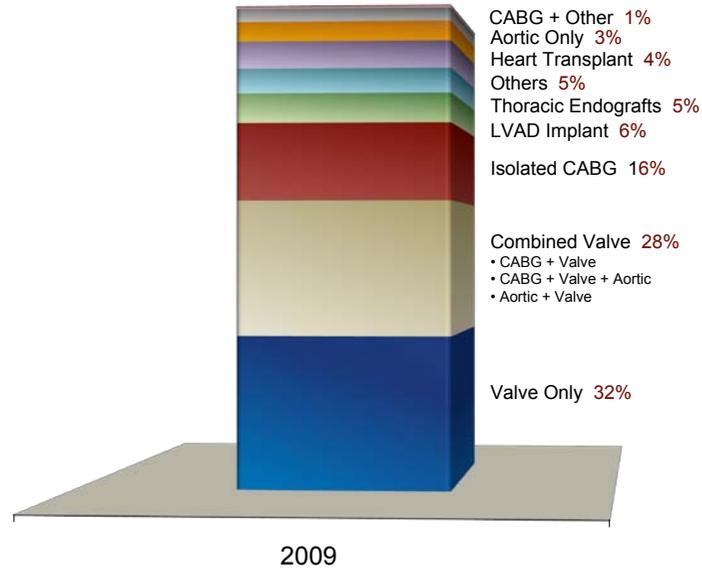
Our division of adult Cardiac Surgery continues to be a leader in all aspects of adult cardiac surgery with clinical interests and expertise in the operative treatment of coronary artery disease and the treatment of structural heart disease. Our operative treatment of valvular heart disease utilizes valve repair and valve preservation as well as valve replacement by standard or minimally invasive approaches. We are a leader in clinical treatment and research on Hypertrophic Cardiomyopathy (HCM) as well as Heart Transplantation and implantable assist devices.



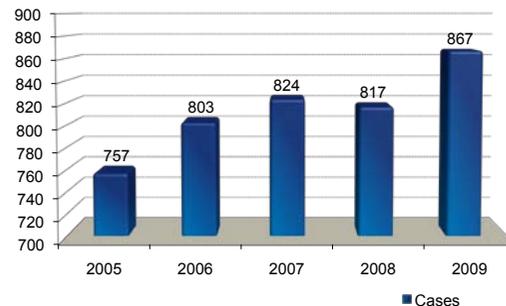
Our aortic program includes open operative approaches as well as endovascular approaches for all portions of the aorta. We have expanded our program in the operative treatment of atrial and ventricular arrhythmias through standard as well as minimally invasive operative approaches. We have also expanded our program in pulmonary endarterectomy.

Richard L. Prager, M.D.
 Professor of Surgery • Head, Division of Adult Cardiac Surgery • Director, Cardiovascular Center

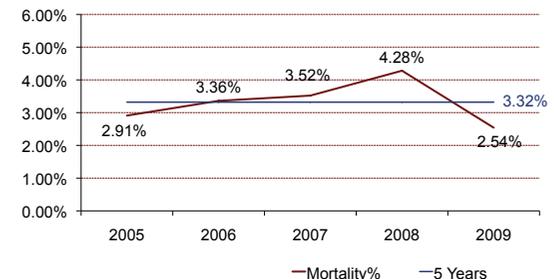
2009 Distribution of Cases



Adult Cardiac Surgery Volume



Adult Cardiac Surgery Overall Operative Mortality



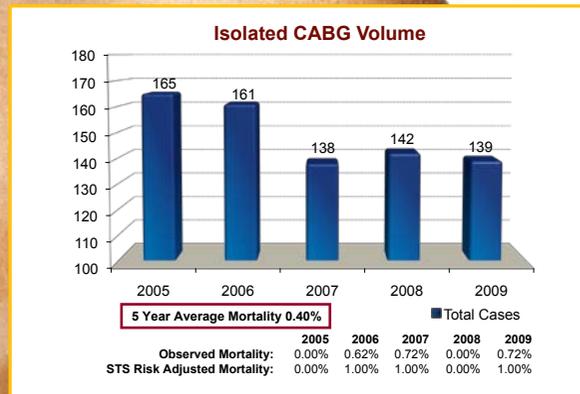
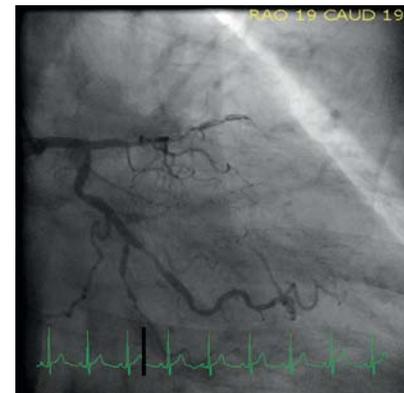
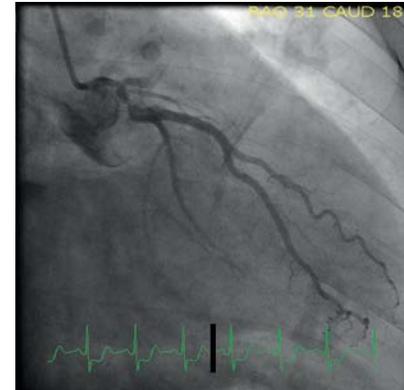
The Cardiovascular Intensive Care Unit (CVICU)

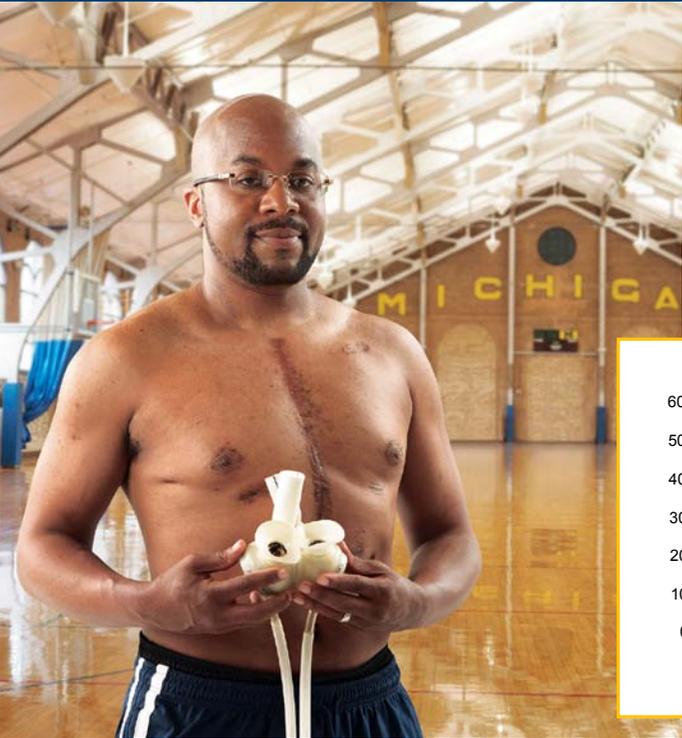
In the CVC there is a 24-bed CVICU providing care to critically ill adult cardiovascular and thoracic patients. The care of the patients in the ICU is multidisciplinary with responsibility for clinical care shared between the surgeons and the critical care intensivists. The unit is staffed 24 hours a day with critical care intensivists, and an advance practice team of Nurse Practitioners (NPs) and Physician Assistants (PAs). This ICU provides the highest level of care for our patients and their families. Unique services include cardiopulmonary support devices including temporary and permanent VADs, total artificial heart systems, and extracorporeal membrane oxygenation (ECMO), providing a form of life support for patients with severe and abrupt heart and/or lung failure. The University of Michigan provides ECMO support for nearly 100 newborns and adult patients a year. Our 36-bed telemetry step down unit is also staffed 24 hours a day by our advance practice team and highly skilled nurses.



Coronary Artery Disease

Utilizing a collaborative approach with our cardiologists for the optimum treatment of patients with cardiovascular disease and improved medical treatment and Interventional approaches, the number of patients considered for coronary artery bypass grafting (CABG) has declined while risks and co-morbidities have increased in this group of patients. Despite this, mortality at University of Michigan for CABG is 0.4% for the last 5 years, significantly below the national benchmarks. We offer standard surgical approaches along with techniques that do not require the use of the heart lung machine.





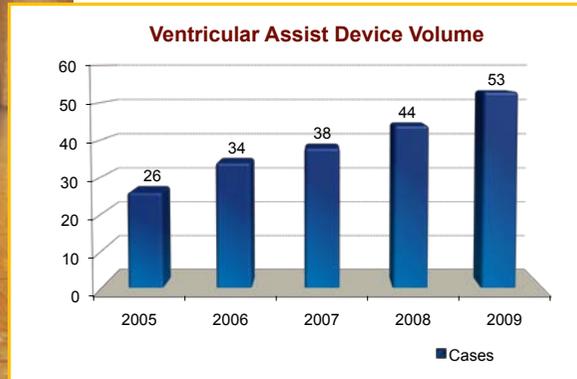
The Center for Circulatory Support

The Center for Circulatory Support at the University of Michigan is an internationally-recognized, multidisciplinary group of physicians and allied health professionals providing medical treatment of adult and pediatric patients with cardiac disorders

resulting in end-stage heart failure or cardiogenic shock. The Center for Circulatory Support is a regional and national referral center for these patients and offers the most sophisticated options in mechanical circulatory support.

Ventricular Assist Devices

The University of Michigan Center for Circulatory Support is one of only a few institutions worldwide which have access to both investigational and FDA-approved mechanical circulatory support systems. This allows for the selection of the most appropriate device based on each patient's individual needs. Our physicians are actively participating in several clinical trials evaluating new mechanical circulatory support devices in addition to developing new types of devices. To date in 2010 we have implanted 60 ventricular



- AB5000 Ventricular Assist Device - Abiomed



- Berlin Heart Ventricular Assist Device - Berlin Heart



- Syncardia Total Artificial Heart - Syncardia Systems, Inc.



- HeartMate II® Left Ventricular Assist System - Thoratec Corp.



- BVS 5000 Ventricular Assist Device - Abiomed



- TandemHeart™ pVAD Ventricular Assist Device - CardiacAssist, Inc.



- DuraHeart™ Left Ventricular Assist System - Terumo Heart, Inc.



- Thoratec® CentriMag® Blood Pump - Thoratec Corp.



- Impella 2.5 Percutaneous Ventricular Assist Device - Abiomed



- HeartWare® HVAD™ System - HeartWare International, Inc.



- HeartMate® XVE Left Ventricular Assist Device - Thoratec Corp.



- Thoratec® IVAD™ Implantable Ventricular Assist Device - Thoratec Corp.



assist devices and are following more than 90 patients as long-term outpatients.

Mechanical Circulatory Support

Mechanical circulatory support is considered in patients with end-stage heart failure or cardiogenic shock. There are now a variety of devices capable of pumping blood to restore circulation of vital organs, even temporarily replacing the function of the native heart. Once the patient is stabilized, procedures such as bypass surgery, stent insertion, and/or medications can be offered to assist the injured heart to recover. Alternatively, if damage to the heart is beyond repair, patients can be considered for heart transplantation or implantation of more permanent heart replacement pumps that can allow individuals to lead active and productive lives.

Extracorporeal Membrane Oxygenation (ECMO)

Some patients may develop lung failure in addition to heart failure. Supplemental oxygen or even artificial respirators are often incapable of providing life-sustaining oxygen or removing dangerous carbon dioxide

when the lungs are severely affected. Another form of life support can stabilize these patients while the organs recover. This treatment is termed ECMO and involves insertion of catheters into the large blood vessels of the neck or groin. Using pumps, blood is circulated through membranes capable of transferring oxygen and carbon dioxide, similar to our native lungs. This blood is then circulated back into the body. Patients can be supported for days to weeks, until the heart and lungs recover, or until an implantable replacement or transplant becomes available. The University of Michigan has the largest ECMO experience in the world, and frequently hosts visitors from around the globe for education and training. Our team is capable of instituting ECMO within minutes or, under special circumstances, traveling to referring institutions to initiate ECMO for a safer transport to our center.



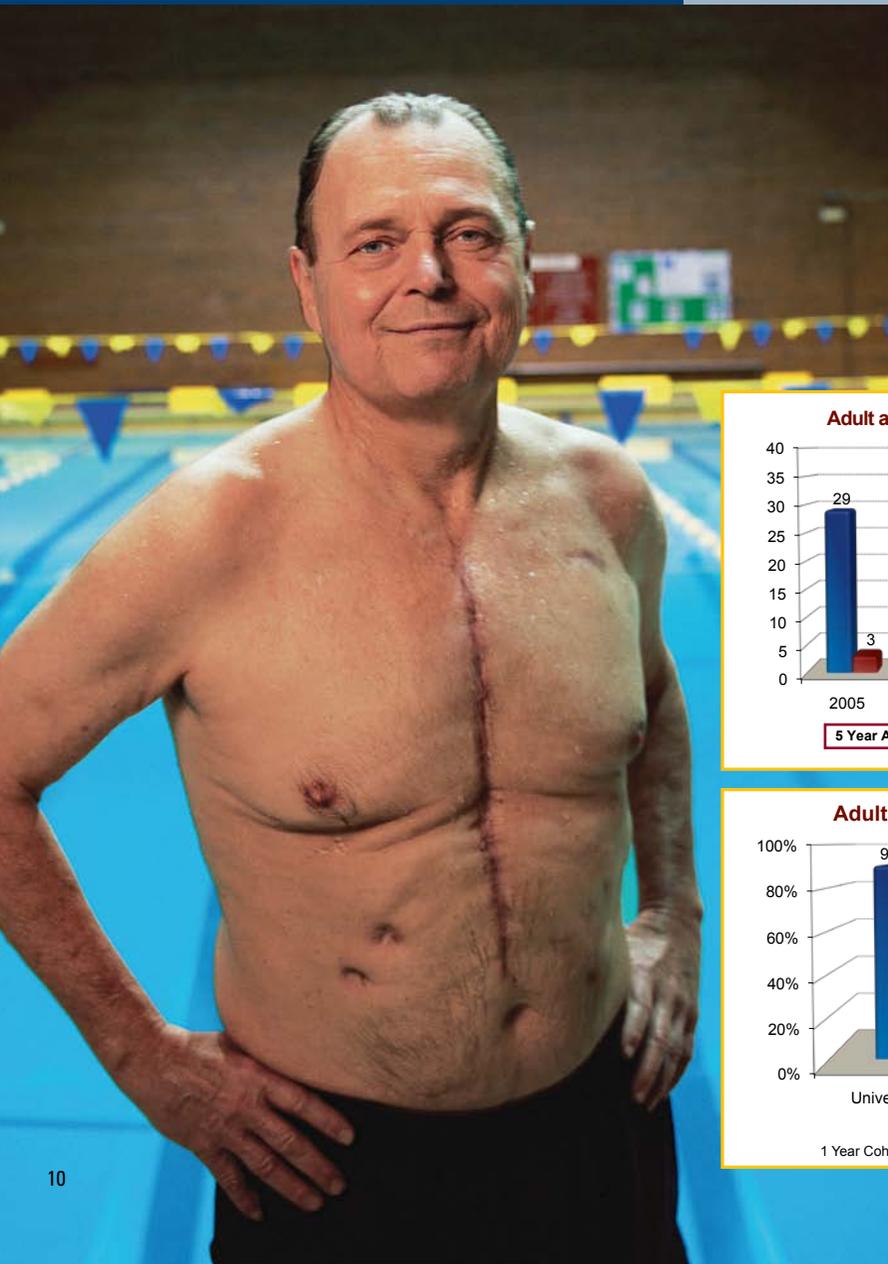
*Dr. Robert H. Bartlett,
Professor Emeritus of Surgery*

The Gold Seal of Approval

The University of Michigan's Center for Circulatory Support earned the Gold Seal of Approval® for health care quality on April 10, 2008, and was one of the first centers to be awarded Disease-Specific Care Certification for Advanced Ventricular Assist Devices by The Joint Commission. Recertification by the Joint Commission was received in March 2010.



To earn this distinction, a disease management program undergoes an extensive, unannounced, on-site evaluation by a team of Joint Commission reviewers every two years. The program is evaluated against Joint Commission standards through an assessment of a program's processes, the program's ability to evaluate and improve care within its own organization, and interviews with patients and staff.



Heart Failure

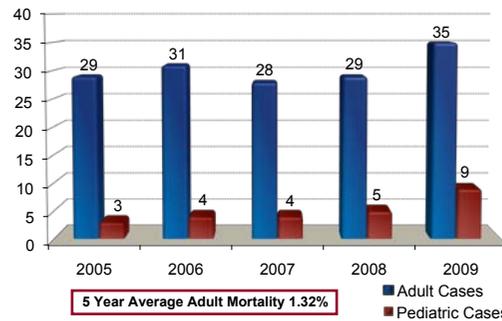
The University of Michigan Cardiac Transplant Program is the leading cardiac transplant center in Michigan, performing over 30 cardiac transplants a year. The Cardiovascular Center has three adult cardiac transplant

surgeons and seven heart failure and transplant cardiologists with advanced training in managing the complexities of this patient population. Because the University of Michigan is a high volume transplant center, we provide the multidisciplinary care required for the complex transplant patient, encompassing specialists in advanced circulatory support, cardiac critical care, nutrition, social work, congenital heart disease, inherited cardiomyopathies, and transplant infectious disease. We also enroll all patients under the care of a University of Michigan cardiac transplant specialist into our post-transplant telemanagement program.

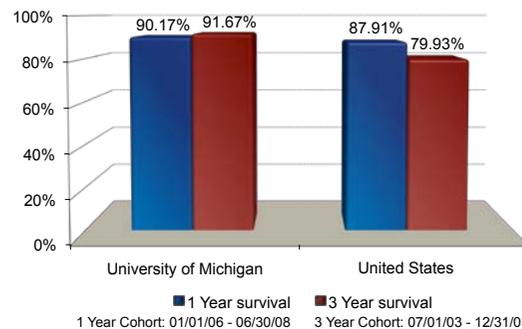
As a result of this multidisciplinary approach, University of Michigan Cardiac Transplant Program boasts a **91% three year post transplant survival**, compared to an expected survival of 79%. We have performed nearly 800 adult heart transplants.

The University of Michigan Pediatric Heart Transplant Program offers coordinated and comprehensive evaluation, treatment and follow-up for pediatric heart transplant patients. Our program began in 1984 with our first transplant. We have performed more than 200 pediatric heart transplants.

Adult and Pediatric Heart Transplant Volume



Adult Heart Transplant Survival Rates



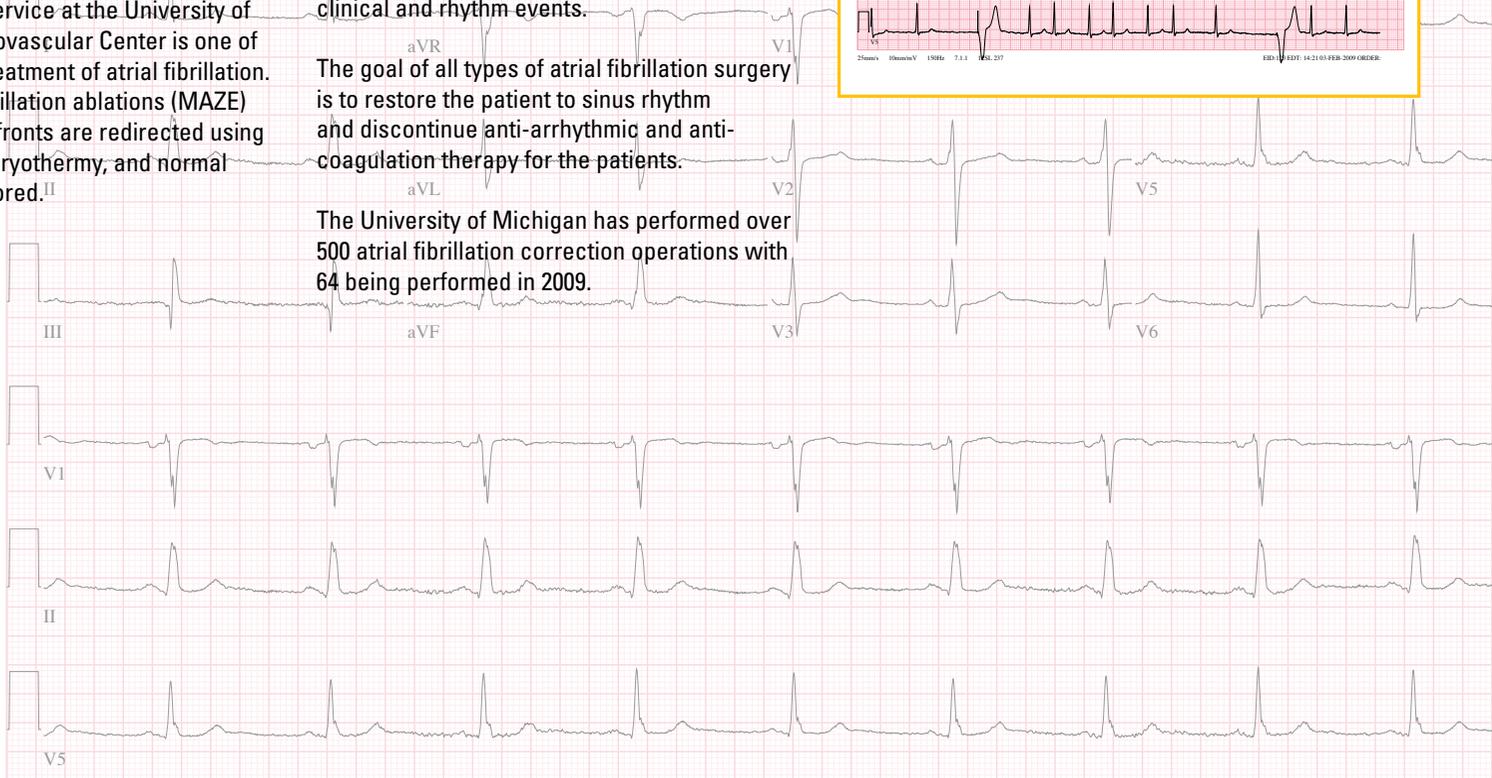
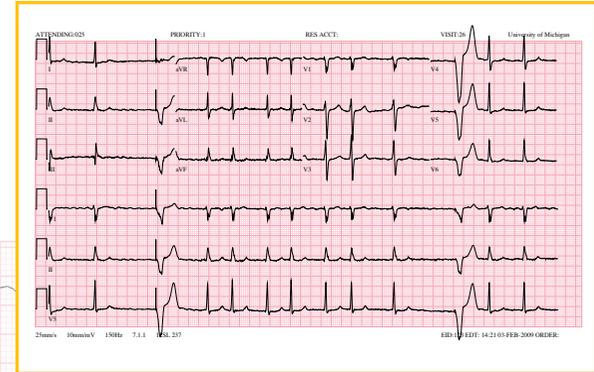
Cardiac Arrhythmias

Surgery for the treatment of atrial fibrillation includes minimally invasive approaches and concomitant surgery for atrial fibrillation at the time of other major cardiac surgery including coronary bypass and valvular surgery. The choice of operation depends upon the patient's condition. In collaboration with the electrophysiology service at the University of Michigan, the Cardiovascular Center is one of the leaders in the treatment of atrial fibrillation. In surgical atrial fibrillation ablations (MAZE) the electrical wave fronts are redirected using radio frequency or cryotherapy, and normal sinus rhythm is restored.¹¹

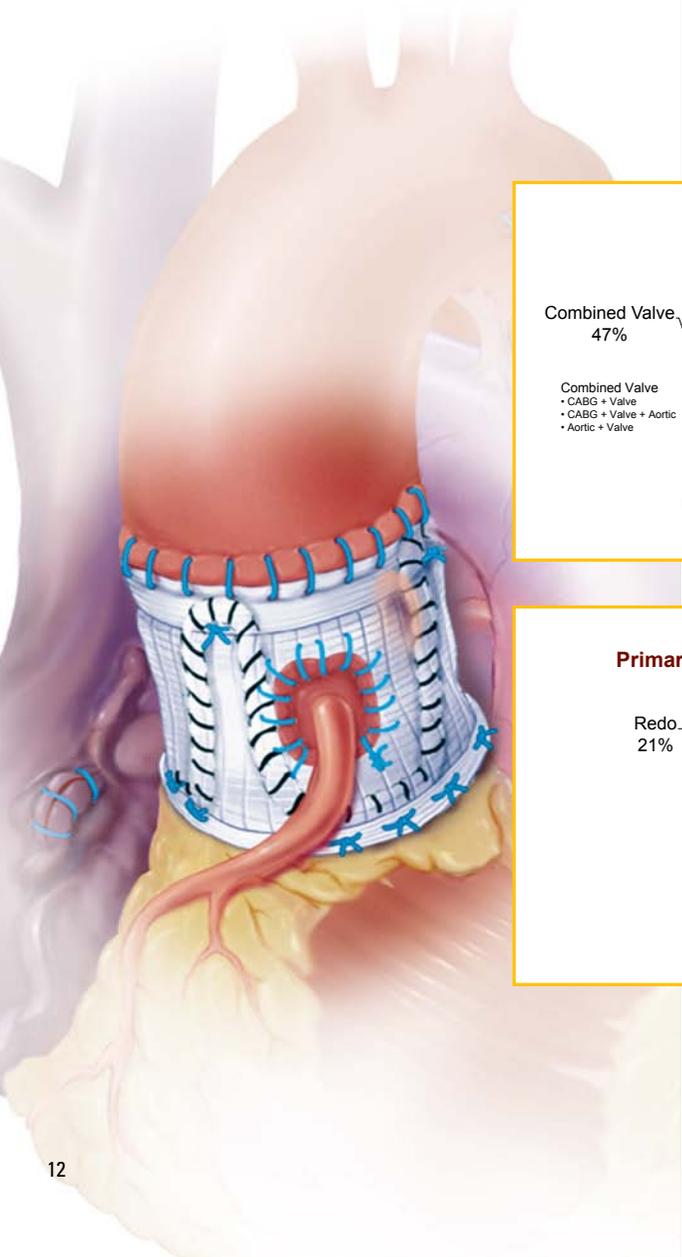
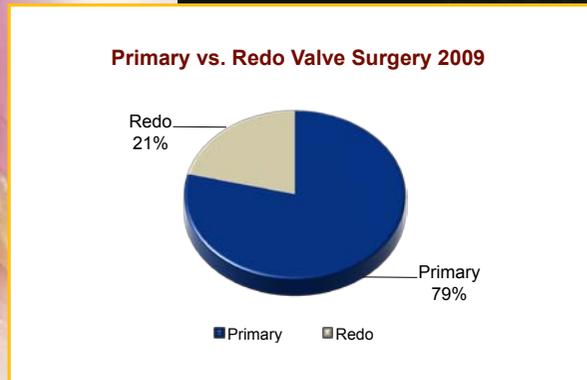
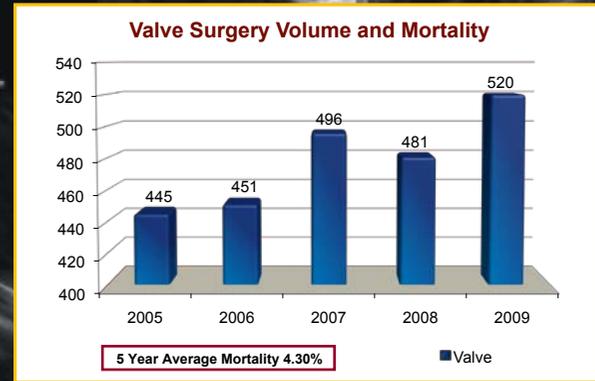
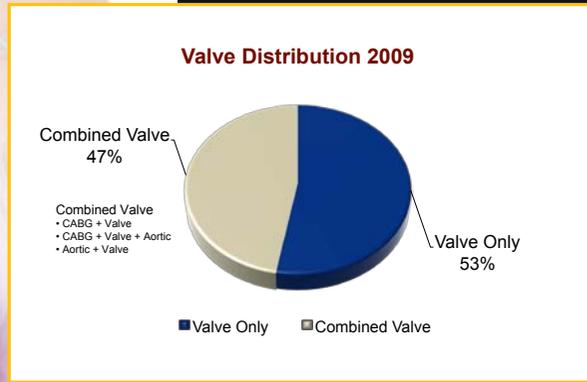
Recently we have begun a program of stand-alone atrial fibrillation correction surgery for patients in permanent atrial fibrillation who have failed all of the modalities of therapy. These patients are approached through a very small subxiphoid incision. The outcomes have been very gratifying and the patients are followed closely in terms of long-term success rates, quality of life, and the occurrence of later clinical and rhythm events.

The goal of all types of atrial fibrillation surgery is to restore the patient to sinus rhythm and discontinue anti-arrhythmic and anti-coagulation therapy for the patients.

The University of Michigan has performed over 500 atrial fibrillation correction operations with 64 being performed in 2009.



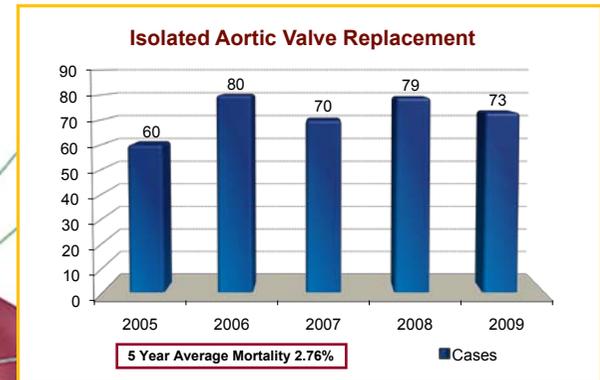
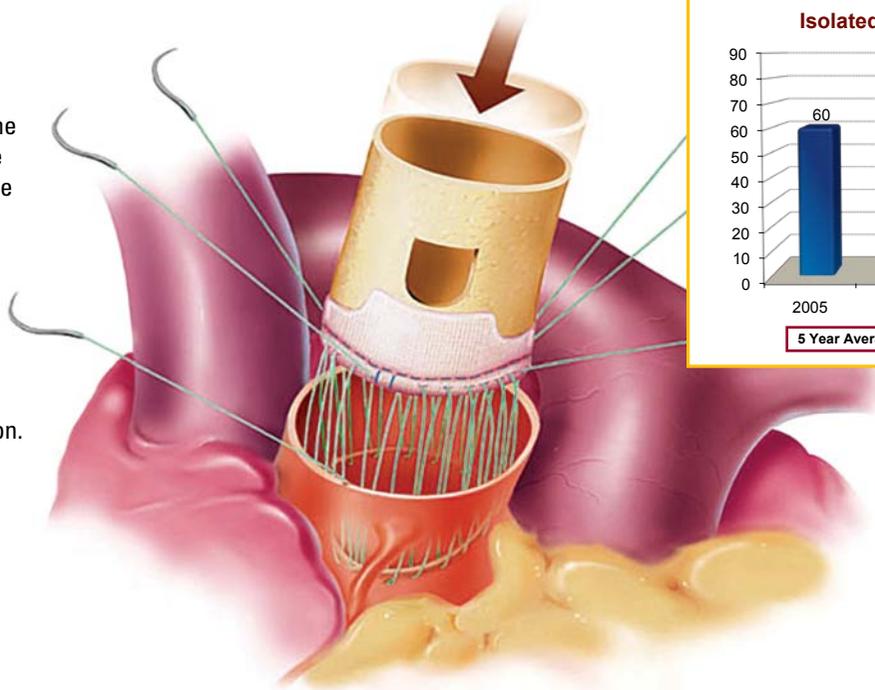
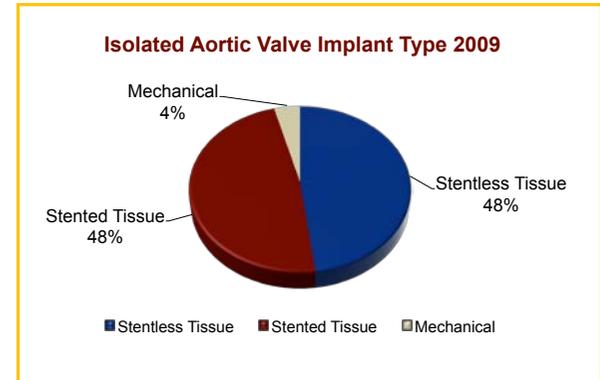
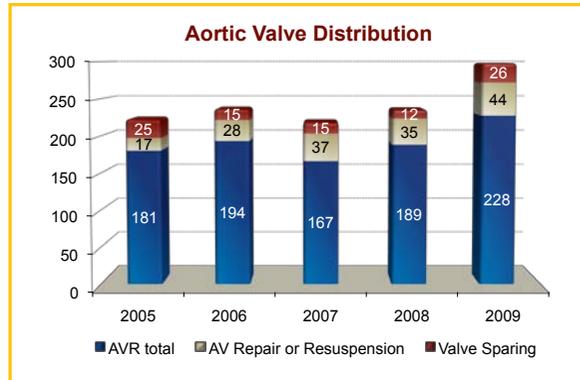
Univ of Michigan CVC-Cardiac Echo S-H



Aortic Valve Disease

As one of the largest aortic and aortic valve programs in the country, we see many patients with complex aortic valve problems. Our experience has led to the discovery of new, more effective treatments that benefit all of our patients. With our multidisciplinary approach, we are able to determine which patients would benefit from valve sparing options for improved long-term outcomes or from minimally invasive surgery.

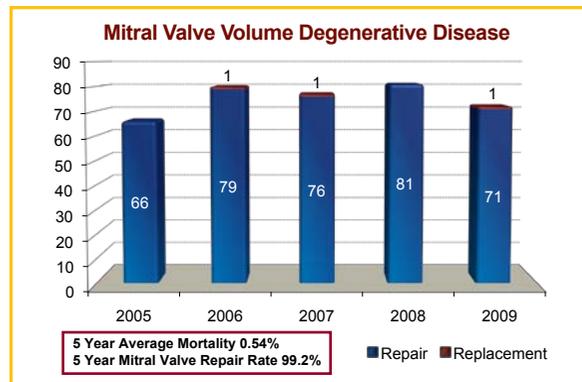
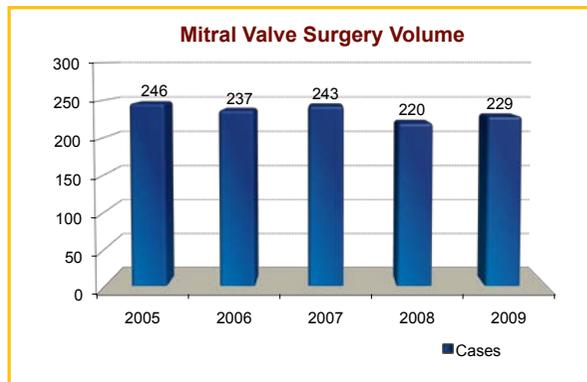
Our surgeons have excellent outcomes in treating associated aortic aneurysm disease at the same time a patient is undergoing a valve replacement procedure. Our decade of experience in performing valve sparing operations on the aortic root has improved the quality of life for many of our patients. The valve sparing procedure is especially beneficial for patients who are younger or who have connective tissue diseases and aortic dissection. We also offer minimally invasive treatment of aortic valve disease including both catheter-based and limited incision approaches.



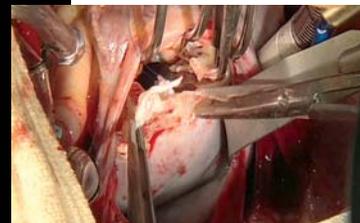
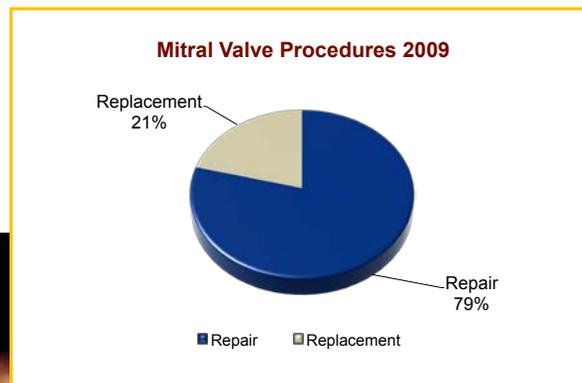
Mitral Valve Disease

The University of Michigan is an internationally known center for mitral valve surgery. As shown in the graphs, the vast majority of patients with mitral valve disease are able to undergo valve repair rather than replacement at the University of Michigan. The operative approaches include standard sternotomy or minimally invasive non sternal approaches. Complex mitral valve repair is accomplished at the University of Michigan with both excellent short- and long-term results and patients return to normal activity as early as 2 weeks postoperatively.

Furthermore, the University of Michigan is a leader in the treatment of mitral regurgitation associated with heart failure from both dilated and ischemic cardiomyopathies.



The faculty at the University of Michigan have published extensively on the approaches and outcomes of mitral valve procedures and are leaders in valve reconstruction and preservation operations. Our volume of mitral reparative surgery is one of the highest in the nation.



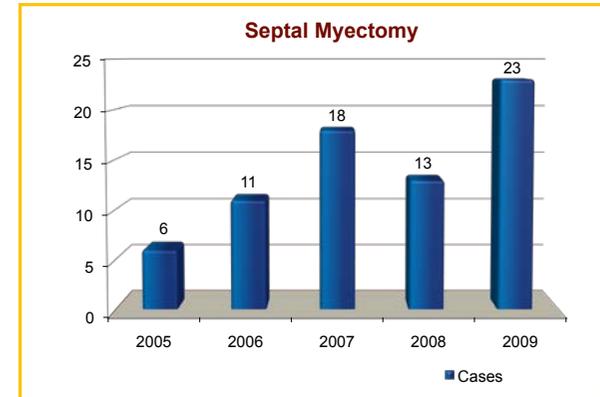
Hypertrophic Cardiomyopathy

Hypertrophic Cardiomyopathy or HCM is a heart condition where the heart muscle thickens abnormally. This thickening can occur in different parts of the heart, but usually occurs within the left ventricle. This thickening usually does not compromise the pumping or squeezing action of the heart, but can make it less compliant and slower to fill up with blood. The thickening usually occurs in the ventricular septum and may interfere with the normal functioning of the heart by:

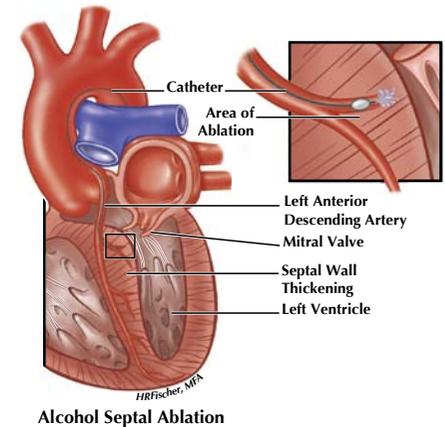
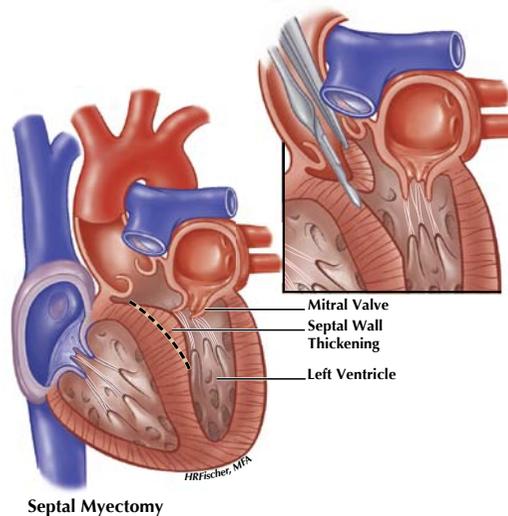
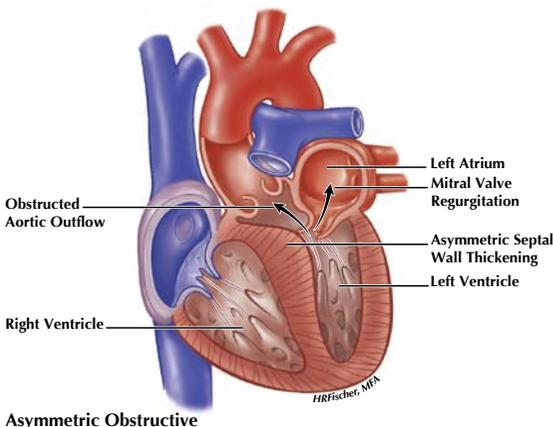
- narrowing the outflow of blood from the left ventricle
- reducing the ability of the heart to relax and fill with blood during the relaxation phase
- reducing the ability of the valves of the heart to function properly.

The University of Michigan HCM Program is specialized in the care of patients and families with hypertrophic cardiomyopathy. From the latest imaging techniques to sophisticated genetic profiling, our team offers superior care with an emphasis on compassion and communication.

At the University of Michigan, we are proud of our team based approach. Our HCM program offers interaction with a genetic counselor, specialty nurse, cardiologists and cardiac surgeons. All are focused on giving you the best possible information to help clarify your diagnosis and maximize the treatment options available to you and your family.



The HCM Program at the University of Michigan continues to grow as well as the number of patients referred for surgical treatment.



Revolutionary Treatment for Thoracic Aortic Pathology

The University of Michigan CVC offers a multidisciplinary team of thoracic aortic specialists, skilled in the full range of care for any aortic pathology. From acute aortic dissections to stable aneurysms in the thoracic aorta, we offer patients a broad array of diagnostic, medical, endovascular and open surgical options. We also offer access to genetic testing to help our patients' families understand their own risk.

The Thoracic Aortic Program at the University of Michigan is one of the largest in the country. Our documented outcomes include some of the lowest mortality rates for even the most complex thoracic aortic reconstructions, including those needing circulatory arrest.

Conditions We Treat

- Thoracic aortic aneurysm and pseudoaneurysm
- Aortic dissection, acute and chronic
- Thoracoabdominal aneurysms
- Aortic rupture
- Penetrating aortic ulcer
- Traumatic aortic injury
- Aortic intramural hematoma
- Arteritis (giant cell, Takayasu's, temporal)
- Connective tissue disorders (Marfan syndrome, Ehlers-Danlos syndrome, Loy-Dietz)

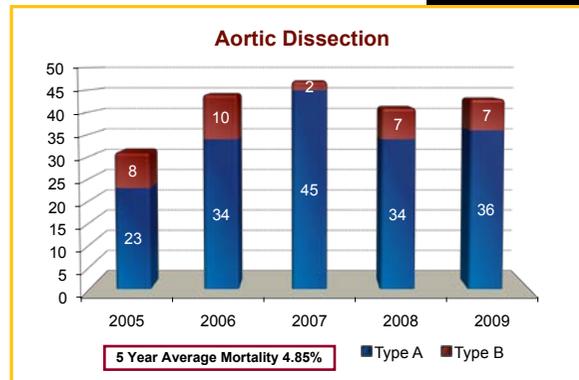
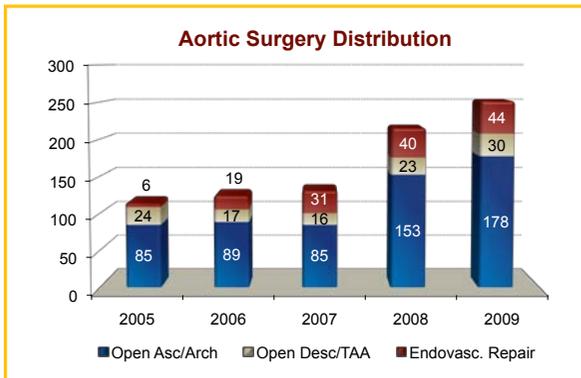


*Dr. G. Michael Deeb,
Founding Director,
Multidisciplinary
Aortic Clinic*

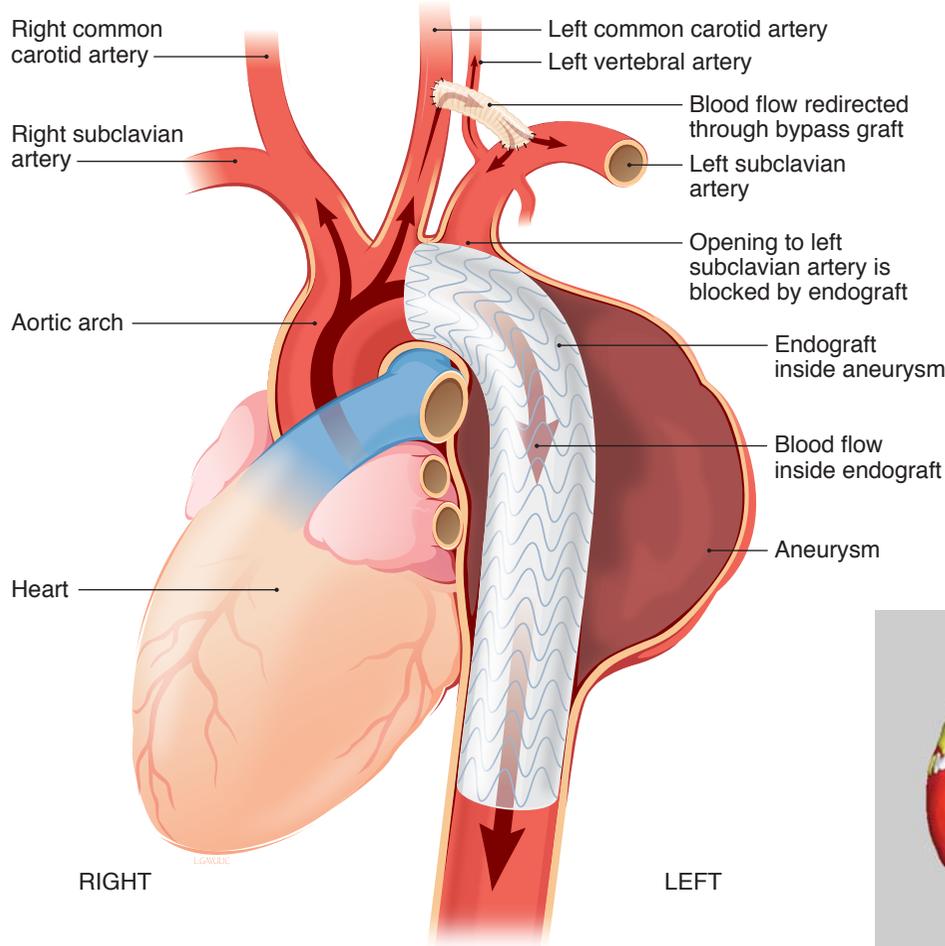


Hallmarks

- Hybrid operating room with fluoroscopy
- Interventional procedure suites with 64-slice CT
- Access to clinical trials of investigational stent-grafts
- Treatment decisions based on the best medical evidence and interdisciplinary consultation
- Research-driven protocols for risk prediction
- 3D cardiothoracic imaging

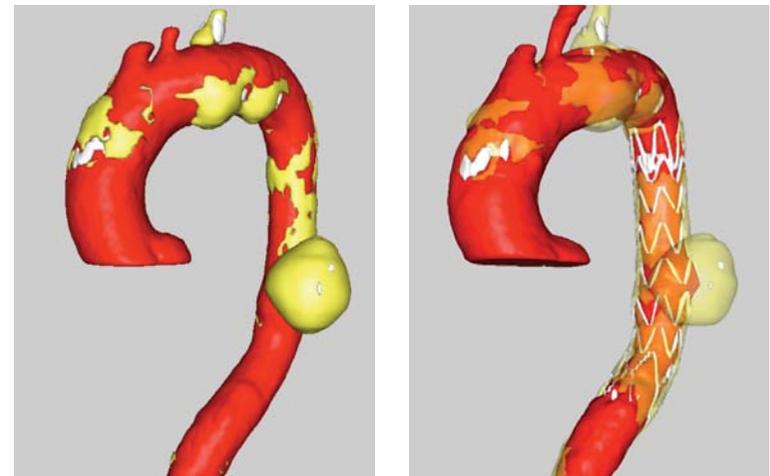


Blood Flow After Carotid Subclavian Bypass and TEVAR



Endovascular Therapy

Endovascular treatment has emerged as a true alternative to open surgery – and a life-saving option for some patients who are not optimal open surgical candidates. We have been performing thoracic endovascular aortic repair (TEVAR) procedures since 1993, far longer than most centers, using a variety of stent graft devices. These procedures can shorten hospital stays and recovery periods, and may not require general anesthesia. Based upon our experience in thoracic endografting over the last two decades, we have identified certain groups of patients that may be treated more effectively with this less invasive approach. Recently, we published a long-term analysis of our results, including a 96% procedure success rate. We achieved low morbidity and mortality over a mean follow-up period of 46 months in a population that was largely made up of high-risk surgical patients, including many with ruptured aneurysms and dissections.



From the Head of the Division of Pediatric Cardiovascular Surgery



These are exciting times for the Division of Pediatric Cardiovascular Surgery. Recent advances in patient care, education and research have continued to improve the outlook for our patients with congenital heart disease. Complex congenital heart lesions, like hypoplastic left heart syndrome, that were universally fatal only a few decades ago, are now successfully treated thanks to the pioneering work of surgeons like Dr. Edward L. Bove and his colleagues at the University of Michigan Congenital Heart Center. These advances in management and technology will be enhanced when the new, state-of-the-art C.S. Mott Children's and Von Voigtlander Women's Hospital opens in November 2011.

There have also been important recent changes to standardize the education of congenital heart surgeons. Under the leadership of Dr. Bove, the American Board of Thoracic Surgery has recognized Congenital Cardiac Surgery as a boarded subspecialty of Thoracic Surgery. Along with this change is the requirement for teaching programs to achieve the standards of resident education set forth by the Accreditation Council for Graduate Medical Education (ACGME). The Division of Pediatric Cardiovascular Surgery is one of the select programs in the United States to have such an ACGME-approved residency program.

The Division of Pediatric Cardiovascular Surgery has also taken a lead role nationally in clinical research. Under the guidance of Dr. James G. Gurney, The Michigan Congenital Heart Outcomes Research and Discovery (M-CHORD) program, the clinical research arm of the University of Michigan Congenital Heart Center, was established. M-CHORD members have received a federal grant to form a consortium of pediatric cardiac critical care units, to improve the intensive care of our patients. The Division of Pediatric Cardiovascular Surgery also provided the leadership for the very first multi-institutional, randomized trial ever performed in congenital heart surgery, the results of which were published in the *New England Journal of Medicine*.

The Division of Pediatric Cardiovascular Surgery has a long and rich history in the treatment of children and adults with congenital heart disease, and we are committed to continue to lead the field into the future with innovative treatment, outstanding education and cutting-edge research.

Richard G. Ohye, M.D.

Associate Professor of Surgery • Head, Division of Pediatric Cardiac Surgery • Surgical Director, Pediatric Cardiac Transplantation Program • Program Director, Congenital Cardiac Surgery Residency Program • Co-Director, Michigan Congenital Heart Center

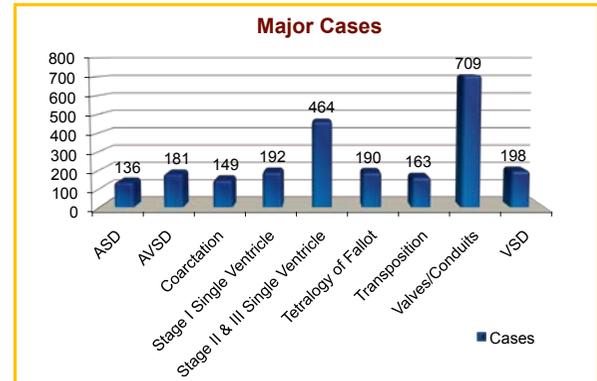
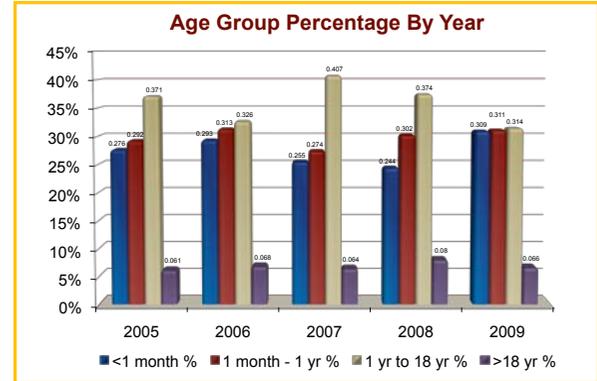
Saving Children's Lives

The University of Michigan Congenital Heart Center (MCHC) is one of the largest programs for children and adults with congenital heart disease (CHD) in the United States. We are a comprehensive team of cardiologists, surgeons, anesthesiologists, nurses, and other healthcare professionals dedicated solely to the care of the CHD patient and their family. We perform more pediatric procedures than nearly all other programs across the country, including approximately 900 total cardiac operative procedures annually, 600 of which are open heart procedures. We also perform 700 diagnostic cardiac catheterizations, 200 interventional catheterizations (including fetal interventions) and thousands of echocardiograms each year. Over 25,000 children have been cared for since the program began in 1985. This makes us one of the most experienced programs in the country.

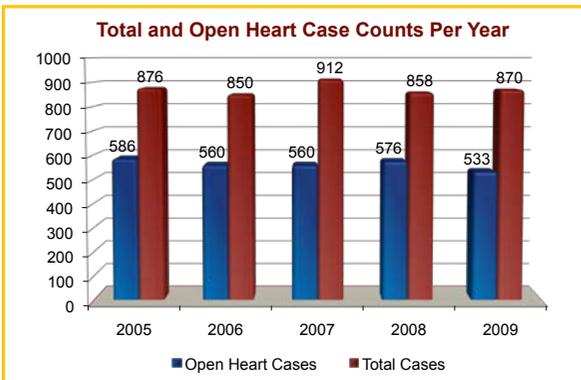


As a high volume center, we have staff committed only to patients with CHD. For example, we are one of the few centers in the country with a separate intensive care unit dedicated to CHD patients, staffed by pediatric cardiologists with specialized training in intensive care. In this intensive care unit, we have an expert cohort of nurses, respiratory therapists, dieticians, pharmacists and social workers who are dedicated to the care of CHD patients and their families.

We specialize in the management of complex congenital heart disease and have more experience treating the single ventricle patient than most centers worldwide. Early complete repair for suitable cardiac defects is performed whenever possible using innovative, evidence-based medicine. The overall success rates are nearly unrivaled by any other institution in the United States. While the MCHC serves



both children and adults with congenital heart disease, approximately half of the patients treated at our program are less than one year old. Half of the patients treated at the University of Michigan travel from outside our region for their care at the MCHC, some traveling from around the globe as far away as South America and the Far East.





Your Child, Your Patient, and the Michigan Difference



Whether you are a parent searching for the best care for their child or a referring physician seeking superior outcomes for your patient, the University of Michigan Congenital Heart Center is uniquely able to provide optimal care for the CHD patient. With a blend of compassionate

family-centered care, innovative medical and surgical treatments driven by evidence-based medicine, and cutting edge facilities, the physicians, nurses and other staff at Michigan are dedicated to delivering the best possible care available anywhere in the world. As a designated Destination Program of the University of Michigan Health Systems, the MCHC also has the resources and infrastructure to ensure that patients and families coming to our program from around the world have the assistance they need to guide them every step of the way through their journey. Surgeons at the University of Michigan were among the first in the nation to perform open heart surgery on children in the 1950s, and in that proud tradition, the current team at the MCHC continues to be one of the Leaders and Best in the care of the patient with CHD.

Hybrid Pediatric Cardiac Surgery

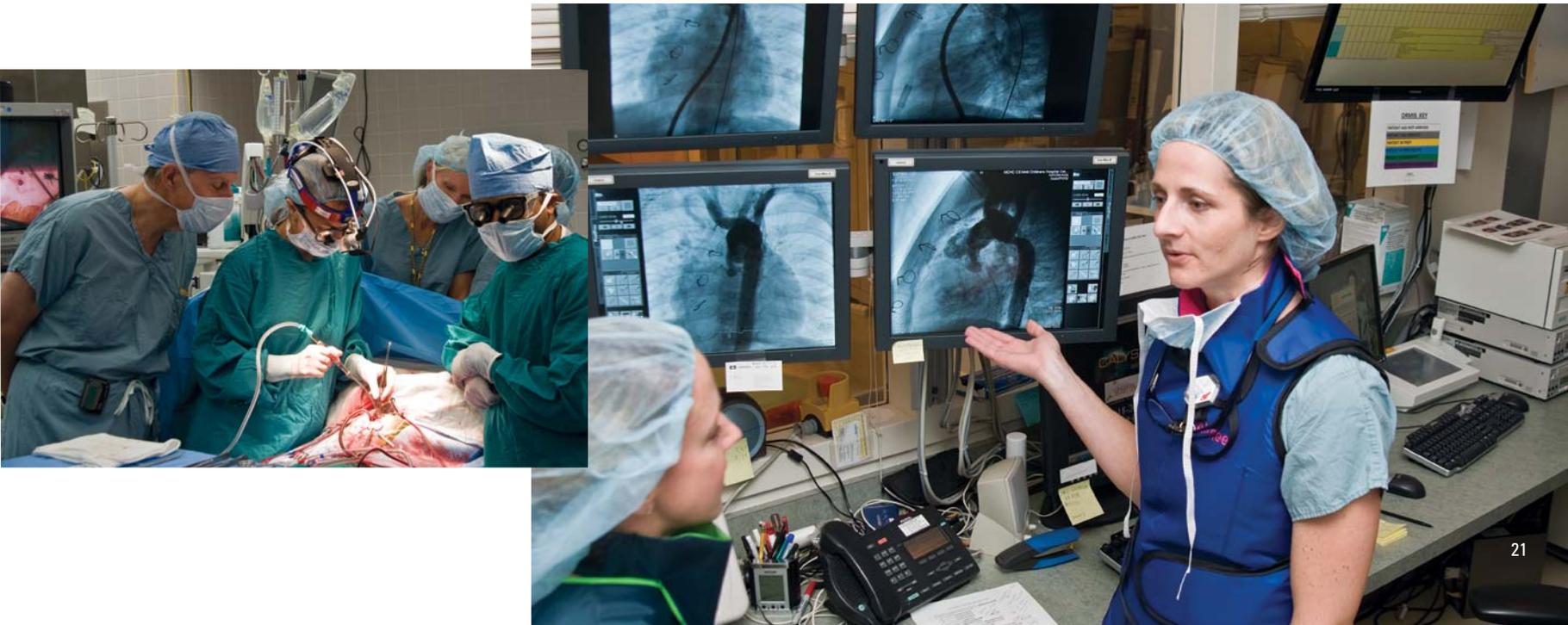
A hallmark of the Michigan Congenital Heart Center is the dynamic collaboration between pediatric cardiac surgery and pediatric cardiology. Hybrid pediatric cardiac surgery is an emerging field that combines the skills and techniques used by pediatric cardiac surgeons and interventional pediatric cardiologists.

The goal of hybrid pediatric cardiac surgery is to reduce the magnitude of therapeutic interventions on children by decreasing the

numbers or the invasiveness of the procedures, or by increasing their effectiveness by opening new therapeutic possibilities. Hybrid interventions are useful when either surgery or catheter-based interventions alone are not able to achieve an adequate result or when the combination of the two fields produce a better outcome or less trauma to the patient. The University of Michigan continues to lead the field in innovation with the establishment of our hybrid program which offers a multitude of hybrid interventions for patients with anatomic defects amenable to this approach.

Hybrid procedures offered at the Michigan Congenital Heart Center:

- Periventricular and peratrial septal defect closure
- Peratrial atrial septal stenting
- Hybrid stage 1 palliation for hypoplastic left heart syndrome
- Periventricular pulmonary valvotomy for pulmonary atresia/intact ventricular septum
- Intraoperative vascular stenting
- Percutaneous pulmonary valve implantation.



Fetal Cardiac Intervention

The Michigan Congenital Heart Center has developed a fetal cardiac intervention program through the formation of a multidisciplinary team including pediatric cardiologists, maternal-fetal medicine obstetricians, pediatric and maternal anesthesiologists, fetal surgeons, social workers, pediatric nurse practitioners, and obstetrical nurses. The mission of this highly specialized team is to improve the short- and long-term outcome of neonates with some of the most severe cardiac defects by intervening before babies are born.



if a defect can be created at that time. Creation of a larger hole with a balloon catheter before the baby is born has the potential to decrease the progressive lung damage and improve the chances the baby will survive and do well after delivery.

Some forms of HLHS begin as critical aortic stenosis, a severe narrowing of the aortic valve or outlet valve to the heart, but have a normal sized left heart. If the narrowing of the valve can be opened with a balloon catheter while the baby is still developing in the womb, this may halt the development of HLHS by allowing more normal flow through and growth of the left heart.

The Fetal Cardiac Intervention Program provides compassionate, comprehensive, multidisciplinary care for the family of an unborn child with critical aortic stenosis or hypoplastic left heart syndrome with restrictive atrial septal defect.

- Critical Aortic Stenosis
 - Fetal balloon aortic valvuloplasty to open the stenotic aortic valve before the growth of the LV is negatively altered has the potential to significantly improve overall outcomes.
 - Fetal balloon aortic valvuloplasty is ideally performed at 22-24 weeks gestation.
- Hypoplastic Left Heart Syndrome with restrictive atrial septal defect
 - Fetal atrial septoplasty to open the atrial septal defect has the potential to prevent the irreversible damage to the pulmonary vasculature, and also prevent the need for emergent, high risk intervention at birth.
 - Fetal atrial septoplasty is ideally performed at 30-32 weeks gestation.

Other Services Provided:

- Comprehensive fetal cardiac evaluation including detailed fetal echocardiogram and consultation with the fetal cardiac intervention team
- Coordination of continued follow up and monitoring throughout the pregnancy, either at the patient's home institution or at the University of Michigan C.S. Mott Children's Hospital
- Anticipatory guidance for families regarding ongoing care after birth
- Transitioning of cardiac care after delivery
- Ongoing communication and coordination with referring physicians.

Adult Congenital Heart Disease

The Adult Congenital Heart Disease program at the University of Michigan provides comprehensive cardiac care to adults with all varieties of congenital heart disease. The adult congenital program features a team approach, and includes practitioners from both the University of Michigan Congenital Heart Center and the University of Michigan Cardiovascular Center. The program is led by physicians board certified in Internal Medicine as well as Pediatrics and Pediatric Cardiology.

Services offered through the adult congenital heart disease program include congenital echocardiograms, cardiac magnetic resonance imaging, advanced electrophysiology procedures, and diagnostic and therapeutic cardiac catheterization. The adult congenital

dysrhythmia clinic features evaluation by an adult electrophysiologist, congenital electrophysiologist, as well as an adult congenital physician to determine the optimal treatment for adults with congenital heart disease and complex arrhythmias.

The Adult Congenital Program works closely with cardiac surgeons from both the Michigan Congenital Heart Center and the Cardiovascular Center, and takes advantage of the experience of physicians within both centers. The Adult Congenital Program is able to access surgical services from one of the highest volume congenital heart surgery programs in the country. In addition, the program works closely with the Aortic and Mitral Valve programs at the Cardiovascular Center to provide its patients with skilled and experienced care for patients with these types of heart disease.

The Adult Congenital program works closely with many other subspecialty areas for the non-cardiac care of adults with congenital heart disease. Physicians from the adult congenital program work closely with the high-risk obstetrics team in the care of women with congenital heart disease prior to, during, and after pregnancy. Additional services include combined visits with the University of Michigan Heart Failure and Transplant program, as well as the Pulmonary Hypertension Program at the University of Michigan Cardiovascular Center. Both programs offer state-of-the-art treatments and technologies for patients with severe disease.

Patients also have the opportunity to participate in ongoing research projects related to congenital heart disease. Ongoing projects include study of the long-term outcomes of adults with tetralogy of Fallot, sleep apnea in congenital heart disease, and quality of life in adult congenital heart disease.

All new patients receive an extensive initial evaluation and review of their medical history. A comprehensive patient education session is provided to inform patients of their congenital heart defect, as well as signs and symptoms which could be danger signs for worsening cardiac status. Timely communication and involvement of the referring physician are an important part of care for all patients.



The New C.S. Mott Children's Hospital and Von Voigtlander Women's Hospital

C.S. Mott Children's and Women's Hospital is known worldwide for its excellent clinical, educational and research programs. Experienced and innovative colleagues with diverse expertise collaborate to provide the highest quality family-centered care for pregnant women, newborns, children, adolescents and adults with CHD. In November 2011, a new, free-standing C.S. Mott Children's Hospital and Von Voigtlander Women's Hospital will open for patient care with 348 beds and 16 operating suites.

This state-of-the-art, 12 story, 1.1 million square foot hospital will further enhance the ability of the healthcare providers of the MCHC to offer the finest care available to patients and their families with CHD. While the technological advances made possible by the new facility are crucial to the optimal care of our patients, we

remain committed to family-center care, which seeks to involve the entire family in the healing process. The new hospital was designed specifically with the families in mind with many amenities, such as accommodations within the intensive care unit for families to stay, as an integral part of the design plan.



Research

In the University of Michigan section of Cardiac Surgery, clinical investigators and basic researchers work together every day to develop deeper understanding and promising approaches to solving and treating heart disease.

Cardiac Surgery faculty have scientific interests in basic, translational and clinical research and are an integral part of the effort to establish premier cardiovascular research at University of Michigan. Our investigators are part of the first wave of investigators scheduled to reside within the cardiovascular research cluster under development at the new NCRC site at the University of Michigan. This cluster integrates outstanding research teams with diverse research interests and approaches. A key goal for this cluster is to develop and encourage discovery and innovation by fostering collaboration and cross-fertilization among investigators. Our faculty will serve as important anchors for heart failure and congenital heart research in this venture.

The overall research mission of Cardiac Surgery faculty is to advance the fight against cardiovascular disease. Basic research discoveries by our faculty have generated new insight into complex processes contributing to and responsible for heart disease. Faculty interests range from studies to understand motor and molecular switch proteins involved in regulating pump performance by the heart to genetic, environmental and dietary contributions to heart failure. Our investigators utilize a diverse array of approaches encompassing techniques ranging from molecular biology, genetics, and biophysics to whole organism physiology and sophisticated bioinformatic analysis of gene and protein expression in hearts. Advances in our understanding of heart function from these studies performed at the bench also are translated to the clinic by investigators on our faculty. Translational studies include the development of innovative drugs, devices, and clinical approaches for treating heart disease as well as participation in the groundbreaking clinical trials necessary to bring these advances to the bedside.

Valve Trials

1. Medtronic, Inc - Medtronic Corevalve U.S. Pivotal Trial.
2. Carpentier - Edwards PERIMOUNT Magna Mitral Valve Trial.
3. Destiny Trial: Effects of Mitral Valve Annuloplasty with the Geoform Ring on Left Ventricular Geometry and Function in Patients with Cardiomyopathy.
4. Medtronic, Inc - Long-term evaluation of the Freestyle Valve.
5. Medtronic, Inc - Training for safe and effective use of the Medtronic Freestyle Bioprosthetic Valve.
6. Bicuspid Aortic Valve registry.
7. Analysis of factors associated with successful outcomes following medical management or surgical management of aortic valve disease.

Thoracic Aorta Trials

1. Medtronic, Inc - Evaluation of the clinical performance of the Valiant Thoracic Stent Graft with Captivia Delivery System for the treatment of acute complicated Type B aortic dissections.
2. Medtronic, Inc - Evaluation of the clinical performance of the Valiant Thoracic Stent Graft with Captivia Delivery System for the Endovascular treatment of blunt thoracic aorta injuries (RESCUE).
3. Medtronic, Inc - Evaluation of the Medtronic AVE Talent Thoracic Stent Graft System for the treatment of thoracic aortic aneurysms.
4. Bolton Medical - A phase II clinical study of the safety and efficacy: Thoracic stent grafts in thoracic aorta pathologies.

5. Cook Incorporated - Thoracic TAA Endovascular Graft clinical investigation.
6. Cook Incorporated - TAA Endovascular Graft post-approval study.
7. Gore W.L & Associates, Inc - Evaluation: Thoracic Endoprosthesis for the treatment of complex pathology of the descending thoracic aorta.
8. Gore W.L & Associates, Inc - Evaluation: Thoracic Endoprosthesis for the treatment of descending thoracic aneurysms.
9. Gore W.L & Associates, Inc - Evaluation: Thoracic Endoprosthesis for the primary treatment of descending thoracic aneurysms.
10. Gore W.L & Associates, Inc - Evaluation: Thoracic Endoprosthesis for the treatment of traumatic transection of the descending thoracic aorta.
11. Gore W.L & Associates, Inc - Evaluation: Thoracic Endoprosthesis for the treatment of acute complicated Type B aortic dissections.
12. Lombard Medical Technologies - Prospective aneurysm trial: High angle Aorfix Bifurcated Stent Graft.

Congenital trials

1. NIH/NHLBI - Single Ventricle Reconstruction Trial: a randomized controlled trial comparing two techniques for the Norwood Procedure.
2. NIH/NHLBI - Effects of Glycemic Control on Immunity: to evaluate the effects of tight glycemic control on immune function in children in the post-operative period following cardiopulmonary bypass.
3. Nina Starr Braunwald Award, Thoracic Surgery Foundation for Research and Education, "Development of a Congenital Heart Assessment of Sensory and Motor Status (CHASMS) Instrument for Infants Following Congenital Heart Surgery."
4. Tight Glycemic Control and Neurocognitive Outcomes in Children Undergoing Cardiopulmonary Bypass.
5. Jack Carlson Memorial Research Grant - Evaluation and prevention of long-term functional impairment associated with prolonged ICU stay.
6. Genetic Modification of Cardiac Motor Proteins in Normal and Failing Myocytes.





Outcomes Research

1. Michigan Congenital Heart Outcomes Research and Discovery (M-CHORD) Program: to develop a clinical and translational research program at the University of Michigan Congenital Heart Center.
2. UMHS Heart Transplant and VAD Database.
3. Michigan Society of Thoracic and Cardiovascular Surgeons Quality Collaborative.
4. Multidisciplinary Aortic Clinic Outcomes Database.
4. SynCardia Systems, Inc - The SynCardia CardioWest Temporary Total Artificial Heart (TAH-t) Post Market Surveillance Study.
5. The Relationship of Sleep Pattern Disturbance, Cognition, and Self Care in Adults with Long-Term Left Ventricular Assist Devices.
6. Quality Assured Service, Inc - VADWatch Telehealth Monitoring of Patients on a Ventricular Assist Device in a Residential Setting.
7. Self-Concept and Lifestyle Modification of Adults Living with Long-Term Implantable Left Ventricular Assist Devices.

Circulatory Support Research

1. Heartware, Inc - The Evaluation of the HeartWare Ventricular Assist System for the Treatment of Advanced Heart Failure Continued Access Protocol Amendment.
2. Terumo Heart, Inc - Study Title: Evaluation of the Safety and Effectiveness of the DuraHeart Left Ventricular Assist in Patients Awaiting Cardiac Transplantation.
3. NHLBI: INTERMACS - Interagency Registry of Mechanical Assisted Circulatory Support.
8. Thoratec Corporation: The HeartMate II LVAS Pivotal Study Protocol.
9. HeartMate II Quality of Life Study.
10. Exercise Performance with the HeartMate II Left Ventricular Assist Device.
11. NIH - Developing a novel mechanical blood pump for temporary circulatory support.
12. Berlin Heart EXCOR Pediatric Ventricular Assist Device Trial.
13. Outcome study on patients requiring temporary circulatory support.

M-CHORD

The Michigan Congenital Heart Outcomes Research and Discovery Program (M-CHORD) is the clinical and translational research core of the University of Michigan Congenital Heart Center (MCHC). M-CHORD provides comprehensive research support and training for faculty, staff, fellows, residents and medical students who care for children and adults with congenital heart defects and children with

acquired heart disease. Although focused primarily in Pediatric Cardiology and Pediatric Cardiovascular Surgery, M-CHORD is a multidisciplinary program that collaborates with Pediatric Critical Care Medicine, Pediatric Nephrology, Pediatric Anesthesiology, Child Behavioral Health, Pediatric Oncology, the School of Public Health, and other disciplines with a common interest in patients with heart disease and their families.

The aims of M-CHORD are to:

- Design and conduct clinical, translational and epidemiologic research in pediatric heart disease to help optimize health outcomes and guide clinical decision making through new or improved treatment and management strategies.
- Educate and train the next generation of physician-scientists in pediatric heart care who will gain experience in conducting applied research in pediatric heart disease to promote improved health outcomes.





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Faculty and Locations



Richard L. Prager, M.D.

Professor of Surgery • Head, Division of Adult Cardiac Surgery • Director, Cardiovascular Center

Dr. Prager received his medical degree from the State University of New York, Downstate in Brooklyn. He completed his Thoracic Surgery residency at the University of Michigan.

Dr. Prager maintains ongoing interests in adult cardiac surgery, health outcomes research, patient safety, organizational efficiencies, and education.

Dr. Prager leads the Michigan Society of Thoracic and Cardiovascular Surgeons Quality Collaborative Initiative and is Chair of the Society of Thoracic Surgeons National Audit Task Force, Chair of the task force on the adult cardiac surgery database, Chair of the Society of Thoracic Surgeons Task Force on Quality Initiatives and Chair of the STS Work Force on Associate Members. He is a Director of the University of Michigan’s Cardiovascular Center and recently assumed the role of Program Director of the Thoracic Surgery residency.



Steven F. Bolling, M.D.

Professor of Surgery • Director, Multidisciplinary Mitral Valve Clinic • Director, Myocellular Biology Laboratory

Dr. Bolling received his medical degree from the University of Michigan Medical School. He completed his Thoracic Surgery residency at Johns Hopkins Hospital.

Dr. Bolling’s interest and expertise are in mitral valve pathology and reconstruction. His innovative approach to mitral valve repair in patients with end-stage left ventricular failure and his extensive experience recognize Dr. Bolling as a national and international expert on mitral valve disease. He continues to run an NIH-funded basic science laboratory, as well as the University of Michigan Integrative Medicine Research Center.



G. Michael Deeb, M.D.

Herbert Sloan Collegiate Professor of Surgery • Founding Director, Multidisciplinary Aortic Clinic

Dr. Deeb received his medical degree from the University of Pittsburgh. He completed his Thoracic Surgery residency at the University of Pittsburgh. Dr. Deeb created the renaissance of the heart transplant program, initiated lung transplantation and facilitated the heart/lung transplant program at the University of Michigan.

His current clinical interests include the treatment of patients with aortic valve disease as well as complex disorders of the aorta including aneurysm and dissection and he has one of the largest practices treating aortic aneurysmal disease and aortic valve repair in the United States with a national referral network.



Jonathan W. Haft, M.D.

Assistant Professor of Surgery & Anesthesia • Director, Extracorporeal Life Support Program • Associate Director, Cardiovascular Intensive Care Units

Dr. Haft received his medical degree from the University of Miami. He completed his Thoracic Surgery residency at the University of Michigan. He is the director of the Extracorporeal Life Support Program, replacing the legendary program founder, Dr. Robert Bartlett.

His interests include the use of mechanical circulatory support for heart failure and shock, critical care, and heart transplantation. Additionally, he is the associate director of the Cardiovascular Intensive Care Unit at the University of Michigan Cardiovascular Center and he is the Division Chief of Cardiothoracic Surgery at the Ann Arbor Veterans Affairs Hospital.



Francis D. Pagani, M.D., Ph.D.

Otto Gago, M.D. Professor of Surgery • Surgical Director, Adult Heart Transplantation • Director, Center for Circulatory Support

Dr. Pagani received his medical degree from Georgetown University. He completed his Thoracic Surgery residency at the University of Michigan. His research focuses on the use of mechanical circulatory support in the treatment of end-stage heart disease and use of stem cell transplantation for myocardial regeneration. The Center for Circulatory Support (VAD Program), under Dr. Pagani's direction, is one of the most recognized and respected programs in the nation as is the cardiac transplantation program.

His clinical interests include adult cardiac surgery with emphases on Heart Transplantation, Hypertrophic Cardiomyopathy/Myectomies, Heart Failure and Mechanical Circulatory Support Systems.



Himanshu J. Patel, M.D.

Associate Professor of Surgery • Director, Multidisciplinary Aortic Program

Dr. Patel received his medical degree from the Johns Hopkins School of Medicine. He completed his Thoracic Surgery residency at the University of Michigan. Dr. Patel specializes in surgery for thoracic and thoracoabdominal aortic disease, and surgery for valvular and aortic root disease. He has significant experience in both open and endovascular therapy of the thoracoabdominal aorta, and minimally invasive options for valve replacement, as well as valve sparing approaches.

His research interests focus on outcomes after operative and medical therapy for thoracic aortic disease and aortic valvular disease. Dr. Patel also has a keen interest in development of endovascular solutions for complex thoracic aortic pathology, including development of newer devices.



Matthew A. Romano, M.D.

Assistant Professor of Surgery

Dr. Romano received his medical degree from Loma Linda School of Medicine. He completed his Thoracic Surgery Residency at the University of Michigan. He joined the faculty in 2009 following the completion of his residency and Fellowship in Thoracic Surgery and Surgical Critical Care at the University of Michigan. During this time he received advanced training in the surgical treatment of aortic disease and heart transplantation at the University of Michigan. Dr. Romano operates at both the University of Michigan Cardiovascular Center and at the Ann Arbor Veterans Affairs Hospital.

His clinical and research interests include mechanical circulatory support for heart failure and shock, heart transplantation, aortic diseases and minimally invasive cardiac surgery techniques.



Edward L. Bove, M.D.

Helen and Marvin Kirsh Professor of Surgery • Head, Section of Cardiac Surgery

Dr. Bove received his medical degree from Albany Medical College. He completed his Thoracic Surgery residency at the University of Michigan. He also completed a Pediatric Cardiac Surgery fellowship at the Hospital for Sick Children in London. Dr. Bove is a renowned pediatric cardiac surgeon and an internationally recognized expert on the treatment of complex congenital heart disease. The Division of Pediatric Cardiac Surgery is one of the busiest congenital heart programs in the U.S. and the largest in the state of Michigan, performing over 900 procedures annually.

Dr. Bove's particular research interest is in the area of computer flow modeling of the circulation in complex congenital heart disease. Dr. Bove has received support for his research from the American Heart Association; the National Heart, Lung and Blood Institute; the National Institutes of Health, and the Leducq Foundation.



Eric J. Devaney, M.D.

Associate Professor of Surgery

Dr. Devaney received his medical degree from the University of California Los Angeles School of Medicine. He completed his Thoracic Surgery residency and Pediatric Cardiac Surgery fellowship at the University of Michigan. Dr. Devaney's clinical interests and expertise range from the neonatal surgical management of complex congenital heart disease to the treatment of adults with congenital heart disease. He also has an active interest in left ventricular assist device therapy for pediatric heart failure.

In addition to his clinical activities, Dr. Devaney creates outcomes studies in congenital heart disease in order to evaluate therapies and establish benchmarks for the discipline. He also pursues basic science research in the molecular biology of cardiac muscle function and heart failure. Currently, his laboratory is investigating the role of sarcomeric gene mutations in the normal and failing heart.



Jennifer C. Hirsch, M.D.

Assistant Professor of Surgery, Pediatric Cardiac Surgery • Assistant Professor of Pediatrics, Pediatric Cardiac Intensive Care Unit

Dr. Hirsch received her medical degree from Harvard Medical School. She completed her Thoracic Surgery residency and Pediatric Cardiac Surgery fellowship at the University of Michigan. Her clinical interests are in fetal interventions and the postnatal management of these neonates as well as hybrid interventions.

Her research focus is on quality of life and functional outcomes for children following congenital heart surgery. She is active nationally in the Society of Thoracic Surgeons Congenital Database and the Congenital Quality Measures Initiative.



Richard G. Ohye, M.D.

Associate Professor of Surgery • Head, Division of Pediatric Cardiovascular Surgery • Surgical Director, Pediatric Cardiac Transplantation Program • Program Director, Congenital Cardiac Surgery Residency Program • Co-Director, Michigan Congenital Heart Center

Dr. Ohye received his medical degree from Ohio State University. He completed his Thoracic Surgery residency at Ohio State University and his Pediatric Cardiac Surgery fellowship at the University of Michigan. Dr. Ohye's major clinical interests are in complex congenital heart defect repair and pediatric heart transplantation.

His research interests are in clinical and translational research and are supported by his role as a founding member of the Michigan Congenital Heart Outcomes Research and Discovery (M-CHORD) program. Dr. Ohye is the study chair of a 14-center randomized trial comparing techniques for the Norwood operation for hypoplastic left heart syndrome, the first multi-institutional prospective trial ever performed in congenital heart surgery.



Mahender Macha, M.D.
Assistant Professor of Surgery

Dr. Macha received his medical degree from the University of Michigan. He completed his Thoracic Surgery residency at Stanford University. He helped initiate the Cardiac Surgery Program at the University of Michigan affiliate hospital Allegiance Health in Jackson, Michigan in 2007. In addition to his active clinical practice, he has an interest in both clinical and basic science research related to end-stage heart failure and the development of innovative therapies.



Vincent A. Simonetti, M.D.
Assistant Professor of Surgery

Dr. Simonetti received his medical degree from Wayne State University. He completed his Thoracic Surgery residency at Wayne State University and The Detroit Medical Center and spent an additional year as a clinical and research fellow in Cardiopulmonary Transplantation at Henry Ford Hospital. He practices at the University of Michigan's affiliate cardiac surgery program at Allegiance Health.



Frank L. Fazzalari, M.D.
Assistant Professor of Surgery

Dr. Fazzalari received his medical degree from the University of Michigan. He completed his Thoracic Surgery residency at Massachusetts General Hospital/Harvard Medical School. He completed a Critical Care Fellowship as well as an ECLS/ECMO Fellowship at the University of Michigan and initiated the program at the University of Michigan's cardiac surgery affiliate at Crittenton Hospital. His research interests focus on outcomes and system organization.



Margaret V. Westfall, PhD.
Associate Professor of Surgery and Physiology

Dr. Westfall received her PhD in Physiology from Loyola University in Chicago. Her research interest is focused on understanding the protein kinase C signaling cascade and its role in modulating cardiac contractile function. She is NIH funded and her laboratory will be an anchor for cardiac surgery in the North Campus Research Complex.





The University of Michigan's commitment to care is not limited to our local community. From collaborative outreach and shared surgical services, U-M faculty members work in conjunction with physicians and researchers at partner institutions to create a network of innovation, communication, and education.



Allegiance Health Jackson, MI

Allegiance is a community-owned and locally-governed health system that has served the Jackson community and surrounding counties since 1918. The Allegiance Heart and Vascular Center has partnered with the University of Michigan to provide high quality cardiac surgery and features a Cardiac Universal Bed Unit designed to create a healing environment and to emphasize patient comfort and family privacy as much as to incorporate modern technology. The Center has a strong emphasis on innovation and measuring and reporting outcomes.



C.S. Mott Children's Hospital Ann Arbor, MI

C.S. Mott Children's Hospital is known worldwide for its excellent clinical, educational and research programs.

Experienced and innovative colleagues with diverse expertise collaborate to provide the highest quality family centered care for pregnant women, newborns, children, and adolescents. The hospital has consistently ranked high in the *U.S. News & World Report* America's Best Hospitals honor roll and nationally ranked in eight pediatric specialty areas of ten featured in this special report.



University of Michigan Health System Ann Arbor, MI

The University of Michigan Health System (UMHS) consistently ranks

high by the *U.S. News & World Report* America's Best Hospitals honor roll and is currently ranked 14th. U-M is the only hospital in Michigan to make this honor roll for 15 consecutive years and currently has excellence in 15 specialty care programs. Other rankings have also placed U-M's patient care among the country's finest. In recent years, UMHS has received a number of top-quality honors from groups including the Leapfrog Group, Thomson Reuters, AARP, and the American Hospital Association.



Crittenton Hospital Medical Center Rochester, MI

Crittenton Hospital Medical Center offers the communities of Oakland,

Macomb, and Lapeer counties the highest quality cardiac surgery. Since first opening its doors in 1967, Crittenton has prided itself on enhancing the health status of the community it serves by offering compassionate, quality medical care. The unique partnership with the Section of Cardiac Surgery at the University of Michigan allows Crittenton Hospital to offer a comprehensive cardiac surgical program.



The Veteran's Administration Ann Arbor Healthcare System Ann Arbor, MI

The VA Ann Arbor Healthcare System provides care to nearly 22,000 veterans

in Southeast Michigan and Northwest Ohio. The VA Hospital offers numerous specialty care programs, including a cardiac care center. The VA Hospital also has a comprehensive research program in many areas of study, including cardiovascular disease. As a teaching facility, the VA Hospital provides training to more than 1100 students and health care professionals a year. The University of Michigan Cardiac Surgery faculty operate at the Ann Arbor VA where nearly 200 cardiac operations are performed each year.



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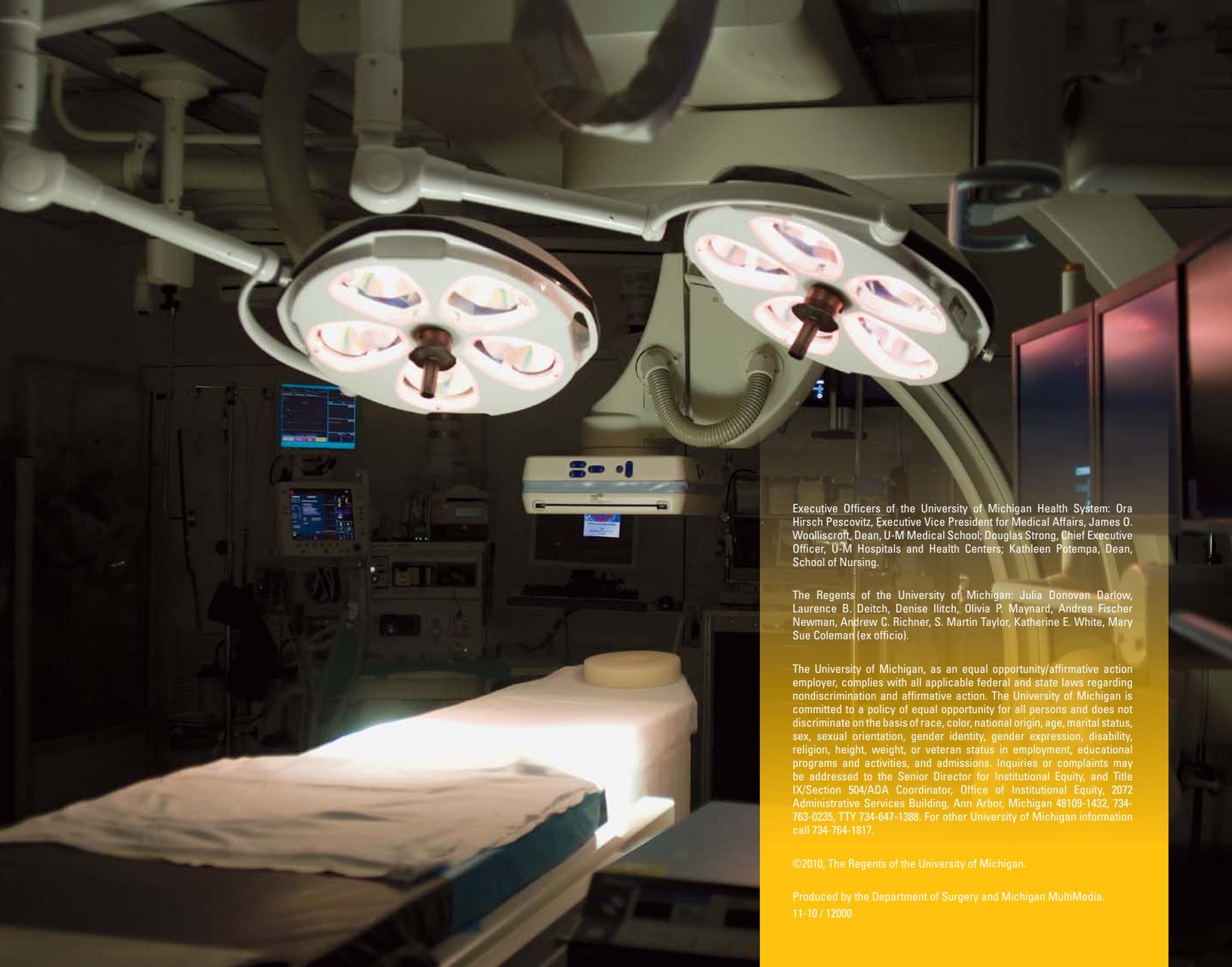


Appointments

Adult Cardiac Surgery
888.287.1082
Pediatric Cardiac Surgery
877.262.4628

Allegiance Hospital
517.817.7605

Crittenton Hospital
248.601.6190



Executive Officers of the University of Michigan Health System: Ora Hirsch Pescovitz, Executive Vice President for Medical Affairs, James O. Woolliscroft, Dean, U-M Medical School; Douglas Strong, Chief Executive Officer, U-M Hospitals and Health Centers; Kathleen Potempa, Dean, School of Nursing.

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