MICHIGAN MEDICINE
UNIVERSITY OF MICHIGAN

CARDIAC SURGERY
FRANKEL CARDIOVASCULAR CENTER
C.S. MOTT CHILDREN'S HOSPITAL

# Department of CARDIAC SURGERY
# REPORT & OUTCOMES 2016-2017

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# WELCOME

## From the Chair of the Department of Cardiac Surgery

As Chair, it is my pleasure to update you on the progress and accomplishments our Department has made over the past year. We have continued to expand the clinical and basic science faculty to support and enhance our three-part mission of clinical care, research and teaching.

The Section of Adult Cardiac Surgery, under the leadership of Dr. Himanshu J. Patel, continues to grow in clinical volume. This remarkable growth during competitive market conditions and rapidly changing times is a reflection of the well-recognized expertise of our faculty and their efforts to develop a wide breadth of innovative services. At the Frankel Cardiovascular Center (FCVC), our faculty performed over 1,400 major operations during the last year. This represents a near doubling of our volume since the opening of the FCVC and we are projecting to grow over the years ahead. Our transcatheter aortic valve replacement program (TAVR) has flourished and is now one of the busiest in the nation. Other clinical programs in valve reconstruction/replacement, open and endovascular aortic surgery, as well as transplantation and assist devices remain very busy. Recently, Dr. Steven Bolling has initiated a new program in percutaneous mitral valve repair. We have recruited highly skilled faculty to join our team of surgeons to enhance our expanding aortic and valve surgery programs.

The Section of Pediatric Cardiovascular Surgery, led by Dr. Richard Ohye, continues to experience a busy clinical workload, performing over 900 cardiac operations last year. The Congenital Heart Center remains a major referral center, receiving patient referrals from around the country and overseas with approximately one-half of our patients coming from outside our region. One of our faculty members, Dr. Ming Si, has led the development of the pediatric cardiovascular ventricular assist program with innovative devices to support smaller and younger patients. In addition to his clinical activity, Dr. Si also maintains a productive basic science lab in cardiac regenerative medicine. Dr. Jennifer Romano has developed an active hybrid surgery program to improve the outcomes of some of the most seriously ill newborns referred to our center, many of whom had little or no options in the past.

The Department of Cardiac Surgery, along with the Section of General Thoracic Surgery, continues to have three of the most competitive residency and fellowship programs in the country. Currently, we maintain a traditional two-year fellowship program in cardiothoracic surgery, as well as an integrated six-year residency matching directly out of medical school. In addition, the University of Michigan continues to have one of only a few ACGME approved congenital heart surgery residency programs in the nation. All the residents in our various adult and pediatric cardiac surgery programs are outstanding and we are proud to be able to call them University of Michigan graduates.

In addition to our clinical activities, the Department's research portfolio has also grown substantially. With the addition of Drs. Eugene Chen and Zhong Wang, we now have a nucleus of clinical and basic scientists working together at the North Campus Research Center in the area of stem cell research. This area holds great promise as our team investigates ways to grow new heart cells, blood vessels, and valves. In addition, the Department has placed great emphasis in health services research, now formally recognized by the establishment of the Section of Health Services Research and Quality. Under the direction of Dr. Donald Likosky, this group has advanced our efforts in quality and safety as well in the organization and structure of our outcomes research efforts. These accomplishments have been recognized on both the State and national levels as some of the highest quality clinical research performed anywhere.

We are proud of the latest *U.S. News & World Report* hospital rankings, rating University of Michigan Hospitals #6 overall in Honor Roll, #3 in Pediatric Cardiology and Heart Surgery, and #10 in Adult Cardiology and Heart Surgery.

As our Department continues to grow, we will seek to collaborate with our colleagues in adult and pediatric cardiology, interventional radiology, anesthesia, vascular surgery, critical care, and other related disciplines. The future of cardiac care is changing with the evolution of new technology. Cardiac Surgery at the University of Michigan continues to lead the efforts to develop surgical treatments to meet the needs of our patients and society.

Sincerely,

Edward L. Bove, M.D.
Helen and Marvin Kirsh Professor of Cardiac Surgery
Chair, Department of Cardiac Surgery

# NEWS & NOTES

**Richard L. Prager, M.D.**, was presented with the esteemed Coeur D'Or (Heart of Gold) Award for Excellence by the American Heart Association. He is currently the President of the Society of Thoracic Surgeons.

**Himanshu J. Patel, M.D.**, was promoted to Head, Section of Adult Cardiac Surgery in July 2016. Dr. Patel is currently the Medical Co-Director of both the Multidisciplinary Aortic Program and the Structural Heart Program.

**Jennifer C. Romano, M.D.**, was promoted from Assistant Professor to Associate Professor of Cardiac Surgery, Section of Pediatric Cardiovascular Surgery. She recently assumed the role of Program Director of the Congenital Residency Program.

**Jonathan W. Haft, M.D.**, was elected President of the American Society of Artificial Internal Organs (ASAIO) in June 2017. He is now the Associate Program Director of the Residency Program.

**Bo Yang, M.D.**, was awarded a K08 grant from the National Institutes of Health titled "Effect of mutations in the TGF-beta pathway genes on smooth muscle cell differentiation using patient derived iPSCs."

**Francis D. Pagani, M.D., Ph.D.**, chairs the Council on Clinical Practice and Member Engagement at the Society of Thoracic Surgeons.

**Karen M. Kim, M.D.**, was appointed Assistant Professor of Cardiac Surgery, Section of Adult Cardiac Surgery in September 2015. She received her B.A. in biochemistry from Harvard University and her M.D. from Tufts University in Boston. She completed her surgical residency at Massachusetts General Hospital in Boston and then proceeded to the University of Pennsylvania where she completed both her cardiothoracic surgery residency and an advanced fellowship in aortic and endovascular surgery. Dr. Kim's clinical interests include all areas of adult cardiac surgery with a special interest and focus in the area of open and endovascular approaches to complex aortic valve and aortic diseases. Dr. Kim's research interest is focused on health services research in the area of complex aortic disease and therapeutic treatment options.

**Paul C. Tang, M.D., Ph.D.**, was appointed Assistant Professor of Cardiac Surgery, Section of Adult Cardiac Surgery and joined the Department in June 2017. He received his Ph.D. in Vascular Immunology from Yale University and his M.D. from University of New South Wales, Australia. He completed his surgical residency at Yale-New Haven Hospital & State University of New York at Buffalo. He completed his Cardiothoracic fellowship and Advanced Cardiac fellowship at Duke University Medical Center. Dr. Tang's research interests include Aneurysm Biology & Vascular Remodeling, Aortic Surgery Outcomes and Heart Transplant and Mechanical Circulatory Support.

**Peter Sassalos, M.D.**, joined the Section of Pediatric Cardiovascular Surgery as a Clinical Assistant Professor of Cardiac Surgery in July 2017. He received his medical degree from Case Western Reserve University in 2006 and began his residency in general surgery at the University of Michigan followed by a two-year residency in cardiothoracic surgery. He completed his residency in Pediatric Cardiac Surgery in June 2016. Dr. Sassalos has been honored with awards including the Presidential Scholar at Wayne State University, the Arnold Coran Teaching Award, the Robert H. Bartlett Chief Resident Teaching Award from the University of Michigan Department of Surgery, and the Bronze Beeper Teaching award (twice) from Michigan Medicine.

**Michael P. Thompson, Ph.D.**, joined the Section of Health Services Research and Quality as an Assistant Professor of Cardiac Surgery in July 2017. He received a Bachelor of Science in Human Biology and a Bachelor of Science in History, Philosophy and Sociology of Science from Michigan State University. He earned a Masters of Public Health in Epidemiology from the University of Michigan, then returned to Michigan State, earning his Ph.D. in Epidemiology in 2015. Dr. Thompson had been working as a Postdoctoral Associate for the Health Services and Policy Research Group at the University of Tennessee Health Science Center in Memphis. His current research focuses on evaluating the effects of health policy, health system redesign, and changes in clinical practice on patients undergoing cardiac surgery.

# EDUCATION & TRAINING

**Training the Next Generation of Cardiac Surgeons Since 1928**

The University of Michigan was the first in the United States to offer a residency in thoracic surgery, built on the philosophy that this type of surgery is so complicated that residents need two years of special education in operating in the chest. The residency, pioneered by Dr. John Alexander, Michigan's first Director of Thoracic Surgery, has become the educational standard for thoracic surgical residency training. As the institution that launched the first residency, Michigan is a national training model where education is a priority, not an afterthought. We have a nearly 90-year-old focus on educating future general thoracic and heart surgeons. Our goal has always been for our residents to receive an education that allows them to perform at the highest level in thoracic surgery with hands-on experience. The Department has a long tradition of producing well-trained surgeons who go on to be leaders in the field.

**Offering Three Pathways of Training:**

1) The traditional two-year thoracic surgery program is offered for those who have completed either a general or vascular surgery residency. It provides two years of cardiac & thoracic surgery training.

2) The integrated program, which began in July 2013, is geared toward medical students who know they wish to become cardiothoracic surgeons. Instead of first completing general surgery training and then beginning a separate residency in cardiothoracic surgery, trainees enter a cardiothoracic residency directly out of medical school. This six-year program includes a variety of rotations in the early years, including general surgery, critical care, cardiac imaging, and other relevant surgical and non-surgical specialties. In 2016, the University of Michigan Department of Cardiac Surgery integrated program was one of only 26 such programs in the country.

3) Congenital Cardiac Surgery Residency, one of only 12 programs in the country approved by the Accreditation Council for Graduate Medical Education, is geared toward those who want to specialize in infants and children.

The success of the program can be seen in its graduates—five now lead pediatric cardiac surgery programs across the country; a sixth leads a thoracic surgery section. Seven are directors of pediatric cardiac surgery programs in their native countries.

**Current Residents**

**Claude Beaty, M.D.** Pediatric Fellow | House Officer VIII

**Curtis Bergquist, M.D.** I-6 Resident | House Officer II

**Alexander Brescia, M.D.** I-6 Resident | House Officer III

**Tyler Grenda, M.D.** Junior Resident | House Officer VIII

**Reilly Hobbs, M.D.** Junior Resident | House Officer VIII

**Candis Jones, M.D.** I-6 Resident | House Officer II

**Kellianne Kleeman, M.D.** I-6 Resident | House Officer IV

**Jivong Moon, M.D.** Advanced Congenital Cardiac Surgery Fellow

**Michael Pienta, M.D.** I-6 Resident | House Officer I

**Terry Shih, M.D.** Senior Fellow | House Officer VIII

**Vikram Sood, M.D.** I-6 Resident | House Officer V

**Sarah Ward, M.D.** I-6 Resident | House Officer V

**Tessa Watt, M.D.** I-6 Resident | House Officer IV

**William Weir, M.D.** I-6 Resident | House Officer III

**Stephanie Worrell, M.D.** Senior Fellow | House Officer VIII

**Bree Ann Young, M.D.** I-6 Resident | House Officer I

**Nursing at Michigan**

The Cardiovascular ICU was awarded the Silver Beacon Award for Excellence in 2016. This award is given to mark a significant milestone on the path to exceptional patient care and a healthy work environment.

The University of Michigan has also earned Magnet recognition, the highest honor in nursing. Only 6 percent of U.S. hospitals earn the coveted honor, given to organizations that meet rigorous standards for quality patient care, nursing excellence and innovation in professional nursing practice.

**CVC Innovation Award**

The Cardiovascular ICU was awarded the first annual Frankel Cardiovascular Center (FCVC) Clinical Innovation Challenge. The purpose of this challenge is to give every staff member an opportunity to submit ideas to make improvements within the FCVC. This year, 36 unique ideas were submitted, including the winning idea to have mobility aides to promote early ambulation for patients in the Cardiovascular ICU.

# BASIC SCIENCE & TRANSLATIONAL RESEARCH UPDATE

Our Basic Science & Translational Research is led by **Y. Eugene Chen, M.D., Ph.D.** Research in the Department is both basic and translational with scientists focused on finding new ways to fight heart disease on many fronts, including the molecular biology of heart failure and many others. Lab space is primarily at the North Campus Research Complex where researchers actively pursue the University's mission to expand its capabilities as one of the nation's top translational research institutions. The research program comprises approximately 4,000 square feet in the North Campus Research Complex. These laboratories support the majority of basic research in the Department. Many of the basic research projects are being performed in collaboration with other departments including Internal Medicine, Physiology, Pharmacology, and Biomedical Engineering. Another research arm is devoted to clinical trials where healthy individuals, as well as those with specific diseases and conditions, volunteer to help develop new and better surgical techniques, diagnostic tools and prevention mechanisms.

# HEALTH SERVICE RESEARCH & QUALITY UPDATE

The Department's Health Service Research & Quality is led by **Donald S. Likosky, Ph.D.** Dr. Likosky's work has created new insights into patterns and consequences of care and reduction in unwarranted variation in clinical practice, primarily within the context of regional and national quality improvement organizations. Under grants through the Agency for Healthcare Research and Quality, Dr. Likosky has partnered with surgeons from the Michigan Society of Thoracic and Cardiovascular Surgeons Quality Collaborative to evaluate determinants of variability in blood utilization, as well as post-operative and hospital acquired infections following coronary artery bypass grafting (CABG).

Under a separate grant from the Agency for Healthcare Research and Quality, Dr. Likosky created a network of regional cardiac surgical quality improvement collaboratives, the National Cardiac Surgery Quality IMPROVEment (IMPROVE) Network, which seeks to increase the value of cardiovascular surgical care by developing, evaluating and sharing best practice knowledge gained from quality improvement projects across the member organizations. In partnership with members from the clinical community, a cardiovascular perfusion registry was created to link surgical data with data elements reflecting technology and processes of cardiovascular perfusion care.

This registry, called Perfusion Measures and Outcome (PERForm), provides the foundation for participating centers to assess and improve the care and outcomes for patients undergoing cardiac surgery. The PERForm registry is now being used at cardiac surgical programs across the United States.

The Section of Health Services Research and Quality is used by faculty to discover new treatments for patients with acquired and congenital cardiovascular disease. Its rich data warehouse includes both clinical and administrative data and is linked to the National Death Index for the assessment of long-term survival. Clinical faculty receive contemporaneous benchmarking reports to facilitate ongoing evaluation and targeted improvement in clinical outcomes. HSRQ has full-time data warehouse and biostatical support, and convenes monthly Research-in-Progress seminars to provide critical feedback on projects led by faculty or trainees. Faculty, in partnership with the Section of Health Services Research and Quality, continue to actively participate in the evaluation of current healthcare policies, and contribute to the development of more effective statewide and national policies aimed at improving the efficiency and reliability of cardiac surgical practices.

HSRQ continues to invest in the educational mission of the Department. Medical students and surgical trainees have participated and/or led investigations leveraging the infrastructure created through the Section.

# OUTCOMES

## U-M CARDIAC SURGERY PROGRAMS CLINICAL CARE HIGHLIGHTS CY2016

### Inpatient Discharges

ADULT
**1,795**

CONGENITAL
**949**

### Surgical Operations

ADULT
**1,404**

CONGENITAL
**1,037**

### Heart Transplants

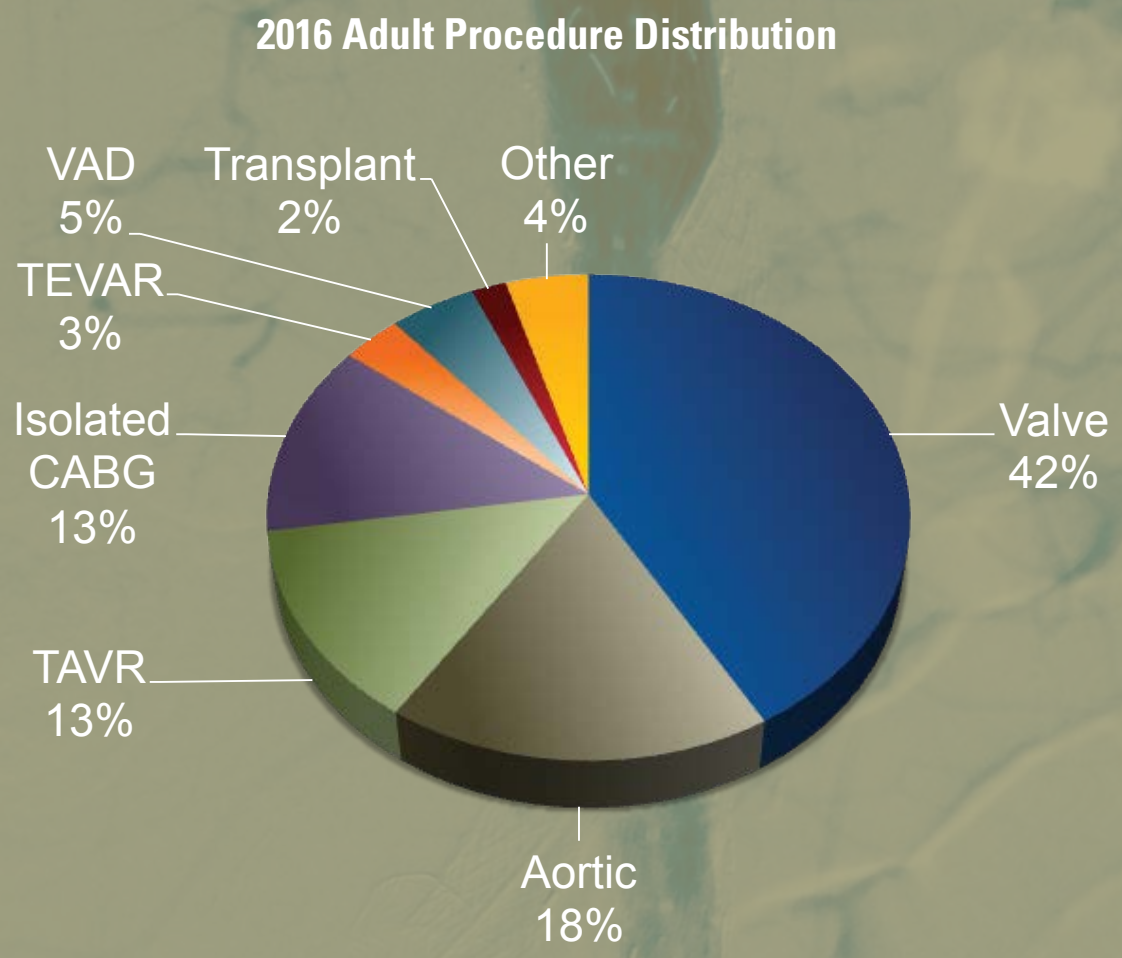
ADULT
**27**

PEDIATRIC
**9**

### Ventricular Assist Devices Implanted

**67**

# ADULT CARDIAC SURGERY




## Overview

The Section of Adult Cardiac Surgery is led by Himanshu J. Patel, M.D. This Section continues to maintain strong clinical programs in the traditional areas of myocardial revascularization, cardiac valve repair and replacement, and cardiac transplantation and circulatory support devices. Significant growth has come in areas of newer technology: thoracic endovascular aortic repair [TEVAR] and transcatheter aortic valve replacement [TAVR]. In collaboration with the Division of Cardiology, we have continued to develop new methods of providing efficient cost-effective care to our patients in the Frankel Cardiovascular Center. In addition, expansion of our inpatient facilities to include additional operating room time and ICU beds is occurring within the Cardiovascular Center, which opened in 2007.

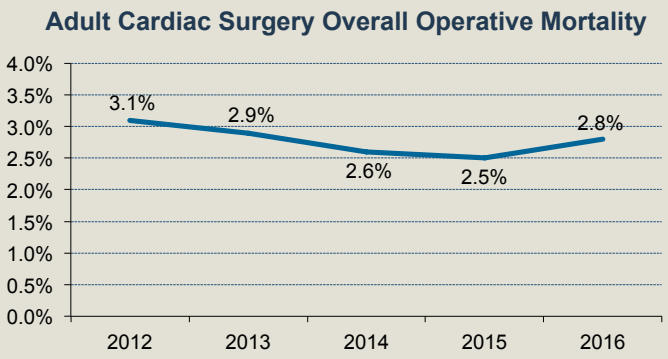
# Overview (continued)

As cardiac surgery continues to advance, U-M's Section of Adult Cardiac Surgery is playing a major role in the evolution of diagnoses and treatments for cardiac and thoracic aortic diseases. The Section and the Frankel Cardiovascular Center continue to focus on achieving the finest outcomes and the most appropriate treatment for our patients.

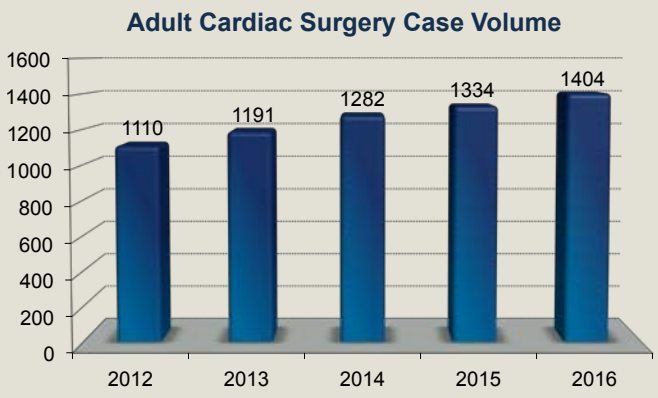
For example, our cardiac surgery team offers pulmonary thromboendarterectomy (PTE) as a treatment option for patients with chronic thromboembolic pulmonary hypertension (CTEPH). Our program is currently the only institution in the state and one of only a few in the country to offer PTE therapy. We have observed highly successful outcomes, improving the quality of life for these patients.

**Pulmonary Thrombo-endarterectomies since 2011**

**65**



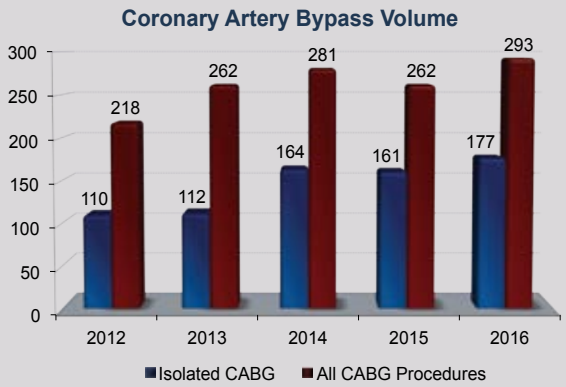

*The average operative mortality for all cardiac surgery cases over the last 5 years was 2.8%. In 2016, the operative mortality for all cases was 2.8%.*




*The Section of Adult Cardiac Surgery performed 1,404 Adult Cardiac operations in 2016.*

# Ischemic Heart Disease

Utilizing our collaborative heart team 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 CABG has remained steady while risks and co-morbidities have increased in this group of patients.




**5 year average isolated CABG operative mortality 1.0%**

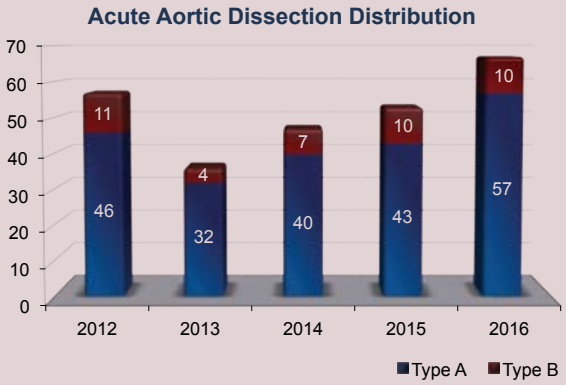
| | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|
| **Observed Mortality:** | 1.8% | 0.9% | 0.0% | 0.0% | 2.3% |
| **STS Risk Adjusted Mortality:** | 1.9% | 0.8% | 0.0% | 0.0% | 2.0% |

*Coronary artery bypass grafting (CABG) procedures represent 13% of our volume of operations in 2016. Our outcomes are noteworthy with a 5 year average mortality of 1.0%.*

*Note: STS (as seen in chart below) is the Society of Thoracic Surgeons and the STS database remains a standard for comparison in the United States.*

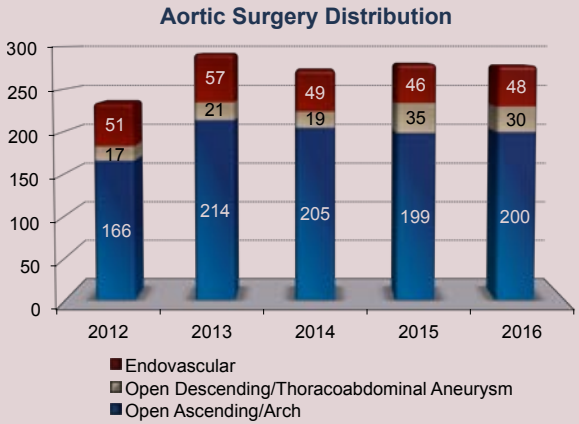
# Aortic Disease

The U-M Aortic Program offers innovative treatments and has one of the lowest mortality rates in the country. This multidisciplinary team of specialists from 6 different specialties combine to treat all types of aortic disease including: colon aortic valve disease, bicuspid aortic valve, thoracic aneurysms (including ascending, arch and descending), aortic dissection, and aortic related connective tissue disorders. Our surgeons continue to maintain one of the largest aortic practices in the U.S. and offer medical management, open surgical options, and endovascular repair of the aorta.




**5 year average operative mortality 7.3%**
**2016 operative mortality Type A: 5.3% | Type B: 0.0%**

*The University of Michigan is a destination center for patients with acute aortic dissections. The 5 year average operative mortality for surgically repaired aortic dissections is a remarkable 7.3%. The 2016 operative mortality for Type A dissections is 5.3%. The 2016 operative mortality for Type B dissections is 0.0%.*




*The University of Michigan Frankel CVC continues to perform a large number of complex aortic surgical procedures every year.*

# Valve Surgery

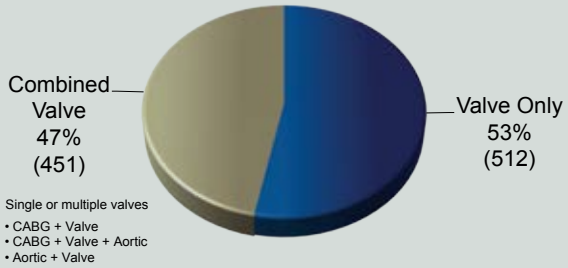
## Overview

The University of Michigan is a regional and national leader in valve surgery.

## TAVR Valve Options

The TAVR program is able to offer options for patients that are at high and intermediate risk for morality and morbidity. We are also enrolling patients in the Medtronic Low Risk Trial. The unique structure of this program utilizes a team of cardiac surgeons and interventional cardiologists with years of surgical experience and advanced skills. Working together, this team is able to provide several options and innovative procedures for our patients.

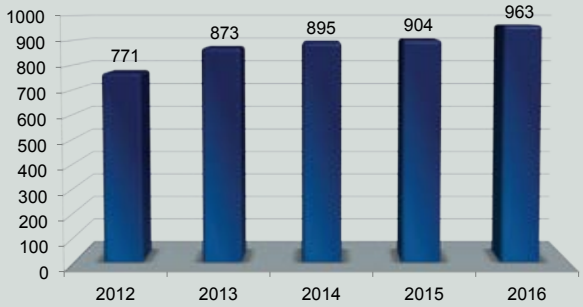
### 2016 Valve Distribution




**Includes TAVR**

*47% of the valve procedures are combined with other cardiac procedures.*

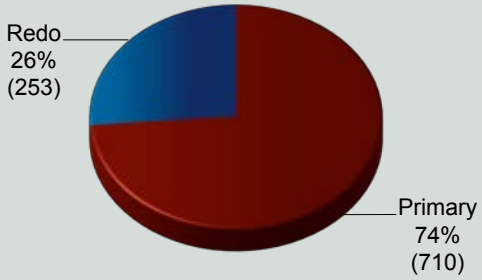
### All Valve Surgery Volume




**5 year average operative mortality 2.2% (includes TAVR)**

*Valve procedures represent the major proportion of the adult cardiac procedures at the Frankel Cardiovascular Center. The number of cases is increasing as well as the complexity.*

### 2016 Primary vs. Redo Valve Distribution



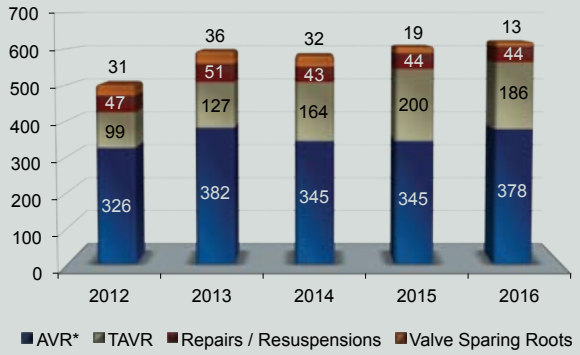

*Just over a quarter of the valve operations at the University of Michigan Frankel CVC are re-operations.*

# Valve Surgery

## Aortic Valve Surgery

We maintain one of the largest practices nationally for patients with aortic valve disease and continue to be a leader nationally and internationally in the breadth and quality of care for patients with this disease. Our team offers patients complex aortic valve operations, including valve sparing, stentless valves, and combined aortic surgery.

### Aortic Valve Distribution




***AVR includes any case where the aortic valve was replaced**

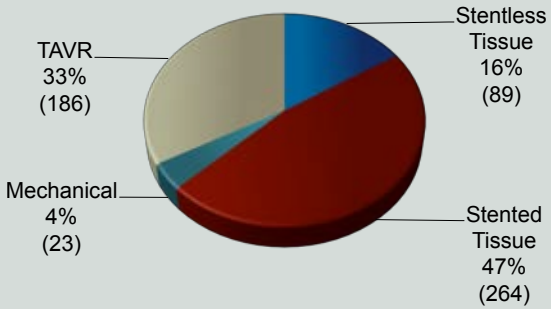
*The number of aortic valve procedures includes an increasing number of Transcatheter Aortic Valve Replacement (TAVR) procedures.*

### Isolated Aortic Valve Replacement Volume


**5 year average operative mortality 1.1%**
**2016 operative mortality 0.9%**

*Isolated aortic valve replacement procedures replace the aortic valve only. The Frankel CVC 5 year average operative mortality for isolated aortic valve replacement is 1.1%. Our operative mortality for 2016 was 0.9%. Note: Aortic valve replacement procedures chart excludes TAVR.*

### 2016 Aortic Valve Implant Type Distribution



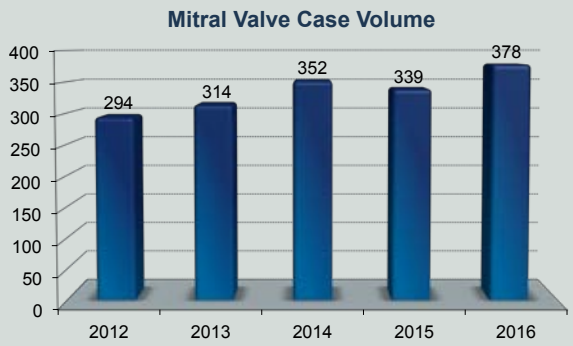

*The types of valve used in isolated aortic valve replacement procedures are predominantly tissue valves, either stented porcine or bovine, or a stentless porcine valve.*

*The University of Michigan Cardiovascular Center has more than 20 years of experience using stentless valves and was involved in the early research studies using these valves.*

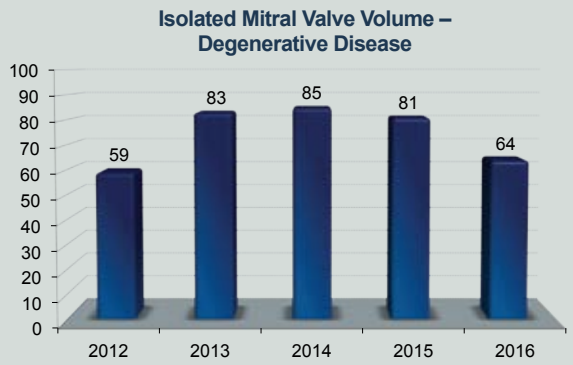
# Valve Surgery

## Mitral Valve Surgery

U-M continues to have one of the largest mitral valve experiences in the country, and has cared for thousands of patients with mitral valve disease. This experience coupled with our dedicated multi-disciplinary team approach, has resulted in a 99.8% repair rate over the last 5 years for patients with degenerative mitral valve disease. We have taken a leadership role in understanding indications and opportunities for patients with mitral valve disease.



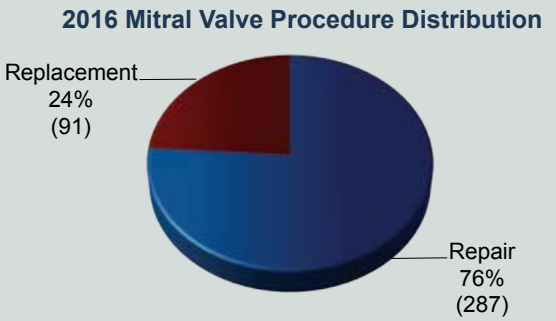

*The mitral valve surgery volume has increased over the last 5 years. Many of these procedures repair the mitral valve instead of replacing it.*




**5 year mitral valve repair rate 99.8%**

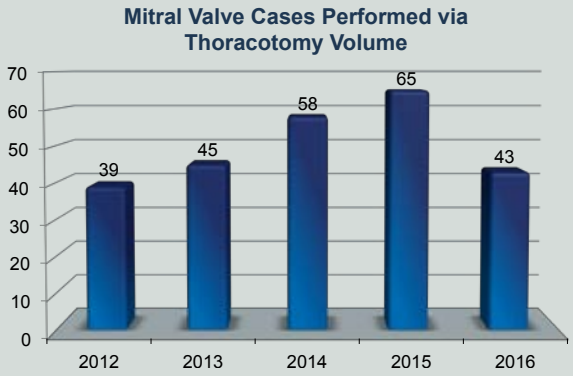
**3 out of 372 mitral valves with degenerative disease were replaced over the last 5 years**

*Mitral valve repair procedures account for over 99% of the mitral valve procedures performed on patients with degenerative mitral valve disease. Only 3 out of 372 mitral valves with degenerative disease were replaced over the last 5 years.*




**2016 operative mortality 2.4%**

*Over three quarters of the mitral valve procedures are repairs.*

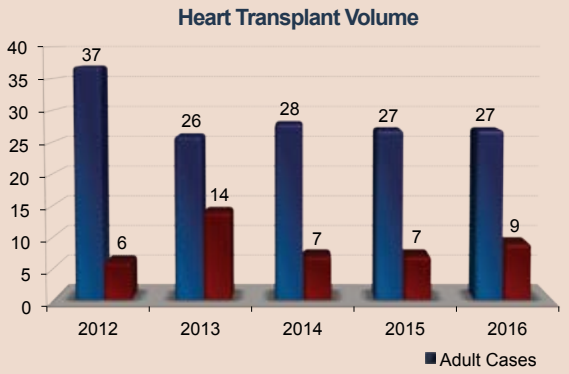



*Mitral valve procedures performed via thoracotomy include complex redo operations as well as primary minimally invasive procedures.*

# Heart Failure

## Cardiac Transplant

Our cardiac transplant program is the leading cardiac transplant center in Michigan, performing an average of 30 adult and 8 pediatric heart transplants each year. As a high volume center, we offer the multidisciplinary care required to perform and manage the care of this complex patient population.



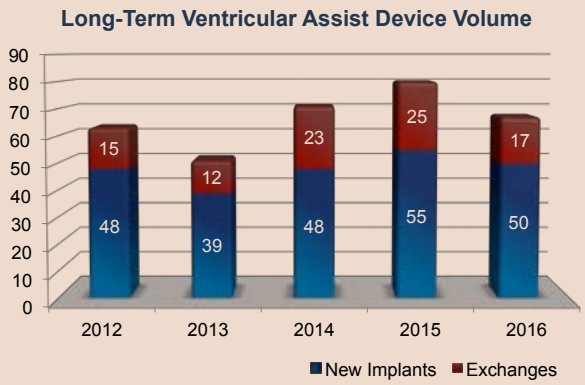

**5 year average operative mortality 6.2%**
**Adult 2016 operative mortality 0.0%**

*The University of Michigan Heart Transplant program was established in 1970 and the number of adult and pediatric heart transplants has remained steady since then. The one- and three-year survival rates are favorable compared to national rates.*

## Center for Circulatory Support/VAD

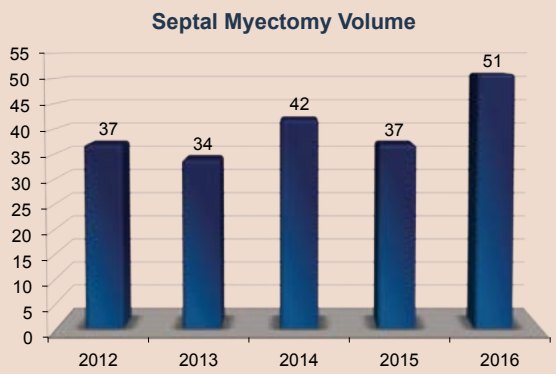
The Center for Circulatory Support at U-M is one of only a few programs with access to many investigational and FDA approved VADs. With one of the largest VAD programs in the U.S., we implanted 67 VADs in 2016 and are following more than 150 as long-term outpatients. Our VAD program was also recertified by the Joint Commission in the Disease Specific Care Certification for Advanced Ventricular Assist Devices.

*The Ventricular Assist Device Program is managing more than 150 patients long-term at home with their devices.*




## Hypertrophic Obstructive Cardiomyopathy

U-M has one of the few dedicated clinics and is a leader in the U.S. in the diagnosis and treatment of hypertrophic and other inherited cardiomyopathies. Septal myectomy is often a treatment option, improving symptoms in over 90% of patients.




*42 of the 51 myectomies performed in 2016 were for a diagnosis of Hypertrophic Obstructive Cardiomyopathy (HOCM).*

# PEDIATRIC CARDIOVASCULAR SURGERY

## Congenital Overview

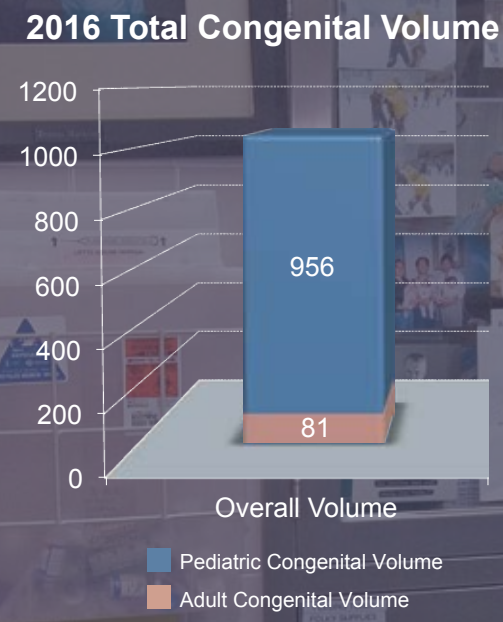
The Section of Pediatric Cardiovascular Surgery is led by Richard G. Ohye, M.D. This Section continues to be one of the busiest congenital heart programs in the U.S. and the largest in the State of Michigan. Our surgical faculty and staff are located on the same floor as our colleagues from Pediatric Cardiology, in C.S. Mott Children's Hospital. This encourages greater collaboration in teaching, research and patient care in the Michigan Congenital Heart Center, one of the premier congenital heart centers in the country. The University of Michigan is consistently ranked by *U.S. News & World Report* as the #1 center in the state of Michigan, and #6 in the nation in 2017. Pediatric Cardiology and Heart Surgery was ranked #3 in the nation in 2017.

Our Pediatric Cardiovascular Surgery program is considered one of the highest volume programs in the nation by the Society of Thoracic Surgeons (STS).

Over the past two decades alone, our Pediatric Cardiology program has cared for nearly 25,000 patients, making us one of the largest, most experienced programs worldwide. The pediatric cardiac surgeons at C.S. Mott Children's Hospital have earned international renown for their expertise in treating the most complex congenital heart defects. Our program is an international referral center for conditions such as hypoplastic left heart syndrome and other single ventricle lesions, high-risk biventricular repairs, complex forms of transposition of the great arteries and many other congenital abnormalities.

As we have continued to grow as an international destination for complex congenital heart disorders, our patient population has taken on an increasingly high-risk profile. Of the 61 programs reporting their 2012-2015 outcomes on the Society of Thoracic Surgeons (STS) Public Reporting Website, we were one of the two U.S. centers performing the highest number of STAT category 5 (highest complexity category) cases during this time period. We have achieved excellent outcomes, performing better than what would be expected for our complex case-mix, as reported by the STS.

We also lead and participate in numerous projects aiming to advance care and outcomes for patients undergoing pediatric and congenital heart surgery.



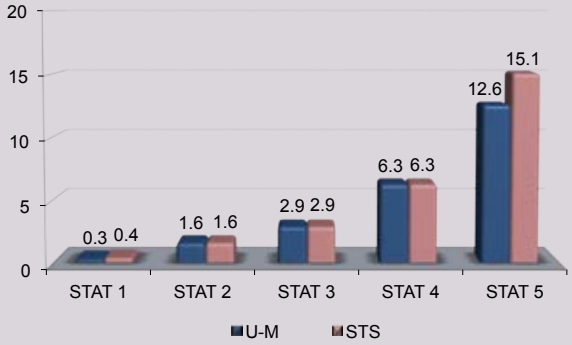

*Our annual surgical volume significantly exceeds the 250 cases/year benchmark that the STS uses to identify high volume programs. Our adult congenital volume continues to grow.*

## 2016 Post Operative Length of Stay by STAT Category


**U-M and STS 5 year aggregate outcome data (2012-2016)**

*Our post operative length of stay (LOS) is shorter compared to national averages. This bar chart shows median LOS.*

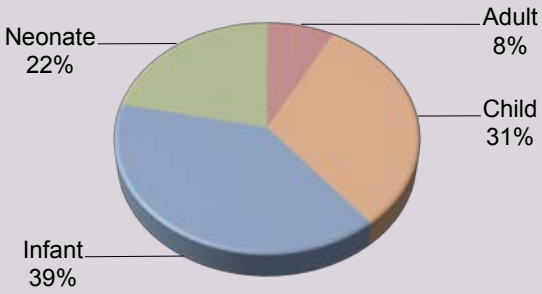
## 2016 30-Day Mortality by STAT Category



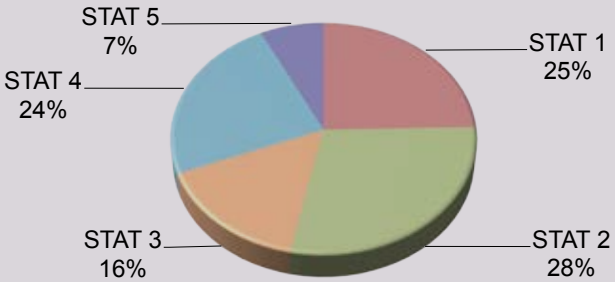

**U-M and STS 5 year aggregate outcome data (2012-2016)**

*Our pediatric cardiovascular surgery mortality rates are lower than national benchmarks, particularly for the most complex cases.*

## 2016 Congenital Volume by Age Group




*Neonate = less than 30 days old*
*Infant = up to 1 year of age*
*Adult = over 18 years*
*Child = 1-18 years old*




*STAT = Society of Thoracic Surgeons-European Association for Cardiothoracic Surgery Risk Stratification System; Category 1 = least complex, Category 5 = most complex.*

# FACULTY

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*Chief of Cardiothoracic Surgery, Ann Arbor VA Hospital*
*President of ASAIO*

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*Co-Director, Michigan Congenital Heart Center*

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*Associate Professor of Molecular and Integrative Physiology*

**Bo Yang, M.D., Ph.D.**
*Assistant Professor of Cardiac Surgery*

# LOCATIONS

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.

**Transfers/Referrals Appointments**

**University of Michigan**
M-LINE:
800.962.3555

**Henry Ford Allegiance Hospital**
517.817.7605

**Mercy Health**
231.672.8643

## ADULT CARDIAC CARE

**The Frankel Cardiovascular Center (CVC)**
Ann Arbor, MI

The Frankel Cardiovascular Center (CVC), at the corner of Ann Street and Observatory in Ann Arbor, Michigan, provides care for adult patients with a wide spectrum of cardiovascular diseases. This 6-story interdisciplinary facility includes clinics, diagnostic laboratories, operating rooms, intensive care units and all the support services essential for a 21st century medical enterprise.

## PEDIATRIC CARDIAC CARE

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

The Congenital Heart Center (CHC) in C.S. Mott Children's Hospital, located at 1500 East Medical Center Drive, is at the heart of the University of Michigan Health System. The building opened in 2011, and the 12-story children's hospital offers state-of-the-art care for patients from all over the world.

# SATELLITE LOCATIONS


**Henry Ford 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.

**Mercy Health**
Muskegon, MI

Mercy Health offers expert services at the Heart and Vascular Center in Muskegon. Some of Michigan's top cardiologists, vascular surgeons and cardiothoracic surgeons provide a complete range of heart and vascular care including cardiac surgery, vascular surgery, heart diagnostics and cardiac rehabilitation.

**The Veterans Administration Ann Arbor Healthcare System**
Ann Arbor, MI

The Veterans Administration 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. It 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 1,100 students and health care professionals each year. The University of Michigan's Cardiac Surgery faculty operate at the Ann Arbor VA where nearly 200 cardiac operations are performed each year.


DR. PRAGER







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FRANKEL CARDIOVASCULAR CENTER
MICHIGAN MEDICINE

C.S. MOTT CHILDREN'S HOSPITAL
MICHIGAN MEDICINE

**medicine.umich.edu/dept/cardiac-surgery**

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UNIVERSITY OF MICHIGAN

# CARDIAC SURGERY

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