From the Directors

We are pleased to share the latest University of Michigan Samuel and Jean Frankel Cardiovascular Center (CVC) Activity and Outcomes Report. We continue to strive to be the most advanced academic heart and vascular center in the world. By merging technology with the talents of our experienced faculty and staff, we are providing leading-edge cardiovascular care to enhance the lives of our patients.

Our commitment to delivering collaborative care across all disciplines of heart and vascular disease is something we are most proud of, and is an ongoing effort that involves the expertise of a dedicated, multidisciplinary team.

This year, we announced a major change in our leadership, with Dr. Thomas W. Wakefield appointed as a Director of the Frankel CVC. Dr. Wakefield brings considerable expertise in Vascular Surgery and will continue to lead the Section of Vascular Surgery at U-M, a post he has held since 2004.

Dr. Wakefield follows Dr. James C. Stanley, one of our founding Directors, as he resumes his role as Professor of Vascular Surgery. During his tenure as Director, Dr. Stanley helped establish the Frankel CVC’s collaborative care model, setting the standard for the highest quality practice model.

We continue to build on our research initiatives, incorporating the most innovative technologies to better understand cardiovascular disease and find potential cures. As you turn the pages, you will read about the many ways in which the U-M Frankel CVC is pioneering innovations in all areas of cardiovascular care.

The U-M Frankel CVC team is proud to be a leader in combating cardiovascular disease. We look forward to expanding partnerships with our referring physicians and Frankel CVC friends and supporters to further the advancement of medicine and patient care. Please join us as we move cardiovascular care forward together.
Coronary Heart Disease
COMPREHENSIVE CARE FOR HEART DISEASE

Coronary heart disease is the most common type of heart disease. It is the leading cause of death for both men and women in the United States. The Frankel CVC uses a “heart team” collaborative approach that includes the patient in determining the most appropriate therapy for his or her coronary artery disease.

Surgical Options
Our faculty is renowned for its expertise in a wide variety of innovative services. Even with the declining number of cardiac surgical cases nationwide, our procedure volume continues to grow. Our surgeons perform standard on-pump coronary bypass as well as beating heart, off-pump bypass, with arterial conduits routinely used.

Angioplasty and Stenting
The Advanced Interventional Cardiology Program offers patients comprehensive and individualized care, with our skilled team of interventional cardiologists using the latest technologies available for angioplasty and stenting. For acute myocardial infarction patients, our time from door to intervention is well below the national goal of 90 minutes, utilizing a team approach and in-house staff.

Multiple assist devices may be implanted to maintain blood supply to the heart tissue during high-risk angioplasty and as a bridge to Left Ventricle Assist Device (LVAD) or cardiac transplantation, including the TandemHeart™ Percutaneous Ventricular Assist Device, Impella 2.5 and 5.0 Catheters and ECMO.
### CAB Volume

<table>
<thead>
<tr>
<th>Year</th>
<th>CAB procedures</th>
<th>Isolated CAB</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>119</td>
<td>163</td>
</tr>
<tr>
<td>2013</td>
<td>150</td>
<td>112</td>
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<tr>
<td>2012</td>
<td>108</td>
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<td>2011</td>
<td>101</td>
<td>93</td>
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<tr>
<td>2010</td>
<td>104</td>
<td>121</td>
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### PCI Volume

<table>
<thead>
<tr>
<th>Year</th>
<th>PCI</th>
<th>PCI for MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>445</td>
<td>99</td>
</tr>
<tr>
<td>2013</td>
<td>438</td>
<td>98</td>
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<tr>
<td>2012</td>
<td>424</td>
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<tr>
<td>2011</td>
<td>512</td>
<td>86</td>
</tr>
<tr>
<td>2010</td>
<td>440</td>
<td>100</td>
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### PCI Mortality (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>Observed Mortality</th>
<th>BMC2 Expected Mortality</th>
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</thead>
<tbody>
<tr>
<td>2010</td>
<td>2.2</td>
<td>1.1</td>
</tr>
<tr>
<td>2011</td>
<td>1.9</td>
<td>1.3</td>
</tr>
<tr>
<td>2012</td>
<td>2.4</td>
<td>2.0</td>
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<tr>
<td>2013</td>
<td>2.4</td>
<td>1.8</td>
</tr>
<tr>
<td>2014</td>
<td>2.3</td>
<td>2.1</td>
</tr>
</tbody>
</table>

### Isolated CAB Mortality (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>Isolated CAB Observed Operative Mortality</th>
<th>STS Unadjusted Operative Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>1.9</td>
<td>1.9</td>
</tr>
<tr>
<td>2013</td>
<td>1.3</td>
<td>2.4</td>
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<tr>
<td>2012</td>
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<tr>
<td>2011</td>
<td>2.3</td>
<td>1.8</td>
</tr>
<tr>
<td>2010</td>
<td>3.2</td>
<td>2.4</td>
</tr>
</tbody>
</table>

### Median Door-to-Balloon Time (in minutes)

<table>
<thead>
<tr>
<th>Year</th>
<th>Median Door-to-Balloon Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>50</td>
</tr>
<tr>
<td>2013</td>
<td>54</td>
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<tr>
<td>2012</td>
<td>55</td>
</tr>
<tr>
<td>2011</td>
<td>53</td>
</tr>
<tr>
<td>2010</td>
<td>54</td>
</tr>
</tbody>
</table>

National goal is 90 minutes or less.

### Acute MI Process Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>CVC</th>
<th>National Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA AT DISCHARGE</td>
<td>99%</td>
<td>99%</td>
</tr>
<tr>
<td>STATIN AT DISCHARGE</td>
<td>98%</td>
<td>99%</td>
</tr>
<tr>
<td>PCI WITHIN 90 MINUTES</td>
<td>98%</td>
<td>96%</td>
</tr>
</tbody>
</table>

Source: Hospital Compare October 2013 – September 2014
The Frankel CVC’s Structural Heart Program features a multidisciplinary heart team consisting of cardiologists, cardiac surgeons and radiologists working together to provide innovative treatments to patients with valve and structural heart disorders.

Our services include all possible treatment options for valve and structural heart disorders. We specialize in managing the most complex cases and offer patients expert care through:

* Prevention of atrial appendage embolic events with surgical occlusion, percutaneous atrial appendage occlusion and percutaneous trans-pericardial occlusion, combined with optimal anticoagulation strategies
* PFOs and ASDs
* Paravalvular leak closures
* Comprehensive management of aortic, mitral and tricuspid valve disease

Valve Disease

All available treatment options — both clinical and those involving new technologies — are used to treat valvular dysfunction at all heart valve positions. Frankel CVC doctors are pioneering the future of treatment for valve dysfunction with an expanding minimally invasive program and new transcatheter therapies as well as standard surgical approaches. U-M doctors have the highest volume in Michigan in the treatment of valve disease.
The Frankel Cardiovascular Center is the first heart center in the nation to perform percutaneous implantation of the Edwards SAPIEN XT device to replace a patient’s tricuspid valve. Our team of highly skilled specialists is a national leader in expanding minimally invasive valve treatment options to all heart valve positions.
Aortic Valve Disease

Open Approach
Historically, open surgical repair of the aortic valve was the standard treatment for severe aortic stenosis. For more than 25 years, the Frankel CVC has been a leader in aortic valve replacement in both volume and outcomes.

The Frankel CVC is one of only a few sites in the nation to conduct the TRANSFORM clinical trial for the INTUITY valve system developed by Edwards Lifesciences. This trial offers a potentially significant advancement in valve replacement surgery because it allows the surgeon to implant the valve with only three sutures, significantly decreasing the time required for the surgical intervention.

Transcatheter Approach
For intermediate- to extreme-risk patients who do not qualify for open surgical repair, transcatheter aortic valve replacement (TAVR) offers a viable alternative. The TAVR team at the Frankel CVC is well equipped and fully experienced in the complete spectrum of minimally invasive devices. Interventional cardiologists and cardiac surgeons work closely together for a seamless approach to these procedures.

Our team has experience delivering these devices through a variety of access points, depending on the individual patient, including: femoral, transapical, direct aortic or subclavian arteries.

The U-M team is also breaking new ground in the treatment of bicuspid aortic valve (BAV) disease. Our doctors have the most experience in the U.S. in studying and treating patients with BAV disease. U-M has recently established a Bicuspid Aortic Valve registry and is looking at patients with this disease to identify the long-term effects of this common congenital disease.

We offer the following TAVR options:

Commercially Available
- Edwards SAPIEN XT
- Medtronic CoreValve®
- Medtronic Evolut™ R

Clinical Trials
- Medtronic SURTAVI
- Medtronic Expanded Use
- Edwards PARTNER II
- Boston Scientific’s REPRISE III

Our team of experts is on the leading edge for aortic stenosis treatment and has access to all the newest devices available through clinical trials as well as FDA-approved devices.

Our multidisciplinary approach also enables us to offer additional options for patients with complex aortic valve problems, including:
- Valve-sparing operations on the aortic root
- Catheterization of paravalvular leaks
- Placement of stentless aortic valves
- Hypothermic circulatory arrest procedures
An American Hero

Ray Tollefson barely survived World War II. As a U.S. Army Ranger, the 90-year-old remembers D-Day well, including the severe injuries he sustained during the battle at Normandy, and his ultimate mission to stay alive. Ray not only survived the war, he went on to live a full, happy life, which continues today, thanks to the Transcatheter Aortic Valve Replacement (TAVR) he received at the University of Michigan Frankel Cardiovascular Center for his aortic stenosis.

Ray’s life-saving TAVR procedure enabled him to fulfill an important wish: to travel to France to commemorate the 70th anniversary of D-Day.

“The first time I met Dr. Stanley Chetcuti, he told me, ‘We’re going to take care of you.’ Anybody I see nowadays is amazed at how active I am compared to the way I used to be. What they did for me is a miracle.”

— Ray Tollefson

Watch a video of Ray as he tells his story at umhealth.me/TAVRstory.

Aortic Valve Distribution

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>REPLACEMENT</td>
<td>249</td>
<td>270</td>
<td>323</td>
<td>382</td>
<td>345</td>
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<tr>
<td>TAVR</td>
<td>–</td>
<td>27</td>
<td>99</td>
<td>127</td>
<td>164</td>
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<tr>
<td>AV REPAIR OR RESUSPENSION</td>
<td>60</td>
<td>65</td>
<td>47</td>
<td>51</td>
<td>43</td>
</tr>
<tr>
<td>VALVE SPARING</td>
<td>34</td>
<td>25</td>
<td>31</td>
<td>36</td>
<td>32</td>
</tr>
</tbody>
</table>

U-M TAVR TICKER
550 aortic valves replaced and counting
**Mitral Valve Disease**

**Open Approach**

The Mitral Valve Clinic at the Frankel CVC is one of the largest practices in the country with a focus on mitral valve repair. Our team’s extensive experience in the operating room is a direct result of high procedure volume, which translates into better outcomes for patients overall.

Mitral valve repair is one of the few cardiac procedures where a patient’s life horizon returns to what it would have been naturally without a mitral valve condition. Performing these repairs in patients before their mitral valve disease progresses into life-threatening heart conditions such as atrial fibrillation, embolism, blood clots, stroke and congestive heart failure is our top priority. We offer surgical valve replacement in cases where that is the patient’s best option.

Each member of the Mitral Valve Clinic team has extensive experience in diagnosing, monitoring and treating mitral valve disease, including mitral regurgitation, mitral stenosis and mitral valve prolapse (Barlow’s syndrome).

Our Mitral Valve Clinic is also a leader in the treatment of mitral regurgitation associated with heart failure from both dilated and ischemic cardiomyopathies.

**Transcatheter Approach**

Our cardiac surgeons and interventional cardiologists work together to offer patients endovascular options for mitral valve repair and replacement, including:

- Commercially available MitraClip® device indicated for patients with degenerative mitral regurgitation
- Participating in Abbott’s CoAPT trial, treating functional mitral regurgitation with the MitraClip®

**CLINICAL TRIALS**

**CoAPT**
Clinical Outcomes Assessment of the MitraClip® Percutaneous Therapy for extremely high-surgical-risk patients.

**Edwards Lifesciences PARTNER II**
Sapien 3 valve (Edwards’ 3rd generation TAVR and 2nd generation XT valve).

**REPRISE III**
Pivotal IDE trial for Boston Scientific’s Lotus™ Valve System.

**PERIGON Pivotal Trial**
Determine the safety and effectiveness of Model 400 aortic valve bioprosthesis in patients with aortic valve disease.

**Edwards Lifesciences TRANSFORM**
Evaluate the safety and effectiveness of the EDWARDS INTUITY valve system.

[umcvc.org/researchstudies](http://umcvc.org/researchstudies)
As leading providers of complete care for all types of aortic disease, the Multidisciplinary Aortic Program (MAP) at the Frankel CVC brings together experts from cardiac surgery, vascular surgery, interventional cardiology and interventional radiology to formulate the best comprehensive plan for each patient. Our mortality rates are among the lowest in the country, despite a high volume of complex cases.

Specialists at the Frankel CVC provide treatment and therapy — from management and medical therapies to minimally invasive and open surgical repairs — for all types of aortic-disease-related conditions, including:
• Ascending and arch aneurysms
• Descending thoracic and abdominal aortic aneurysms
• Aortic dissection

**Inherited Aortic Disease**

The Frankel CVC’s MAP has expertise in treating complex aortic disease patients, particularly those with the following conditions:
• Connective tissue disorders such as Marfan Syndrome, Ehlers-Danlos Syndrome and Loeys-Dietz Syndrome
• Bicuspid aortic valve disease
• Suspected familial disease
• Arteriosclerotic aortic disease

Comprehensive workup and care for these complex patients includes access to genetic testing and counseling as well as experts from other relevant specialties, such as high-risk obstetrics and orthopaedics.

### All Aortic Surgical Volume

<table>
<thead>
<tr>
<th>Procedure</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCENDING/ARCH WITH OR WITHOUT AVR</td>
<td>166</td>
<td>214</td>
<td>205</td>
</tr>
<tr>
<td>DESCENDING THORACIC AORTIC ANEURYSM</td>
<td>17</td>
<td>21</td>
<td>19</td>
</tr>
<tr>
<td>THORACIC ENDOVASCULAR REPAIR</td>
<td>51</td>
<td>57</td>
<td>49</td>
</tr>
<tr>
<td>OPEN ABDOMINAL AORTIC ANEURYSM</td>
<td>25</td>
<td>45</td>
<td>60</td>
</tr>
<tr>
<td>ENDOVASCULAR ABDOMINAL AORTIC ANEURYSM</td>
<td>52</td>
<td>60</td>
<td>68</td>
</tr>
</tbody>
</table>

### Abdominal Aortic Aneurysm Treatment 2014

- OPEN 47%
- ENDO 53%
The multidisciplinary team of doctors at U-M performed the first ever implantation of the GORE® TAG® Thoracic Branch Endoprosthesi.
EXPERTISE IN COMPLEX CARE (CONTINUED)

Fenestrated and Branched Endograft Technology
New technology involving minimally invasive endovascular stent graft repair allows more patients to be treated for complex aortic disease. Fenestrated endograft technologies are covered stents with holes (called fenestrations) that correspond to the position of the major arteries branching out from the aorta.

While historical treatment for aortic aneurysms involving major branch vessels required an open surgical procedure, Frankel CVC providers can now treat patients with minimally invasive fenestrated and branched endografts in the abdominal aorta and the aortic arch. Ongoing clinical trials and approved usage of these devices include:

* Branched Arch Endograft Technology (GORE® TAG® Thoracic Branch Endoprosthesis Device)
* Zenith® Fenestrated AAA Endovascular Graft for aneurysms extending to the kidney artery

EVAR and TEVAR
Endovascular Aortic Repair (EVAR) and Thoracic Endovascular Aortic Repair (TEVAR) have emerged as true alternatives to conventional surgery for many patients suffering from aneurysmal disease of the aorta. These are life-saving, minimally invasive options for some patients who are not optimal candidates for traditional open repair. These procedures can shorten hospital stays and recovery periods. With more than two decades of experience in performing EVAR and TEVAR procedures, our surgical team can provide comprehensive care to all aortic patients.

CLINICAL TRIALS

GORE® TAG® Thoracic Branch Endoprosthesis
Evaluation of the GORE TAG Thoracic Branch Endoprosthesis. U-M was the first hospital in the world to perform this implantation.

CHIP
Cardiovascular Health Improvement Project.

N-TA3CT
Determine whether treatment with doxycycline in patients with small abdominal aortic aneurysms will lead to reduced aneurysm growth.

umcvc.org/researchstudies
Two-Time Survivor Is Back To A Full Life

Lori Eslick’s heart issues began as a newborn when she was diagnosed with a heart murmur and bicuspid aortic valve disease. Years later, a routine EKG led to the diagnosis of an ascending aortic aneurysm. Lori came to the U-M CVC in November 2009 and underwent aortic surgery later that month. After her surgery, the CVC team kept a close eye on her condition, examining her on a regular basis. Then, four years later, a second aneurysm was discovered just below where her previous aneurysm had been repaired. In both cases, the mother of two had no outward symptoms. Today, she’s pursuing her passion for painting and is “back to living.”

“If I didn’t have regular appointments with the U-M team, I might not have had a good outcome. They saved my life two times. I’m grateful for the kind of care they gave me. I’m back and now running 5Ks. It’s a beautiful thing to be able to achieve my goals, thanks to the U-M team.”

— Lori Eslick

Read Lori’s full story at umhealth.me/AneurysmStory.
The Cardiac Arrhythmia Service at the Frankel CVC is a high-volume tertiary referral center for the management of complex arrhythmias, including atrial fibrillation, supraventricular and ventricular tachycardia, atrial flutter, PVCs and WPW syndromes. We also specialize in care for patients with complex device conditions, such as malfunction of devices and leads, infected devices and extraction of leads and devices.

Each year our dedicated electrophysiologists perform approximately 1,000 ablations and more than 500 device procedures, including pacemakers, ICDs and biventricular devices. We are one of a few centers in the country with this level of volume and experience. We are also at the forefront of implanting MRI-compatible pacemakers, ICDs and subcutaneous ICDs.

Our team of cardiologists is also one of the first in the nation to use the WATCHMAN™ Left Atrial Appendage Closure Device, a breakthrough alternative to blood thinners to prevent stroke in patients with non-valvular atrial fibrillation.

On the research front, in partnership with the Center for Arrhythmia Research, we are working toward creating new technology to facilitate the mapping of complex arrhythmias, particularly atrial fibrillation. Our combined efforts are moving the field forward in our understanding and treatment of the most challenging and prevalent heart rhythm conditions.

In addition to catheter ablations and device procedures, we provide:

- Cardiac resynchronization in patients with heart failure
- An FDA-approved program for atrial appendage occlusion for prevention of stroke in patients with atrial fibrillation
The U-M electrophysiology team has implanted the state’s first patient with BIOTRONIK’s Iforia heart device — the only implantable cardioverter defibrillator approved for investigational use in magnetic resonance imaging.

CLINICAL TRIALS

Victory AF  
Evaluate the risk of procedure- and/or device-related strokes in subjects with persistent atrial fibrillation undergoing ablation with the phased RF system.

AdaptResponse  
Test the hypothesis that market-released CRT devices that contain the AdaptivCRT® (aCRT) algorithm have a superior outcome compared to standard CRT devices in CRT-indicated patients with normal AV conduction and LBBB.

SICD-PAS  
A multi-site registry enrolling subjects who have been implanted with the Subq ICD device.

umcv.org/researchstudies
Heart Failure Management
Our heart failure services include a telemanagement team of nurses as well as an inpatient team of nurse practitioners and physician assistants to ensure safe, collaborative patient-and family-centered care.

Ventricular Assist Devices (VAD) Program
The U-M Ventricular Assist Devices (VAD) Program is one of only a few programs worldwide with access to many investigational and FDA-approved VADs, including Thoratec Corporation’s HeartMate II® and HeartMate III®, HeartWare and SynCardia Total Artificial Heart. With 20 years of experience, our VAD Program specialists work closely with referring physicians in the evaluation and selection of the most appropriate treatment and device based on each patient’s needs. Find out more at umcvc.org/researchstudies.

Our VAD Program earned the Gold Seal of Approval® for health care quality in 2008, and was one of the first centers to be awarded Disease-Specific Care Certification for Advanced Ventricular Assist Devices by The Joint Commission. We have received recertification from The Joint Commission every two years, and most recently in March 2014.

Extra Corporeal Life Support (ECLS)
The University of Michigan is the world leader in ECLS, which was pioneered at the University. Our team is capable of instituting Extra Corporeal Membrane Oxygenation (ECMO) within minutes or, under special circumstances, traveling to referring institutions to initiate ECMO for a safer transport to our center.
Dedicated Patient Pays It Forward

Furman Dillard had been experiencing heart issues since 2000 when he was diagnosed with cardiomyopathy. His doctor recommended he be seen at the U-M Frankel CVC, where it was determined he needed a defibrillator due to an irregular heartbeat. Then, in 2010, Furman suffered a series of strokes and, ultimately, organ failure. His only option was a left ventricular assist device (LVAD), which was implanted in 2012. Since the surgery, Furman is walking, working out, cooking his own food and feeling fortunate to be alive.

With nine children, 27 grandchildren and seven great grandchildren, Furman isn’t ready to leave this world. “I have plenty to do,” he says. And that includes paying it forward by educating new LVAD patients at U-M as well as training first responders and firefighters throughout the area, who he says must understand the unique needs of an LVAD patient requiring emergency medical attention.

“My care team was phenomenal. They knew what they were doing. I was confident I would get better with their care. Now, I feel fortunate to be able to help other LVAD patients.”

— Furman Dillard

Read more about Furman’s story at umhealth.me/LVADstory.
EXPERTS IN HEART FAILURE THERAPIES (CONTINUED)

Cardiac Transplant Program
The U-M Frankel CVC is the leading cardiac transplant center in Michigan, performing an average of 30 adult cardiac transplants each year. Our transplant team includes multidisciplinary specialists with extensive experience in managing the complexities of transplant patients, including:

- Adult cardiac transplant surgeons
- Heart failure and transplant cardiologists with advanced training in transplantation
- Advanced circulatory support
- Cardiac critical care
- Nutritionists
- Social workers

Our team also works closely with faculty who specialize in congenital heart disease, inherited cardiomyopathies and transplant infectious diseases to provide each patient with seamless, comprehensive care.

CLINICAL TRIALS

MOMENTUM III
Evaluate the Thoratec HeartMate III® left ventricular assist device for use as long-term support for patients who are not candidates for cardiac transplantation; will also be evaluated for short-term support options for patients awaiting transplantation.

ATTR-ACT Study
Evaluate efficacy, safety and tolerability of daily oral dosing of Tafamidis Meglumine 20 mg or 80 mg in comparison to placebo.

SynCardia Total Artificial Heart (TAH-t) 50cc Trial
Evaluate transplant-eligible patients at imminent risk of death from biventricular heart failure. Two arms of the study include patients ages 10 to 18 and patients ages 19 to 75.
Young Man Goes Home With Total Artificial Heart To Await Transplant

Stan Larkin has been battling heart disease since 2007, when he collapsed at a basketball game. Heart tests revealed a condition called right ventricular dysplasia, a disease considered a leading cause of cardiac arrest.

U-M surgeons implanted a defibrillator to help regulate Stan’s heart rhythm, but his heart disease worsened to cardiogenic shock, a medical emergency that can be fatal if not treated right away. Doctors removed his failing heart and replaced it with the SynCardia Total Artificial Heart, a mechanical pump to bridge him to transplantation.

First connected to Big Blue, a large driver that kept him confined to the hospital, he was switched to the Freedom driver to power the total artificial heart. His care marks two milestones: Stan is the first U-M patient to make the transition to the Freedom driver and the first patient in Michigan to go home with it.

“I had a lot of questions but I was enthusiastic to learn,” says Stan, who wears his device strapped to his back. “This is what’s keeping me going. I can’t wait to get a heart transplant so I can truly feel like myself again.”

Read more about Stan’s story at umhealth.me/PortableHeartStory.

U-M heart failure surgeons have implanted 11 total artificial hearts to date.

CTSN Cell Therapy LVAD Trial II
Investigate whether injecting allogeneic mesenchymal precursor cells (stem cells) into the heart during implantation of a left ventricular assist device will improve long-term myocardial function.

HeartWare MVAD®
Evaluate the clinical safety and performance of the HeartWare MVAD System, a versatile, miniaturized and hematologically advanced circulatory assist system designed for full support of patients with advanced heart failure.

EXPAND (Portable Organ Care System – OCS™)
A new paradigm to preserve, monitor and assess donor hearts during the time between removal of the heart from the donor and implanting the heart. The OCS device will perfuse the heart with oxygen and nutrients during transport and keep the donor heart functioning at normal body temperature.

umcv.org/researchstudies
With the increase in cancer survivorship, there is a need to better understand how cancer therapies can affect the heart during and after treatment. The Cardio-Oncology Clinic is a multidisciplinary partnership between the Frankel CVC and the Comprehensive Cancer Center. As one of a few institutions in the country to offer this level of coordinated care, our goal is to work with oncologists as part of a team to treat cancer patients and survivors who develop cardiac problems, as well as cardiac patients who are diagnosed with cancer.

Through the Cardio-Oncology Clinic, cardiologists and oncologists collaborate to improve quality of life for patients and eliminate barriers to effective treatment by:

• Working with patients who are diagnosed with a heart problem prior to cancer treatment
• Preventing heart disease in patients who are at risk
• Closely monitoring patients who are receiving potentially cardiotoxic cancer treatments
• Treating cardiac problems related to cancer therapy so patients can continue treatment as soon as possible
• Using echocardiographic strain imaging to screen patients who are at high risk for heart disease due to cardiotoxic drugs
• Following up with pediatric and adult cancer survivors — these patients are at higher risk than the general population for developing heart disease later in life

Cardiotoxicity

Oncologists and cardiologists at the U-M Cardio-Oncology Clinic evaluate patients at risk for heart disease or those who have developed cardiotoxicity as a result of cancer treatment. Without interrupting treatment, they work to identify and address cardiovascular risks and reduce the toxic effects of cancer therapies on the heart. Research in the Cardio-Oncology Clinic includes projects where scientists are working to better understand the mechanisms of cardiotoxicity at the cellular level, and participating in new chemotherapeutic drug studies with the goal of minimizing cardiotoxicity in future cancer drugs.

Cardiac Tumor Program

Recently launched as a multi-center effort, the Cardiac Tumor Program brings together a Review Board of leading experts from around the country via monthly videoconference to develop coordinated care practices and to better understand the genetics of heart tumors. U-M’s multidisciplinary Review Board takes an individualized approach to determine whether surgery, chemotherapy, radiation or other therapies will result in the best patient outcome.
University of Michigan’s Adult Sarcoma Survivorship Clinic is the first of its kind. A joint collaboration between the University of Michigan Comprehensive Cancer Center and the Frankel Cardiovascular Center’s Cardio-Oncology program, the Sarcoma Survivorship Clinic is uniquely located in the Frankel Cardiovascular Center.

The Sarcoma Survivorship Clinic was established to provide long-term care for sarcoma survivors by preventing or diagnosing and treating chronic illnesses to improve sarcoma patients’ survival and quality of life. Oncologist Laurence Baker and cardio-oncologist Monika Leja lead the clinic. Dr. Baker has been treating sarcoma patients for more than 40 years and Dr. Leja specializes in preventing or minimizing heart damage caused by chemotherapy and radiation therapy for cancer treatment.

The Survivorship Clinic is for sarcoma survivors, age 18 and older, who were treated with systemic chemotherapy with or without radiation therapy and have been off of all therapy for two or more years. The Clinic also serves patients who are moving from a pediatric clinic to an adult clinic.

One of the major goals of this Clinic is to treat the unique and chronic medical conditions that can arise in cancer patients after their treatments are complete. This includes, but is not limited to, cardiac health, psychosocial evaluation, nutrition, improving functional status and fertility, renal, endocrine and metabolic evaluation. The focus of the Clinic is personalized care and treating all the psychological and medical needs of cancer survivors.
Vascular Disease

EXCELLENCE IN ADULT AND PEDIATRIC VASCULAR SURGICAL CARE

At the Frankel CVC, our attention never diverts from providing the best patient care experience. Our standard of excellence ensures the best possible vascular surgery outcomes, from initial clinic visits through subsequent follow-up appointments.

We participate in both the Vascular Intervention Collaborative (VIC) and the Vascular Quality Initiative (VQI) to allow us to benchmark and improve outcomes.

Our surgeons specialize in open vascular surgery and the use of minimally invasive endovascular procedures for a wide range of vascular conditions, including:

- Abdominal aortic aneurysm
- Carotid artery disease
- Peripheral arterial disease
- Renal artery disease
- Thoracoabdominal aortic aneurysm
- Thoracic outlet syndrome
- Varicose veins
- Venous insufficiency
- Vertebral artery disease

Pediatric Vascular Disease Program

For the past three decades, the Pediatric Vascular Disease Program at the University of Michigan has been the country’s most preferred destination for children in need of surgical management of occlusive or aneurysmal diseases of the abdominal aorta and its branches. A multidisciplinary team is led by vascular surgeons and includes physicians from the specialties of interventional radiology, pediatric nephrology, intensive care and anesthesia, as well as nurses and social workers with broad knowledge of pediatric renovascular hypertension and childhood abdominal aortic coarctation. Our patients come from the world over, including Western Europe, the Middle East and many major children’s hospitals in Canada and across the United States.
U-M vascular surgeons performed the first Endurant® IIs endograft in the state of Michigan. This graft configuration allows surgeons to more easily adapt to aortic and iliac artery anatomies by giving more options for the modular components of the graft.

M-LINE 800-962-3555

Activity and Outcomes Report • 2014 Data • 23
The multidisciplinary Interventional Radiology Program at the Frankel Cardiovascular Center is a leading and innovative partner in the diagnosis and treatment of vascular disease using cutting-edge diagnostic and minimally invasive, image-guided procedures to improve patient outcomes and reduce hospital stays.

We specialize in treating:
- Aortic aneurysms and dissections
- Arteriovenous malformations
- Carotid artery disease
- Inferior vena cava filter placement and management
- Massive and sub-massive pulmonary embolism
- Percutaneous transcatheter angioplasty
- Peripheral arterial disease and peripheral vascular disease
- Renal artery stenosis/secondary hypertension
- Varicose and spider veins
- Vascular malformations
- Vascular occlusive disease (recanalization and stenting)
- Venous thrombosis (acute and chronic)
- Pelvic congestion syndrome and varicoceles

Vascular Disease
CUTTING-EDGE TREATMENTS IN INTERVENTIONAL RADIOLOGICAL CARE

CLINICAL TRIALS

VIVO
Evaluate the Zilver® Vena™ Venous Stent in the treatment of symptomatic iliofemoral venous outflow.

ACCelerated Thrombolysis for Post-Thrombotic Syndrome
Evaluate the efficacy of ultrasound accelerated thrombolysis using the EkoSonic® Endovascular System.

umcvc.org/researchstudies

Vascular and Interventional Radiology Volume

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume</th>
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</thead>
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<td>2013</td>
<td>759</td>
</tr>
<tr>
<td>2012</td>
<td>760</td>
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Venous Health
A FULL SPECTRUM OF CARE FOR VENOUS DISEASE

The Venous Health Program at the Frankel CVC is a multidisciplinary, large-volume clinic that provides full service for the entire spectrum of a patient’s venous disease. The program features subspecialty care, establishing a uniform treatment approach. Our team includes specialists from vascular surgery, vascular medicine and interventional radiology at both the Frankel CVC and at our Vein Centers in Livonia and Troy.

Innovative treatments available include:
• Radiofrequency ablations/laser ablations for superficial venous reflux
• Phlebectomies using TRIVEX technique (available in only one other site in Michigan) for the removal of large and extensive varicose veins
• Pharmacomechanical thrombolysis for a more aggressive treatment of iliofemoral venous thrombosis
• Recanalization of central veins to treat significant chronic venous insufficiency or obstruction

We also offer consultative and educational programs for referring physicians, especially those who are some distance from Ann Arbor, to help them manage venous disease patients locally.

Vein Centers
We offer patients another clinical option through the Vein Centers in Livonia and Troy. These centers serve as the initial triage for the Venous Health Program and are outpatient procedural sites, which allow us to serve patients more efficiently. The Vein Centers also specialize in cosmetic vein treatments.

Clinic Volume

<table>
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<tr>
<th></th>
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<tr>
<td>TROY VEIN CENTER</td>
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The Troy Vein Center opened in August 2014.
The Peripheral Arterial Disease Program at the University of Michigan Frankel Cardiovascular Center brings together a strong team of experts from interventional cardiology, interventional radiology, cardiovascular medicine, vascular medicine and vascular surgery all in one location.

Any patient with PAD can be seen in our clinic, from mild cases to limb-threatening, disabling conditions. Our team meets regularly to discuss individual cases and develop optimal management strategies for every patient. We also work closely with podiatry and diabetes specialists to prevent amputations where possible. Few other centers offer such a complete PAD treatment program.

Collaborative Approach
Our coordination of a standardized outpatient experience, as well as increased access to wound care and pain management services, ensures the best care. Collaboration across physician specialties and coordination of quality improvement efforts translate into optimal revascularization strategies, fewer procedural complications and improved guideline-recommended medical therapy.

In addition, our PAD program provides:

• Comprehensive testing in an Intersocietal Accreditation Commission (IAC) vascular lab
• Immediate access to all patients with any degree of PAD, from mild to severe
• State-of-the-art angiographic equipment with access and expertise in multiple minimally invasive endovascularization modalities
• Hybrid endovascular operating rooms for combined operative and minimally invasive procedures
• Expertise in limb-sparing and limb-salvaging procedures
• Same-day evaluations, including imaging
• Treatment interventions, including angioplasty, stenting, endarterectomy, atherectomy and bypass graft surgery
• Exercise rehabilitation, smoking cessation program, dietary counseling and prosthetics services
• Consultative and educational programs for referring physicians

CLINICAL TRIALS

Physical Activity Daily
Help inactive adults with peripheral arterial disease start and continue a walking program.

BEST-CLI
Evaluate the effectiveness of best endovascular vs best surgical revascularization in patients with CLI (critical limb ischemia).

umcvc.org/researchstudies
Maxine Kilkoin Is Walking Proud

An artificial limb hasn’t slowed Maxine Kilkoin down. In fact, she’s doing more today than ever, thanks to the treatment she received at the University of Michigan Frankel CVC. The 87-year-old says the doctors at U-M helped her keep her leg for five years after her prior physician recommended it be removed due to peripheral artery disease (PAD).

Over the span of five years and after many procedures to remove blood clots, including stents, to extend the use of Maxine’s right leg, the CVC team helped her with the final decision to remove the leg when the time was right.

Today, Maxine continues to live with her PAD, which has progressed to her other leg. But she’s confident she’ll get the treatment she needs at U-M to enable her to keep her leg as long as possible.

“If I can get five more years out of this one, I’ll be 93. I’ve had a good life. I thank the Lord for U-M.”

— Maxine Kilkoin

Read Maxine’s full story at umhealth.me/PADStory.
The cardiovascular imaging services available at the Frankel CVC are among the top laboratories and centers in the country. Our faculty, staff and technologists maximize our research facilities to bring state-of-the-art equipment and techniques into the clinic. Our team is able to serve large volumes of patients and provide unparalleled levels of detail, including imaging of complex and less common diseases. We collaborate with specialists throughout the Health System and beyond to ensure the most effective diagnosis, analysis and treatment for patients.

**Our Services Include:**

**Nuclear Cardiology**

The Frankel CVC Nuclear Cardiology laboratory and PET imaging center are fully equipped with advanced SPECT/CT and PET/CT imaging systems. We also offer a variety of specialized nuclear tests to diagnose rare causes of cardiac disease, such as sarcoidosis and myocarditis.

**Cardiac and Vascular CT**

Our advanced CT scanners use powerful computer processing techniques that help us acquire images with the lowest possible radiation dose and the highest possible image quality. In partnership with our advanced image-processing laboratory, we are able to routinely generate three-dimensional models to aid in diagnosis and treatment decisions.

**Diagnostic Vascular Unit**

The U-M Diagnostic Vascular Unit (DVU) provides a full spectrum of arterial and venous examinations, including ultrasound, Doppler and plethysmography-based studies. The DVU services both the outpatient and inpatient aspects.

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### Cardiovascular Imaging Volume 2014

<table>
<thead>
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<th>Service</th>
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<tr>
<td>DIAGNOSTIC VASCULAR STUDIES</td>
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of the Health System. Accreditation by the Intersocietal Accreditation Commission is current and has been ongoing for many years. Locations for DVU imaging include the University Hospital, Frankel CVC, Domino’s Farms, Briarwood, Northville and Taubman Center.

Cardiac MR
The high-resolution images obtained with cardiac MR allow us to skillfully demonstrate cardiovascular anatomy, make extremely accurate measurements of cardiac function and identify areas of cardiac scar, important in planning advanced cardiac procedures. These techniques provide an evaluation and diagnosis of many cardiac diseases that are difficult to identify with any other non-invasive test.

Echocardiography
Our Echocardiography Laboratories perform all types of conventional and advanced echocardiograms, including:
- 2-D
- 3-D transesophageal
- Stress
- Strain imaging
The Inherited Cardiomyopathy Clinic at the Frankel CVC is one of only 29 in the country specializing in the treatment of inherited cardiomyopathies, including hypertrophic cardiomyopathy (HCM). Our pediatric and adult clinicians work closely with each other, along with specialists in electrophysiology, heart failure and radiology, to provide the most comprehensive care to patients and families living with these diseases.

Serving a large volume of patients through our clinic, we offer up-to-date knowledge and treatment recommendations, including:

- Expert consultation
- State-of-the-art imaging, including echocardiography and cardiac MRI
- Cardiopulmonary stress testing
- Genetic testing and counseling for individuals and families
- Medical therapies
- Electrophysiology and surgical procedures

Our physicians treat entire families and coordinate care between adult and pediatric clinics so that family members can be seen on the same day. Our team also includes skilled nurses, genetic counselors and researchers.
Hypertrophic Obstructive Cardiomyopathy

Obstructed Aortic Outflow
Mitral Valve Regurgitation
Asymmetric Septal Wall Thickening
Left Atrium
Right Ventricle
Left Ventricle

CLINICAL TRIALS

VANISH
(Valsartan for Attenuating Disease Evolution in Early Sarcometric HCM) Evaluate the safety and effectiveness of valsartan in an asymptomatic young population of patients with hypertrophic cardiomyopathy.

HCMR
Examine features of cardiac MRI and biomarkers to predict adverse outcomes in HCM.

LIVE-HCM
(Lifestyle and Exercise in HCM) Determine how lifestyle and exercise impact the well-being of individuals with HCM.

SHaRe
(Sarcomeric Human Cardiomyopathy Registry) Build community of cardiovascular geneticists and research-based cardiologists to support the development of novel therapies for patients with heritable heart disease.

umcvc.org/researchstudies
The University of Michigan Comprehensive Stroke Program includes an expanded, specially trained, multidisciplinary team of experts in emergency medicine, vascular surgery, cardiology, neurology, neurosurgery, neurocritical care, neurointerventional radiology, internal medicine and physical medicine and rehabilitation. The program offers patients the highest level of comprehensive stroke care, from reducing the risk of stroke to the most advanced stroke treatments. The team includes eight board-certified vascular neurologists who are active in national stroke guideline development and offer a depth of knowledge about all types of stroke.

**Emergency Stroke Care**

Our emergency response services, including Survival Flight, bring patients to our hospital quickly and safely. Our tPA delivery timing surpasses the standards outlined in the American Stroke Association “Get With The Guidelines®” program, a testament to our well-trained and efficient emergency room staff. When a patient is not a candidate for IV tPA, he or she is evaluated and treated by a specially trained neurovascular team in our neurointerventional radiology suite — the only one of its kind in the area.

**Inpatient Stroke Care**

Stroke patients are cared for in our dedicated Stroke Unit and Neuro-Intensive Care Unit, which have been shown to decrease complications and improve survival and functional outcomes following stroke. Patients receive personalized guidelines for the best recovery strategies upon discharge.
Timing Key In Stroke Victim’s Recovery

When Joaquin Uy suffered a massive stoke on Christmas Day, his family feared for his life. Joaquin was immediately taken to the University of Michigan emergency room, where a team of doctors diagnosed his condition and administered the clot-busting medication tPA.

“We treated him within 20 minutes and the next day he could move his right side again,” says U-M’s Dr. Eric Adelman. “He could speak. He was even walking. We sent him home the next day.”

The Uy family was prepared for the worst, knowing that Joaquin’s stroke could mean permanent debilitation or even death. “We never expected him to make such a full recovery,” says his wife. “We brought him home to all eight grandchildren. We were all so happy.”

See Joaquin’s full story at umhealth.me/StrokeStory.

Preventive Stroke Care

The Stroke Clinic provides screening and preventive care to high-risk patients. We work with patients to diagnose and treat conditions that increase risk for stroke. Our location in the Frankel CVC promotes collaboration with cardiologists and vascular surgeons. Together, we put the best stroke prevention plan into action for each patient, which may range from lifestyle changes to the most sophisticated testing and treatment in an effort to decrease stroke risk.

Our Commitment to Excellence

The U-M Comprehensive Stroke Program is accredited as a Comprehensive Stroke Center by the Joint Commission. Team members from the stroke program helped in authoring as well as participating in the American Stroke Association “Get With The Guidelines” Quality Initiative. We have repeatedly been designated as an American Heart Association Gold Plus stroke hospital, the highest stroke quality designation. This award recognizes hospitals that provide consistently excellent care following evidence-based guidelines. The AHA has recognized the quality of stroke care provided at U-M since 2005.

In May 2015, AHA/ASA presented UMHS with two awards: Stroke Get With The Guidelines Gold Plus and Target Stroke Honor Roll Elite Plus. UMHS is the first hospital in Michigan to receive the Target Stroke Honor Roll Elite Plus award.
Pulmonary Hypertension
UNPARALLELED EXPERTISE IN DIAGNOSIS AND TREATMENT

The Pulmonary Hypertension Program at the Frankel CVC is the largest and most experienced program in the state, and one of the largest in the country, with a team of physicians, nurse clinicians, research coordinators and support staff. We are a comprehensive, single resource for the care and treatment of patients who live with all stages of this challenging disease.

Partnership with Scleroderma Clinic
Early diagnosis of pulmonary arterial hypertension (PAH) is key for scleroderma patients. The Pulmonary Hypertension Program regularly partners with U-M’s Scleroderma Clinic to investigate new and better screening techniques and treatments for systemic sclerosis-associated PAH. Some of our current projects include:

- A recently published study on the novel, evidence-based DETECT algorithm for diagnosing PAH at earlier stages
- Phase 2 multi-center Rituximab trial
- Metabolomics screening

Pulmonary Hypertension Research
Research gives patients direct access to the latest therapies to treat and manage pulmonary hypertension. We are active in several clinical and translational projects. We are actively enrolling in two new IRB-approved trials, including:

- A Phase 2 trial of an oral prostacyclin receptor agonist in patients with Group 1 PAH
- A Phase 2 trial of a first-in-class small molecule inhibitor of apoptosis signal-regulating kinase 1 (ASK-1), which is being developed for treatment of diseases with a high burden of oxidative stress, including PAH
A late-stage drug trial is showing the effectiveness of selexipag to treat pulmonary arterial hypertension. U-M’s Dr. Vallerie McLaughlin, director of the Pulmonary Hypertension Program, presented the GRIPHON trial data at the 2015 American College of Cardiology meeting.

**Pulmonary Hypertension Care Centers**
The U-M program was one of the first in the country (and the first in the state) to be accredited as a Center of Comprehensive Care (CCC) through the Pulmonary Hypertension Association’s Pulmonary Hypertension Care Centers (PHCC) program.

**Treatment for Chronic Thromboembolic Pulmonary Hypertension**
As part of the multidisciplinary team, Cardiac Surgery offers pulmonary endarterectomy as a treatment option for chronic thromboembolic pulmonary hypertension patients. The University of Michigan is currently the only institution in the state, and one of only a few in the region, to offer this therapy.

**Pulmonary Hypertension Breakthrough Initiative**
The University of Michigan serves as the Data Coordinating Center for the PHBI, a network of multidisciplinary, collaborative transplant and research centers that distributes stored clinical specimens and relevant data to researchers and for use in groundbreaking research to better understand the molecular basis of pulmonary arterial hypertension. Funding for this important network has been extended another five years via a large NIH grant.

**Clinic Volume**

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>1,687</td>
</tr>
<tr>
<td>2013</td>
<td>1,651</td>
</tr>
</tbody>
</table>

**CLINICAL TRIALS**

**SYMPHONY**
A study of macitentan in pulmonary arterial hypertension to validate the PAH-SYMPACT.

**Arena APD811-003**
A Phase 2 trial of APD811, an oral IP receptor agonist, in patients with pulmonary arterial hypertension.

**Gilead — GS-US-4997**
A Phase 2 study of GS-4997 in subjects with pulmonary arterial hypertension.

[umcvc.org/researchstudies](http://umcvc.org/researchstudies)
The Adult Congenital Heart Disease Program at the Frankel CVC provides expert care to adult patients living with congenital heart disease. Our multidisciplinary team of congenital heart disease specialists treats the full spectrum of these inherited conditions with extensive experience in imaging, electrophysiology, interventional catheterization and cardiac surgery, while our expert clinical nurse coordinators oversee patient care between visits. Our goal is to ensure patients with these conditions enjoy a better quality of life through access to the latest in treatment options, education, technologies and research.

Percutaneous interventions, among other treatments, offer today’s patients more options for successful outcomes and a higher quality of life. The University of Michigan Congenital Heart Center has performed more than 80 percutaneous pulmonary valve replacements.

**Ongoing Coordinated Care**

Patients with congenital heart disease require lifelong management and care. All of our physician providers are board-certified in adult internal medicine as well as congenital heart disease and pediatrics. Our program partners with other specialists within the University of Michigan Health System to coordinate care across these disciplines as needed. Our collaborators include experts from:

- High-risk obstetrics
- Heart failure and transplantation
- Cardiac surgery
- Electrophysiology/arrhythmia
- Pulmonary hypertension
- Aortic disease/aortic surgery
In addition to Ann Arbor, the Adult Congenital Heart Disease Program participates in comprehensive pediatric and adult congenital cardiology clinics for families throughout the state of Michigan, including Lansing, Marquette, Petoskey and Traverse City.
The Women’s Heart Program at the Frankel CVC is a vibrant research and clinical venue focused on addressing prevention, diagnosis and treatment of heart disease in women across the lifespan, from childbearing years through menopause and beyond. We offer a comprehensive program with cardiac rehabilitation, stress management, nutrition and exercise counseling, and many testing modalities all in the same building.

Our multidisciplinary team is comprised of experts who specialize in women’s heart health, including physicians, nutritionists and exercise physiologists. We coordinate cardiovascular care for women and act as a central point of contact for patients, other cardiovascular specialists within the Frankel CVC and referring physicians.

Research has shown that women who have gestational diabetes, gestational hypertension and postpartum cardiomyopathy are at increased risk for future cardiovascular disease. As we learn more about how cardiovascular disease presents differently in women than men, we are expanding our knowledge and expertise in providing preventive care earlier in their lives, most notably during pregnancy.
Spreading An Important Message

Deidre Todd’s health challenges began after the birth of her child in 2009 when she was 43. “I thought my exhaustion and fatigue were the result of being an older mom,” she says. A few months after her son’s birth, she developed a condition that was diagnosed as bronchitis, but she continued to feel weak and run down for months. After extensive testing, Deidre was diagnosed with cardiomyopathy. She now has an automatic implantable cardioverter defibrillator and feels blessed to be living a healthy life.

“I was in heart failure, but never associated my symptoms with a heart issue. I want to spread the message that women need to take care of themselves and know the signs of heart disease. Don’t dismiss your instincts.”

— Deidre Todd

Read more about Deidre at umhealth.me/MomHeartStory.
Preventive Cardiology
HELPING PATIENTS EMBRACE LIFESTYLE MODIFICATIONS

In keeping with the Frankel CVC’s mission to deliver holistic cardiovascular care, one of our most important efforts is to prevent coronary and other vascular diseases with early, evidence-based interventions and treatments. Through our Lipid Management, Metabolic Fitness and Cardiac Rehabilitation programs, we can provide patients with a level of care and resources not commonly available at other institutions.

Our Preventive Care team includes physicians, nurse practitioners, nutritionists and exercise physiologists who specialize in the management of lipids, metabolic syndrome, nutrition and exercise. Together, they actively participate in patient care, research and education. The team has also published a number of manuscripts during the past three years with research emphasis on air pollution, lipids, cardiac rehabilitation, hypertension and lifestyle interventions.

Lipid Management — This multidisciplinary service determines why the lipids (cholesterol, HDL, triglycerides) are abnormal and develops a lifestyle and, when necessary, drug treatment plan to reduce the risk of heart and vascular disease for patients.

Metabolic Fitness — Our team of cardiovascular experts is focused on helping patients manage and reverse the metabolic syndrome, which reduces the risk of diabetes and heart disease.

Cardiac Rehabilitation — A multidisciplinary group of specialists empowers patients by providing them with information about diet, exercise and relaxation techniques for an overall improved lifestyle. The program provides the expertise of dedicated dietitians, exercise physiologists, yoga instructors, nurse practitioners and cardiologists.

Enhanced External Counter Pulsation (EECP) — This non-invasive treatment helps lower the number and intensity of angina episodes via external inflatable cuffs that are applied around the lower legs, upper legs and buttocks. The inflation and deflation of the cuffs is timed to the cardiac cycle by continuous telemetry ECG monitoring. The program features 7 weeks of continuous treatments, which require daily visits for one hour, Monday through Friday.

CLINICAL TRIALS

FOURIER
Assess the impact of additional LDL-cholesterol reduction on major cardiovascular events when AMG 145 is used in combination with statin therapy.

GAUSS
Evaluate the effect of 24 weeks of AMG 145 on percent change from baseline in low-density lipoprotein cholesterol (LDL-C) in hypercholesterolemic subjects.

Internet-based Walking Program for Patients with Peripheral Arterial Disease
Compare the effectiveness of different modes for PAD walking rehabilitation programs and test the effectiveness of an Internet-based walking program to enhance long-term adherence to regular participation in physical activity.

umcvc.org/researchstudies
HELPING PATIENTS CONTROL BLOOD PRESSURE

The U-M Comprehensive Hypertension Center, designated as such by the American Society of Hypertension, is a national leader in the treatment of hypertension. We ensure patients get the proper diagnosis and an individualized treatment program to control both rare and common forms of hypertension.

As part of Cardiovascular Disease Prevention and Rehabilitation at U-M, our hypertension experts use both traditional and more innovative approaches, and have access to highly precise measurement devices available only in a specialty center.

Beyond identifying the optimal medical regimen for each patient, our Hypertension Center employs a team of experts, including nutritionists, exercise physiologists and stress management counselors. We offer a comprehensive approach tailored for each individual involving lifestyle recommendations, alternative therapies and traditional medications as needed. Often, we can offer enrollment into clinical trials in hypertension for eligible and interested patients.

Diagnosing Hypertension
To diagnose hypertension, we perform highly accurate, specialized blood pressure monitoring and conduct urine and blood tests tailored to each patient’s needs. We order an electrocardiogram or cardiac ultrasound to look for heart muscle damage or thickening. Additional testing available only at a specialty clinic such as our Comprehensive Hypertension Center is ordered as needed to help identify the cause of hypertension as well as the best treatment approach.

We also offer training in proper home blood pressure monitoring as well as 24-hour ambulatory monitoring, which is increasingly recognized as the best possible method to characterize the health risks related to high blood pressure, especially during sleep.

Many patients are referred to U-M because they haven’t reached their goals, have “resistant” hypertension, are intolerant to medications, have “white coat hypertension” or potentially have an underlying “secondary” cause of their high blood pressure.

Most often, our treatment strategy involves lifestyle changes together with an optimized medical regimen and proper home blood pressure monitoring. However, in some circumstances, catheter-based or surgical interventions may be helpful to control the hypertension. In a small number of patients, surgery is required to remove hormone-secreting tumors that cause resistant hypertension, and in some, the hypertension is cured or improved by performing an angioplasty or surgery on the arteries leading to the kidney.

THE BRIDGE CLINIC
Within 7 to 14 days of being discharged from the hospital, U-M patients meet with a nurse practitioner at one of our Bridge Clinics for a thorough education on the reason for the admission and review of the treatment required, as well as assessment of follow-up care, cardiovascular resources needed and cardiologist appointments. Our data has shown that patients who participate in the Bridge Clinic are at less risk for readmission or emergency room visits.
In an evolving health care environment, the institutional anchors of quality and safety are more important than ever in providing the best patient care as efficiently and effectively as possible. Throughout the Frankel CVC, our focus on quality and safety is essential to our efforts to promote comprehensive coordinated care within and across the University of Michigan Health System. We regularly measure specific cardiovascular care with national benchmarks, continuously make adjustments and improvements in our practices and survey patients, families and referring physicians for satisfaction ratings.

For more information about our Quality and Safety measures, visit www.uofmhealth.org/quality-safety.

**RECOGNITION**

In FY14, the U-M Health System was recognized for quality and safety by several national organizations:

- **“A” Grade** for Leapfrog Group’s Hospital Safety Score evaluation.
- **Blue Distinction Center+** for Cardiac Care by Blue Cross Blue Shield of Michigan.
- Named by the **Institute for Patient- and Family-Centered Care** as an exemplar for engaging patients and families in their care.
- Named by **Becker’s Hospital Review** to its 2014–15 list, “100 hospitals and health systems with great heart programs.”
- **Top Performer** on Key Quality Measures by The Joint Commission.
- Recognized as the **best hospital in Michigan** and the metro area by *U.S. News & World Report’s* list of 2015–16 Best Hospitals. Also **ranked nationally** in 11 areas, including 31st in cardiology and heart surgery.
Education

PARTNERS IN KNOWLEDGE

One of the main pillars of the Frankel CVC’s mission is education. Expanding our understanding of cardiovascular disease across the lifespan is a collaborative effort among clinicians and scientists, patients and their families. Our focus on the exploration of better treatments, disease mechanisms, genetics and myriad other factors that impact patient care supports our educational partnerships with you, our referring physicians, to improve outcomes for all.

Patient and Family Education
The Frankel CVC’s Mardigian Wellness Resource Center is available to provide top-quality, reliable information about cardiovascular health in patient-friendly language. Our goal is to help patients and families understand their health conditions, make informed decisions and become active members of their health-care team.

Ongoing Communication
Subscribe to our monthly e-newsletter for news on research, procedures, services and CME courses available at the Frankel CVC. Contact Physician Liaison Erika Laszlo at M-LINE 800-962-3555 or email physicianliaisons@med.umich.edu to sign up.

CONTINUING EDUCATION

Throughout the year, the U-M Frankel CVC offers physicians, mid-level providers and nurses a variety of continuing medical education courses and seminars taught by our faculty.

UPCOMING COURSES:
The Workup and Treatment of Peripheral Arterial Disease from a Multidisciplinary Approach
Saturday, October 24, 2015
The Inn at St. John’s, Plymouth, MI

INFORMATIONAL DINNERS:
For the past year, U-M faculty have presented Informational Dinners on a variety of cardiovascular-related topics at locations throughout Michigan. This is a unique opportunity for our faculty to interact with doctors, mid-level providers and nurses, share their expertise and discuss a variety of issues. Positive survey feedback from past attendees has demonstrated that these Informational Dinners are viewed as valuable and worthwhile. Past topics include heart failure, TAVR, stroke and PAD.

U-M doctors look forward to sharing information with our referring physicians in an informal, interactive environment and welcome the opportunity to hear your thoughts on topics you’d like us to pursue in the future. Upcoming topics, based on referring physician feedback, include electrophysiology, mitral valve disease and many others.

For more information about the dates and locations of upcoming dinners, contact Erika Laszlo at 734-647-1164 or ellaszlo@umich.edu. Informational Dinners are complimentary and participants can receive one CME credit.

SAVE THE DATE!
The 29th Annual Cardiology Update will be held August 19–21, 2016, at The Grand Hotel, Mackinac Island, MI.
Research
Finding the Right Match
Our scientists and physicians are collaborating across disciplines to fulfill the Frankel CVC’s mission of discovering new and better ways to prevent, diagnose and treat cardiovascular disease. As part of the robust and top-funded research environment at the University of Michigan, every clinical department and program within the Frankel CVC is actively engaged in research. Early access to expanded treatment options, from drug therapies and devices to prevention and procedures, is available to referring physicians and patients through these studies.

Cardiovascular clinical trials need all types of volunteers, from those who live with or have a family history of specific conditions, to those who are healthy. As part of our efforts to continuously improve the volunteer experience, finding the right patients for each trial is central to our research. This is why partnering with you, our referring physicians, is critically important.

Katie Wopinsky
Clinical Research Recruitment Coordinator
Katie collaborates with you and your patients to find the most appropriate match available in our cardiovascular clinical trials. She also provides you with additional information about individual trials and direct patient referral.

Please contact Katie for answers to your questions or for additional information about our research programs. Call 1-888-286-4420, email CVCVolunteer@med.umich.edu or visit www.umcvc.org/researchstudies. Katie welcomes your valuable feedback, which enables her to provide you with the best possible service.

Patients and their families can sign up to be matched with research studies for specific health conditions through UMClinicalStudies.org, the greater University’s research community website.

Physician Liaison Program
Your Frankel CVC Connection
Communication with you, our referring physicians, is central to improving coordination of patient care. The University of Michigan Health System Physician Liaison Program offers personalized service to community-based physicians in Ann Arbor and throughout the region.

Erika Laszlo
Physician Liaison for the Frankel Cardiovascular Center
Erika is here to provide you with the best possible service. She is available not only for on-site visits, but also to:

• Provide information about new cardiovascular services, treatment options and clinical trials
• Assess your needs and determine how we can best meet them
• Share outreach opportunities from our clinical faculty

Please contact Erika for answers to your questions or for additional information about our services. Call M-LINE 800-962-3555 or email physicianliaisons@med.umich.edu. Erika welcomes your feedback, which enables her to provide top-quality service that meets your needs.
Referring Physician Communications
Committed to Solid Partnerships
The U-M Frankel CVC is committed to creating a seamless communications system with you, our referring physicians. Our Attending Provider Communication Standards represents our strategic plan to ensure a solid partnership with you.

Michelle Donnelly, M.A.
Referring Physician Communication Lead
Michelle coordinates efforts with attending physicians to provide you with efficient clinical updates regarding inpatient and outpatient care. Michelle works to:

• Identify and resolve any communication gaps and monitor systems to prevent them
• Provide timely clinical updates regarding hospital-to-hospital transfers
• Ensure appropriate flow of correspondence for all patients referred

Please contact Michelle for answers to your questions or for additional information about our services. Call 734-232-4144 or email RP_communications@med.umich.edu. Michelle welcomes your feedback to help ensure exceptional service that meets your needs.

M-LINE
M-LINE is a single, 24-hour, toll-free number for you, our referring physicians, and your staff seeking access to clinical services and faculty at the University of Michigan Health System. The M-LINE staff works closely with personnel across the Health System to provide efficient and personalized service.

To make a referral or speak with one of our specialists, contact M-LINE 24 hours a day, 7 days a week.

M-LINE
800-962-3555

For additional referral information, visit the UMHS Health Provider website:

www.med.umich.edu/umhs/health-providers
Physician Listing

General Cardiology
Geoffrey Barnes, M.D.
Mark R. Benson, M.D., Ph.D.
James B. Byrd, M.D.
Sunil K. Das, M.D.*
Melinda B. Davis, M.D.
Sharlene M. Day, M.D.
Kim A. Eagle, M.D.
Daniel T. Eitzman, M.D.
Peter M. Farrehi, M.D.
James B. Froehlich, M.D., M.P.H.
Santhi K. Ganesh, M.D.
Sascha Goonewardena, M.D.
Adam S. Helms, M.D.
Elizabeth A. Jackson, M.D.
Theodore J. Kolias, M.D.
Troy M. LaBounty, M.D.
Kenneth J. Tobin, D.O.
Elina Yamada, M.D.

Echocardiography
William F. Armstrong, M.D.
David S. Bach, M.D.
Nicole M. Bhave, M.D.
Peter G. Hagan, M.D.
Mohamed Kenaan, M.D.
Theodore J. Kolias, M.D.
Troy M. LaBounty, M.D.
Sara Saberi, M.D.
Kenneth J. Tobin, D.O.

Interventional Cardiology
Eric R. Bates, M.D.
Stanley J. Chetcuti, M.D.
Claire S. Duvernay, M.D.
P. Michael Grossman, M.D.
Hitinder S. Gurm, M.D.
Daniel S. Menees, M.D.
Brahmajeek K. Nallamothu, M.D.
Michael Thomas, M.D.

Electrophysiology
Frank M. Bogun, M.D.
Aman Chugh, M.D.
Thomas C. Crawford, M.D.
Ryan T. Cunnane, M.D.
Hamid Ghanbari, M.D.
Krit Jongnarangsin, M.D.
Rakesh Latchamsetty, M.D.
Fred Morady, M.D.
Hakan Oral, M.D.
Justin Sanders, M.D.

Heart Failure/Transplant
Keith D. Aaronson, M.D.
Monica Colvin, M.D.
David Bradley Dyke, M.D.
Reema Hasan, M.D.
Scott Hummel, M.D.
Todd M. Koelling, M.D.
John M. Nicklas, M.D.
Maryse Palardy, M.D.
Adam B. Stein, M.D.
Audrey H. Wu, M.D.

Hypertension
Robert D. Brook, M.D.
James B. Byrd, M.D.
Kenneth A. Jamerson, M.D.
Susan Steigerwalt, M.D.
Alan B. Weder, M.D.*

Cardiothoracic Imaging
Prachi Agarwal, M.D.
Anil Attili, M.D.
Aamer Chughtai, M.D.
Paul Cronin, M.D.
Maryam Ghadimi Mahani, M.D.
Ella Kazerooni, M.D.
Aine M. Kelly, M.D.
Troy M. LaBounty, M.D.
Venkatesh Murthy, M.D., Ph.D.
Smita Patel, M.D.
Perry Pernicano, M.D.
Leslie Quint, M.D.
Mohamed Sayyoun, M.D.
Jadranka Stojanovska, M.D.
Kara Udager, M.D.
Dharshan Vummidi, M.D.

Nuclear Cardiology
James Corbett, M.D.
Venkatesh Murthy, M.D., Ph.D.

Adult Cardiac Surgery
Steven F. Bolling, M.D.
G. Michael Deeb, M.D.
Frank L. Fazzalari, M.D.
Jonathan W. Haft, M.D.
Francis D. Pagani, M.D., Ph.D.
Himanshu J. Patel, M.D.
Richard L. Prager, M.D.
Matthew A. Romano, M.D.
Bo Yang, M.D., Ph.D.

* Emeritus Faculty
Congenital Cardiac Surgery
Edward L. Bove, M.D.
Jennifer Hirsch-Romano, M.D.
Richard G. Ohye, M.D.
Ming-Sing Si, M.D.

Vascular Surgery
Ramon Berguer, M.D., Ph.D.
Dawn M. Coleman, M.D.
Enrique Criado, M.D.
Emily Wilcox Cummings, M.D.
Jose A. Diaz, M.D.
Jonathan L. Eliason, M.D.
C. Alberto Figueroa, Ph.D.
Katherine A. Gallagher, M.D.
Peter K. Henke, M.D.
Daniel D. Myers, DVM
Nicholas H. Osborne, M.D.
Lisa E. Pavone, M.D.
James C. Stanley, M.D.
Thomas W. Wakefield, M.D.

Interventional Radiology
Kyung Cho, M.D.*
Narasimham Dasika, M.D.
Joseph J. Gemmete, M.D.
Marcus Jarboe, MD.
Minhaj Khaja, M.D., M.B.A.
Venkataramu Krishnamurthy, M.D.
Bill Majdalany, M.D.
Paula M. Novelli, M.D.
Wael A. Saad, M.D.
James J. Shields, M.D.
Ravi Srinivasa, M.D.
David M. Williams, M.D.
Jonathan Willatt, M.D.

Interventional Neuroradiology
Neeraj Chaudhary, M.D.
Joseph J. Gemmete, M.D.
Aditya S. Pandey, M.D.
B. Gregory Thompson, M.D.

Cardiovascular Anesthesiology
Matthew D. Caldwell, M.D.
Anna V. Dubovoy, M.D.
Timur Z. Dubovoy, M.D.
Neal Duggal, M.D.
Lisa Irwin, M.D.
Paul E. Kazanjian, M.D.
Michael Mathis, M.D.
Sean Neill, M.D.

Critical Care Faculty
Jehad I. Albataineh, M.D.
Ross Blank, M.D.
Christopher Cassara, M.D.
Murtaza Diwan, M.D.
Milo C. Engoren, M.D.
Baber Fiza, M.D.
Kyle Gunnerson, M.D.
Jonathan W. Haft, M.D.
Mark Hausman, M.D.
William Lynch, M.D.
Michael D. Maile, M.D.
Andrew Rosenberg, M.D.
Matthew Sigakis, M.D.
Brian J. Woodcock, M.D.

Stroke Neurology
Eric E. Adelman, M.D.
Devin L. Brown, M.D., M.S.
James F. Burke, M.D., M.S.
Lewis B. Morgenstern, M.D.
Lesli E. Skolarus, M.D., M.S.
Michael M. Wang, M.D., Ph.D.
Darin B. Zahuranec, M.D., M.S.

Interventional Neuroradiology
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Joseph J. Gemmete, M.D.
Aditya S. Pandey, M.D.
B. Gregory Thompson, M.D.

Adult Congenital
Martin L. Bocks, M.D.
Timothy B. Cotts, M.D.
Mark Norris, M.D.
Locations

1. **Frankel Cardiovascular Center**  
   1500 E. Medical Center Drive  
   Ann Arbor, MI 48109

2. **Domino’s Farms**  
   4000 Ave Maria Drive  
   Lobby A, Suite 1300  
   Ann Arbor, MI 48106

3. **Briarwood Health Associates**  
   325 Briarwood Circle, Building 5  
   Ann Arbor, MI 48108

4. **Brighton Health Center**  
   8001 Challis Road  
   Brighton, MI 48116

5. **Canton Health Center**  
   1051 N. Canton Center Road  
   Canton, MI 48187

6. **Chelsea Health Center**  
   14700 E. Old US 12  
   Chelsea, MI 48118

7. **Livonia Health Center**  
   20321 Farmington Rd  
   Livonia, MI 48152

8. **Livonia Vein Center**  
   19900 Haggerty Road  
   Livonia, MI 48152

9. **Saline Health Center**  
   700 Woodland Drive  
   Saline, MI 48176

10. **Northville Health Center**  
    39901 Traditions Drive  
    Northville, MI 48168

11. **Troy Vein Center**  
    1777 Axtell Road, Suite 201  
    Troy, MI 48084
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