THE STRENGTH IT TAKES

IU Health Cardiovascular

2014 Surgical Outcomes Report



Indiana University Health



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U.S.News & World Report's Top 50 Adult Cardiology & Heart Surgery Program: Indiana's only nationally ranked cardiovascular program



U.S.News & World Report's Top 50 Pediatric Cardiology & Heart Surgery Program: Indiana's only nationally ranked cardiovascular program



A commitment to quality outcomes

Indiana University Health Cardiovascular is privileged to share our program highlights through this 2014 Cardiovascular Surgical Outcomes Report. IU Health has been a leader in cardiovascular surgery performing numerous firsts in Indiana, including open heart surgery, heart transplant, ventricular assist device implantation, total artificial heart surgery, heart-lung transplant and the first robotic mitral valve repair.

IU Health Cardiovascular remains dedicated to advancing evidence-based medicine and providing preeminent care throughout Indiana. IU Health provides unparalleled collaboration across the state of Indiana. Comprehensive forums for physicians, support staff and administrators are held to share clinical expertise, research and translation of best policies leading to preeminent care. Quarterly case reviews, database management and patient-centered care enable optimum medical therapy for each patient.

IU Health physicians are affiliated with Indiana University School of Medicine and are nationally and internationally recognized for their work in research, education and treatments. More than 80 percent of top specialists in their areas work with IU Health. IU Health Cardiovascular is ranked as one of the top 50 cardiology and heart surgery programs in the country by *U.S.News & World Report*. IU Health is proud to have been named to the *U.S.News & World Report's* prestigious Honor Roll. The Honor Roll represents the top one percent of hospitals nationwide across a broad spectrum of patient care. IU Health is proud to be ranked as one of the 17 hospitals selected nationally and the only hospital in Indiana.

In the pages that follow, we describe some of our key programs and initiatives. We hope you will recognize and appreciate the commitment that IU Health has to patient care, research and education detailed throughout this report.

Sincerely,

Mary R. Bakke

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Cardiovascular Surgery Program

IU HEALTH CARDIOVASCULAR SURGICAL CENTERS OF EXCELLENCE

- IU Health Arnett Hospital
- IU Health Ball Memorial Hospital
- IU Health Bloomington Hospital
- IU Health Methodist Hospital

The Indiana University Health Cardiovascular Surgery Program is on the leading edge of diagnostic techniques, treatments and therapies for cardiovascular disease, including the most complex and rare conditions. Patients benefit from our multidisciplinary team approach across the continuum of care in both the inpatient and outpatient settings.

- Preoperative case conferences convene weekly with surgeons, cardiologists, radiologists, advance providers and care coordinators. The multidisciplinary team reviews high risk and complex patients to determine the best treatment option.
- Preoperative huddles by the operating room team ensure a standard approach is used to communicate patient risk and a patient-focused plan of care.

IU Health Methodist Hospital cardiovascular care units pioneered the development of Accountable Care Units at IU Health University and Methodist hospitals. Being on the forefront of multidisciplinary care, IU Health is improving inpatient and outpatient outcomes through a HRSA Grant and partnership with the IUSOM and IUSN by targeting relational coordination among current and future multidisciplinary teams.



2014 Adult CT Surgery volume*

IU Health Methodist Hospital

IU Health Regional Partners**

*Total number of cases noted at the top of each bar. Includes only cases submitted to STS. **Includes IU Health Arnett Hospital, IU Health Ball Memorial Hospital, IU Health Bloomington Hospital, Columbus Regional, IU Health La Porte Hospital, IU Health Saxony Hospital and ProHealth Care

Data source: STS



Structural Heart and Valvular Surgery Program

IU Health Structural Heart Valve multidisciplinary team is comprised of 14 specialists in imaging cardiology, interventional cardiology, cardiothoracic surgery and radiology across four locations (Arnett, Ball, Bloomington and Indianapolis). Aligning with American Heart Association guidelines, IU Health structural heart valve experts utilize a multidisciplinary approach in diagnosing and treating valvular disease with standard and innovative therapies, including transcatheter aortic valve replacement (TAVR).

All patients undergoing isolated valve replacements were free from stroke and mortality outcomes remain lower than the national average for STS Registry participants nationally.

As a high volume referral center for complex and high valvular disease, IU Health Methodist Hospital performs the innovative valvular therapy Transcatheter Aortic Valve Replacement (TAVR) with quality outcomes.

2014 Aortic Valve Replacement Outcomes

	All AVR	STS Registry
Mortality	1.3%	2.4%
Stroke	0%	1.1%

2014 Mitral Valve Replacement Outcomes

	All MVR	STS Registry
Mortality	0%	4.9%
Stroke	0%	2%

TAVR Outcomes Table

In-hospital outcomes	2014
Total procedures completed	25
Patients with post-procedure LOS > 6 days	4% (1/25)
Device success	100% (25/25)
Stroke (any)	0% (0/25)
Major bleeding	0% (0/25)
Acute kidney injury	4% (1/25)
All-cause mortality (in hospital)	8% (2/25)

2014 IU Health Valve Procedure Volumes





Thoracic and Thoracoabdominal Aortic Program

IU Health Methodist Hospital is the state's referral center for complex aortic diseases and emergencies.

IU Health Methodist Hospital Procedure Volume



Ascending
Descending
Thorocoabdominal

Due to the complexity and high risk of aortic procedures, the procedures are only performed at IU Health Methodist Hospital

Data Source: STS registry

IU Health Methodist Hospital is a leader in both open and endovascular techniques, earning a reputation of having the some of the best outcomes in the world. Offering traditional open and innovative endovascular techniques contribute to the a track record of more than 95 percent survival in elective and emergent procedures.

		Mortality		Stroke		Renal Failure				
		STS benchmark %	MH%	# of outliers	STS benchmark %	# of outliers	MH%	STS benchmark %	MH%	# of outliers
Ascending	103	3.8	2.9	3	6.7	3.30	7	3.1	1.9	2
Descending	13	8.8	0	0	6.7	6.7	1	8.3	0	0
Thorcoabdominal	37	14.8	5.4	2	0	4.4	0	14.9	2.7	1
TEVAR	13		7.7	1			1			0
TOTAL	166			1						

2014 IU Health Methodist Hospital Aortic Volume

survival >95% rate

Data STS registry



Coronary Revascularization (Coronary Artery Bypass Graft-CABG)

Despite national decline in open heart procedure volume with 88 percent of open heart programs performing < 200 cases per year, IU Health cardiovascular surgeons continue to perform a large volume of isolated CABG and combined CABG procedures.

TO REFER A PATIENT CALL 800.622.4989

2014 CABG volume



IU Health Arnett Hospital, IU Health Ball Memorial Hospital and **IU Health Bloomington Hospital**

Data STS registry

*Combined CABG indicates any procedure performed concomitantly with a valve or aortic procedure

One example of IU Health providing unparalleled collaboration across the state of Indiana is the access to IU Health Academic Health Center readiness to care for the complex patient, on-site or as a resource to providers to discuss the best treatment option.

Performing a high volume of isolated and combined CABGs, IU Health is prepared to care for the most complex patient with 24/7 transfer pathways, availability to advance heart care specialists and mechanical assist devices that include but are not limited to ECMO, open and catheter mechanical assist devices.

Vascular Disease Program

RISK FACTORS FOR VASCULAR DISEASE INCLUDE:

- Age 50 or over
- Hypertension
- Smoking
- Obesity
- Diabetes
- Hypercholesterolemia
- COPD
- Physical inactivity

The integrated vascular team at IU Health encompasses specialists in vascular surgery, interventional cardiology, interventional radiology and cardiovascular surgery working together to determine the optimal approach to vascular disease. Although vascular disease affects about 10 million people nationally, the majority of individuals do not experience any symptoms and often go undiagnosed. With access to a full range of diagnostic techniques, IU Health partners with our referring physicians to offer free and low-cost patient and community screenings.

Member of the Society for Vascular Surgery Vascular Quality Initiative (SVS VQI $^{\circ}$)

Indiana University Health has been a member of the Society for Vascular Surgery Vascular Quality Initiative (SVS VQI®) since 2012. Launched in 2011, the VQI® is a network of 18 regional groups and 358 centers in 46 states and Ontario. Midwest Vascular Collaborative (MVC), the VQI® Midwest regional group, is a quality improvement group operating under the governance of the Society for Vascular Surgery PSO (SVS PSO). MVC is represented by over 170 regional physician members and nearly 18 participating hospitals, throughout Indiana, Kentucky, Western Ohio and Eastern Illinois. MVC has access to more than 10,000 vascular procedures, regionally, and over 237,000 records nationwide to benchmark and improve vascular care, detection, delivery and rehabilitation.

The mission of the MVC is to improve quality of care, safety, effectiveness and cost of caring for the patients with vascular disease whom we serve. The PSO allows the collection of patient-identified data for quality improvement purposes without requiring individual patient consent or prior IRB approval. Physicians at IU Health are able to develop risk-adjusted and outcomes-based measures, based on data collected in the clinical data performance platform (PATHWAYS) and access real-time, customizable benchmarked reports on major outcomes and processes of care. As a PSO model, none of the data shared can be used for marketing, peer review or other endeavors—allowing a larger focus on enhanced care. Since 2012, IU Health has performed 292 carotid endarterectomies and 118 EVARs.

EVAR	2013	2014	
IU Health Methodist Hospital	N=50	N=53	
Death during hospitalization	4.0% (2)	0.0% (0)	

Data Source: VQI



The integrated vascular team at IU Health performs interventional/surgical procedures each year with a combination of management approaches and technologies. The IU Health team treats the full range of vascular disease, from claudication to limb salvage and stroke. Leading edge research and therapies allow our team to successfully treat patients who have often undergone one or more procedures elsewhere. This unique collaboration with referring physicians results in improved quality of life for patients with complex conditions.

Cook Zenith[®] Fenestrated Stent Graft

Our vascular program provides access to the latest technologies, including the Cook Zenith[®] Fenestrated Stent Graft, the only FDA approved system for the endovascular treatment of pararenal aneurysms. IU Health Methodist Hospital was the first hospital in the state to implant this fenestrated stent graft and our surgeons have one of the largest experiences in the country in the treatment of patients with this fenestrated system. IU Health vascular surgeons are hopeful this new procedure will have a less than or equal to 1 percent mortality rate.



Vascular Surgery Fenestrated Stent Graft Volume By Year



IU HEALTH ALSO PERFORMS A WIDE RANGE OF VASCULAR DIAGNOSTICS, INTERVENTIONS AND SURGERIES INCLUDING:

INTERVENTIONS:

- Carotid artery stenting
- Thoracic and complex EVAR
- Endovascular AAA repair
- Peripheral vascular intervention aortic
- Peripheral vascular intervention lower extremity
- Visceral/mesenteric and renal artery revascularization
- Treatment of venous disease
- Endoleaks after EVAR/TEVAR
- Embolization of aneurysms, pseudoaneurysms and vascular malformations
- Peripheral artery revascularization
- Acute pulmonary embolism
- Endovascular foreign body removal
- Hemodialysis access and maintenance

SURGERIES:

- Carotid artery endarterectomy
- AAA repair
- Lower extremity bypass
- Aortic bypass
- Axillary to femoral bypass
- Hemodialysis access

Data Source: Internal data

Level One Vascular Emergency Program

TRANSFER CRITERIA

The Level One Vascular Emergency Program at IU Health Methodist Hospital is equipped to handle every vascular emergency, including:

- Ascending thoracic aortic dissections/aneurysms
- Descending thoracic aortic dissections/aneurysms
- Abdominal aortic aneurysms (AAA) (ruptured and symptomatic)
- Acute limb ischemia

INTEGRATED APPROACH

The Level One Vascular Emergency Program is an integrated treatment approach with EMS, referring facilities, cardiothoracic and vascular surgeons, and multiple departments and staff within IU Health Methodist Hospital. This collaboration reduces treatment delays and provides evidence-based therapies to all our cardiac and vascular patients.

When life and limb are at stake

IU Health Methodist Hospital implemented the Level One Vascular Emergency Program in August 2009. Since the initiation of this program, time from diagnosis to treatment has decreased by 16 percent. This program was, and is still today, the only one of its kind in the state of Indiana. The high mortality rate of vascular emergency patients underscores the importance of timely treatment and intervention. Speed is the key in the preparation and treatment of vascular emergencies.

The Level One Vascular Emergency Program is designed as a "one-call-does-it-all" system. By activating the system, the referring facility is assisted with the following:

- Access to the IU Health Transfer Center nurse liaison, who remains dedicated to the referring facility and IU Health Methodist Hospital treatment teams throughout the transfer process;
- Assistance with the most appropriate, closest advanced life support transportation, either by air or ground, to IU Health Methodist Hospital in Indianapolis;
- Connection to the appropriate surgeon and comprehensive treatment team within minutes;
- Facilitation of physician-to-physician communication and nursing report;
- Access to IU Health Radiology cloud imaging technology which enables quick transfer of images via a secure internet delivery system facilitating treatment decisions prior to arrival.

The development of this program has created the opportunity to evaluate our treatment algorithms and processes in order to improve outcomes, quality and effectiveness. As a result, more than 90 referring facilities throughout Indiana, Kentucky and Illinois have utilized this process.

Level One Vascular Volumes by Year



AAA
Thoracic
Acute limb ischemia

Data source: Internal data 2014



Carotid Disease Program

Comprehensive carotid treatments are available for routine and high-risk patients. The integrated vascular team at IU Health is a preeminent provider in the treatment of carotid stenosis. Our long-standing collaboration with our Neuroscience Center of Excellence continues to strive to reduce the incidence of death and disability related to stroke.

In addition, the outcomes at IU Health for carotid stenosis are better than the national average and our patients are living to tell about it.

CEA	2013	2014
IU Health Methodist Hospital	N=129	N=110
Death during hospitalization	0.8% (1)	0.9% (1)

Data Source: VQI

Stroke One Emergency Transfer Program

When it comes to treating stroke patients, every second counts. Time lost is brain lost, so getting the right care at the right time is essential. IU Health Methodist Hospital is home to Indiana's only Comprehensive Stroke Center, where the onsite specialists in neurology, neurosurgery and neuro-interventional radiology are ready to treat ischemic and aneurysm stokes 24/7.

Activation criteria

- Acute ischemic stroke
- Subarachnoid hemorrhage
- Intracranial hemorrhage

Treatment options, depending on the type of stroke may include:

- Intravenous TPA
- Intra-arterial treatment or mechanical embolectomy
- Aneurysm treatment
- Surgical clipping
- Coil embolization
- Carotid endarterectomy
- Carotid stenting

RISK FACTORS FOR STROKE INCLUDE:

- Family history
- High blood pressure
- Smoking
- Obesity
- Diabetes
- Carotid artery disease
- Atrial fibrillation
- TIAs
- High blood cholesterol
- Physical inactivity
- Obesity
- Excessive alcohol use

Thoracic Surgery Program

CLINICAL FIRSTS

The IU Health Cardiovascular Program has a strong heritage of performing many clinical firsts.

- First open heart surgery in Indiana
- First private hospital in the world to perform a heart transplant
- First heart transplant in Indiana
- First ventricular assist device implantation in Indiana
- First total artificial heart in Indiana
- First heart-lung transplant in Indiana
- First double-lung transplant in Indiana
- First robotic mitral valve repair in Indiana
- World's first double lung and pancreas transplant
- Indiana's largest ECMO program
- Indiana's only recognized adult congenital disease program

The thoracic surgeons at IU Health specialize in the diagnosis and treatment of a broad range of malignant and benign diseases of the lung, esophagus and mediastinum.

Lung cancer is now the most common cause of cancer-related deaths in both males and females in United States and the incidence of esophageal cancer is increasing as a result of gastroesophageal reflux. Our multidisciplinary thoracic oncology program includes internationally recognized leaders in thoracic surgery, medical and radiation oncology, pulmonary medicine and gastroenterology, who collaborate for optimal patient care. Leading edge clinical trials and innovative treatments can frequently be offered. IU Health physicians involved with our thoracic oncology program also closely collaborate with referring physicians to arrange local treatment where feasible for patient convenience.

The Indiana Health Melvin and Bren Simon Cancer Center holds the distinction of being the only National Cancer Institute-Designated Cancer Center in the state of Indiana.

Video-assisted, minimally invasive pulmonary resections can frequently be offered for early stage lung cancers, which result in less pain, shorter hospital stays and a quicker return to normal activities. Complex pulmonary resections are also performed for more advanced tumors. Our thoracic surgeons are internationally recognized experts in the treatment of esophageal and mediastinal neoplasms, having developed techniques that reduce the incidence of complications after removal of these difficult tumors.

Key thoracic interventions

- Minimally invasive pulmonary resections
- Open complex
- Esophagostomy
- Malignancy
- Benign
- Lung cancer screening
- Benign esophageal disorders
- Perforations reflux/diaphragm hernia

- Strictures
- Achalasia
- Mediastina
- Tumors malignancy/benign
- Thymectomy
- Tumors/myasthenia gravis
- Minimally invasive sympathectomy
- Hyperhidrosis



Level One Esophageal Emergency Program

Coordination, collaboration and speed improve outcomes

Our IU Health thoracic surgeons, gastroenterologists and radiologists have established a novel "level-one" program designed exclusively for the management of patients with either suspected or diagnosed esophageal perforations. This is a unique program, which expedites multidisciplinary care of these critically ill patients. Since its inception in 2013, over 70 patients have been referred through this program. Many patients can be managed conservatively or with endoscopically placed stents. Patients requiring emergency surgery can usually be transported directly to our operating rooms within two to three hours of referral. We believe that this emergency multidisciplinary program has reduced the otherwise very high morbidity and mortality of these life-threatening illnesses.

Esophageal Perforation Etiology



Iatrogenic Perforation (n = 16)
Boerhaave Syndrome (n = 20)

Other Causes (n = 8)

Data source: IU Health Level One Esophageal Emergency Database 2014

Esophageal Perforation Interventions



Data source: IU Health Level One Esophageal Emergency Database 2014

LEVEL ONE EMERGENCY PROGRAMS AT INDIANA UNIVERSITY HEALTH INCLUDE:

- Level One Esophageal Program
- Level One Heart Attack Program
- Level One Pulmonary Embolism Program
- Level One Shock Program
- Level One Vascular Emergency Program

To transfer an adult patient call **877.247.1177.**

Research and innovation

DR. JOHN FEHERANBACHER

Dr. John W. Fehrenbacher is an IU Health thoracic surgeon and Director of the Thoracic Aortic Surgery Program known for his groundbreaking Deep Hypothermia and Circulatory Arrest procedures for thoracic and abdominal aneurysms—specialty procedures he developed and perfected.

Early in his career, these complex procedures became the focus of his work. His results with DHCA are outstanding with mortality rate at 3.1 percent. The national average is 15 percent.

Dr. Fehrenbacher has also pioneered other "firsts" in Indiana:

- First lung transplant in 1989,
- First heart-lung transplant also in 1989, and
- First bilateral lung transplant in 1991.

His priority is now to train other physicians in the use of his DHCA procedure.

Indiana University Health Aortic Center of Excellence is proud to present Dr. Joel S. Corvera and Dr. Saila T. Pillai, two renowned thoracic surgeons working together to continue the legacy built by Dr. John W. Fehrenbacher.

Today's discoveries for tomorrow's therapies

Research defines the goals of IU Health and drives IU Health Cardiovascular to continuously pursue better, safer, more effective diagnostic and treatment options for our patients. Our comprehensive health system and seamless collaboration across specialties provides access to the latest clinical trials. Research in progress includes:

- HeartWare HVAD Lateral The HeartWare HVAD placed by thoracotomy approach in hopes to lessen adverse events/complications
- CryoLife CLOT Perclot vs. Arista for hemostasis during and after cardiac/abdominal surgery (Dr. Michael House is sub-investigator)
- SynCardia 50cc Total Artificial Heart (smaller version of the total artificial heart used in HeartMate III°, the newest LVAD from Thoratec that should decrease adverse events)

A preeminent cardiovascular center committed to patient care, research and education, the IU Health Cardiovascular program has a strong heritage of physician leaders in the areas of innovation and education.

The relationship between IU Health and the Indiana University School of Medicine creates an unparalleled approach to developing future advancements for cardiovascular disease. To further enhance this relationship, IU Health and the IU School of Medicine jointly established the Strategic Research Initiative, which includes an initial investment of \$150 million dollars over five years. The IU Health Cardiovascular program is one key component of this initiative to support transformational research within the cardiovascular program, including:

- Comprehensive heart failure, including genetics and biorepositories
- Pharmacogenomics to promote drug efficacy and safety
- Data coordinating center for cardiovascular outcomes research

IU Health is leading the nation in stem and progenitor cell therapies for peripheral arterial disease

Dr. Michael Murphy and Raghu Motaganahalli are the national PIs for the phase III MOBILE Trial. This is a pivotal multi-center trial designed to assess the efficacy of a patient's own bone marrow cells in improving blood flow and preventing leg amputation in subjects with advance peripheral arterial disease. The study is scheduled for completion of its assessment of the **152** patients enrolled and the results to be published this fall.

IU Health vascular surgery, one of only seven centers in the U.S. selected by the National Institutes of Health to conduct stem cell trials in cardiovascular disease, also completed the Patients with Claudication Treated with Aldehyde Dehydrogenase Bright cells (The PACE Trial) as the leading enrollers in this network of renowned stem cell research centers in the U.S. The investigators expect to present their results at the Nov. 2016 American Heart Association conference.



The IU Health Cardiovascular Team

CARDIOLOGY

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INTERVENTIONAL RADIOLOGY

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ADULT CARDIOTHORACIC SURGERY

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PEDIATRIC CARDIOTHORACIC SURGERY

John Brown, MD Mark Rodefeld, MD Mark Turrentine, MD

THORACIC SURGERY

Thomas Birdas, MD DuyKhanh Ceppa, MD Kenneth Kesler, MD Karen Rieger, MD

VASCULAR SURGERY

George Akingba, MD Michael Dalsing, MD Andres Fajardo, MD Alok Gupta, MD Gary Lemmon, MD Raghu Motaganahalli, MD Michael Murphy, MD Alan Sawchuk, MD

THORACIC TRANSPLANT SURGERY

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FOR MORE INFORMATION

 IMACS OneCall: 317.916.3500 or 800.622.4989

 Online: iuhealth.org/methodist/cardiovascular



Indiana University Health

A private, nonprofit organization, Indiana University Health is Indiana's largest comprehensive health system and is comprised of hospitals, physicians and allied services dedicated to providing preeminent care throughout Indiana and beyond. Our unique partnership with the Indiana University School of Medicine gives our highly skilled physicians access to innovative treatments using the latest research and technology.

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