This project would not have been possible without the commitment and expertise of a team led by Umesh Khot, MD; Pam Goepfarth; Sandra Hays; and Candi McCane.

Graphic design and photography were provided by Brian Kohlbacher and Cleveland Clinic’s Center for Medical Art and Photography.
Measuring and understanding outcomes of medical treatments promotes quality improvement. Cleveland Clinic has created a series of Outcomes books similar to this one for its clinical institutes. Designed for a physician audience, the Outcomes books contain a summary of many of our surgical and medical treatments, with a focus on outcomes data and a review of new technologies and innovations.

The Outcomes books are not a comprehensive analysis of all treatments provided at Cleveland Clinic, and omission of a particular treatment does not necessarily mean we do not offer that treatment. When there are no recognized clinical outcome measures for a specific treatment, we may report process measures associated with improved outcomes. When process measures are unavailable, we may report volume measures; a relationship has been demonstrated between volume and improved outcomes for many treatments, particularly those involving surgical and procedural techniques.

In addition to these institute-based books of clinical outcomes, Cleveland Clinic supports transparent public reporting of healthcare quality data. The following reports are available to the public:

- Joint Commission Performance Measurement Initiative (qualitycheck.org)
- Centers for Medicare and Medicaid Services (CMS) Hospital Compare (HospitalCompare.hhs.gov), and Physician Compare (medicare.gov/PhysicianCompare)
- Cleveland Clinic Quality Performance Report (clevelandclinic.org/QPR)

Our commitment to transparent reporting of accurate, timely information about patient care reflects Cleveland Clinic’s culture of continuous improvement and may help referring physicians make informed decisions.

We hope you find these data valuable, and we invite your feedback. Please send your comments and questions via email to:

OutcomesBooksFeedback@ccf.org or scan here.

To view all of our Outcomes books, please visit clevelandclinic.org/outcomes.
Dear Colleague:

Welcome to this 2015 Cleveland Clinic Outcomes book. Every year, we publish Outcomes books for 14 clinical institutes with multiple specialty services. These publications are unique in healthcare. Each one provides an overview of medical or surgical trends, innovations, and clinical data for a particular specialty over the past year. We are pleased to make this information available.

Cleveland Clinic uses data to manage outcomes across the full continuum of care. Our unique organizational structure contributes to our success. Patient services at Cleveland Clinic are delivered through institutes, and each institute is based on a single disease or organ system. Institutes combine medical and surgical services, along with research and education, under unified leadership. Institutes define quality benchmarks for their specialty services and report on longitudinal progress.

All Cleveland Clinic Outcomes books are available in print and online. Additional data are available through our online Quality Performance Report (clevelandclinic.org/QPR). The site offers process measure, outcome measure, and patient experience data in advance of national and state public reporting sites.

Our practice of releasing annual outcomes books has become increasingly relevant as healthcare transforms from a volume-based to a value-based system. We appreciate your interest and hope you find this information useful and informative.

Sincerely,

Delos M. Cosgrove, MD
CEO and President
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Prefer an e-version?
Visit clevelandclinic.org/OutcomesOnline, and we'll remove you from the hard-copy mailing list and email you when next year’s books are online.
Dear Colleagues,

Thank you for your interest in this annual summary of accomplishments and innovations of the Sydell and Arnold Miller Family Heart & Vascular Institute. This 2015 publication is a testament to Cleveland Clinic’s commitment to tracking and reporting outcomes to help guide patient decisions and enable us to continuously improve patient care.

Our successes in 2015 include stellar outcomes and other achievements, such as:

• Recognition as the nation’s No. 1 heart care program by *U.S. News & World Report* for the 21st consecutive year

• Ranking among the 1% of US hospitals that earned a 3-star (highest) score in all 3 categories of the Society of Thoracic Surgeons’ (STS) risk-adjusted quality ratings for adult cardiac surgery, and also achieving a 3-star STS rating in lobectomy for lung cancer

• Publication of major papers in journals such as the *New England Journal of Medicine* and *JAMA*, as well as presentation of groundbreaking research at the American College of Cardiology’s Annual Scientific Session

• Revitalization of our Pediatric and Adult Congenital Heart Program with the addition of Hani Najm, MD, and Elizabeth (Tess) Saarel, MD, to lead the team of 6 heart surgeons and cardiologists

• Growth of the Cleveland Clinic Cardiovascular Specialty Network to include 25 allied or affiliated centers nationwide that contract with large employers

• Continuation of pioneering research to understand the effects of gut flora on the development of cardiometabolic diseases

• Leadership in major trials of the first leadless pacemakers and in the development of new, breakthrough medications to treat patients with heart failure

• First human use of a new transcatheter mitral valve developed by our physicians

We are deeply grateful for the generosity and kindness of our many donors who allow us to continue our research mission to improve the care of our patients.

We welcome your feedback, questions, and ideas for collaboration. Please contact me via email at OutcomesBooksFeedback@ccf.org and reference the Heart & Vascular book in your message.

Sincerely,

Lars G. Svensson, MD, PhD
Chairman, Miller Family Heart & Vascular Institute
Professor of Surgery, Cleveland Clinic Lerner College of Medicine
Cleveland Clinic’s Sydell and Arnold Miller Family Heart & Vascular Institute is home to many of the world’s finest physicians practicing cardiovascular medicine and surgery. In 2015, Cleveland Clinic was named the No. 1 heart care program in America by *U.S. News & World Report*. This marked the 21st consecutive year the program received this honor.

More than 1000 nurses and 227 physicians work together in the institute to ensure that every patient receives the highest level of care. Many patients with cardiovascular diseases come to Cleveland Clinic after being told all treatment options have been exhausted and nothing more can be done to help them.

The institute addresses a wide variety of conditions and treatment needs through its 3 broad departments — Cardiovascular Medicine, Thoracic and Cardiovascular Surgery, and Vascular Surgery. Patient needs are further met through a system of subspecialty centers and clinics that collaborate across departments to foster innovative approaches to care and advance research initiatives to improve patient outcomes.

By combining the fundamental elements outlined above — a patient-centric, individualized approach to care, multidisciplinary collaboration, and unparalleled staff experience and expertise — the Miller Family Heart & Vascular Institute is able to achieve the extraordinary volumes and outcomes reported in the pages of this book.
### Heart & Vascular Institute Overview

<table>
<thead>
<tr>
<th></th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient visits</td>
<td>542,702</td>
</tr>
<tr>
<td>Admissions</td>
<td>13,364</td>
</tr>
<tr>
<td>Beds</td>
<td>422</td>
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<tr>
<td>Coronary intensive care</td>
<td>24</td>
</tr>
<tr>
<td>Heart failure intensive care</td>
<td>10</td>
</tr>
<tr>
<td>Cardiac, vascular, and thoracic surgery intensive care</td>
<td>76</td>
</tr>
<tr>
<td>Private patient rooms</td>
<td>283</td>
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<tr>
<td>Same-day recovery</td>
<td>29</td>
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</table>

### Surgical Procedures

#### Cardiac Surgery

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac surgeries</td>
<td>4072</td>
</tr>
<tr>
<td>Valve surgeries</td>
<td>2943</td>
</tr>
<tr>
<td>Coronary artery bypass grafting (isolated and combined)</td>
<td>1508</td>
</tr>
<tr>
<td>Aortic repairs</td>
<td>1185</td>
</tr>
<tr>
<td>Surgeries for septal myectomy</td>
<td>193</td>
</tr>
<tr>
<td>Congenital heart surgeries (adult and pediatric)</td>
<td>481</td>
</tr>
<tr>
<td>Robotically assisted cardiac surgeries</td>
<td>105</td>
</tr>
</tbody>
</table>

#### Transplant Surgery

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart transplants</td>
<td>48</td>
</tr>
<tr>
<td>Lung transplants</td>
<td>97</td>
</tr>
</tbody>
</table>

#### Thoracic Surgery

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>General thoracic surgeries</td>
<td>1551</td>
</tr>
<tr>
<td>Esophageal surgeries</td>
<td>277</td>
</tr>
</tbody>
</table>

#### Vascular Surgery

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vascular surgeries (open and endovascular)</td>
<td>2992</td>
</tr>
<tr>
<td>Bypass surgeries</td>
<td>165</td>
</tr>
<tr>
<td>Arteriovenous access surgeries</td>
<td>398</td>
</tr>
</tbody>
</table>

The data reported in the Institute Overview reflect volumes at Cleveland Clinic's main campus only. Data in other areas of the book may reflect volumes for main campus and other Cleveland Clinic hospitals. For a complete list of Cleveland Clinic hospitals, visit [clevelandclinic.org](http://clevelandclinic.org).
### Aortic Surgery

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open ascending aorta and aortic arch repairs</td>
<td>720</td>
</tr>
<tr>
<td>Open descending aorta and thoracoabdominal repairs</td>
<td>66</td>
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<tr>
<td>Open abdominal aortic aneurysm repairs</td>
<td>85</td>
</tr>
<tr>
<td>Endovascular ascending aorta repairs</td>
<td>7</td>
</tr>
<tr>
<td>Endovascular descending aorta and thoracoabdominal repairs</td>
<td>216</td>
</tr>
<tr>
<td>Endovascular abdominal aortic aneurysm repairs</td>
<td>93</td>
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</table>

### Cardiovascular Medicine Procedures

#### Interventional Cardiology

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic cardiac catheterizations</td>
<td>8153</td>
</tr>
<tr>
<td>Interventional cardiac procedures</td>
<td>1610</td>
</tr>
<tr>
<td>Percutaneous aortic valvuloplasties</td>
<td>47</td>
</tr>
<tr>
<td>Percutaneous mitral valvuloplasties</td>
<td>41</td>
</tr>
<tr>
<td>Percutaneous atrial septal defect and patent foramen ovale closures</td>
<td>32</td>
</tr>
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</table>

#### Electrophysiology

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrophysiology ablations</td>
<td>1559</td>
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<tr>
<td>Ablations for atrial fibrillation</td>
<td>863</td>
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<tr>
<td>Device implants</td>
<td>1435</td>
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<tr>
<td>Leads extracted</td>
<td>180</td>
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</table>

#### Diagnostic and Cardiac Imaging

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Echocardiograms</td>
<td>78,162</td>
</tr>
<tr>
<td>Cardiac CT scans</td>
<td>7747</td>
</tr>
<tr>
<td>Cardiac MRI scans</td>
<td>3286</td>
</tr>
<tr>
<td>Stress tests</td>
<td>7910</td>
</tr>
<tr>
<td>Nuclear cardiology tests</td>
<td></td>
</tr>
<tr>
<td>Tc-Myoview-rest</td>
<td>4344</td>
</tr>
<tr>
<td>Tc-Myoview-stress</td>
<td>4252</td>
</tr>
<tr>
<td>Rubidium heart (PET)</td>
<td>824</td>
</tr>
<tr>
<td>FDG heart (PET)</td>
<td>501</td>
</tr>
<tr>
<td>MUGA</td>
<td>82</td>
</tr>
<tr>
<td>N-13 ammonia heart</td>
<td>52</td>
</tr>
</tbody>
</table>

Patients from **76 countries** received cardiovascular care at Cleveland Clinic in 2015.

Patients from all **50 states** traveled to Cleveland Clinic in 2015 for cardiovascular care.
In 2015, Cleveland Clinic surgeons performed 5999 thoracic and cardiac procedures at Cleveland Clinic’s main campus. A total of 1278 procedures were performed at Cleveland Clinic’s Hillcrest Hospital, Fairview Hospital, and Cleveland Clinic Florida. For a complete list of Cleveland Clinic hospitals, visit clevelandclinic.org.

23%
A total of 23% of cardiac surgeries at Cleveland Clinic in 2015 were reoperations. These procedures are associated with more complexity and greater risk than primary (first-time) operations.

Surgical Procedure Volume by Type and Location (N = 7277) 2015

Cleveland Clinic surgeons perform a large volume of cardiovascular and thoracic procedures. The 7277 surgeries in 2015 were performed at Cleveland Clinic’s main campus, Fairview Hospital, Hillcrest Hospital, and Cleveland Clinic Florida. For a complete list of Cleveland Clinic hospitals, visit clevelandclinic.org.
Cardiac Surgery Volume: Cleveland Clinic Main Campus, Fairview Hospital, and Hillcrest Hospital (N = 4353)

2015

A total of 23% of cardiac surgeries performed during 2015 were reoperations. Reoperations are more complex than primary (first-time) surgeries.

Isolated Procedures, In-Hospital Mortality (N = 1671)

2015

Cleveland Clinic's Heart & Vascular Institute surgeons achieved lower-than-expected in-hospital mortality rates for patients who had isolated procedures. Isolated procedures are those done without any other surgical procedure.

Source: Society of Thoracic Surgeons (STS)
National Adult Cardiac Surgery Database 2015
Combined Cardiovascular Procedures, In-Hospital Mortality (N = 308)

2015

Combined procedures are those performed with another surgical treatment. These procedures are associated with greater risk and complexity than isolated procedures. Despite this, Cleveland Clinic’s surgeons in the Heart & Vascular Institute achieved lower-than-expected in-hospital mortality rates. This graph reflects only procedures classified in categories by the Society of Thoracic Surgeons. Cleveland Clinic surgeons perform many surgeries that cannot be classified because of the complexity and/or rarity of the procedure.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2015

General Thoracic Surgery Volume

2011 – 2015

Cleveland Clinic surgeons performed 1551 general thoracic surgical procedures in 2015.
Cleveland Clinic surgeons performed 7416 vascular surgeries in 2015. A total of 2992 of these procedures were done at Cleveland Clinic's main campus, and 4424 were performed at Cleveland Clinic hospitals throughout greater Cleveland. For a complete list of Cleveland Clinic hospitals, visit clevelandclinic.org.

Major Thoracic Surgery by Type (N = 1551)

Cleveland Clinic thoracic surgeons are experienced in all types of thoracic procedures. The majority of thoracic surgeries in 2015 involved the airway.

Vascular Surgery Volume

Cleveland Clinic surgeons performed 7416 vascular surgeries in 2015. A total of 2992 of these procedures were done at Cleveland Clinic's main campus, and 4424 were performed at Cleveland Clinic hospitals throughout greater Cleveland. For a complete list of Cleveland Clinic hospitals, visit clevelandclinic.org.
Vascular Surgery by Approach: Cleveland Clinic Main Campus and Regional Hospitals (N = 7416)

2015

Cleveland Clinic surgeons use an endovascular approach whenever it is the best option for the patient. Endovascular surgery is associated with lower rates of morbidity and mortality, and patients have a shorter recovery compared with open approaches.

Vascular Surgery, In-Hospital Mortality: Cleveland Clinic Main Campus (N = 8259)

2011 – 2015

The overall in-hospital mortality rate for vascular surgery at Cleveland Clinic from 2011 through 2015 was 1.7%, which was far below the expected rate of 5.4%. In addition, the in-hospital mortality rates associated with patient age were also lower than expected for all groups.

Source: Solucient
Cardiac Catheterization Laboratory Procedures (N = 11,601)
Cleveland Clinic is a regional and national referral center for percutaneous coronary intervention (PCI). A total of 11,601 cardiac catheterization procedures were done in 2015 to treat patients with simple and complex ischemic heart disease.

The data comparisons below demonstrate outcomes at Cleveland Clinic compared with those at hospitals included in the American College of Cardiology National Cardiovascular Data Registry (ACC-NCDR) CathPCI Registry® that perform more than 500 PCIs per year. Data are based on a 1-year rolling average; therefore, totals reported here may differ from those reported elsewhere in this book.

Medical Conditions Among Patients Undergoing PCI Procedures (N = 1527)

Patients with complex medical backgrounds present greater challenges for PCI procedures. In 2015, patients who had PCI at Cleveland Clinic had more complex backgrounds than patients at comparable hospitals.

Use of Appropriate Process Measures: Medications (N = 1527)

One of the ACC-NCDR key performance measures is the use of appropriate adjunctive medications before and after PCI. Cleveland Clinic achieved 100% use for all medication categories, which exceeds rates at comparable hospitals.

Source: ACC-NCDR database
In 2015, the rates of major vascular complications and stroke associated with PCI procedures at Cleveland Clinic were better than the rates at comparable hospitals. The rate of risk-adjusted bleeding events was slightly higher due to the use of hybrid procedures, such as valve replacement plus PCI, that are performed less frequently at other hospitals. Cleveland Clinic is continuously striving to achieve the best possible outcomes for patients.

CABG = coronary artery bypass grafting

*Source: ACC-NCDR database*
PCI Procedures — Chronic Total Occlusion Technical Success
With Hybrid Approach (N = 86)
2014 – 2015

Chronic total occlusion (CTO) occurs in about 15% to 30% of patients with indications for coronary artery testing. Patients typically have a diminished quality of life due to anginal symptoms in spite of maximal antianginal therapy and/or significant ischemia during noninvasive ischemic testing. Benefits of CTO PCI are relief of anginal symptoms and improvement in left ventricular function, survival, and quality of life.

Cleveland Clinic interventionalists exhibit a very high success rate with this extremely complex type of PCI procedure.

PCI Procedures — Use of Radial Access (N = 1520)
2015
In 2015, Cleveland Clinic performed more PCI procedures using radial access than did other comparable hospitals. The use of radial access is associated with reductions in bleeding complications, readmission rates, infection, and recovery time compared with PCI procedures done using a femoral approach.
Surgical Treatment for Ischemic Heart Disease (N = 1508)

CABG Volume

Cleveland Clinic surgeons performed 1508 coronary artery bypass graft (CABG) procedures in 2015. A total of 692 were in combination with another procedure and 816 were isolated procedures, including reoperations.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated</td>
<td>816</td>
</tr>
<tr>
<td>CABG + other</td>
<td>692</td>
</tr>
</tbody>
</table>

CABG Volume, Primary and Reoperations (N = 1508)

The majority of CABG procedures at Cleveland Clinic in 2015 were primary operations. A primary operation is the first time a patient has a particular procedure. Reoperations are repeat procedures and are considerably more complex.

CABG Plus Other Procedure, In-Hospital Mortality (N = 692)

In-hospital mortality rates among patients who had CABG surgery plus another procedure at Cleveland Clinic in 2015 (primary and reoperations) were lower than expected.

Source: Data from the Vizient Clinical Data Base/Resource Manager™ used by permission of Vizient. All rights reserved.
Cleveland Clinic surgeons performed 816 isolated CABG procedures in 2015. The overall inpatient hospital mortality rate was 0.9%, which was lower than the expected rate of 1.9%.

Isolated CABG Procedures, In-Hospital Mortality (N = 816)

2014 – 2015

Many patients who have CABG reoperations at Cleveland Clinic have very complex medical histories, which creates a higher risk of death. Despite these increased risks, the inpatient hospital mortality rates for primary operations and reoperations were lower than expected (0.4% and 1.9%, respectively).

Isolated CABG Procedures, In-Hospital Mortality
Primary and Reoperation (N = 816)

2015

Approximately 12% to 15% of US hospitals received the STS “3 star” rating for CABG surgery. This denotes the highest category of quality. In the current analysis of national data covering the period from July 1, 2014, through June 30, 2015, the CABG surgery performance at Cleveland Clinic was found to lie in this highest quality tier, thereby earning the STS 3-star rating.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2015
Isolated CABG: Additional Outcomes
Deep Sternal Wound Infection
2014 – 2015

The rate of deep sternal wound infection after CABG surgery was lower than expected at Cleveland Clinic in 2015. The rate at Cleveland Clinic was 0%, compared with the expected rate of 0.4%.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2015
Ventilator Time > 24 Hours
2014 – 2015
A total of 7.7% of patients who had isolated CABG surgery at Cleveland Clinic in 2015 spent more than 24 hours on a ventilator. This is lower than the expected rate of 9.5%.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2015

In-Hospital Reoperation
2014 – 2015
The rate of in-hospital reoperation after isolated CABG surgery was lower than expected at Cleveland Clinic in 2015.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2015

Postoperative Stroke
2014 – 2015
The expected rate of postoperative stroke after isolated CABG surgery was 1.2% in 2015. The rate was slightly lower (1.1%) at Cleveland Clinic.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2015
Cleveland Clinic was 100% compliant with all Society of Thoracic Surgeons’ process measures in 2015. Measures include use of a perioperative beta blocker; use of a beta blocker, statin, and aspirin at discharge; and use of an internal mammary artery during isolated CABG surgery.

**Postoperative Renal Failure**  
2014 – 2015

Postoperative renal failure occurred in 1.5% of patients who had isolated CABG surgery at Cleveland Clinic in 2015. This was lower than the expected rate of 3.6%.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2015

**CABG All-Cause 30-Day Mortality and All-Cause 30-Day Readmissions**  
July 2012 – June 2015

The Centers for Medicare & Medicaid Services (CMS) calculates 2 CABG outcomes measures based on Medicare claims and enrollment information. The most recent risk-adjusted data available from CMS are shown. Although Cleveland Clinic’s CABG patient mortality and readmissions rates are slightly lower than the US national rates, CMS ranks Cleveland Clinic’s performance on each as “no different than” the respective US national rate. To further reduce avoidable readmissions, Cleveland Clinic is focused on optimizing transitions from hospital to home or postacute facility. Specific initiatives have been implemented to ensure effective communication, education, and follow-up.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2015
Acute Myocardial Infarction

AMI All-Cause 30-Day Mortality and All-Cause 30-Day Readmissions
July 2012 – June 2015

Percent

<table>
<thead>
<tr>
<th></th>
<th>Cleveland Clinic</th>
<th>National ratea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Readmissions</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

N = 462 731

*aSource: medicare.gov/hospitalcompare

The Centers for Medicare & Medicaid Services (CMS) calculates 2 AMI outcomes measures based on Medicare claims and enrollment information. The most recent risk-adjusted data available from CMS are shown. Although Cleveland Clinic's AMI patient mortality rate is slightly lower than the US national rate, CMS ranks Cleveland Clinic's performance as “no different than” the US national rate. Cleveland Clinic's AMI readmissions rate is slightly higher than the US national rate and also ranked by CMS as “no different than” the US national rate. To further reduce avoidable readmissions, Cleveland Clinic is focused on optimizing transitions from hospital to home or postacute facility. Specific initiatives have been implemented to ensure effective communication, education, and follow-up.
**Electrophysiology Laboratory Procedures by Type (N = 5175)**
Cleveland Clinic electrophysiologists use specialized approaches to diagnose and treat patients with a wide variety of arrhythmias. They are noted for their expertise in ablation procedures and management of patients with pacemakers and defibrillators.

2015 Volume

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Volume</th>
<th>CRT (N = 85)</th>
<th>Non-CRT (N = 587)</th>
<th>CRT (N = 355)</th>
<th>Non-CRT (N = 408)</th>
<th>CRT (N = 1478)</th>
<th>PVAI (N = 863)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead Extractions</td>
<td></td>
<td>(N = 180)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacemakers</td>
<td>1600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICDs</td>
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<td>(N = 408)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardioversions</td>
<td>1200</td>
<td>(N = 355)</td>
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<td></td>
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<td></td>
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<tr>
<td>Ablations, by Condition</td>
<td>1600</td>
<td>(N = 863)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**Pulmonary Vein Antrum Isolation Procedures (N = 4041)**

2011 – 2015 Volume

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>776</td>
</tr>
<tr>
<td>2012</td>
<td>819</td>
</tr>
<tr>
<td>2013</td>
<td>811</td>
</tr>
<tr>
<td>2014</td>
<td>722</td>
</tr>
<tr>
<td>2015</td>
<td>863</td>
</tr>
</tbody>
</table>

Pulmonary vein antrum isolation (PVAI) essentially disconnects the pathway of the abnormal heart rhythm and prevents atrial fibrillation.

CRT = cardiac resynchronization therapy, ICD = implantable cardioverter defibrillator, PVAI = pulmonary vein antrum isolation

*aThe total number of procedures includes electrophysiology studies, ICD testing, temporary pacers, loop recorders, and electrophysiology special procedures (endomyocardial biopsy, esophageal pacing, right heart catheterization, venography, and other). These are not included in the graph.
PVAI Success Rates
Success is defined as a restored sinus rhythm without recurrence of atrial fibrillation (AF) after the patient has stopped taking antiarrhythmic medications for at least 12 months after the procedure. This is influenced by a number of factors, including the length of time the patient has been in AF and the presence or absence of underlying heart disease.

In a recent study\(^1\) of 831 patients who underwent pulmonary vein antrum isolation at Cleveland Clinic, 81% of patients with paroxysmal AF were arrhythmia-free while off antiarrhythmic drugs at 12 months postablation. Paroxysmal AF is defined as AF that terminates within days without cardioversion. A total of 7.8% of this patient population had AF after 1 year postablation (late-recurrence AF).

The success rate is lower for patients with persistent or long-standing persistent AF (65% for a single ablation procedure) and is affected by the presence of valvular heart disease or other underlying problems.

A total of 161 patients who had early recurrence of AF had a repeat ablation procedure. At 14 months post repeat ablation, 78.9% were arrhythmia-free while off antiarrhythmic drugs. Of the 27 patients who had late-recurrence AF and a repeat ablation, 74.1% were arrhythmia-free while off antiarrhythmic drugs at 17 months post repeat ablation.

PVAI Complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>N</th>
<th>Percent</th>
<th>Benchmark Rate(^2) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>0</td>
<td>0</td>
<td>0.15</td>
</tr>
<tr>
<td>Tamponade</td>
<td>4</td>
<td>0.46</td>
<td>1.31</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>0</td>
<td>0</td>
<td>0.09</td>
</tr>
<tr>
<td>Hemothorax</td>
<td>0</td>
<td>0</td>
<td>0.02</td>
</tr>
<tr>
<td>Sepsis, abscesses, endocarditis</td>
<td>0</td>
<td>0</td>
<td>0.01</td>
</tr>
<tr>
<td>Permanent diaphragmatic paralysis</td>
<td>0</td>
<td>0</td>
<td>0.17</td>
</tr>
<tr>
<td>Total femoral pseudoaneurysm</td>
<td>1</td>
<td>0.12</td>
<td>0.93</td>
</tr>
<tr>
<td>Total arterial venous fistula</td>
<td>0</td>
<td>0</td>
<td>0.54</td>
</tr>
<tr>
<td>Valve damage/requiring surgery</td>
<td>0</td>
<td>0</td>
<td>0.07</td>
</tr>
<tr>
<td>Atrioesophageal fistula</td>
<td>0</td>
<td>0</td>
<td>0.04</td>
</tr>
<tr>
<td>Stroke</td>
<td>1</td>
<td>0.12</td>
<td>0.23</td>
</tr>
<tr>
<td>Transient ischemic attack</td>
<td>0</td>
<td>0</td>
<td>0.71</td>
</tr>
<tr>
<td>Pulmonary vein stenosis requiring intervention</td>
<td>5</td>
<td>0.58</td>
<td>0.29</td>
</tr>
<tr>
<td>Vascular access injury complications</td>
<td>3</td>
<td>0.35</td>
<td>–</td>
</tr>
<tr>
<td><strong>Total</strong>(^a)</td>
<td>14</td>
<td><strong>1.62</strong></td>
<td><strong>4.56</strong></td>
</tr>
</tbody>
</table>

\(^a\)The total percentage was calculated by dividing the total number of complications (N = 14) by the total number of PVAI procedures (N = 863).

\(^2\)The overall risk associated with PVAI in 2015 was 1.62%.

References
Cardiac Rhythm Disorders

PVAI Complications
It can take months or years for patients to develop pulmonary vein (PV) stenosis after a PVAI. The table details the incidence of PV stenosis after PVAI from 2009 through 2015, which is consistent with data previously published by Cleveland Clinic. The data are updated annually.

Cleveland Clinic obtains a 3-month postablation CT scan to screen for PV stenosis. Most centers do not screen all PVAI patients for PV stenosis upon follow-up. This may explain the higher percentages of PV stenosis at Cleveland Clinic, as routine screening results in the identification of more cases.

Ablation of Ventricular Arrhythmia, Volume and Success Rates (N = 227)

2015
Cleveland Clinic is a national referral center for patients with ventricular arrhythmias. In 2015, a total of 227 ablations were done. Partial success means that among patients with multiple arrhythmias, at least 1 arrhythmia was ablated.

Complications
A major complication is defined as one that leads to prolongation of hospital stay or to another hospitalization, requires additional intervention for treatment, and/or results in significant injury or death.

Major Complications Among Patients With Ejection Fraction < 50% (N = 125)

<table>
<thead>
<tr>
<th>Complication</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudoaneurysm</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>Vascular dissection/laceration and death within 30 days</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3</strong></td>
<td><strong>2.4</strong></td>
</tr>
</tbody>
</table>

Major Complications Among Patients With Ejection Fraction ≥ 50% (N = 102)

<table>
<thead>
<tr>
<th>Complication</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pericardial effusion with percutaneous intervention</td>
<td>2</td>
<td>1.96</td>
</tr>
</tbody>
</table>

References
3. Aliot EM, Stevenson WG, Almendral-Garrote JM, Bogun F, Calkins CH, Delacretaz E, Della Bella P, Hindricks G, Jais P, Josephson ME, Kautzner J, Kay GN, Kuck KH, Lerman BB, Marchlinski F, Reddy V, Schalij MJ, Schilling R, Soejima K, Wilber D; European Heart Rhythm Association (EHRA); Registered Branch of the European Society of Cardiology (ESC); Heart Rhythm Society (HRS); American College of Cardiology (ACC); American Heart Association (AHA). EHRA/HRS Expert Consensus on Catheter Ablation of Ventricular Arrhythmias: developed in a partnership with the European Heart Rhythm Association (EHRA), a Registered Branch of the European Society of Cardiology (ESC), and the Heart Rhythm Society (HRS); in collaboration with the American College of Cardiology (ACC) and the American Heart Association (AHA). Heart Rhythm. 2009 Jun;6(6):886-933.
In 2015, Cleveland Clinic surgeons performed 461 procedures, including minimally invasive approaches, to treat patients with atrial fibrillation. The majority of procedures were done at the same time as valve surgery. The overall in-hospital mortality rate was 0.86% (N = 4).

AF = atrial fibrillation, CABG = coronary artery bypass grafting

ICD Implants
In-Hospital Risk-Adjusted Complications (N = 689)

The in-hospital risk-adjusted complication rate for implantable cardioverter defibrillator (ICD) implants at Cleveland Clinic was 0.97, which represents better outcomes than the all-hospitals 90th and 50th percentiles. Implants include initial implant and generator-change procedures. Exclusions are lead-only procedures, patients who also have epicardial lead implants placed during the procedure, and those who also have lead extractions at the time of implant. Complications include cardiac arrest, coronary venous dissection, device-related infection, myocardial infarction, pneumothorax, emergency cardiac surgery, set screw problems, cardiac perforation, hemothorax, lead dislodgement, pericardial tamponade, transient ischemic attack, hematoma, and death.
### Initial Implantation Complications: Pacemaker and ICD\(^a\)

#### 2015

<table>
<thead>
<tr>
<th>Complications Measured for 30 Days</th>
<th>Pacemaker (N = 441) N (%)</th>
<th>ICD (N = 376) N (%)</th>
<th>Overall (N = 817) N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Pneumothorax or hemothorax plus a chest tube</td>
<td>1 (0.23)</td>
<td>0 (0)</td>
<td>1 (0.12)</td>
</tr>
<tr>
<td>Hematoma plus a blood transfusion or evacuation</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Cardiac tamponade or pericardiocentesis</td>
<td>2 (0.45)</td>
<td>1 (0.27)</td>
<td>3 (0.37)</td>
</tr>
</tbody>
</table>

#### Complications Measured for 90 Days

<table>
<thead>
<tr>
<th>Complications</th>
<th>Pacemaker (N = 441) N (%)</th>
<th>ICD (N = 376) N (%)</th>
<th>Overall (N = 817) N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Pneumothorax or hemothorax plus a chest tube</td>
<td>8 (1.81)</td>
<td>3 (0.80)</td>
<td>11 (1.35)</td>
</tr>
<tr>
<td>Hematoma plus a blood transfusion or evacuation</td>
<td>0 (0)</td>
<td>3 (0.80)</td>
<td>3 (0.37)</td>
</tr>
<tr>
<td>Cardiac tamponade or pericardiocentesis</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Mechanical complications requiring a system revision</td>
<td>11 (2.49)</td>
<td>7 (1.86)</td>
<td>18 (2.20)</td>
</tr>
<tr>
<td>Device-related infection</td>
<td>0 (0)</td>
<td>3 (0.80)</td>
<td>3 (0.37)</td>
</tr>
<tr>
<td>Additional device implantation</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Total(^b)</td>
<td>11 (2.49)</td>
<td>7 (1.86)</td>
<td>18 (2.20)</td>
</tr>
</tbody>
</table>

ICD = implantable cardioverter defibrillator

\(^a\)Initial implant: No prior device had been implanted (includes all brady and tachy devices); excludes special devices such as laptop and loop recorders.

\(^b\)Percentage totals were rounded.

### Secondary Implantation Complications: Pacemaker and ICD

#### 2015

<table>
<thead>
<tr>
<th>Procedure Type</th>
<th>N</th>
<th>Major Complications (%)</th>
<th>Benchmark (%)(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICD with lead addition</td>
<td>92</td>
<td>1.09</td>
<td>17.40</td>
</tr>
<tr>
<td>ICD without lead addition</td>
<td>185</td>
<td>2.16</td>
<td>5.80</td>
</tr>
<tr>
<td>Pacemaker with lead addition</td>
<td>41</td>
<td>4.88</td>
<td>5.88</td>
</tr>
<tr>
<td>Pacemaker without lead addition</td>
<td>139</td>
<td>0.72</td>
<td>2.27</td>
</tr>
</tbody>
</table>

ICD = implantable cardioverter defibrillator

### Reference

Lead Extraction Procedures (Leads in Place > 1 Year or Requiring Extraction Technology)  
(N = 1038)  
2011 – 2015

Electrophysiologists at Cleveland Clinic perform a high number of lead extractions. Many patients have complex conditions that result in referral to Cleveland Clinic physicians. Leads may need removal because of electrical malfunctions, blocked blood vessels, or infection. In most cases, the leads can be removed without opening the chest or heart. Major complications are defined as those causing death or intrathoracic bleeding.

<table>
<thead>
<tr>
<th>Volume</th>
<th>Extraction Procedures</th>
<th>Leads Extracted</th>
</tr>
</thead>
<tbody>
<tr>
<td>2500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Clinical success rate: 97.9%
Major complications: 1.6%

*Success is defined as removal of all the required leads without causing bleeding from the veins or heart.

Device Clinic Evaluations Volume (N = 41,504)  
2015

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pacemaker evaluations</td>
<td>19,450</td>
</tr>
<tr>
<td>ICD evaluations</td>
<td>22,054</td>
</tr>
</tbody>
</table>

ICD = implantable cardioverter defibrillator

Cleveland Clinic was the first hospital in the country to integrate a patient database for pacemaker and implantable cardioverter defibrillator follow-up with electronic medical records. This innovative approach to follow-up allows staff to keep track of patients’ health conditions regardless of the patients’ location. Remote monitoring is also associated with increased longevity and decreased need for in-person follow-up.

The institute uses the MyChart® function in Epic, Cleveland Clinic’s electronic medical record system, to quickly notify patients of their device status.
Cleveland Clinic surgeons have implanted more than 12,500 bioprosthetic aortic valves since the 1990s, with excellent short- and long-term outcomes.

In 2015, Cleveland Clinic surgeons performed 2943 valve surgeries.
Primary Operation and Reoperation Volume (N = 2943)

Cleveland Clinic surgeons performed 2943 valve procedures in 2015. A total of 2199 were primary operations and 744 were reoperations (25%).

Primary Operation and Reoperation In-Hospital Mortality (N = 2943)

Patients who have valve surgery reoperations have a somewhat higher risk of death compared with patients who have a primary operation, due to the overall decrease in health over time. Despite this, the in-hospital mortality rates were lower than expected for both reoperations and primary procedures.

Source: Data from the Vizient Clinical Data Base/Resource Manager™ used by permission of Vizient. All rights reserved.
Valve Disease

In-Hospital Mortality by Type (N = 2943)

<table>
<thead>
<tr>
<th>Type</th>
<th>2015 Percent</th>
<th>Cleveland Clinic</th>
<th>STS expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical Isolated AVR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transcatheter AVR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVR + CABG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolated MVR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MVR + CABG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolated MV Repair</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Septal Myectomy*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 442 303 214 89 28 324 193

The 2015 in-hospital mortality rates for all types of valve surgery at Cleveland Clinic were lower than expected.

AVR = aortic valve replacement, CABG = coronary artery bypass grafting, MV = mitral valve, MVR = mitral valve replacement

*These valve surgery cases do not have established STS expected mortality rates due to the complexity of the procedures.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2015

Aortic Valve Surgery

2011 – 2015

In 2015, 1936 aortic valve procedures were performed at Cleveland Clinic.
**STS Rating for Aortic Valve Replacement**

June 2012 – June 2015

Cleveland Clinic ranked among the top 8% of US hospitals for aortic valve replacement (AVR) surgery, earning the Society of Thoracic Surgeons’ (STS) 3-star rating for this category. This denotes the highest category of quality.

---

**Participant Score (95% Confidence Interval)**

<table>
<thead>
<tr>
<th>Participant Score</th>
<th>STS Mean Participant Score</th>
<th>Participant Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>97.4% (96.8, 97.9)</td>
<td>94.7%</td>
<td>3 stars</td>
</tr>
</tbody>
</table>

STS Rating for Aortic Valve Replacement

Min 82.3

8th 92.1

50th 95.1

90th 97.0

Max 98.5

Cleveland Clinic

STS

● = STS mean participant score

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2015

---

**Isolated Aortic Valve Replacement Complications (N = 442)**

2015

Cleveland Clinic had lower-than-expected rates of complications for isolated aortic valve replacement surgery.

---

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2015
Aortic valve replacement, in combination with coronary artery bypass graft (CABG) surgery, is a complex operation. Despite this complexity and the associated increase in risks, in-hospital mortality rates for both primary operations and reoperations were low.

**STS Rating for Coronary Artery Bypass Grafting and Aortic Valve Replacement**

**June 2012 – June 2015**

Cleveland Clinic ranked among the top 6.3% of US hospitals for coronary artery bypass graft (CABG) surgery plus aortic valve replacement (AVR), earning the Society of Thoracic Surgeons’ (STS) 3-star rating for this category (based on data from July 2012 through June 2015). This denotes the highest category of quality.

<table>
<thead>
<tr>
<th>Participant Score (95% Confidence Interval)</th>
<th>STS Mean Participant Score</th>
<th>Participant Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>95.5%</td>
<td>91.7%</td>
<td><strong>3</strong></td>
</tr>
<tr>
<td>(94.6, 96.3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2015

**Combined Coronary Artery Bypass Grafting and Aortic Valve Replacement**

**In-Hospital Mortality (N = 214)**

**2015**

<table>
<thead>
<tr>
<th>Percent</th>
<th>Cleveland Clinic</th>
<th>STS expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Aortic valve replacement, in combination with coronary artery bypass graft (CABG) surgery, is a complex operation. Despite this complexity and the associated increase in risks, in-hospital mortality rates for both primary operations and reoperations were low.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2015
Mitral Valve Surgery
Volume, Repair vs Replacement
2011 – 2015

Cleveland Clinic performs mitral valve repair procedures rather than replacement whenever possible. Mitral valve repair is associated with better survival, improved lifestyle, better preservation of heart function, and a lower risk of stroke and infection (endocarditis) compared with mitral valve replacement. Repair procedures also do not require postprocedure anticoagulation therapy.

Isolated Mitral Valve Surgery
In-Hospital Mortality (N = 413)
2015

The 2015 in-hospital mortality rates for Cleveland Clinic patients who had isolated mitral valve surgery were lower than expected for both repair and replacement procedures.

As world leaders in mitral valve repairs, Cleveland Clinic surgeons performed robotically assisted mitral valve surgery on 1000 patients from 2006 to 2014. The mortality rate was 0.1% (N = 1).

Surgical Treatment of Active Infective Endocarditis

Primary Operation, In-Hospital Mortality
2013 – 2015

The in-hospital mortality rates for patients who had primary operations for infective endocarditis were lower than expected in 2015.

Reoperation, In-Hospital Mortality
2013 – 2015

The in-hospital mortality rates for patients who had reoperations for infective endocarditis were lower than expected in 2015.

Source: Data from the Vizient Clinical Data Base/Resource Manager™ used by permission of Vizient. All rights reserved.
**Transcatheter Aortic Valve Replacement**

Cleveland Clinic is a national leader in the use of percutaneous treatment options for patients with valve disease.

**Volume and In-Hospital Mortality**

2011 – 2015

A total of 303 patients had transcatheter aortic valve replacement (TAVR) procedures at Cleveland Clinic in 2015. The in-hospital mortality rate was 2.3% compared with an expected rate of 7.2%.

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

Since the inception of the transcatheter aortic valve replacement (TAVR) program in 2006, Cleveland Clinic has become a world leader in the use of this specialized treatment in patients carefully selected based upon stringent clinical criteria. A total of 1028 patients have had this procedure done from 2010 to 2015, and the in-hospital mortality rate was 1.7% compared with the expected rate of 7.7%.

Source: STS/ACC TVT Registry
Cleveland Clinic began its transcatheter aortic valve replacement (TAVR) program in 2006. From 2010 to 2015, 1028 TAVR procedures have been performed with a lower-than-expected mortality rate (1.7% vs 7.7%).

Source: Society of Thoracic Surgeons (STS)/American College of Cardiology (ACC) Transcatheter Valve Therapy (TVT) Registry

Of the 875 TAVR procedures performed from 2012 through 2015, 73% have been done using a transfemoral approach.
Cleveland Clinic surgeons perform some of the most complex aortic procedures in the world. They achieve excellent outcomes through the combination of experience and use of the most advanced conventional, minimally invasive, and endovascular techniques to treat all sections of the aorta. Over the past 20 years, thoracic aorta surgical volumes have increased by 6 times, and the program is now the largest in the world.

Cleveland Clinic's **Acute Aortic Treatment Center** provides rapid transport, treatment, and follow-up for patients with aortic dissection and impending aneurysm rupture. In 2015, 5632 patients were transported by Cleveland Clinic's Critical Care Transport team. More than 20% of the patients transported were treated in the Sydell and Arnold Miller Family Heart & Vascular Institute, and many had acute aortic syndromes. Call **877.379.CODE (2633)** to expedite the transfer of patients with acute aortic syndromes.

---

**Aortic Surgery**

**Volume and Type**

**2011 – 2015**

<table>
<thead>
<tr>
<th>Year</th>
<th>Open Ascending/Arch Repair (N = 718)</th>
<th>Open Descending/Thoracoabdominal Repair (N = 66)</th>
<th>Endovascular Descending/Thoracoabdominal Repair (N = 216)</th>
<th>Open Abdominal Repair (N = 85)</th>
<th>Endovascular Abdominal Repair (N = 93)</th>
<th>Endovascular Ascending Aorta Repair (N = 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>1173</td>
<td>500</td>
<td>200</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>2012</td>
<td>1194</td>
<td>500</td>
<td>200</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>2013</td>
<td>1219</td>
<td>500</td>
<td>200</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>2014</td>
<td>1230</td>
<td>500</td>
<td>200</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>2015</td>
<td>1185</td>
<td>500</td>
<td>200</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

**2015 Totals**

- Open ascending/arch repair (N = 718)
- Open descending/thoracoabdominal repair (N = 66)
- Endovascular descending/thoracoabdominal repair (N = 216)
- Open abdominal repair (N = 85)
- Endovascular abdominal repair (N = 93)
- Endovascular ascending aorta repair (N = 7)

---

**In-Hospital Mortality (N = 1185)**

**2015**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Elective</th>
<th>Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ascending/Arch</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Descending</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>TAAA</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>AAA</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Open/Endovascular**

AAA = abdominal aortic aneurysm, TAAA = thoracoabdominal aortic aneurysm

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Aortic Disease

Guidelines Clarification for Aneurysm Repair in Patients With a Bicuspid Aortic Valve

A recent guidelines clarification statement by ACC/AHA/STS recommends more aggressive replacement of the ascending aorta for some patients, provided the surgery center has documented excellent outcomes for elective ascending aorta replacement surgery. This recommendation applies to those with an aortic diameter > 5 cm or a maximum aortic area-to-height ratio > 10 and risk factors such as a family history or hypertension in the setting of a bicuspid aortic valve.\textsuperscript{1,2} This clarification statement was, in part, based on research published by Cleveland Clinic’s Aorta Center.

References


Emergency Ascending Aorta and Aortic Arch Open Surgery Volume and In-Hospital Mortality
2011 – 2015

Cleveland Clinic surgeons performed 215 emergency open repairs of the ascending aorta and aortic arch in 2015, including acute aortic dissections and ruptures. These procedures are particularly urgent and challenging. The in-hospital mortality rate was 7.4% in 2015.

Ascending Aorta Stent Grafting

Surgeons at Cleveland Clinic’s Aorta Center have pioneered and become world leaders in performing less invasive transcatheter repairs of the ascending aorta. To date, they have performed more than 30 procedures. These techniques offer the highest-risk patients a safe treatment option, when there previously had been no safe alternative. The image to the right is from an 85-year-old man who had a large pseudoaneurysm behind the sternum. Early feasibility trials with newer devices designed specifically for this indication will begin in the coming months.

Reference

Aortic Disease

An increasing number of patients with connective tissue disorders such as Marfan syndrome and Loeys-Dietz syndrome are being diagnosed with aortic aneurysms. Up to 2% of the population is born with a bicuspid aortic valve that is commonly associated with thoracic aortic aneurysm.

Valve-Preserving Operations
Cleveland Clinic surgeons are among the most experienced in the world at performing valve-preserving aortic root aneurysm repairs (modified David’s valve reimplantation procedure). They have performed 569 of these procedures, including 62 in 2015 (0% in-hospital mortality). In a recently published analysis of 178 patients with connective tissue disorder, freedom from reoperation at 6 years was 92%. Cleveland Clinic surgeons are also using this technique more often to stabilize the aortic root in patients who have bicuspid aortic valves (intraoperative photograph shown).1

Modified David’s Valve Reimplantation Procedure

Less Invasive Endovascular Treatment for Aortic Arch Disease
Because the vessels that supply the brain originate from the aortic arch, outcomes after surgery involving this segment are particularly dependent on experience. Even at high-volume centers, some high-risk patients may benefit from an alternative treatment. Cleveland Clinic aortic surgeons helped develop totally endovascular techniques to repair the arch. Both double-branched endovascular devices (left) and single-branched devices (right) are being investigated in trials at Cleveland Clinic.1,2

References
### Aortic Arch Aneurysm Repairs

**Elective Aortic Arch Aneurysm Open Surgery Volume, Stroke Rate, and In-Hospital Mortality**

**2011 – 2015**

At Cleveland Clinic in 2015, 116 patients had elective surgery to repair the aortic arch. The in-hospital mortality rate was 3.4%, compared with the expected rate of 5.1%.

![Graph showing elective surgery volume, stroke rate, and in-hospital mortality from 2011 to 2015.]

**Emergency Aortic Arch Aneurysm Open Surgery Volume, Stroke Rate, and In-Hospital Mortality**

**2011 – 2015**

A total of 93 Cleveland Clinic patients had emergency open procedures to repair the aortic arch in 2015.

![Graph showing emergency surgery volume, stroke rate, and in-hospital mortality from 2011 to 2015.]

### Novel Hybrid Arch Repair

Hybrid aortic surgery involves the use of multiple techniques and tools, including cardiopulmonary bypass, active cooling, continuous direct blood flow to the brain, and direct placement of stent graft devices for extended repair in patients with complex disease involving the aortic arch. Cleveland Clinic aortic surgeons have developed new techniques to perform a modified branched frozen elephant trunk procedure to reduce the time and risk associated with conventional extended open repair.
Physicians and surgeons in Cleveland Clinic’s Aorta Center have the largest single-center experience in the US for treating patients with aortic dissection involving the descending aorta. Up to half of these patients go on to have thoracic endovascular aortic repair during the acute or chronic phase of follow-up. Cleveland Clinic uses a prospectively collected database to track these patients and better understand the natural history and outcome of their care.

**Descending Thoracic Aortic Disease**
Aortic dissections and ruptured aneurysms commonly occur in the descending thoracic aorta (DTA). Patients with these conditions need prompt evaluation and treatment. Cleveland Clinic surgeons use open and endovascular repair techniques with excellent outcomes, and they tailor the choice to each patient’s needs.

### DTA Repair Volume and Type (N = 882)
2011 – 2015

- 21% open elective (N = 185)
- 10% open emergency (N = 89)
- 23% endovascular emergency (N = 203)
- 46% endovascular elective (N = 405)

The majority of the 882 DTA repairs performed at Cleveland Clinic from 2011 through 2015 were done using an endovascular approach.

### DTA Repair In-Hospital Mortality (N = 882)
2011 – 2015

Extensive experience with both open and endovascular treatment options for patients with descending thoracic aortic disease results in lifesaving therapy for patients. This includes even those who require high-risk emergency treatment.
Lifelong Disease Management

Patients with aortic dissection and/or aortic aneurysm often have multiple segments of their aorta affected by the disease at any one time and may develop new aneurysms or further degeneration during long-term follow-up. The Aorta Team at Cleveland Clinic’s Aorta Center provides comprehensive management of all patients with aortic disease, including lifelong follow-up in the dedicated aorta clinic. After patients survive an emergency event or if they are fortunate enough to have their aortic disease discovered before an emergency, their regularly scheduled visits will typically include a visit with both a surgeon and a cardiologist. Dedicated heart and vascular imaging specialists ensure that imaging studies such as CT scans or MRIs are done as safely and accurately as possible by tailoring the data acquisition to each patient’s condition.

Outpatient Aortic Visits

2013 – 2015

Continuing the Legacy of Innovative Endovascular Aneurysm Repair

Cleveland Clinic surgeons have been intimately involved in the development of endografts for the treatment of patients with aortic disease. The first endografts for abdominal aortic aneurysms were used at Cleveland Clinic in 1995. Since then, Cleveland Clinic physicians have been actively involved in device development and trials and have helped lead the evaluation of new systems and treatment approaches.
Thoracoabdominal Aortic Aneurysm Surgeries (N = 656)
The most challenging aortic procedures involve patients with thoracoabdominal aortic aneurysms (TAAAs). Cleveland Clinic surgeons have extensive experience using both open and endovascular techniques to treat these patients.

TAAA Surgeries by Crawford Classification of Aortic Aneurysms
2011 – 2015

Thoracic Endovascular Repair First for Extensive Aortic Disease: The Staged Hybrid Approach
Open and endovascular approaches to aortic repair are complementary. Patients with the most extensive disease such as those with chronic aortic dissection or connective tissue disorders often require multiple operations staged over time. By combining open and endovascular procedures to completely replace the aorta, the overall risk can be lessened.1,2

References
TAAA Surgery Volume and Type (N = 656)
2011 – 2015

100%

67% endovascular branch vessel grafts (N = 437)

33% open surgeries (N = 219)

Cleveland Clinic surgeons performed 656 procedures to treat patients with TAAAs from 2011 through 2015.

TAAA Surgery In-Hospital Mortality (N = 656)
2011 – 2015

Percent

2011 – 2014
2015
Expected

0 5 10 15 20
Endovascular Open Open
Elective
Emergency

The complex nature of TAAA procedures is associated with a greater risk of death. Cleveland Clinic continuously strives to maintain the lowest mortality rates possible.

Branched Aortic Endografts for Inoperable Patients With Extensive Aneurysms

Fenestrated and branched endografts allow treatment of patients with complex aortic disease that involves the visceral and renal vessels of the aorta. Cleveland Clinic surgeons started developing and using this technology in 2001. The endografts can safely be used to treat patients with the most extensive aneurysmal disease that affects the aorta, including those deemed unfit for conventional open surgery.

Despite the complexity of these type II and III thoracoabdominal aortic aneurysms and the increased risks for these patients, the mortality rate was only 4.8%, and preservation of blood flow to the visceral vessels was achieved in more than 98% of the branches.\(^1\)

Reference

Aortic Disease

Abdominal Aortic Aneurysms
The abdominal aorta is second to the ascending aorta for aneurysm repair volume at Cleveland Clinic. Surgeons treat patients with abdominal aortic aneurysms (AAAs) both below and adjacent to the renal arteries using both open and endovascular repair procedures.

AAA Procedure Volume and Type (N = 843)

Cleveland Clinic surgeons performed 843 AAA repairs from 2011 through 2015. Outcomes at Cleveland Clinic are excellent for both types of surgery.

Preservation of Pelvic Flow
Over the past decade, Cleveland Clinic physicians helped pioneer the use of branched aortic endografts designed to preserve blood flow to the internal iliac arteries during repair of aortoiliac artery aneurysms. The use of this technology can help preserve blood flow in the pelvis following aneurysm repair, which can prevent complications such as pain, spinal cord ischemia, and bowel ischemia. Because of their experience, Cleveland Clinic physicians have helped lead enrollment in national trials that resulted in FDA approval of the endografts.

Open AAA Repair Volume and Type (N = 392)

Cleveland Clinic surgeons performed 392 open AAA repairs from 2011 through 2015. The majority of these procedures were elective.
Cleveland Clinic surgeons performed 451 endovascular AAA repair procedures from 2011 through 2015. A total of 37 fenestrated grafts were used to repair juxtarenal aneurysms. In 2015, Cleveland Clinic surgeons achieved a 0% in-hospital mortality rate for elective open AAA repairs.

Cleveland Clinic surgeons achieved 0% in-hospital mortality rates for both elective and emergency endovascular AAA repair in 2015.

EVAR Failures Require Both Open and Endovascular Expertise

Endovascular aneurysm repair (EVAR) is not always durable, and some patients require additional repair after several years. Cleveland Clinic surgeons have developed innovative methods to safely and effectively remove failed aortic endografts. In addition, Cleveland Clinic surgeons have the most experience among US doctors in salvaging these repairs using fenestrated endografts, allowing for a less invasive approach.
Hypertrophic obstructive cardiomyopathy (HOCM) is thickening of the lower chambers of the heart. The septal muscle, which divides the right and left chambers, is especially affected. The condition can impede blood flow from the heart to the aorta. Cleveland Clinic physicians use a comprehensive approach to diagnose and treat patients with HOCM. This approach includes a physical exam, EKGs, chest x-ray, and MRI. Cleveland Clinic has a special interest in HOCM and is actively screening patients and their family members for genetic abnormalities associated with the disease.

### Patient Volume

2015

Hypertrophic obstructive cardiomyopathy (HOCM) is thickening of the lower chambers of the heart. The septal muscle, which divides the right and left chambers, is especially affected. The condition can impede blood flow from the heart to the aorta. Cleveland Clinic physicians use a comprehensive approach to diagnose and treat patients with HOCM. This approach includes a physical exam, EKGs, chest x-ray, and MRI. Cleveland Clinic has a special interest in HOCM and is actively screening patients and their family members for genetic abnormalities associated with the disease.

### HOCM Surgical Volume (N = 949)

2011 – 2015

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>183</td>
</tr>
<tr>
<td>2012</td>
<td>178</td>
</tr>
<tr>
<td>2013</td>
<td>205</td>
</tr>
<tr>
<td>2014</td>
<td>190</td>
</tr>
<tr>
<td>2015</td>
<td>193</td>
</tr>
</tbody>
</table>

Cleveland Clinic continues to be one of the nation's leaders for volume and outcomes among patients with HOCM. In 2015, a total of 193 patients had surgical treatment for HOCM.
Surgical Procedure Distribution (N = 193)

2015

The largest subset of patients with HOCM who had surgical repair at Cleveland Clinic in 2015 had an isolated septal myectomy.

100%a

- 40% isolated septal myectomy (N = 77)
- 34% septal myectomy + valve (N = 66)
- 9% septal myectomy + other (N = 19)
- 8% septal myectomy + valve + other (N = 15)
- 4% septal myectomy + coronary artery bypass + valve (N = 7)
- 4% septal myectomy + coronary artery bypass (N = 7)
- 1% septal myectomy + coronary artery bypass + valve + other (N = 2)

aProcedural percentages are rounded.

Septal Myectomy In-Hospital Mortality

2013 – 2015

The expected in-hospital mortality rate for patients who had a septal myectomy in 2015 was 0.9%. The rate at Cleveland Clinic was lower (0.5%).

Source: Data from the Vizient Clinical Data Base/Resource Manager™ used by permission of Vizient. All rights reserved.
Congenital Heart Disease

Congenital heart disease affects an estimated 1 million people in America. Each year, approximately 1 in every 120 babies born in the US has a congenital heart defect. In some cases, the disease is life-threatening at birth. However, many people with a congenital heart condition do not know about it for years. Experts at Cleveland Clinic have extensive experience in the diagnosis and treatment of patients with all forms of congenital heart disease. The services of the Center for Pediatric and Adult Congenital Heart Disease are further enhanced by the Special Delivery Unit. The unit provides in utero diagnosis of complex heart conditions and immediate treatment after birth. Patients with more complex congenital heart disease who have surgery often require additional treatment or procedures throughout their lifetime and, therefore, need follow-up care from a team of experts in congenital heart disease.

Percutaneous Closure Procedures for Adult Congenital Heart Disease

Volume and Outcomes (N = 32)

2015

A total of 32 patients had percutaneous closure procedures at Cleveland Clinic in 2015. The success rate was 100%, and the mortality rate was 0% for both ASD and PFO closures.

Norwood Procedure In-Hospital Mortality (N = 16)

July 2011 – June 2015

Hypoplastic left heart syndrome (HLHS) is a very complex cardiac defect that affects newborns. This condition is likely the most challenging congenital heart defect to manage. Patients with this single-ventricle condition can often be treated with the Norwood procedure, which is the most complex and highest-risk procedure in the staged reconstruction treatment of patients with HLHS. However, the expertise of Cleveland Clinic's pediatric cardiac surgeons results in better survival rates than the national average for this procedure.

Source: Society of Thoracic Surgeons Congenital Database 2015
**Adult Congenital Heart Surgery**

**Volume and Type (N = 341)**

2015

Cleveland Clinic cardiac surgeons performed 341 open heart surgeries on patients with congenital cardiac disease. With advances in medical care and better long-term survival, the volume of these patients is increasing.

**In-Hospital Mortality (N = 341)**

2013 – 2015

The in-hospital mortality rate for adult congenital heart surgery at Cleveland Clinic in 2015 was 1.5%, compared with the expected rate of 3%. Many of these patients have very complex medical backgrounds and conditions and have had multiple surgeries.

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

AAOCA = anomalous aortic origin of a coronary artery,
ASD = atrial septal defect, CABG = coronary artery bypass grafting,
VAD = ventricular assist device, VSD = ventricular septal defect
Pediatric Congenital Heart Surgery

Volume and Type (N = 140)

2015

Cleveland Clinic surgeons performed 140 pediatric congenital heart surgeries in 2015. Procedures in the “other” category include truncus arteriosus repair and procedures of varying complexity.

In-Hospital Mortality (N = 140)

2012 – 2015

Cleveland Clinic is committed to achieving the best possible outcomes for patients. The in-hospital mortality rate for pediatric congenital heart surgery patients in 2015 was well below the expected rate of 3.4%.

Source: Society of Thoracic Surgeons (STS) National Database 2015

ASD = atrial septal defect, ASO = arterial switch operation, AV = atrioventricular, PA = pulmonary arterioplasty, PDA = patent ductus arteriosus ligation, RV = right ventricle, TOF = tetralogy of Fallot, VSD = ventricular septal defect
Pericardial Disease

Pericardial Disease Patient Volume
2011 – 2015

Pericardial disease includes a group of conditions that affect the pericardium, the double-layered sac that surrounds the heart. Cleveland Clinic's Center for the Diagnosis and Treatment of Pericardial Disease serves patients with a variety of pericardial syndromes. The multispecialty approach used at Cleveland Clinic involves cardiologists, surgeons, and imaging specialists, which enhances collaboration in the management of these diseases. Patient volume continues to rise, and in 2015 there were 2027 visits to the center.

The number of patients with pericardial disease who come to Cleveland Clinic for treatment continues to grow due to the unique diagnosis and treatment options available.

Pericardial Disease Outpatient Clinic Volume, New Consult Patients, by Diagnosis (N = 642)

2015

The majority of new patients seen in Cleveland Clinic's pericardial disease outpatient clinic in 2015 were diagnosed with pericardial effusion without pericarditis, followed by acute, recurrent, and constrictive pericarditis syndromes.

N = 132 96 63 26 325
Pericardial Disease

**Pericardial Disease Etiology (N = 642)**

**2015**

Pericarditis can be caused by a number of conditions; however, the cause is commonly unknown. In 2015, 346 new-consult patients seen at Cleveland Clinic had pericarditis of unknown origin.

- **54%** idiopathic (N = 346)
- **31%** postpericardiotomy syndrome (N = 200)
- **6%** autoimmune (N = 39)
- **5%** other (N = 35)
- **2%** infectious (N = 11)
- **2%** radiation (N = 11)

**Pericardial Procedures (N = 197)**

**2015**

The majority of pericardial procedures performed at Cleveland Clinic in 2015 were pericardiocentesis procedures. This percutaneous treatment is used to drain large pericardial effusions. Echocardiography is used during the procedure to improve outcomes.

- **49%** pericardiocentesis (N = 96)
- **29%** pericardectomy (N = 58)
- **22%** window (N = 43)

Heart Transplant Volume 2011 – 2015

2015 Volume (N = 48)

Cleveland Clinic's cardiac transplant program is one of the largest in the US and is the leading center in Ohio. Cleveland Clinic surgeons performed 48 heart transplant procedures in 2015.

Heart Transplant 1-Year and 3-Year Survival Rates

Survival (%)

Cleveland Clinic is committed to achieving the best possible outcomes for patients. Our surgeons have more than 20 years of experience with heart transplantation. This level of expertise resulted in survival rates that were better than expected.

Source: Scientific Registry of Transplant Recipients, December 2015. srtr.org

*Expected rate based on risk adjustment
Ventricular Assist Device Implantation Volume (N = 301)
2011 – 2015

Cleveland Clinic has more than 25 years of experience with ventricular assist devices (VADs). They can be used to help preserve heart function in patients who are awaiting transplant (bridge-to-transplant) or as a final treatment option (destination therapy). In 2015, VADs were used as bridge-to-transplant in 38 patients, and 27 patients received VADs as destination therapy.

Ventricular Assist Device Implantation, In-Hospital Mortality
2013 – 2015

The in-hospital mortality rate for patients who had ventricular assist device implantation at Cleveland Clinic in 2015 was 11%, compared with the expected rate of 17%.

Source: Data from the Vizient Clinical Data Base/Resource Manager™ used by permission of Vizient. All rights reserved.
The 2-year survival rate for patients who had a left ventricular assist device implant at Cleveland Clinic has increased over time to an impressive 80%. This significant improvement is due to the clinical expertise of our physicians, as well as advances in technology.

The Centers for Medicare & Medicaid Services (CMS) calculates 2 heart failure outcomes measures based on Medicare claims and enrollment information. The most recent risk-adjusted data available from CMS are shown. Cleveland Clinic’s heart failure patient mortality rate is “better than” the US national rate. Although Cleveland Clinic’s heart failure readmissions rate is slightly higher than the US national rate, CMS ranks Cleveland Clinic’s performance as “no different than” the US national rate. To further reduce avoidable readmissions, Cleveland Clinic is focused on optimizing transitions from hospital to home or postacute facility. Specific initiatives have been implemented to ensure effective communication, education, and follow-up.
Cleveland Clinic performed 519 lung transplants from 2011 through 2015 — the second largest number of lung transplants in the US.

### Lung Transplant Procedures, Volume and Type
2011 – 2015

Cleveland Clinic surgeons performed 97 lung transplants in 2015.

### Primary Disease of Lung Transplant Recipients
July 2014 – June 2015

- **62%** idiopathic pulmonary fibrosis (N = 65)
- **20%** emphysema/chronic obstructive pulmonary disease (N = 21)
- **18%** other (N = 18)

Idiopathic pulmonary fibrosis was the most common primary disease among patients who had lung transplant procedures at Cleveland Clinic in 2015.

Source: Scientific Registry of Transplant Recipients, December 2015. [srtr.org](http://srtr.org)
**Ex Vivo Lung Perfusion**

The majority (about 80%) of lungs donated for transplant are not usable due to infection, damage, or excess fluid. However, ex vivo lung perfusion allows many of these lungs to be converted to lungs that are transplantable, allowing more lives to be saved. Ex vivo perfusion involves attaching the lungs outside the body to a machine that perfuses them with a solution that helps remove excess water while they are being ventilated. If lung function improves, the lungs can be transplanted. Cleveland Clinic has experimented with this technique for 4 years and is now in the phase where these reconditioned lungs are being transplanted.

**Reference**

Peripheral artery disease (PAD) results from the buildup of plaque (atherosclerosis) in the arteries of the legs. For people with PAD, symptoms may be mild, requiring no treatment except modification of lifestyle (smoking cessation, diet modification, increased exercise, medications as indicated). In some people, the blockages may become more extensive with accompanying pain and disability that limits walking. In the most advanced cases, individuals may be at risk for loss of limbs unless circulation is improved. For these patients with severe PAD, attempts to improve blood flow in the leg are usually indicated. The goals of improving blood flow to the limbs are to reduce pain, improve functional ability and quality of life, and prevent amputation.

**Lower Extremity Percutaneous Interventional Procedures (N = 393)**

Cleveland Clinic's team of vascular surgeons and interventional cardiologists performs a high volume of complex percutaneous peripheral vascular interventional procedures.

### 2015 Volume

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angioplasty</td>
<td>196</td>
</tr>
<tr>
<td>Atherectomy</td>
<td>24</td>
</tr>
<tr>
<td>Stenting</td>
<td>149</td>
</tr>
<tr>
<td>Thrombolysis</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>393</td>
</tr>
</tbody>
</table>

### Lower Extremity Interventional Procedures, In-Hospital Overall Mortality (N = 393)

#### 2015

Source: Data from the Vizient Clinical Data Base/Resource Manager™ used by permission of Vizient. All rights reserved.
**Lower Extremity Surgery Volume and 30-Day Mortality (N = 249)**
A total of 249 lower extremity surgical procedures were performed at Cleveland Clinic in 2015. Mortality rates were lower than expected.

**Lower Extremity Surgery**
**Overall 30-Day Mortality**

2015

<table>
<thead>
<tr>
<th>Percent</th>
<th>Cleveland Clinic</th>
<th>Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

**Lower Extremity Surgery**
**30-Day Mortality by Procedure**

2015

<table>
<thead>
<tr>
<th>Percent</th>
<th>Cleveland Clinic</th>
<th>Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 82 47 120

**Femoral Artery Occlusion**

The common femoral arteries, especially on the right, and the iliac arteries are severely diseased.

Inflow patency is restored with common femoral endarterectomy and iliac intervention.
Peripheral Vascular Disease

Executive Health Screening Program
2011 – 2015

The Executive Health Screening Program is designed to identify any potential peripheral vascular disorders that can affect a patient’s health and well-being. The exam can identify problems such as carotid artery stenosis, which is a risk factor for stroke; peripheral artery disease, which can indicate an increased risk of heart attack and stroke and impair function and quality of life; and abdominal aortic aneurysm (AAA). A ruptured AAA is almost entirely preventable if it is identified and the patient is monitored; however, about 15,000 people die each year in the US due to ruptured AAAs.

Noninvasive Vascular Lab Ultrasound Study
Volume and Distribution (N = 50,268)
2015

The Noninvasive Vascular Laboratory provides service 7 days a week to diagnose arterial and venous disorders throughout the vascular tree and for follow-up after revascularization procedures, such as bypass grafts and stents. In 2015, the staff performed 50,268 vascular lab ultrasound studies at Cleveland Clinic's main campus and throughout the greater Cleveland region. All Cleveland Clinic vascular lab technologists are certified registered vascular technologists, which exemplifies Cleveland Clinic's commitment to quality patient care.
**Fibromuscular Dysplasia**

Fibromuscular dysplasia (FMD) is a vascular condition in which there is abnormal cell growth in the walls of medium and large arteries. This can cause the arteries to become narrowed (stenosis) and can also lead to aneurysm and dissection. Cleveland Clinic’s FMD program is dedicated to caring for and educating patients with FMD. It conducts research to better understand the condition and treatment options.

**Fibromuscular Dysplasia, Volume**
*2011 – 2015*

![Graph showing volume of FMD cases from 2011 to 2015](image)

**Thrombosis Center**

Cleveland Clinic’s Thrombosis Center was established in 2009. It includes a multidisciplinary group of specialists in vascular medicine, vascular surgery, adult and pediatric care, hematology, interventional radiology, cardiology, cardiac surgery, and laboratory medicine. The group works together to provide the best possible treatment to patients with deep vein thrombosis, pulmonary embolism, and hypercoagulable states.
A total of 1877 patients received treatment in the Lower Extremity Wound Clinic at Cleveland Clinic in 2015.

**Iliac Stenting**

Cleveland Clinic physicians performed 108 iliac stent procedures in 2015. The use of stents to treat patients with iliac occlusive disease is associated with excellent outcomes that include restored blood flow and minimal complications.
**Iliac Stenting, In-Hospital Mortality Rate**

**2014 – 2015**

<table>
<thead>
<tr>
<th>Percent</th>
<th>Cleveland Clinic</th>
<th>Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Femoral Endarterectomy With Stenting, In-Hospital Mortality**

**2014 – 2015**

In 2015, Cleveland Clinic performed 120 femoral endarterectomy procedures with stenting. This hybrid procedure is used in place of an aortic femoral bypass for patients with complex aortoiliac occlusive disease.

<table>
<thead>
<tr>
<th>Percent</th>
<th>Cleveland Clinic</th>
<th>Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: Data from the Vizient Clinical Data Base/Resource Manager™ used by permission of Vizient. All rights reserved.
**Peripheral Vascular Disease**

**Angioplasty Volume**

2012 – 2015

Lower extremity angioplasty offers a minimally invasive alternative to treat patients with severe claudication and limb-threatening ischemia. Cleveland Clinic physicians performed 74 tibial and 103 femoral-popliteal angioplasty procedures in 2015.

**Tibial Bypass Volume**

2011 – 2015

Veins are the preferred conduit for treating patients with limb-threatening ischemia, but when unavailable, a prosthetic graft is used. Typically offered when endovascular options are not durable, vein bypasses are preferred for younger, lower-risk patients.
Cerebrovascular Disease

Cleveland Clinic’s commitment to innovation often includes treatments that are not commercially available. This includes the newest treatment devices and approaches for patients with cerebrovascular disease. Carotid stenting and endarterectomy are 2 such options. Cleveland Clinic is included in the Vascular Quality Initiatives (VQI) Registry, which is a nationwide prospective database to collect and analyze outcomes of surgical and minimally invasive carotid procedures. Participation in the registry allows collaboration within Cleveland Clinic and with other institutions to enhance cerebrovascular treatment outcomes and maintain quality reporting.

### Cerebrovascular Disease

**Procedural Complications**

<table>
<thead>
<tr>
<th>Year</th>
<th>N</th>
<th>MI (%)</th>
<th>Stroke (%)</th>
<th>In-Hospital Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carotid stenting</td>
<td>321</td>
<td>0.9</td>
<td>1.2</td>
<td>1.5</td>
</tr>
<tr>
<td>Carotid endarterectomy</td>
<td>1235</td>
<td>0.8</td>
<td>2.0</td>
<td>0.3</td>
</tr>
</tbody>
</table>

MI = myocardial infarction

### In-Hospital Mortality

**2015**

The in-hospital mortality rates for patients treated for cerebrovascular disease at Cleveland Clinic were below the expected rates (1.5%, carotid stenting; 0.3%, carotid endarterectomy vs expected rates of 3.3% and 2%, respectively).

Source: Data from the Vizient Clinical Data Base/Resource Manager™ used by permission of Vizient. All rights reserved.
Cleveland Clinic thoracic surgeons treat patients with a wide variety of diseases of the lung and esophagus. The staff is composed of specialists in lung and esophageal cancer, lung failure, airway disease, swallowing disorders, and other diseases. Diagnosis and treatment approaches include the most advanced techniques, such as minimally invasive surgery.

**General Thoracic Surgery**

**Volume and In-Hospital Mortality**

2011 – 2015

<table>
<thead>
<tr>
<th>Volume</th>
<th>In-hospital mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>8</td>
</tr>
<tr>
<td>1500</td>
<td>6</td>
</tr>
<tr>
<td>1000</td>
<td>4</td>
</tr>
<tr>
<td>500</td>
<td>2</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

N = 2000

In 2015, Cleveland Clinic surgeons performed 1551 thoracic procedures. The in-hospital mortality rate was 2.1%.

**Major Thoracic Surgery**

**Distribution by Type (N = 1551)**

2015

- **20% airway (N = 315)**
- **19% pulmonary (N = 299)**
- **19% mediastinum/mediastinum/chest wall/diaphragm (N = 300)**
- **18% esophagus (N = 277)**
- **18% pleura (N = 273)**
- **6% other\(^a\) (N = 87)**

\(^a\)“Other” category includes thymectomies, wedge resections, tumor surgeries, paraesophageal hiatal hernia repairs, and thyroidectomies.

Cleveland Clinic thoracic surgeons perform a variety of procedures to treat patients with even the most complex diseases.
Pulmonary Resection
2011 – 2015

Cleveland Clinic surgeons performed 280 pulmonary resections in 2015.

Combined Morbidity and 30-Day Mortality
2011 – 2015

A participant’s estimated standardized incidence ratio (SIR) is defined as the ratio of the participant’s estimated risk-adjusted rate (RAR) divided by the overall Society of Thoracic Surgeons’ (STS) observed outcome rate. An SIR value less than 1.0 implies that the participant’s risk-adjusted outcome rate is lower than the overall STS rate.

30-Day Mortality
2011 – 2015

*Single quarter reported for these years
The majority of pulmonary resections performed at Cleveland Clinic in 2015 were open and video-assisted lobectomies. Video-assisted thoracic surgery (VATS) and robotic techniques are used when appropriate to yield the best possible outcomes for each patient.

VATS = video-assisted thoracic surgery

Many of the procedures Cleveland Clinic thoracic surgeons perform can be done using both open and video-assisted thoracic surgery (VATS) techniques. The use of VATS or robotic techniques is associated with less postoperative pain, a shorter length of stay, and faster return to normal activities.
Pulmonary Resection for Lung Cancer  
Combined Morbidity and 30-Day Mortality (N = 598)  
January 2013 – December 2015  

Cleveland Clinic surgeons performed 598 pulmonary resections for lung cancer from January 2013 through December 2015. The risk-adjusted rates for morbidity and 30-day mortality were among the best in the country.

<table>
<thead>
<tr>
<th>Eligible Procedures</th>
<th>Unadjusted Rate</th>
<th>Risk-Adjusted Rate (95% Confidence Interval)</th>
<th>Standardized Incidence Ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>598</td>
<td>4.8%</td>
<td>4.6% (3.3, 6.1)</td>
<td>0.61 (0.44, 0.82)</td>
</tr>
</tbody>
</table>

Max = 2.43  
25th = 1.18  
Median = 1.00  
75th = 0.88  
Min = 0.40

STS mean participant score


Lobectomy for Stage I Lung Cancers

2011 – 2015

Cleveland Clinic surgeons use video-assisted/robotic techniques whenever appropriate for patients having lobectomies. These procedures are less invasive than open procedures and can improve outcomes.

VATS = video-assisted thoracic surgery
Lobectomy for Lung Cancer

Composite Quality Rating
January 2013 – December 2015

<table>
<thead>
<tr>
<th>Participant Score (95% Confidence Interval)</th>
<th>STS Mean Participant Score</th>
<th>Participant Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>98.2%</td>
<td>97.2%</td>
<td>3 stars</td>
</tr>
<tr>
<td>(97.54, 98.80)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Lobectomy

Length of Stay
2015

The median length of stay was lower among patients who had video-assisted lobectomies compared with those who had open procedures.

Days (Median)

<table>
<thead>
<tr>
<th>Open Lobectomy</th>
<th>Video-Assisted Lobectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>109</td>
<td>105</td>
</tr>
</tbody>
</table>

N = 214
Cleveland Clinic thoracic surgeons performed 212 esophageal procedures in 2015 and achieved a lower-than-expected in-hospital mortality rate (0.9% vs 2.6%).

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

Cleveland Clinic thoracic surgeons treat patients with a diverse range of conditions, including malignant and benign diseases. Cleveland Clinic is a quaternary referral center for complex esophageal disease.
Esophagectomy for Esophageal Cancer
Combined Morbidity and 30-Day Mortality (N = 156)
January 2013 – December 2015

<table>
<thead>
<tr>
<th>Eligible Procedures</th>
<th>Unadjusted Rate</th>
<th>Risk-Adjusted Rate (95% Confidence Interval)</th>
<th>Standardized Incidence Ratio (95% Confidence Interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>156</td>
<td>16.0%</td>
<td>16.7% (11.7, 22.3)</td>
<td>0.60 (0.42, 0.80)</td>
</tr>
</tbody>
</table>

Max 1.89
25th 1.21
Median 1.08
75th 0.90
Min 0.50

○ = STS mean participant score


Cleveland Clinic surgeons performed 156 esophagectomy procedures for patients with esophageal cancer from January 2013 through December 2015. The combined morbidity and 30-day mortality risk-adjusted rate was among the best in the country.
The Section of Preventive Cardiology and Rehabilitation at Cleveland Clinic provides patients with a comprehensive assessment to identify traditional and emerging nontraditional cardiovascular risk factors. The section collaborates with referring physicians to create individualized treatment plans. Patients typically have a limited number of visits and return to their primary care or referring physician for care.

### LDL Levels Among Statin-Tolerant Adults

Patients taking statins for both primary and secondary prevention experienced reductions in low-density lipoprotein (LDL) cholesterol levels. Patients were seen at baseline, defined as their first visit, and had at least 2 follow-up visits within the past 2 years. The time between visits varied from patient to patient.

#### Primary Prevention, Statin-Tolerant Adults

**2015 Volume (N = 1402)**

2007 – 2015

**LDL Median Value**

<table>
<thead>
<tr>
<th>Year</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>117 mg/dL</td>
</tr>
<tr>
<td>2015</td>
<td>81.5 mg/dL</td>
</tr>
</tbody>
</table>


#### Secondary Prevention, Statin-Tolerant Adults

**2015 Volume (N = 911)**

2007 – 2015

**LDL Median Value**

<table>
<thead>
<tr>
<th>Year</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>90.5 mg/dL</td>
</tr>
<tr>
<td>2015</td>
<td>64 mg/dL</td>
</tr>
</tbody>
</table>


LDL = low-density lipoprotein
**LDL Levels Among Statin-Intolerant Adults**

Patients referred to the prevention clinic who could not tolerate statins still experienced reductions in LDL levels. Patients included in these data had at least 2 follow-up visits within the past 2 years.

**Primary Prevention, Statin-Intolerant Adults**

2015 Volume (N = 420)

2007 – 2015

**Secondary Prevention, Statin-Intolerant Adults**

2015 Volume (N = 474)

2007 – 2015
Impact of Preventive Cardiology on Blood Pressure Among Patients With Diastolic Blood Pressure ≥ 90 mm Hg or Systolic Blood Pressure ≥ 140 mm Hg (N = 728)

Baseline is defined as first visit. Follow-up data are from most recent visit. Patients included in these data had at least 2 follow-up visits in the past year.

2015

Median Value (mm Hg)

<table>
<thead>
<tr>
<th>Systolic</th>
<th>Diastolic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>Follow-up</td>
</tr>
</tbody>
</table>

Pediatric Preventive Cardiology and Metabolic Clinic Lipid Levels (N = 157)

2015

Median Value (mg/dL)

<table>
<thead>
<tr>
<th>LDL</th>
<th>HDL</th>
<th>Triglycerides</th>
<th>Total Cholesterol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>2nd follow-up</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

HDL = high-density lipoprotein, LDL = low-density lipoprotein

The Pediatric Preventive Cardiology and Metabolic Clinic offers expert assessment, lifestyle management advice, medication, and monitoring for patients aged < 21 years with cardiometabolic dyslipidemia as well as genetic dyslipidemia. Data are for patients with genetic dyslipidemia who had at least 1 follow-up visit in 2015.
Impact of Preventive Cardiology on HbA1c Levels Among Patients With Diabetes and HbA1c ≥ 7 at Baseline
2015 Volume (N = 1383)

Baseline is defined as first visit. Follow-up data are from most recent visit. Patients included in these data had at least 2 follow-up visits in the past year.

2007 – 2015

![Graph showing HbA1c levels from 2007 to 2015](image-url)
**Cardiac Rehabilitation**

Outcomes measured in the Cardiac Rehabilitation Program include those related to functional capacity, quality of life, blood pressure, and weight.

**Improvement in Exercise Capacity by Exercise Stress Test (N = 247)\(^a\)**

**2015**

**METs**

The metabolic equivalent of task (MET) is the ratio of the working metabolic rate to the resting metabolic rate. Each 1-MET increase in functional capacity reduces the risk of mortality by 8% to 12%. The median predicted reduction in all-cause mortality for patients in the program based on improvement in functional capacity (METs) was approximately 15%.

\(^a\)Data represent all cardiac rehab patients with entry visit in 2015.

**Improvement in Systolic Blood Pressure (N = 247)\(^a\)**

**2015**

The mean blood pressure for patients entering rehab is already well controlled. After rehab, the mean blood pressure decreased by 6 mm Hg.

\(^a\)Data represent all cardiac rehab patients with entry visit in 2015.
Improvement in Weight (N = 247)\textsuperscript{a}

The median weight loss for patients who completed the Cardiac Rehabilitation Program was 9 pounds.

2015

\textbf{Weight (lb)}

\begin{tabular}{ll}
\hline
Entry & Exit \\
Before Cardiac Rehab & After Cardiac Rehab \\
\hline
195 & 185 \\
\hline
\end{tabular}

\textsuperscript{a}Data represent all cardiac rehab patients with entry visit in 2015.
Improvement in Quality of Life Assessment (N = 247)

Patients who completed the Cardiac Rehabilitation Program experienced improved physical and emotional quality of life. Quality of life is measured using the SF-36® Health Survey. This is a validated measure that tracks overall wellness of patients in cardiac rehabilitation.

2015

**SF-36 Score**

- Physical Summary Score
- Mental Summary Score

- Entry (start of cardiac rehab)
- Exit (completion of cardiac rehab)
American College of Surgeons National Surgical Quality Improvement Program

The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP®) objectively measures and reports risk-adjusted surgical outcomes based on a defined sampling and abstraction methodology. These outcomes data reflect Cleveland Clinic's vascular surgery ACS NSQIP performance benchmarked against 499 participating sites.

Vascular Surgery Outcomes
July 2014 – June 2015

<table>
<thead>
<tr>
<th>Outcome</th>
<th>N</th>
<th>Observed Rate (%)</th>
<th>Expected Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-day mortality</td>
<td>326</td>
<td>1.23a</td>
<td>3.09</td>
</tr>
<tr>
<td>30-day morbidity</td>
<td>326</td>
<td>16.56b</td>
<td>11.84</td>
</tr>
<tr>
<td>Cardiac event</td>
<td>326</td>
<td>4.29b</td>
<td>2.88</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>326</td>
<td>1.23a</td>
<td>2.03</td>
</tr>
<tr>
<td>Unplanned intubation</td>
<td>326</td>
<td>1.23a</td>
<td>2.23</td>
</tr>
<tr>
<td>Ventilator &gt; 48 hours</td>
<td>325</td>
<td>3.08b</td>
<td>1.82</td>
</tr>
<tr>
<td>Deep vein thrombosis/pulmonary embolism</td>
<td>326</td>
<td>0.00a</td>
<td>0.86</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>326</td>
<td>0.61</td>
<td>1.04</td>
</tr>
<tr>
<td>Surgical site infection</td>
<td>325</td>
<td>4.92</td>
<td>3.49</td>
</tr>
<tr>
<td>Sepsis</td>
<td>316</td>
<td>5.70b</td>
<td>1.42</td>
</tr>
<tr>
<td>Return to operating room</td>
<td>326</td>
<td>9.82</td>
<td>7.56</td>
</tr>
<tr>
<td>Readmission</td>
<td>326</td>
<td>12.27</td>
<td>11.62</td>
</tr>
</tbody>
</table>

*aIdentified as a statistical outlier (lower than expected) by the ACS NSQIP hierarchical model

*bIdentified as a statistical outlier (higher than expected) by the ACS NSQIP hierarchical model
In addition to overall vascular ACS NSQIP outcomes data, data specific to open and endovascular lower extremity vascular surgery are provided, benchmarked against 96 and 50 sites, respectively, and data specific to esophagectomy are benchmarked against 155 participating sites.

**Open Lower Extremity Vascular Surgery Outcomes**

*July 2014 – June 2015*

<table>
<thead>
<tr>
<th>Outcome</th>
<th>N</th>
<th>Observed Rate (%)</th>
<th>Expected Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-day morbidity</td>
<td>43</td>
<td>20.93</td>
<td>19.11</td>
</tr>
<tr>
<td>Cardiac event</td>
<td>43</td>
<td>6.98</td>
<td>5.67</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>43</td>
<td>0.00</td>
<td>0.87</td>
</tr>
<tr>
<td>Unplanned intubation</td>
<td>43</td>
<td>0.00</td>
<td>2.28</td>
</tr>
<tr>
<td>Ventilator &gt; 48 hours</td>
<td>43</td>
<td>0.00</td>
<td>0.55</td>
</tr>
<tr>
<td>Renal failure</td>
<td>43</td>
<td>0.00</td>
<td>0.94</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>43</td>
<td>0.00</td>
<td>1.55</td>
</tr>
<tr>
<td>Surgical site infection</td>
<td>43</td>
<td>11.63</td>
<td>7.73</td>
</tr>
<tr>
<td>Sepsis</td>
<td>41</td>
<td>4.88</td>
<td>1.60</td>
</tr>
<tr>
<td>Return to operating room</td>
<td>43</td>
<td>20.93</td>
<td>14.72</td>
</tr>
<tr>
<td>Readmission</td>
<td>43</td>
<td>20.93</td>
<td>16.59</td>
</tr>
<tr>
<td>Amputation</td>
<td>43</td>
<td>0.00</td>
<td>4.23</td>
</tr>
<tr>
<td>Bleeding</td>
<td>43</td>
<td>37.21</td>
<td>19.73</td>
</tr>
<tr>
<td>Myocardial infarction or stroke</td>
<td>43</td>
<td>6.98</td>
<td>2.94</td>
</tr>
<tr>
<td>Untreated loss of patency</td>
<td>43</td>
<td>6.98</td>
<td>2.83</td>
</tr>
<tr>
<td>Wound</td>
<td>43</td>
<td>27.91</td>
<td>12.80</td>
</tr>
</tbody>
</table>

*Identified as a statistical outlier (lower than expected) by the ACS NSQIP hierarchical model*

*Identified as a statistical outlier (higher than expected) by the ACS NSQIP hierarchical model*
## Endovascular Lower Extremity Vascular Surgery Outcomes
### July 2014 – June 2015

<table>
<thead>
<tr>
<th>Outcome</th>
<th>N</th>
<th>Observed Rate (%)</th>
<th>Expected Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-day mortality</td>
<td>69</td>
<td>1.45</td>
<td>1.05</td>
</tr>
<tr>
<td>30-day morbidity</td>
<td>69</td>
<td>8.70$^a$</td>
<td>2.98</td>
</tr>
<tr>
<td>Cardiac event</td>
<td>69</td>
<td>5.80</td>
<td>1.47</td>
</tr>
<tr>
<td>Sepsis</td>
<td>68</td>
<td>0.00</td>
<td>0.84</td>
</tr>
<tr>
<td>Return to operating room</td>
<td>69</td>
<td>5.80</td>
<td>6.20</td>
</tr>
<tr>
<td>Amputation</td>
<td>69</td>
<td>5.80</td>
<td>2.98</td>
</tr>
<tr>
<td>Bleeding</td>
<td>69</td>
<td>7.25</td>
<td>2.98</td>
</tr>
<tr>
<td>Major reintervention of the treated arterial segment</td>
<td>69</td>
<td>7.25</td>
<td>3.94</td>
</tr>
<tr>
<td>Major untreated loss of patency</td>
<td>69</td>
<td>5.80$^a$</td>
<td>1.15</td>
</tr>
</tbody>
</table>

$^a$Identified as a statistical outlier (higher than expected) by the ACS NSQIP hierarchical model
Esophagectomy Outcomes
July 2014 – June 2015

<table>
<thead>
<tr>
<th>Outcome</th>
<th>N</th>
<th>Observed Rate (%)</th>
<th>Expected Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-day morbidity</td>
<td>63</td>
<td>19.05a</td>
<td>37.31</td>
</tr>
<tr>
<td>Unplanned intubation</td>
<td>63</td>
<td>7.94</td>
<td>11.45</td>
</tr>
<tr>
<td>Ventilator &gt; 48 hours</td>
<td>63</td>
<td>9.52</td>
<td>12.52</td>
</tr>
<tr>
<td>Deep vein thrombosis/pulmonary embolism</td>
<td>63</td>
<td>9.52</td>
<td>5.87</td>
</tr>
<tr>
<td>Surgical site infection</td>
<td>63</td>
<td>6.35a</td>
<td>15.33</td>
</tr>
<tr>
<td>Sepsis</td>
<td>63</td>
<td>7.94</td>
<td>12.36</td>
</tr>
<tr>
<td>Return to operating room</td>
<td>63</td>
<td>11.11</td>
<td>13.40</td>
</tr>
</tbody>
</table>

*aIdentified as a statistical outlier (lower than expected) by the ACS NSQIP hierarchical model

Source: facs.org/quality-programs/acs-nsqip
Keeping patients at the center of all that we do is critical. Patients First is the guiding principle at Cleveland Clinic. Patients First is safe care, high-quality care, in the context of patient satisfaction, and high value. Ultimately, our caregivers have the power to impact every touch point of a patient’s journey, including their clinical, physical, and emotional experience.

We know that patient experience goes well beyond patient satisfaction surveys. Nonetheless, by sharing the survey results with our caregivers and the public, we constantly identify opportunities to improve how we deliver exceptional care.

**Outpatient Office Visit Survey — Heart & Vascular Institute**

**CG-CAHPS Assessment**

2014–2015

**Percent Best Response**

<table>
<thead>
<tr>
<th>Service</th>
<th>2014 (N = 11,520)</th>
<th>2015 (N = 20,290)</th>
<th>CG-CAHPS 2014 database average (all practices)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appointment Access (% Always)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doctor Communication (% Yes, Definitely)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doctor Rating (% 9 or 10 on 0–10 scale)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clerical Staff (% Yes, Definitely)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test Results Communication (% Yes)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*In 2013, Cleveland Clinic began administering the Clinician and Group Practice Consumer Assessment of Healthcare Providers and Systems surveys (CG-CAHPS), standardized instruments developed by the Agency for Healthcare Research and Quality (AHRQ) and supported by the Centers for Medicare & Medicaid Services for use in the physician office setting to measure patients’ perspectives of outpatient care.

*Based on results submitted to the AHRQ CG-CAHPS database from 3962 practices in 2014*

*Response options: Always, Usually, Sometimes, Never*

*Response options: Yes, definitely; Yes, somewhat; No*

*Response options: Yes, No*

Source: Press Ganey, a national hospital survey vendor
The Centers for Medicare & Medicaid Services requires United States hospitals that treat Medicare patients to participate in the national Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey, a standardized tool that measures patients’ perspectives of hospital care. Results collected for public reporting are available at medicare.gov/hospitalcompare.

**HCAHPS Domains of Care**

**2014 – 2015**

---

**HCAHPS Overall Assessment**

**2014 – 2015**

**Best Response (%)**

- **Hospital Rating** (% 9 or 10) 0 – 10 Scale
- **Recommend Hospital** (% Definitely Yes) 0 – 10 Scale

The bar chart shows the best response percentages for hospital rating and recommending hospital for 2014 and 2015, along with the national average for all patients.

---

**HCAHPS Domains of Care**

**2014 – 2015**

**Best Response (%)**

- **Discharge Information** % Yes
- **Care Transition** % Strongly Agree
- **Doctor Communication**
- **Nurse Communication**
- **Pain Management**
- **Room Clean** % Always
- **New Medications Communication**
- **Responsiveness to Needs**
- **Quiet at Night**

The bar chart displays the best response percentages for various domains of care, including discharge information, care transition, doctor communication, nurse communication, pain management, room cleanliness, new medications communication, responsiveness to needs, and quiet at night, for 2014 and 2015, along with the national average for all patients.

---

*aBased on national survey results of discharged patients, January 2014 – December 2014, from 4172 US hospitals. medicare.gov/hospitalcompare

*bResponse options: Definitely yes, Probably yes, Probably no, Definitely no

**Source:** Press Ganey, a national hospital survey vendor, 2015
Overview

Cleveland Clinic health system uses a systematic approach to performance improvement while simultaneously pursuing 3 goals: improving the patient experience of care (including quality and satisfaction), improving population health, and reducing the cost of healthcare. The following measures are examples of 2015 focus areas in pursuit of this 3-part aim. Throughout this section, “Cleveland Clinic” refers to the academic medical center or “main campus,” and those results are shown.

Real-time data are leveraged in each Cleveland Clinic location to drive performance improvement. Although not an exact match to publicly reported data, more timely internal data create transparency at all organizational levels and support improved care in all clinical locations.

Improve the Patient Experience of Care

Cleveland Clinic Overall Inpatient Mortality Ratio
2014 – 2015

Cleveland Clinic Central Line-Associated Bloodstream Infection Rate
2015

Cleveland Clinic has implemented several strategies to reduce central line-associated bloodstream infections (CLABSI), including a central-line bundle of insertion, maintenance, and removal best practices. Focused reviews of every CLABSI occurrence support reductions in CLABSI rates.
 Improved screening, risk adjustment, and prevention strategies have supported Cleveland Clinic’s continued improvement with respect to perioperative pulmonary embolism and deep vein thrombosis (AHRQ Patient Safety Indicator 12). Embolism/thrombosis prevention remains a safety priority for Cleveland Clinic.

A pressure ulcer is an injury to the skin that can be caused by pressure, moisture, or friction. These sometimes occur when patients have difficulty changing position on their own. Cleveland Clinic caregivers have been trained to provide appropriate skin care and regular repositioning help while taking advantage of special devices and mattresses to reduce pressure for high-risk patients. In addition, they actively look for hospital-acquired pressure ulcers and treat them quickly if they occur.
Keeping patients at the center of all that we do is critical. Patients First is the guiding principle at Cleveland Clinic. Patients First is safe care, high-quality care, in the context of patient satisfaction, and high value. Ultimately, our caregivers have the power to impact every touch point of a patient’s journey, including their clinical, physical, and emotional experience.

We know that patient experience goes well beyond patient satisfaction surveys. Nonetheless, by sharing the survey results with our caregivers and the public, we constantly identify opportunities to improve how we deliver exceptional care.

**Outpatient Office Visit Survey — Cleveland Clinic**

**CG-CAHPS Assessment**

2014 – 2015

<table>
<thead>
<tr>
<th>Best Response (%)</th>
<th>2014 (N = 167,503)</th>
<th>2015 (N = 227,599)</th>
<th>CG-CAHPS 2014 database average (all practices)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appointment Access</td>
<td>60%</td>
<td>60%</td>
<td>55%</td>
</tr>
<tr>
<td>Specialty Care Doctor Communication</td>
<td>80%</td>
<td>80%</td>
<td>75%</td>
</tr>
<tr>
<td>Primary Care</td>
<td>80%</td>
<td>80%</td>
<td>75%</td>
</tr>
<tr>
<td>Doctor Rating</td>
<td>80%</td>
<td>80%</td>
<td>75%</td>
</tr>
<tr>
<td>Clerical Staff</td>
<td>80%</td>
<td>80%</td>
<td>75%</td>
</tr>
<tr>
<td>Test Results Communication</td>
<td>60%</td>
<td>60%</td>
<td>55%</td>
</tr>
</tbody>
</table>

---

*a* In 2013, Cleveland Clinic began administering the Clinician and Group Practice Consumer Assessment of Healthcare Providers and Systems surveys (CG-CAHPS), standardized instruments developed by the Agency for Healthcare Research and Quality (AHRQ) and supported by the Centers for Medicare & Medicaid Services for use in the physician office setting to measure patients' perspectives of outpatient care.

*b* Based on results submitted to the AHRQ CG-CAHPS database from 3962 practices in 2014

*c* Response options: Always, Usually, Sometimes, Never

*d* Response options: Yes, definitely; Yes, somewhat; No

*e* Response options: Yes, No

Source: Press Ganey, a national hospital survey vendor
**Inpatient Survey — Cleveland Clinic**

**HCAHPS Overall Assessment**

2014 – 2015

**Best Response (%)**

- Hospital Rating (% 9 or 10) 0 – 10 Scale
- Recommend Hospital (% Definitely Yes)^c

The Centers for Medicare & Medicaid Services requires United States hospitals that treat Medicare patients to participate in the national Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey, a standardized tool that measures patients’ perspectives of hospital care. Results collected for public reporting are available at medicare.gov/hospitalcompare.

**HCAHPS Domains of Care^a**

2014 – 2015

**Best Response (%)**

- Discharge Information % Yes
- Care Transition % Strongly Agree
- Doctor Communication
- Nurse Communication
- Pain Management
- Room Clean % Always
- New Medications Communication
- Responsiveness to Needs
- Quiet at Night

^a Except for “Room Clean” and “Quiet at Night,” each bar represents a composite score based on responses to multiple survey questions.

^b At the time of publication, 2015 ratings have not been reported by the Centers for Medicare & Medicaid Services and ratings are not adjusted for patient mix.

^c Based on national survey results of discharged patients, January 2014 – December 2014, from 4172 US hospitals. medicare.gov/hospitalcompare

Source: Centers for Medicare & Medicaid Services, 2014; Press Ganey, a national hospital survey vendor, 2015
Focus on Value

Cleveland Clinic has developed and implemented new models of care that focus on “Patients First” and aim to deliver on the Institute of Medicine goal of Safe, Timely, Effective, Efficient, Equitable, Patient-centered care. Creating new models of Value-Based Care is a strategic priority for Cleveland Clinic. As care delivery shifts from fee-for-service to a population health and bundled payment delivery system, Cleveland Clinic is focused on concurrently improving patient safety, outcomes, and experience.

What does this new model of care look like?

• The Cleveland Clinic Integrated Care Model (CCICM) is a value-based model of care, designed to improve outcomes while reducing cost. It is designed to deliver value in both population health and specialty care.

• The patient remains at the heart of the CCICM.

• The blue band represents the care system, which is a seamless pathway that patients move along as they receive care in different settings. The care system represents integration of care across the continuum.

• Critical competencies are required to build this new care system. Cleveland Clinic is creating disease- and condition-specific care paths for a variety of procedures and chronic diseases. Another facet is implementing comprehensive care coordination for high-risk patients to prevent unnecessary hospitalizations and emergency department visits. Efforts include managing transitions in care, optimizing access and flow for patients through the CCICM, and developing novel tactics to engage patients and caregivers in this work.

• Measuring performance around quality, safety, utilization, cost, appropriateness of care, and patient and caregiver experience is an essential component of this work.
**Improve Population Health**

**Cleveland Clinic Accountable Care Organization Measure Performance 2015**

**National Percentile Ranking**

<table>
<thead>
<tr>
<th>90th</th>
<th>80th</th>
<th>70th</th>
<th>60th</th>
<th>40th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco Screening</td>
<td>Ischemic Vascular Disease</td>
<td>Diabetes</td>
<td>Hypertension</td>
<td>Pneumonia Vaccination</td>
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<tr>
<td>Heart Failure</td>
<td>Falls Screening</td>
<td>Coronary Artery Disease</td>
<td>Colorectal Cancer Screening</td>
<td>Breast Cancer Screening</td>
</tr>
<tr>
<td>BMI Screening</td>
<td>Influenza Vaccination</td>
<td>Depression Screening</td>
<td>Blood Pressure Screening</td>
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</tr>
</tbody>
</table>

As part of Cleveland Clinic’s commitment to population health and in support of its Accountable Care Organization (ACO), these primary care ACO measures have been prioritized for monitoring and improvement. Cleveland Clinic is improving performance in these measures by enhancing care coordination, optimizing technology and information systems, and engaging primary care physicians and specialists directly in the improvement work. These pursuits are part of Cleveland Clinic’s overall strategy to transform care in order to improve health and make care more affordable.

**Reduce the Cost of Care**

**Cleveland Clinic Health System Orthopaedic Surgery Cost per Case 2014 – 2015**

Development and implementation of care paths has improved outcomes and care coordination while reducing unnecessary variations in clinical practice. These efficiencies have reduced the total cost of care. The Total Joint Arthroplasty care paths that were implemented in 2013 have led to year-over-year reductions in the cost per case for these procedures. Additional cost reductions were experienced in 2015 as these care paths were refined and sustained.

**Change in Cost per Case**

![Graph showing change in cost per case](chart.png)

As part of Cleveland Clinic's commitment to population health and in support of its Accountable Care Organization (ACO), these primary care ACO measures have been prioritized for monitoring and improvement. Cleveland Clinic is improving performance in these measures by enhancing care coordination, optimizing technology and information systems, and engaging primary care physicians and specialists directly in the improvement work. These pursuits are part of Cleveland Clinic’s overall strategy to transform care in order to improve health and make care more affordable.
Innovations

Thoracic Endovascular Graft

In November 2015, Cleveland Clinic was the first to implant the Zenith Alpha™ Thoracic Endovascular Graft, developed by Cook Medical. The device is approved by the U.S. Food and Drug Administration for endovascular treatment of select patients with isolated lesions in the descending thoracic aorta. The graft is smaller than other devices and allows expanded treatment options for some patients who may not be eligible for treatment with larger devices.

COMMENCE Trial

Cleveland Clinic is leading the ProspeCtive, nOn-randoMized, MulticENter Clinical Evaluation of Edwards Pericardial Aortic and Mitral Bioprostheses With a New Tissue Treatment Platform (COMMENCE) trial, which involves the use of newer bovine valve preservation techniques to treat patients with aortic valve disease. Cleveland Clinic is a leader in aortic valve replacements. Newer bioprostheses like those being studied in the COMMENCE trial hold the promise of greater durability and long-term freedom from valve failure, especially in younger patients. Data for aortic valve replacements were presented at the American Association for Thoracic Surgery Annual Meeting 2016 (May 14–18, 2016; Baltimore, MD).
Tatara Vascular Guide Wires

Cleveland Clinic spin-off company, Tatara Vascular, LLC, has partnered with a commercial manufacturer in Japan to produce coronary guide wires invented by a Cleveland Clinic physician. The wires are used during catheterization procedures to place stents or during balloon angiography. The wires are more flexible and have a greater torque response compared with other guide wires. The tip has a flexible bend to help clear blocked arteries. The first in-human study was successfully completed in November 2015, and regulatory approval was received in January 2016.

NaviGate Stent

The Navi stent device is a compressible valved stent that is delivered via catheter to replace the mitral valve in patients with mitral valve disease who are ineligible for surgery. The device was developed by Cleveland Clinic researchers and produced by NaviGate Cardiac Structures, Inc. The first human implantation was successfully performed in October 2015. Up to approximately 280,000 people in the US can benefit from this technology each year.
Innovations

**Intraoperative Positioning System**

Cleveland Clinic spin-off company Centerline Biomedical Inc. is continuing development of the Intraoperative Positioning System (IOPS), developed by Cleveland Clinic researchers. The IOPS provides high-quality three dimensional visualization through the use of electromagnetic tracking to guide surgeons during minimally invasive endovascular aortic repair procedures. The technology results in reduced reliance on traditional fluoroscopy, which is based on x-rays and contrast dye, therefore providing a safer alternative.
TMAO and Clot-Related Diseases

Cleveland Clinic research has established a relationship between high levels of trimethylamine N-oxide (TMAO) and the risk of clot-related diseases such as heart attack and stroke. Previous research showed a link between TMAO and the risk of atherosclerosis. TMAO is made by gut microbes and may be elevated in omnivores and vegans alike. However, levels of TMAO are higher in people who eat diets rich in animal products, particularly red meat, egg yolk, and high-fat dairy products. These foods contain abundant amounts of choline, a portion of which turns into TMAO as it is broken down by bacteria in the gut. This more recent research established that TMAO encourages hyper-reactive platelet function, increasing the risk of blood clots. This risk exists even after adjusting for traditional cardiac risk factors, kidney function, inflammation, medication, and cardiovascular disease.
Sydell and Arnold Miller Family Heart & Vascular Institute

General Information and Appointments
800.659.7822

Thoracic and Cardiovascular Surgery Evaluation
Nurse practice managers will expedite patient record review with a Cleveland Clinic surgeon and address questions.
216.444.3500 or 877.8HEART1 (877.843.2781)

Cardiovascular Medicine Appointments/Referrals
216.444.6697 or 800.223.2273, ext. 46697

Vascular Medicine Appointments/Referrals
216.444.4420 or 800.223.2273, ext. 44420

Vascular Surgery Appointments/Referrals
216.444.4508 or 800.223.2273, ext. 44508

Sydell and Arnold Miller Family Heart & Vascular Institute Resource Center
Nurses are available Monday through Friday, 8:30 a.m. to 4:00 p.m., Eastern time, to answer patient questions and concerns about heart and blood vessel disease or to schedule a second opinion.
216.445.9288 or 866.289.6911
or email heartcenter@ccf.org

On the Web at clevelandclinic.org/heart

Staff Listing
For a complete listing of Cleveland Clinic’s Miller Family Heart & Vascular Institute staff, please visit clevelandclinic.org/staff.

Publications
Heart & Vascular Institute staff authored 662 publications in 2015.

For a complete list, go to clevelandclinic.org/outcomes.

Locations
For a complete listing of Cleveland Clinic’s Miller Family Heart & Vascular Institute locations, please visit clevelandclinic.org/heartlocations.
Additional Contact Information

General Patient Referral
24/7 hospital transfers or physician consults
800.553.5056

General Information
216.444.2200

Hospital Patient Information
216.444.2000

General Patient Appointments
216.444.2273 or 800.223.2273

Referring Physician Center and Hotline
855.REFER.123 (855.733.3712)
Or email refdr@ccf.org or visit clevelandclinic.org/refer123

Request for Medical Records
216.444.2640 or 800.223.2273, ext. 42640

Same-Day Appointments
216.444.CARE (2273)

Global Patient Services/International Center
Complimentary assistance for international patients and families
001.216.444.8184 or visit clevelandclinic.org/gps

Medical Concierge
Complimentary assistance for out-of-state patients and families
800.223.2273, ext. 55580, or email medicalconcierge@ccf.org

Cleveland Clinic Abu Dhabi
clevelandclinicabudhabi.ae

Cleveland Clinic Canada
888.507.6885

Cleveland Clinic Florida
866.293.7866

Cleveland Clinic Nevada
702.796.8669

For address corrections or changes, please call 800.890.2467
About Cleveland Clinic

Overview
Cleveland Clinic is an academic medical center offering patient care services supported by research and education in a nonprofit group practice setting. More than 3400 Cleveland Clinic staff physicians and scientists in 140 medical specialties and subspecialties care for more than 6.6 million patients across the system, performing more than 208,000 surgeries and conducting more than 640,000 emergency department visits. Patients come to Cleveland Clinic from all 50 states and more than 180 nations.

Cleveland Clinic is an integrated healthcare delivery system with local, national, and international reach. The main campus in midtown Cleveland, Ohio, has a 1437-bed hospital, outpatient clinic, specialty institutes, labs, classrooms, and research facilities in 42 buildings on 165 acres. Cleveland Clinic’s CMS case-mix index is the second highest in the nation. Cleveland Clinic encompasses more than 150 northern Ohio outpatient locations, including 18 full-service family health centers, 3 health and wellness centers, 9 regional hospitals, an affiliate hospital, and a rehabilitation hospital for children. Cleveland Clinic also includes Cleveland Clinic Florida; Cleveland Clinic Nevada, which includes the Lou Ruvo Center for Brain Health in Las Vegas and urology and nephrology services; Cleveland Clinic Canada; and Sheikh Khalifa Medical City (management contract). Cleveland Clinic Abu Dhabi is a full-service hospital and outpatient center in the United Arab Emirates (UAE), which began offering services in spring 2015. Cleveland Clinic is the second-largest employer in Ohio, with more than 49,000 employees. It generates $12.6 billion of economic activity a year.

Cleveland Clinic supports physician education, training, consulting, and patient services around the world through representatives and offices in Canada, the Dominican Republic, El Salvador, Guatemala, Honduras, Panama, Peru, Saudi Arabia, Turkey, and the United Arab Emirates.

The Cleveland Clinic Model
Cleveland Clinic was founded in 1921 by 4 physicians who had served in World War I and hoped to replicate the organizational efficiency of military medicine. The organization has grown through the years by adhering to the model set forth by the founders. All Cleveland Clinic staff physicians receive a straight salary with no bonuses or other financial incentives. The hospital and physicians share a financial interest in controlling costs, and profits are reinvested in research and education.

Cleveland Clinic established family health centers in surrounding communities beginning in the 1990s. Cleveland Clinic Florida was established in 1987. Marymount Hospital joined Cleveland Clinic in 1995, followed by regional hospitals including Euclid Hospital, Fairview Hospital, Hillcrest Hospital, Lutheran Hospital, Medina Hospital, South Pointe Hospital, and affiliate Ashtabula County Medical Center. In 2015, the Akron General Health System joined the Cleveland Clinic health system.

Internally, Cleveland Clinic services are organized into patient-centered integrated practice units called institutes, each institute combining medical and surgical care for a specific disease or body system. Cleveland Clinic was also one of the first academic medical centers to establish an Office of Patient Experience to work with institutes to ensure the best outcome and experience for every patient.

A Clinically Integrated Network
Cleveland Clinic is committed to providing value-based care, and it has grown the Cleveland Clinic Quality Alliance into the nation’s second-largest and northeast Ohio’s largest clinically integrated network. The network comprises more than 5900 physician members, both employees and independent physicians from the community. Led by its physician members, the Quality Alliance strives to improve quality and consistency of care; reduce costs and increase efficiency; and provide access to expertise, data, and experience.
Cleveland Clinic Lerner College of Medicine

Lerner College of Medicine is known for its small class sizes, unique curriculum, and full-tuition scholarships for all students. Each new class accepts 32 students who are preparing to be physician investigators. In 2016, Cleveland Clinic is building a 165,000-square-foot multidisciplinary Health Education Campus as the new home of the Case Western Reserve University (CWRU) School of Medicine and Cleveland Clinic’s Lerner College of Medicine, as well as the CWRU School of Dental Medicine, the Frances Payne Bolton School of Nursing, and physician assistant and allied health training programs.

Graduate Medical Education

In 2015, nearly 1900 residents and fellows trained at Cleveland Clinic and Cleveland Clinic Florida, which is part of a continuing upward trend.

U.S. News & World Report Ranking

Cleveland Clinic is consistently ranked among the top hospitals in America by U.S. News & World Report. It has ranked No. 1 in heart care and heart surgery since 1995. In 2015, 4 of its programs were ranked No. 2 in the nation: gastroenterology and GI surgery, nephrology, rheumatology, and urology.

Cleveland Clinic Physician Ratings

Cleveland Clinic believes in transparency and in the positive influence of the physician-patient relationship on healthcare outcomes. To continue to meet the highest standards of patient satisfaction, Cleveland Clinic physician ratings, based on nationally recognized Press Ganey patient satisfaction surveys, are published online at clevelandclinic.org/staff.
Resources

**Referring Physician Center and Hotline**

Call us 24/7 for access to medical services or to schedule patient appointments at 855.REFER.123 (855.733.3712), email refdr@ccf.org, or go to clevelandclinic.org/Refer123. The free Cleveland Clinic Physician Referral App, available for mobile devices, gives you 1-click access. Available at the App Store or Google Play.

**Remote Consults**

Anybody anywhere can get an online second opinion from a Cleveland Clinic specialist through our MyConsult service. For more information, go to clevelandclinic.org/myconsult, email myconsult@ccf.org, or call 800.223.2273, ext. 43223.

**Request Medical Records**

216.444.2640 or 800.223.2273, ext. 42640

**Track Your Patients’ Care Online**

Cleveland Clinic offers an array of secure online services that allow referring physicians to monitor their patients’ treatment while under Cleveland Clinic care, as well as access test results, medications, and treatment plans. my.clevelandclinic.org/online-services

DrConnect (online access to patients’ treatment progress while under referred care): 877.224.7367; drconnect@ccf.org or visit clevelandclinic.org/drconnect

**MyPractice Community** (affordable electronic medical records system for physicians in private practice): 216.448.4617

**eRadiology** (teleradiology consultation provided nationwide by board-certified radiologists with specialty training, within 24 hours or stat): 216.986.2915; starimaging@ccf.org

**Medical Records Online**

Patients can view portions of their medical record, receive diagnostic images and test results, make appointments, and renew prescriptions through MyChart, a secure online portal. All new Cleveland Clinic patients are automatically registered for MyChart. clevelandclinic.org/mychart

**Critical Care Transport Worldwide**

Cleveland Clinic’s fleet of ground and air transport vehicles is ready to transfer patients at any level of acuity anywhere on earth. Specially trained crews provide Cleveland Clinic care protocols from first contact. To arrange a transfer for STEMI (ST-elevation myocardial infarction), acute stroke, ICH (intracerebral hemorrhage), SAH (subarachnoid hemorrhage), or aortic syndrome, call 877.379.CODE (2633). For all other critical care transfers, call 216.444.8302 or 800.553.5056.

**CME Opportunities: Live and Online**

Cleveland Clinic’s Center for Continuing Education operates the largest CME program in the country. Live courses are offered in Cleveland and cities around the nation and the world. The center’s website (ccfcme.org) is an educational resource for healthcare providers and the public. It has a calendar of upcoming courses, online programs on topics in 30 areas, and the award-winning virtual textbook of medicine, The Disease Management Project.

**Clinical Trials**

Cleveland Clinic is running more than 2200 clinical trials at any given time for conditions including breast and liver cancer, coronary artery disease, heart failure, epilepsy, Parkinson disease, chronic obstructive pulmonary disease, asthma, high blood pressure, diabetes, depression, and eating disorders. Cancer Clinical Trials is a mobile app that provides information on the more than 200 active clinical trials available to cancer patients at Cleveland Clinic. clevelandclinic.org/cancertrialapp
**Healthcare Executive Education**

Cleveland Clinic has programs to teach people from outside the organization how it operates a major medical center. The Executive Visitors’ Program is an intensive, 3-day behind-the-scenes view of the Cleveland Clinic organization for the busy executive. The Samson Global Leadership Academy is a 2-week immersion in challenges of leadership, management, and innovation taught by Cleveland Clinic leaders, administrators, and clinicians. Curriculum includes coaching and a personalized 3-year leadership development plan. [clevelandclinic.org/executiveeducation](http://clevelandclinic.org/executiveeducation)

**Consult QD Physician Blog**

A blog from Cleveland Clinic for physicians and healthcare professionals. Discover the latest research insights, innovations, treatment trends, and more for all specialties. [consultqd.clevelandclinic.org](http://consultqd.clevelandclinic.org)

**Social Media**

Cleveland Clinic uses social media to help caregivers everywhere provide better patient care. Millions of people currently like, friend, or link to Cleveland Clinic social media — including leaders in medicine.

- Facebook for Medical Professionals [facebook.com/CMEclevelandclinic](http://facebook.com/CMEclevelandclinic)
- Follow us on Twitter [@cleclinicMD](https://twitter.com/cleclinicMD)
- Connect with us on LinkedIn [Clevelandclinic.org/MDlinkedin](http://Clevelandclinic.org/MDlinkedin)
Treating the Whole Patient

The Miller Family Heart & Vascular Institute works with the Office of Patient Experience, Spiritual Care Department, Healing Services, and the Arts & Medicine Institute to provide a wide array of complimentary services to patients and visitors to enhance their total well-being.

Services include manual therapies, Reiki, Healing Touch™, art and music therapy, and guided imagery.

The chapel and Muslim prayer room are available to everyone throughout their time at Cleveland Clinic.

Cleveland Clinic offers live musical performances throughout the year, and patients and visitors can enjoy guided tours of the extensive collection of modern and contemporary art.

The rooftop plaza provides a beautiful view of the city and offers daily activities such as chair massages, labyrinth walk meditation, reiki, and tea.

Patient and Family Health and Education Center

800.223.2273, ext. 43771
healthl@ccf.org

The Patient and Family Health and Education Center is staffed by health educators who provide health and education materials to those who visit and contact the center. Visitors have complimentary access to computers with internet access, audio and video education programs, health education classes, and health screenings. In 2015, there were 9585 visitors to the center and 27,471 requests for information via phone, mail, and email.

Heart & Vascular Institute Resource Nurses

866.289.6911
heartcenter@ccf.org

The Heart & Vascular Institute Resource Center is staffed by dedicated, experienced nurses who answer inquiries about cardiovascular- and thoracic-related topics. The nurses provide information about conditions, treatments, procedures, and Cleveland Clinic’s experience and services. In 2015, there were 26,511 total contacts, which included 3620 webmails; 6274 phone, mail, and in-person contacts; and 8296 online chats, emails, and online contacts.

The nurses also staff a 24/7 post-discharge line for patients who have questions or concerns after they leave Cleveland Clinic. In 2015, the nurses answered 8321 calls.

All patients in the Heart & Vascular Institute receive a follow-up phone call from a registered nurse to discuss any symptoms, complications, or concerns they have once they are home.

Staying in Touch

There are many ways to stay connected to the Heart & Vascular Institute.

For physicians:
• eCardiac Consult, a biweekly physician e-newsletter that provides perspectives on breaking research and practical patient care insights. To subscribe, visit clevelandclinic.org/HVIPhysicianNews.
• Consult QD, a blog for healthcare professionals offering news and perspectives on heart, vascular, and thoracic care from Cleveland Clinic experts. Visit clevelandclinic.org/ConsultQDHeart.

For patients:
• Webcasts and videocasts. Transcripts and a list of upcoming chats are posted at clevelandclinic.org/webchats.
• YouTube channel, youtube.com/clevelandclinic.
• Facebook specialty groups, including LVAD, Lung Transplant, and Women’s Cardiovascular Health.
• Monthly e-newsletter for the latest in heart and vascular disease prevention, treatments, and research, along with helpful tips, videos, and recipes. Subscribe at clevelandclinic.org/heartenews.
• Health Essentials, a blog exploring the most useful and fascinating aspects of health news, with perspectives from Cleveland Clinic experts. Visit health.clevelandclinic.org.
This project would not have been possible without the commitment and expertise of a team led by Umesh Khot, MD; Pam Goepfarth; Sandra Hays; and Candi McCane.

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