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 2014 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
what’s inside

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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 the Sydell and Arnold Miller Family Heart & Vascular Institute’s 2014 outcomes. This annual 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.

2014 was a dynamic year for the Heart & Vascular Institute. In addition to achieving the outcomes reported in the following pages, our caregivers distinguished themselves with a wide range of achievements, including:

- Being recognized as the nation’s No. 1 heart care program by *U.S. News & World Report* for the 20th consecutive year

- Ranking among the 3% of US hospitals to earn a 3-star (highest) score in all 3 categories of the Society of Thoracic Surgeons’ risk-adjusted quality ratings for adult cardiac surgery and thoracic/lung surgery

- Successfully launching an adult heart transplantation program at Cleveland Clinic Florida while performing our highest-ever annual volume of pediatric heart transplants (11) in Cleveland

- Reporting the world’s best results with transfemoral- and transapical-approach transcatheter aortic valve replacement from a 6-year series of Cleveland Clinic cases

- Establishing the Cleveland Clinic Cardiovascular Specialty Network with allied and affiliated centers across the country for contracting with large employers

We are most grateful to our many donors whose generosity and kindness have allowed 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, Heart & Vascular Institute
Professor of Surgery, Cleveland Clinic Lerner College of Medicine
The team of specialists in Cleveland Clinic’s Sydell and Arnold Miller Family Heart & Vascular Institute represents one of the world’s largest and most experienced groups practicing cardiovascular medicine and surgery. Patients from 82 different nations traveled to Cleveland Clinic in 2014 for these specialists’ expertise and patient-focused caregiving.

The Heart & Vascular Institute’s reputation stems from unparalleled volumes and exemplary outcomes. This leadership and dedication is reflected in Cleveland Clinic’s ranking as the nation’s No. 1 heart care program for each of the past 20 years in U.S. News & World Report’s “Best Hospitals” survey.

The institute brings together specialists in three broad departments — Cardiovascular Medicine, Thoracic and Cardiovascular Surgery, and Vascular Surgery — and organizes them into seven sections and 17 subspecialty centers and clinics to foster collaborative caregiving and innovative research. A total of 227 physicians and surgeons and 1,400 nurses work together to care for patients with a variety of conditions that often include complex medical histories.
## Institute Overview

### Heart & Vascular Institute Overview 2014

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Visits</td>
<td>483,596</td>
</tr>
<tr>
<td>Admissions</td>
<td>13,564</td>
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<tr>
<td>Beds</td>
<td>422</td>
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<tr>
<td>Coronary Intensive Care</td>
<td>24</td>
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<tr>
<td>Heart Failure Intensive Care</td>
<td>10</td>
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<tr>
<td>Cardiac, Vascular and Thoracic Surgery Intensive Care</td>
<td>76</td>
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<tr>
<td>Private Patient Rooms</td>
<td>283</td>
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<td>Same-Day Recovery</td>
<td>29</td>
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</table>

### Surgical Procedures

#### Cardiac Surgery

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac Surgeries</td>
<td>4275</td>
</tr>
<tr>
<td>Valve Surgeries</td>
<td>2798</td>
</tr>
<tr>
<td>Coronary Artery Bypass Grafting (Isolated and Combined)</td>
<td>1247</td>
</tr>
<tr>
<td>Thoracic Aortic Repairs</td>
<td>1136</td>
</tr>
<tr>
<td>Surgeries for Septal Myectomy</td>
<td>191</td>
</tr>
<tr>
<td>Congenital Heart Surgeries (Adult and Pediatric)</td>
<td>411</td>
</tr>
<tr>
<td>Robotically Assisted Cardiac Surgeries</td>
<td>105</td>
</tr>
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</table>

#### Transplant Surgery

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Transplants</td>
<td>65</td>
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<tr>
<td>Lung Transplants</td>
<td>106</td>
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</table>

#### Thoracic Surgery

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Count</th>
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<tbody>
<tr>
<td>General Thoracic Surgeries</td>
<td>1492</td>
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<tr>
<td>Esophageal Surgeries</td>
<td>192</td>
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#### Vascular Surgery

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vascular Surgeries (Open and Endovascular)</td>
<td>3120</td>
</tr>
<tr>
<td>Bypass Surgeries</td>
<td>229</td>
</tr>
<tr>
<td>Arteriovenous Access Surgeries</td>
<td>349</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-area 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>
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<tbody>
<tr>
<td>Open Ascending Aorta and Aortic Arch Repairs</td>
<td>762</td>
</tr>
<tr>
<td>Open Descending Aorta and Thoracoabdominal Repairs</td>
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</tr>
<tr>
<td>Open Abdominal Aortic Aneurysm Repairs</td>
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<tr>
<td>Endovascular Descending Aorta and Thoracoabdominal Repairs</td>
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<td>Endovascular Abdominal Aortic Aneurysm Repairs</td>
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</tr>
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</table>

### Cardiovascular Medicine Procedures

#### Interventional Cardiology

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Count</th>
</tr>
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<tbody>
<tr>
<td>Diagnostic Cardiac Catheterizations</td>
<td>7614</td>
</tr>
<tr>
<td>Interventional Cardiac Procedures</td>
<td>1482</td>
</tr>
<tr>
<td>Percutaneous Aortic Valvuloplasties</td>
<td>119</td>
</tr>
<tr>
<td>Percutaneous Mitral Valvuloplasties</td>
<td>12</td>
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<tr>
<td>Percutaneous Atrial Septal Defect and Patent Foramen Ovale Closures</td>
<td>45</td>
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#### Electrophysiology

<table>
<thead>
<tr>
<th>Procedure</th>
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<tbody>
<tr>
<td>Electrophysiology Ablations</td>
<td>1440</td>
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<tr>
<td>Ablations for Atrial Fibrillation</td>
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<tr>
<td>Device Implants</td>
<td>1381</td>
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<td>Leads Extracted</td>
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#### Diagnostic and Cardiac Imaging

<table>
<thead>
<tr>
<th>Procedure</th>
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<tbody>
<tr>
<td>Echocardiograms</td>
<td>76,110</td>
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<tr>
<td>Cardiac Computed Tomography (CT) Scans</td>
<td>7769</td>
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<tr>
<td>Cardiac Magnetic Resonance Imaging (MRI) Scans</td>
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<tr>
<td>Stress Tests</td>
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<tr>
<td>Nuclear Cardiology Tests</td>
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<tr>
<td>Tc-Myoview-Rest</td>
<td>4430</td>
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<tr>
<td>Tc-Myoview-Stress</td>
<td>4425</td>
</tr>
<tr>
<td>Rubidium Heart (PET)</td>
<td>904</td>
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<tr>
<td>FDG Heart (PET)</td>
<td>529</td>
</tr>
<tr>
<td>MUGA</td>
<td>116</td>
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<tr>
<td>N-13 Ammonia Heart</td>
<td>16</td>
</tr>
</tbody>
</table>

Patients from **82 countries** received cardiovascular care at Cleveland Clinic in 2014.

Patients from all **50 states** traveled to Cleveland Clinic in 2014 for cardiovascular care.
In 2014, Cleveland Clinic surgeons performed 13,812 thoracic and cardiac procedures. This total includes 5710 surgeries at the main campus and 8102 at Cleveland Clinic hospitals throughout greater Cleveland. For a complete list of Cleveland Clinic hospitals, visit clevelandclinic.org.

A total of 25% of cardiac surgeries at Cleveland Clinic in 2014 were reoperations. These procedures are associated with more complexity and greater risk than primary (first-time) operations.

Surgeons at Cleveland Clinic’s main campus and locations throughout greater Cleveland perform a large volume of high cardiovascular and thoracic procedures. For a complete list of Cleveland Clinic hospitals, visit clevelandclinic.org.
### Isolated Procedures, In-Hospital Mortality (N = 1392)

**2014**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Cleveland Clinic</th>
<th>STS expected</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>CABG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aortic Valve Replacement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitral Valve Replacement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitral Valve Repair</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

N = 595

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 2014

Abbreviation: CABG = coronary artery bypass graft

### Combined Cardiovascular Procedures, In-Hospital Mortality (N = 308)

**2014**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Cleveland Clinic</th>
<th>STS expected</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aortic Valve Replacement + CABG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitral Valve Replacement + CABG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mitral Valve Repair + CABG</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 209

Combined procedures are those performed in combination 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. Approximately 55% of heart operations performed at Cleveland Clinic could not be classified under STS categories because of the complexity or rarity of the surgery, and these procedures are not performed at other hospitals.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2014

Abbreviation: CABG = coronary artery bypass graft
Cleveland Clinic thoracic surgeons have expertise in all types of thoracic procedures. The majority of surgeries in 2014 were esophageal.

Cleveland Clinic surgeons performed 1435 general thoracic surgical procedures in 2014.

Major Thoracic Surgery by Type (N = 1435)

- 20% Esophagus (N = 291)
- 19% Mediastinum/diaphragm (N = 271)
- 18% Pleura (N = 258)
- 18% Other (N = 256)
- 7% Lung transplant (N = 104)
Cleveland Clinic surgeons performed 7877 vascular surgeries in 2014. A total of 3120 of these procedures were done at the main campus, and 4757 were done at Cleveland Clinic hospitals throughout greater Cleveland. For a complete list of Cleveland Clinic hospitals, visit clevelandclinic.org.

A total of 25% of cardiac surgeries performed at Cleveland Clinic's main campus in 2014 were reoperations. Reoperations are more complex than primary (first-time) surgeries.
The overall in-hospital mortality rate for vascular surgery at Cleveland Clinic was 1.74%, which was far below the expected rate of 5.36%. In addition, the in-hospital mortality rates associated with patient age were also lower than expected for all groups.

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.
Cardiac Catheterization Laboratory Procedures (N = 10,871)

Cleveland Clinic is a regional and national referral center for percutaneous coronary intervention (PCI). A total of 10,871 cardiac catheterization procedures were done in 2014 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.

Risk Factors Among Patients Undergoing PCI Procedures (N = 1482)

Complex medical backgrounds can affect outcomes for patients who have PCI procedures. Patients who had PCI procedures at Cleveland Clinic in 2014 had more complex backgrounds in all categories, except advanced age, compared with comparable hospitals.

Abbreviations: CABG = coronary artery bypass grafting, LV = left ventricular, MI = myocardial infarction

Source: ACC-NCDR database

Use of Adjunctive Medications Before and After PCI Procedures (N = 1482)

One of the ACC-NCDR key performance measures is the use of appropriate adjunctive medications before and after PCI. Cleveland Clinic’s administration rates exceed those of comparable hospitals.

Source: ACC-NCDR database
In 2014, 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. Patients at Cleveland Clinic had greater risk factors than patients at similar hospitals. Cleveland Clinic is continuously striving to achieve the best possible outcomes for patients.

Abbreviation: CABG = coronary artery bypass grafting
Source: ACC-NCDR database

The American College of Cardiology/American Heart Association (ACC/AHA) guideline for PCI inflation for patients who come to the emergency department with ST-elevated myocardial infarction (STEMI) was recently changed from 90 to 60 minutes. Cleveland Clinic continues to improve door-to-balloon time to reduce the risk of mortality and morbidity. In 2014, the median time at Cleveland Clinic was 62 minutes.

Source: ACC-NCDR database
PCI Procedures — Total Chronic Occlusion Technical Success With Hybrid Approach

2014

The risks and complexity of PCI procedures for patients with total chronic occlusion are greater than that of standard PCI. Cleveland Clinic physicians are skilled in these procedures and had greater success rates than did physicians at comparable hospitals in 2014.

Percent

Source: ACC-NCDR database

PCI Procedures — Radial Access (N = 492)

2014

In 2014, 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.

Percent

Source: ACC-NCDR database
Surgical Treatment for Ischemic Heart Disease (N = 1247)

CABG Volume

2014

Cleveland Clinic surgeons performed 1247 coronary artery bypass graft (CABG) procedures in 2014. A total of 652 were in combination with another procedure and 595 were isolated procedures, including reoperations.

CABG Volume, Primary and Reoperations

2014

The majority of CABG procedures at Cleveland Clinic in 2014 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 + Other, In-Hospital Mortality (N = 652)

2014

In-hospital mortality rates among patients who had CABG surgery plus another procedure at Cleveland Clinic in 2014 (primary and reoperations) were lower than expected.

Source: Data from the UHC Clinical Data Base/Resource Manager used by permission of UHC. All rights reserved.
Isolated CABG Procedures, In-Hospital Mortality (N = 595) 2014
Cleveland Clinic surgeons performed 595 isolated CABG procedures in 2014. The overall inpatient hospital mortality rate was 1.2% (N = 7), which was lower than the expected rate of 2.0%.

Percent

<table>
<thead>
<tr>
<th>Volume</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.2</td>
</tr>
<tr>
<td>2014</td>
<td>2.0</td>
</tr>
</tbody>
</table>

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

Isolated CABG Procedures, In-Hospital Mortality Primary and Reoperation (N = 595) 2014
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 at Cleveland Clinic were 3.5% (N = 2) for reoperations and 0.7% (N = 4) for primary operations. Both rates were lower than expected.

Percent

<table>
<thead>
<tr>
<th>Percent</th>
<th>Expected</th>
<th>Cleveland Clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.7</td>
<td>3.8</td>
<td>3.5</td>
</tr>
<tr>
<td>0.9</td>
<td>2</td>
<td>0.7</td>
</tr>
</tbody>
</table>

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

Approximately 12% - 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, 2013, through June 30, 2014, 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 2014
CABG Procedures, Long-Term Follow-Up Diabetic Patients

Cleveland Clinic is committed to long-term follow-up, as it is essential to understanding the overall impact of medical and surgical procedures. Among data collected for patients who have CABG surgery, it is demonstrated that patients with diabetes tend to have lower rates of long-term survival compared with nondiabetic patients.

Isolated CABG: Additional Outcomes

Deep Sternal Wound Infection

2014
The rate of deep sternal wound infection after CABG surgery was lower than expected at Cleveland Clinic in 2014. The rate at Cleveland Clinic was 0.2% compared with the expected rate of 0.3%.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2014
**Ventilator Time > 24 Hours**

2014
A total of 9.6% of patients who had isolated CABG surgery at Cleveland Clinic in 2014 spent more than 24 hours on a ventilator. This is lower than the expected rate of 10%.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2014

**In-Hospital Reoperation**

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

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2014

**Postoperative Stroke**

2014
The expected rate of postoperative stroke after isolated CABG surgery was 1.2% in 2014. The rate was lower (0.8%) at Cleveland Clinic.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2014
Postoperative Renal Failure

2014
Postoperative renal failure occurred in 0.5% of patients who had isolated CABG surgery at Cleveland Clinic in 2014. This was lower than the expected rate of 3.7%.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2014

Coppliance With Process Measures

2014
Cleveland Clinic was 100% compliant in 2014 with all Society of Thoracic Surgeons process measures. The process measures include the 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.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2014
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, Volume and Type (N = 4953)

2014
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. The total number of procedures includes some that are not detailed in the graph below.a

Pulmonary Vein Antrum Isolation Procedures

2014 Volume (N = 772)
2010 – 2014

Volume

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

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

aOther procedures include electrophysiology study, ICD testing, temporary pacer, loop recorders, and electrophysiology special procedures (endomyocardial biopsy, esophageal pacing, right heart catheterization, venography, and other).
**Success Rates of PVAI**

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 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 after this 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-second ablation.


**PVAI Complications**

**2014**

<table>
<thead>
<tr>
<th>Complications</th>
<th>N</th>
<th>Percent</th>
<th>Benchmark Rate&lt;sup&gt;a&lt;/sup&gt;, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>0</td>
<td>0</td>
<td>0.15</td>
</tr>
<tr>
<td>Tamponade</td>
<td>1</td>
<td>0.13</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&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2</td>
<td>0.26</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>2</td>
<td>0.26</td>
<td>0.93</td>
</tr>
<tr>
<td>Total artero-venous fistula</td>
<td>1</td>
<td>0.13</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>Atrial-esophageal fistula</td>
<td>0</td>
<td>0</td>
<td>0.04</td>
</tr>
<tr>
<td>Stroke</td>
<td>1</td>
<td>0.13</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>PV stenosis requiring intervention</td>
<td>3</td>
<td>0.39</td>
<td>0.29</td>
</tr>
</tbody>
</table>

**Total** 10 1.3 4.5

The overall risk associated with PVAI in 2014 was 1.3%.


<sup>b</sup>Cappato et al. measured sepsis, abscesses, and endocarditis requiring surgery. The Cleveland Clinic cases reported here (N = 2) did not require surgery.
PVAI Complications

It can take months or years for patients to develop pulmonary vein (PV) stenosis after a PVAI. In an effort to provide data that are as accurate and transparent as possible, the table to the right details the incidence of PV stenosis after PVAI from 2009 through 2014, and is consistent with data previously published by Cleveland Clinic. The data are updated annually as additional cases of PV stenosis are diagnosed and treated.

The standard of practice at Cleveland Clinic is to obtain a 3-month post-ablation 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 = 217)

2014

Cleveland Clinic is a national referral center for patients with ventricular arrhythmias. In 2014, a total of 217 ablations were done. Partial success means that among patients with multiple arrhythmias, at least one 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 = 117)

<table>
<thead>
<tr>
<th>Complication</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudoaneurysm</td>
<td>1</td>
<td>0.85</td>
</tr>
<tr>
<td>Heart block requiring intervention</td>
<td>1</td>
<td>0.85</td>
</tr>
<tr>
<td>Pericardial effusion/pericardiocentesis</td>
<td>1</td>
<td>0.85</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3</strong></td>
<td><strong>2.56</strong></td>
</tr>
</tbody>
</table>

Major Complications Among Patients With Ejection Fraction ≥ 50% (N = 100)

<table>
<thead>
<tr>
<th>Complication</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vascular dissection/laceration</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1</strong></td>
<td><strong>1</strong></td>
</tr>
</tbody>
</table>

Year of PVAI | PV Stenosis (N) | PVAI Volume (N) | %
---|-----------------|-----------------|---
2009 | 8               | 696             | 1.15 |
2010 | 8               | 693             | 1.15 |
2011 | 5               | 776             | 0.64 |
2012 | 7               | 819             | 0.85 |
2013 | 15              | 811             | 1.85 |
2014 | 3               | 772             | 0.39 |
6-year total | 46 | 4567 | 1.01 |


*Reference: Aliot EM, Stevenson WG, Almdrall-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 2014, Cleveland Clinic surgeons performed 548 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 0.7% (N = 4).

### Atrial Fibrillation Surgical Procedure Volume (N = 548)

- **66%** AF + Valve surgery
  (N = 359; In-hospital mortality, N = 1)
- **18%** AF + Valve surgery + CABG
  (N = 97; In-hospital mortality, N = 2)
- **8%** AF + CABG (N = 46; Hospital mortality, N = 1)
- **6%** AF + Other procedures (N = 34; In-hospital mortality, N = 0)
- **2%** Isolated AF procedures (N = 12; In-hospital mortality, N = 0)

### ICD Implants, In-Hospital Risk-Adjusted Complications

The in-hospital risk-adjusted complication rate for ICD implants at Cleveland Clinic is 0.87, which represents better outcomes than the all-hospitals 90th and 50th percentiles. Implants include initial implant and generator-change procedures. Exclusions are leads-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, TIA, hematoma, and mortality.

<table>
<thead>
<tr>
<th></th>
<th>Cleveland Clinic</th>
<th>All-Hospitals 50th Percentile</th>
<th>All-Hospitals 90th Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.87</td>
<td>1.46</td>
<td>1.10</td>
</tr>
</tbody>
</table>

Source: National Cardiovascular Data Registry® ICD Registry™

Abbreviations: AF = atrial fibrillation, CABG = coronary artery bypass grafting
### Initial Implant Complications: Pacemaker and ICD\(^a\)

2014

<table>
<thead>
<tr>
<th>Complications Measured for 30 Days</th>
<th>Pacemaker (N = 401) N (%)</th>
<th>ICD (N = 362) N (%)</th>
<th>Overall (N = 763) 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>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Hematoma plus a blood transfusion or evacuation</td>
<td>0 (0)</td>
<td>1 (0.28)</td>
<td>1 (0.13)</td>
</tr>
<tr>
<td>Cardiac tamponade or pericardiocentesis</td>
<td>0 (0)</td>
<td>1 (0.28)</td>
<td>1 (0.13)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Complications Measured for 90 Days</th>
<th>Pacemaker (N = 401) N (%)</th>
<th>ICD (N = 362) N (%)</th>
<th>Overall (N = 763) N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical complications requiring a system revision</td>
<td>8 (2.00)</td>
<td>5 (1.38)</td>
<td>13 (1.70)</td>
</tr>
<tr>
<td>Device-related infection</td>
<td>0 (0)</td>
<td>2 (0.55)</td>
<td>2 (0.26)</td>
</tr>
<tr>
<td>Additional device implantation</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8 (2.00)</strong></td>
<td><strong>9 (2.49)</strong></td>
<td><strong>17 (2.23)</strong>(^b)</td>
</tr>
</tbody>
</table>

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

\(^b\)Percentages do not match totals due to rounding.

### Secondary Implantation Complications: Pacemaker and ICD

2014

<table>
<thead>
<tr>
<th>Procedure Type</th>
<th>N</th>
<th>Major Complications, %</th>
<th>Benchmark(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICD with lead addition</td>
<td>72</td>
<td>0%</td>
<td>17.40%</td>
</tr>
<tr>
<td>ICD without lead addition</td>
<td>215</td>
<td>0.93%</td>
<td>5.80%</td>
</tr>
<tr>
<td>Pacemaker with lead addition</td>
<td>25</td>
<td>4%</td>
<td>5.88%</td>
</tr>
<tr>
<td>Pacemaker without lead addition</td>
<td>143</td>
<td>1.39%</td>
<td>2.27%</td>
</tr>
</tbody>
</table>

Device Lead Extractions (Leads in Place > 1 Year or Requiring Extraction Technology)  
Extraction Procedures (N = 1099)  
2010 – 2014  

Electrophysiologists at Cleveland Clinic perform the greatest number of lead extractions in the world. 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.

**Volume**  

<table>
<thead>
<tr>
<th>Extraction Procedures</th>
<th>Leads Extracted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Clinical success rate**  
97.6%  
**Major complications**  
1.8%  

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

---

Device Clinic Evaluations Volume (N = 38,020)  
2014  

<table>
<thead>
<tr>
<th>Pacemaker evaluations</th>
<th>17,470</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICD evaluations</td>
<td>20,550</td>
</tr>
</tbody>
</table>

Abbreviation: 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.

---

2010 – 2014  

**1.7**  
average number of leads extracted per procedure  

**88 months**  
average lead age at removal  

**74 months**  
median lead age at removal
Cleveland Clinic surgeons have implanted more than 12,500 bioprosthetic aortic valve replacements since the 1990s, with excellent short- and long-term outcomes.

In 2014, Cleveland Clinic surgeons performed 2798 valve surgeries. A total of 2174 were primary operations and 624 were reoperations.
The 2014 in-hospital mortality rates for all types of valve surgery were lower than expected at Cleveland Clinic.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2014

Abbreviations: AVR = aortic valve replacement, CABG = coronary artery bypass grafting, MV = mitral valve, MVR = mitral valve replacement, TAVR = transcatheter aortic valve replacement

In 2014, a total of 1762 aortic valve procedures were performed at Cleveland Clinic.
STS Rating for Coronary Artery Bypass Grafting + Aortic Valve Replacement

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 1, 2013, to June 30, 2014). 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>95.8% (94.9-96.6)</td>
<td>91.6%</td>
<td>★★★</td>
</tr>
</tbody>
</table>

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2014

Isolated Aortic Valve Replacement Complications (N = 372)

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 2014
STS Rating for Aortic Valve Replacement

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 (based on data from July 1, 2013, to June 30, 2014). 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>97.6% (97.0-98.1)</td>
<td>94.3%</td>
<td>★★★</td>
</tr>
</tbody>
</table>

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2014

Combined Aortic Valve Replacement & CABG Surgery, In-Hospital Mortality (N = 209) 2014

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 2014
As world leaders in mitral valve repairs, Cleveland Clinic surgeons have performed 423 robotically assisted mitral valve repairs in the past 5 years (2010–2014). The mortality rate was 0.2% (N = 1) compared with the expected rate of 1%–1.2%.

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

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 = 425)
2014

The 2014 in-hospital mortality rates for Cleveland Clinic patients who had isolated mitral valve surgery were lower than expected for both repair and replacement procedures.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database 2014
**Surgical Treatment of Active Infective Endocarditis**

Bacterial (infective) endocarditis is a life-threatening infection of the heart valves or the heart’s inner lining (endocardium). The condition causes growths on or holes in the valves or scarring of the valve tissue, most often resulting in a leaky heart valve. Cleveland Clinic surgeons treat patients with infective endocarditis, including those with advanced disease and prosthetic valve endocarditis.

2010 – 2014

2014 Volume (N =132)

In 2014, Cleveland Clinic surgeons performed 132 valve procedures to treat patients with infective endocarditis. A total of 62 were primary operations and 70 were reoperations.

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**Infective Endocarditis Primary Operation, In-Hospital Mortality 2010 – 2014**

**Infective Endocarditis Reoperation, In-Hospital Mortality 2010 – 2014**

Source: Data from the UHC Clinical Data Base/Resource Manager™ used by permission of UHC. 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. More than 700 patients have had this procedure at Cleveland Clinic with great success. There were 12 in-hospital deaths in the 648-patient cohort (2011–2014, average age 81.15 years), which represented a 1.9% mortality rate compared with the expected rate of 8.28%.

A total of 233 patients had transcatheter aortic valve replacement (TAVR) procedures at Cleveland Clinic in 2014. The in-hospital mortality rate was 1.7% compared with an expected rate of 7.9%.

Source: Data from the UHC Clinical Data Base/Resource Manager™ used by permission of UHC. All rights reserved.
A total of 648 patients had transcatheter aortic valve replacement procedures at Cleveland Clinic from January 2011 through December 2014. The in-hospital mortality rate was 1.9% compared with the expected rate of 8.28%.

The majority of transcatheter aortic valve replacement procedures performed at Cleveland Clinic from January 2011 through December 2014 were done using a transfemoral approach.
Valve Surgery – Primary Operation and Reoperation Volume (N = 2798)

Cleveland Clinic surgeons performed 2798 valve procedures in 2014. A total of 26% were reoperations on patients who had previous open heart surgery.

Valve Surgery – Primary Operation and Reoperation In-Hospital Mortality (N = 2798)

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

Source: Data from the UHC Clinical Data Base/Resource Manager™ used by permission of UHC. All rights reserved.
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 treatment options, including conventional, minimally invasive, and endovascular techniques. Surgeons use a multidisciplinary, comprehensive approach to treat patients with diseases involving all sections of the aorta, from the aortic root to the blood supply and pelvic vasculature. Over the past 20 years, thoracic aorta surgical volumes have increased by 6 times, and the program is now the largest in the world.

Aortic Surgery Volume and Type

2014 Volume (N = 1230)

2010 – 2014

Volume

2014 Totals
- Open ascending/arch repair (N = 762)
- Open descending/thoracoabdominal repair (N = 88)
- Endovascular descending/thoracoabdominal repair (N = 200)
- Open abdominal repair (N = 86)
- Endovascular abdominal repair (N = 94)

Aortic Surgery In-Hospital Mortality (N = 1230)

2014

Percent

Elective

Expected

Emergency

Open/Endovascular

Abbreviations: AAA = abdominal aortic aneurysm, TAAA = thoraco-abdominal aortic aneurysm

Source: Data from the UHC Clinical Data Base/Resource Manager™ used by permission of UHC. All rights reserved.
Aortic Disease (continued)

Aneurysm Repair in Patients with Bicuspid Aortic Valves
2011 – 2013

Cleveland Clinic surgeons performed 281 aortic aneurysm repairs for patients with bicuspid aortic valves in 2014.

Up to 2% of the population is born with a bicuspid aortic valve. It is estimated that 30%-50% of those patients are prone to develop an aneurysm of the proximal aorta including the root, ascending, and arch to varying degrees. In a recent analysis of more than 800 patients with bicuspid valves undergoing both elective and emergency surgery at Cleveland Clinic, mortality was 0.25% and the stroke rate was 0.7%.


In 2014, Cleveland Clinic surgeons performed 762 open procedures to repair the ascending aorta.

Elective Ascending Aorta and Aortic Arch Open Surgery Volume, Stroke Rate, and In-Hospital Mortality 2014 Volume (N = 550) 2010 – 2014

In 2014, Cleveland Clinic surgeons performed 550 elective open procedures to repair the ascending aorta and aortic arch. The in-hospital mortality rate was 1.6%, which was lower than the expected rate of 3%. The rate of stroke was 1.1% at Cleveland Clinic.

Source: Data from the UHC Clinical Data Base/Resource Manager™ used by permission of UHC. All rights reserved.
Emergency Ascending Aorta and Aortic Arch Open Surgery Volume and In-Hospital Mortality
2014 Volume (N = 212)
2010 – 2014

Cleveland Clinic surgeons performed 212 emergency open repairs of the ascending aorta and aortic arch in 2014, including acute aortic dissections and ruptures. These procedures are particularly urgent and challenging, yet in-hospital mortality was low at 7.5%, compared with the expected rate of 8.9%.

Ascending Stent Grafting

Over the past 8 years, aortic surgeons at Cleveland Clinic have pioneered and become world leaders in the use of stent grafts for ascending aorta repair to treat high-risk patients. Indications have included acute type A dissection, intramural hematoma, pseudoaneurysm, and chronic dissection. The use of these novel techniques has saved the lives of many patients.

An increasing number of patients with connective tissue disorders like 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-Sparing Operations**

Cleveland Clinic surgeons are among the most experienced in the world for valve-sparing aortic root aneurysm repairs (“modified David’s valve reimplantation procedure”). They have performed 507 of these procedures, including 71 in 2014 (0% 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.

**Modified David’s Valve Reimplantation Procedure**

2014 Volume (N = 71)

2010 – 2014


**Less Invasive Endovascular Treatment for Aortic Arch Disease**

Aneurysmal disease of the aortic arch remains a surgical challenge. Conventional surgery has limitations for high-risk patients and presents the need for alternative treatment. Cleveland Clinic surgeons have been intimately involved in the development of endograft techniques to repair these types of aneurysms. This includes participation in an international assessment of this procedure to demonstrate the safety and improved outcomes with the use of these techniques.

### Aortic Arch Aneurysm Repairs

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

**2014 Volume (N = 149)**

**2010 – 2014**

At Cleveland Clinic in 2014, a total of 149 patients had elective surgery to repair the aortic arch. The in-hospital mortality rate was 3.4% compared with the expected rate of 4%, and the stroke rate was 2.7%.

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

**2014 Volume (N = 71)**

**2010 – 2014**

A total of 71 Cleveland Clinic patients had emergency open procedures to repair the aortic arch in 2014. The stroke rate was reduced to 1.4%.

### Brain Protection Strategies

Cleveland Clinic surgeons, anesthesiologists, and perfusionists perform more than 400 cases per year using hypothermic circulatory arrest and have mastered the techniques of brain protection. Cleveland Clinic surgeons were the first to demonstrate the benefits of axillary artery cannulation to reduce stroke during complex aortic surgery. In a recently published randomized controlled trial comparing adjunctive brain protection strategies, the rate of stroke was 0.8% and important nuances about cognitive impairment were elucidated.

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## 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 both open and endovascular repair techniques with excellent outcomes, and tailor the choice to each patient’s needs.

### DTA Repair Volume and Type (N = 845)

**2010 – 2014**

- **8%** Open emergency (N = 67)
- **16%** Open elective (N = 139)
- **25%** Endovascular emergency (N = 213)
- **51%** Endovascular elective (N = 426)

The majority of the 845 DTA repairs performed at Cleveland Clinic from 2010 through 2014 were done using an endovascular approach.

### DTA Repair In-Hospital Mortality (N = 845)

**2010 – 2014**

<table>
<thead>
<tr>
<th>Percent</th>
<th>Open</th>
<th>Endovascular</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency</td>
<td>2010-2013</td>
<td>2014</td>
</tr>
<tr>
<td>Elective</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Extensive experience with both open and endovascular treatment options for patients with descending thoracic aortic disease allows us to offer lifesaving therapy to patients. This includes even those who require high-risk emergency treatment. For elective repairs, the in-hospital mortality rate was low at 3.7% for open repairs and 1% for endovascular repairs in 2014.
**Thoracic Endovascular Aortic Repair (TEVAR) for Acute Descending Dissections**

In a recent analysis of 520 patients treated at Cleveland Clinic since 2005 for acute aortic syndrome, 238 (48%) required aortic intervention. A detailed analysis of CT scans demonstrated that several important findings predicted both early and late death or need for intervention.


---

**Permanent Spinal Cord Ischemia Rates Reduced to 0% Following Staged Endovascular Repair**

Neurologic dysfunction, in particular spinal cord ischemia (SCI), is a devastating complication after thoracoabdominal aortic aneurysm (TAAA) surgery. Cleveland Clinic surgeons have demonstrated that performing endovascular TAAA repairs in a staged fashion reduces the incidence and severity of SCI. The rate of permanent SCI among patients who had staged repair was 0%, compared with 17% among those who had a single procedure.


---

**Permanent Paraplegia and Paraparesis Reduced by Papaverine**

In a study conducted at Cleveland Clinic, the use of intrathecal papaverine during descending thoracic aneurysm and thoracoabdominal aortic aneurysm repair halved the risk of paraplegia and reduced the risk of paraparesis to one quarter the rate.

TAAA Surgeries
The most challenging aortic procedures involve patients with thoraco-abdominal 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
2010 – 2014

Cleveland Clinic Approach to Treating Patients With Thoracoabdominal Aortic Aneurysms
Cleveland Clinic uses a team approach to treat patients with thoracoabdominal aortic aneurysms (TAAAs). This strategy enables individualized care tailored to each patient’s needs, anatomy, and medical conditions. This multidisciplinary approach includes early and long-term considerations to ensure patient safety.
Experience With Fenestrated/Branched Endografting for Complex Aortic Aneurysm Disease Results in Low Mortality Rates

Fenestrated and branched endograft technology has allowed for less-invasive treatment of patients with aortic aneurysms that involve the visceral vessels of the aorta. Surgeons at Cleveland Clinic have employed this technology since 2001. The surgeons have over 12 years of experience involving more than 600 juxtarenal AAAs and Type IV TAAAs, and have achieved an aortic-related mortality rate of only 2%. The perioperative mortality rate for more than 350 Type II and III TAAA procedures is only 4.8%.


Cleveland Clinic surgeons have performed 700 procedures to treat patients with TAAAs from 2010 through 2014.

The complex nature of TAAA procedures is associated with a greater risk of mortality. Cleveland Clinic continuously strives to maintain the lowest mortality rates possible. In 2014, the in-hospital mortality rate for endovascular branch vessel procedures was 1.47%. The rate for open elective repairs was 0%. Emergency repairs require open surgery. The mortality rate for these procedures was 6.25%.
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 = 857)

Cleveland Clinic surgeons performed 857 AAA repairs from 2010 through 2014. The majority of these were endovascular procedures, which are associated with less risk. However, outcomes at Cleveland Clinic are excellent for both types of surgery.

Open AAA Repair Volume and Type (N = 387)

Cleveland Clinic surgeons performed 387 open AAA repairs from 2010 through 2014. The majority of these procedures were elective.
Cleveland Clinic surgeons performed 470 endovascular AAA repair procedures from 2010 through 2014. A total of 35 fenestrated grafts were used to repair juxtarenal aneurysms. In 2014, 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 2014.

### Open AAA Repair In-Hospital Mortality (N = 387)

<table>
<thead>
<tr>
<th>Percent</th>
<th>2010 – 2013</th>
<th>2014</th>
<th>Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Emergency</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In 2014, Cleveland Clinic surgeons achieved a 0% in-hospital mortality rate for elective open AAA repairs.

### Endovascular AAA Repair Volume and Type (N = 470)

<table>
<thead>
<tr>
<th>Percent</th>
<th>Elective (N = 419)</th>
<th>Emergency (N = 51)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>89%</td>
<td>11%</td>
</tr>
</tbody>
</table>

Cleveland Clinic surgeons performed 470 endovascular AAA repair procedures from 2010 through 2014. A total of 35 fenestrated grafts were used to repair juxtarenal aneurysms. 0% in-hospital mortality rate for patients with juxtarenal aneurysms treated with fenestrated graft procedures (N = 35) from 2010 through 2014.

### Endovascular AAA Repair In-Hospital Mortality (N = 470)

<table>
<thead>
<tr>
<th>Percent</th>
<th>2010 – 2013</th>
<th>2014</th>
<th>Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elective</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Emergency</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cleveland Clinic surgeons achieved 0% in-hospital mortality rates for both elective and emergency endovascular AAA repair in 2014.
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

**2014**

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.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total HOCM outpatient visits</th>
<th>New patients with HOCM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>203</td>
<td>178</td>
</tr>
<tr>
<td>2011</td>
<td>183</td>
<td>158</td>
</tr>
<tr>
<td>2012</td>
<td>178</td>
<td>158</td>
</tr>
<tr>
<td>2013</td>
<td>205</td>
<td>183</td>
</tr>
<tr>
<td>2014</td>
<td>190</td>
<td>183</td>
</tr>
</tbody>
</table>

### HOCM Surgeries (N = 190)

**2010 – 2014**

Cleveland Clinic continues to be one of the nation’s leaders for volume and outcomes among patients with HOCM. In 2014, a total of 190 had surgical treatment. The in-hospital mortality rate was 0%.
The majority of patients with HOCM who had surgical repair at Cleveland Clinic in 2014 had a septal myectomy in addition to a valve surgery.

- **37%** Isolated septal myectomy (N = 71)
- **30%** Septal myectomy + valve (N = 57)
- **11%** Septal myectomy + valve + other (N = 21)
- **8%** Septal myectomy + other (N = 15)
- **7%** Septal myectomy + coronary artery bypass + valve (N = 13)
- **4%** Septal myectomy + coronary artery bypass (N = 8)
- **2%** Septal myectomy + coronary artery bypass + valve + other (N = 3)
- **2%** Septal myectomy + coronary artery bypass + other (N = 3)

*Procedural percentages are rounded

**Septal Myectomy In-Hospital Mortality**

**2013 – 2014**

The expected in-hospital mortality rate for patients who had a septal myectomy in 2014 was 1.8%. The rate at Cleveland Clinic was lower (0%).

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

2648 septal myectomies have been performed at Cleveland Clinic since 1967.
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 United States 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 Center for Pediatric and Adult Congenital Heart Disease’s services 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 = 46) 2014

A total of 46 patients had percutaneous closure procedures at Cleveland Clinic in 2014. The success rate was 100%, and the mortality rate was 0% for both ASD and PFO closures.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percutaneous ASD closures</td>
<td>18</td>
</tr>
<tr>
<td>Percutaneous PFO closures</td>
<td>28</td>
</tr>
</tbody>
</table>

Abbreviations: ASD = atrial septal defect, PFO = patent foramen ovale

At least 10% of all congenital heart conditions are diagnosed in adulthood.
Adult Congenital Heart Surgery Volume and Type (N = 261)

2014
The largest subset of the 261 adult congenital surgeries performed at Cleveland Clinic in 2014 were aorta surgeries.

Volume

Abbreviations: AAOCA = anomalous aortic origin of a coronary artery, ASD = atrial septal defect, CABG = coronary artery bypass grafting, PAPVR = partial anomalous pulmonary venous return, VAD = ventricular-assist device

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Adult Congenital Heart Surgery In-Hospital Mortality

2014
The in-hospital mortality rate for adult congenital surgery at Cleveland Clinic in 2014 was 1.3%, compared with the expected rate of 2.2%. Many of these patients have very complex medical backgrounds and conditions, and have had multiple surgeries.

Source: Data from the UHC Clinical Data Base/Resource Manager™ used by permission of UHC. All rights reserved.
Pediatric Congenital Heart Surgery Volume and Type (N = 150)

2014

Cleveland Clinic surgeons performed 150 pediatric congenital surgeries in 2014. Procedures in the “other” category included truncus arteriosus repair and various procedures of varying complexity.

Abbreviations: ASD = atrial septal defect, ASO = arterial switch operation, AV = atroventricular, ECMO = extracorporeal membrane oxygenation, PA = pulmonary arterioplasty, PDA = patent ductus arteriosus ligation, RV = right ventricle, TOF = tetralogy of Fallot, VAD = ventricular assist device, VSD = ventricular septal defect

Pediatric Congenital Heart Surgery In-Hospital Mortality

2012 – 2014

Cleveland Clinic is committed to achieving the best possible outcomes for patients. The in-hospital mortality rate for pediatric congenital surgery patients has been reduced by more than 3 percentage points since 2012.
Pericardial Disease

Pericardial Disease: Patient Volume

2014 Volume (N = 1754)

2010 – 2014

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 includes cardiologists, surgeons, and imaging specialists, which enhances collaboration in the management of these diseases. There were 1754 visits to the center in 2014.

![Pericardial Disease: Patient Volume Chart]

Pericardial Disease Syndromes – Outpatient Clinic Volume, New Consult Patients (N = 573)

2014

The majority of patients seen in Cleveland Clinic's pericardial disease center in 2014 were diagnosed with pericardial effusion with pericarditis. This category includes pericardial cysts, neoplasms, pericardial fistula, pericardial thickening, pericardial calcification, and patients with a history of pericardial disease.

![Pericardial Disease Syndromes Chart]
Pericardial Disease Etiology (N = 573)

2014
Pericarditis can be caused by a number of conditions; however, it is common for the cause to be unknown. In 2014, a total of 368 new consult patients seen at Cleveland Clinic had pericarditis of unknown origin.

- **74%** Idiopathic (N = 368)
- **8%** Autoimmune (N = 51)
- **7%** Postpericardiotomy syndrome (N = 89)
- **4%** Infectious (N = 13)
- **4%** Other (N = 47)
- **3%** Radiation (N = 5)

Pericardial Procedures (N = 195)

2014
The majority of pericardial procedures performed at Cleveland Clinic in 2014 were pericardiocentesis procedures. This percutaneous treatment is used to drain large pericardial effusions. Echocardiography is used during the procedure to help improve outcomes.

- **48%** Pericardiocentesis (N = 94)
- **27%** Pericardiectomy (N = 53)
- **25%** Window (N = 48)
Cleveland Clinic’s cardiac transplant program is one of the largest in the United States and is the leading center in Ohio.

**Heart Transplant Volume**

<table>
<thead>
<tr>
<th>2014 Volume (N = 65)</th>
<th>2010 – 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
</tr>
</tbody>
</table>

Cleveland Clinic surgeons performed 65 heart transplant procedures in 2014.

**Heart Transplant Patient 1-Year and 3-Year Survival**

<table>
<thead>
<tr>
<th>Survival (%)</th>
<th>1 Year N = 102</th>
<th>3 Years N = 116</th>
</tr>
</thead>
<tbody>
<tr>
<td>91.2%</td>
<td>1/11 to 12/31/13</td>
<td>1/01/09 to 06/30/11</td>
</tr>
<tr>
<td>91%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>91.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>81.9%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cleveland Clinic is committed to achieving the best possible outcomes for patients. One-year heart transplant survival rates were about as expected, while 3-year rates were higher than expected, partly as a result of using older donor hearts and performing heart transplants in older patients.

*Expected based on risk adjustment
Source: Scientific Registry of Transplant Recipients, December 2014. srtr.org
Ventricular-Assist Device Implantation Volume

2014 Volume (N = 53)

2010 – 2014

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 2014, VADs were used as bridge-to-transplant in 27 patients, and 26 patients received VADs as destination therapy.

Ventricular-Assist Device Implantation, In-Hospital Mortality

2014

The in-hospital mortality rate for patients who had ventricular-assist device implantation at Cleveland Clinic in 2014 was 11%, which is much lower than the expected rate of 17%.
Heart Failure

Heart Failure All-Cause 30-Day Mortality and All-Cause 30-Day Readmissions

July 2011 – June 2014

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. Although Cleveland Clinic’s heart failure patient 30-day 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 heart failure 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 post-acute facility. Specific initiatives have been implemented to ensure effective communication, education, and follow-up.

N = eligible discharges

*Source: medicare.gov/hospitalcompare
Cleveland Clinic has one of the highest-volume lung and heart-lung transplant programs in the United States. It is the leading center in Ohio.

**Lung Transplant Procedures, Volume and Type**

2014 Volume (N = 106)

2010 – 2014

Primary Disease of Lung Transplant Recipients

2014 Volume (N = 104)\(^a\)

July 2013 – June 2014

Idiopathic pulmonary fibrosis was the most common primary disease among patients who had lung transplant procedures at Cleveland Clinic in 2014.

\(^a\)These data include only patients who had lung transplants. It excludes the 2 heart-lung transplant procedures performed in 2014.

Source: Scientific Registry of Transplant Recipients, December 2014. srtr.org
Patients waiting for lung transplantation can become poorer candidates while waiting because of the use of extracorporeal membrane oxygenation (ECMO). This is a method used in very ill patients to add oxygen to and remove carbon dioxide from the blood.

Traditionally, ECMO requires the patient to stay in bed. This causes the muscles to weaken, and patients become less likely to be eligible for transplantation.

Cleveland Clinic is aggressively developing ambulatory ECMO technology to improve transplant candidacy, save lives, and improve outcomes.

The median wait time for lung transplantation at Cleveland Clinic is shorter than in the region as well as throughout the United States.

The mortality rate among Cleveland Clinic patients on the wait-list for lung transplant is not statistically different from the national rate.

---

**Lung Transplant 1-Month and 1-Year Survival**

Patients who undergo lung transplantation at Cleveland Clinic have survival rates as expected and not statistically different from national rates.

*Expected survival rate based on risk adjustment.

Source: Scientific Registry of Transplant Recipients, December 2014. [srtr.org](http://srtr.org)

**Waiting Time for Lung Transplant**

*July 2008 through December 2013*

The median wait time for lung transplantation at Cleveland Clinic is shorter than in the region as well as throughout the United States.

Source: Scientific Registry of Transplant Recipients, December 2014. [srtr.org](http://srtr.org)

**Wait-List Mortality**

*July 2013 through June 2014*

The mortality rate among Cleveland Clinic patients on the wait-list for lung transplant is not statistically different from the national rate.

*Expected survival rate based on risk adjustment.

Source: Scientific Registry of Transplant Recipients, December 2014. [srtr.org](http://srtr.org)
Peripheral arterial 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 of 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 = 615)**
Cleveland Clinic’s team of vascular surgeons and interventional cardiologists performs a high volume of complex percutaneous peripheral vascular interventional procedures.

**Lower Extremity Interventional Procedure Volume and In-Hospital Mortality 2014**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angioplasty</td>
<td>253</td>
</tr>
<tr>
<td>Atherectomy</td>
<td>15</td>
</tr>
<tr>
<td>Stenting</td>
<td>260</td>
</tr>
<tr>
<td>Thrombolysis</td>
<td>87</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>615</strong></td>
</tr>
</tbody>
</table>

| In-hospital mortality | 0.8% |
| Expected mortality    | 2.10% |

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**Lower Extremity Surgery Volume and 30-Day Mortality (N = 410)**
A total of 410 lower extremity surgical procedures were performed at Cleveland Clinic in 2014. Of these, 229 were bypasses, 70 were thrombectomies/embolectomies, and 111 were endarterectomies. Mortality outcomes were as expected in this group of severely ill patients.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>2014 Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bypass</td>
<td>229</td>
</tr>
<tr>
<td>Thrombectomy/embolectomy</td>
<td>70</td>
</tr>
<tr>
<td>Endarterectomy</td>
<td>111</td>
</tr>
</tbody>
</table>

2014 30-Day Mortality (%)

| Mortality                      | 3% |
| Expected mortality             | 5% |

Source: Data from the UHC Clinical Data Base/Resource Manager™ used by permission of UHC. All rights reserved.
Executive Health Screening Program
2014 Volume (N = 736)
2011 – 2014

Volume

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>100</td>
</tr>
<tr>
<td>2012</td>
<td>800</td>
</tr>
<tr>
<td>2013</td>
<td>1000</td>
</tr>
<tr>
<td>2014</td>
<td>1000</td>
</tr>
</tbody>
</table>

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 arterial disease, which can indicate an increased risk of heart attack and stroke and can impair function and quality of life; and abdominal aortic aneurysm (AAA). Ruptured AAAs are almost entirely preventable if an AAA is identified and monitored; however, about 15,000 people die each year in the United States due to ruptured AAAs.

Noninvasive Vascular Lab Ultrasound Study
Volume and Distribution (N = 50,093)
2014

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 2014, the staff performed 50,093 vascular lab 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, Patient Volume**

**2014 Volume (N = 504)**

2010 – 2014

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>300</td>
</tr>
<tr>
<td>2011</td>
<td>400</td>
</tr>
<tr>
<td>2012</td>
<td>500</td>
</tr>
<tr>
<td>2013</td>
<td>600</td>
</tr>
<tr>
<td>2014</td>
<td>700</td>
</tr>
</tbody>
</table>

A total of 1700 patients received treatment in the Lower Extremity Wound Clinic at Cleveland Clinic in 2014.

**Lower Extremity Wound Clinic Volume**

**2014 Volume (N = 1700)**

2010 – 2014

<table>
<thead>
<tr>
<th>Year</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1000</td>
</tr>
<tr>
<td>2011</td>
<td>1500</td>
</tr>
<tr>
<td>2012</td>
<td>2000</td>
</tr>
<tr>
<td>2013</td>
<td>2500</td>
</tr>
<tr>
<td>2014</td>
<td>3000</td>
</tr>
</tbody>
</table>

**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.
Iliac Stenting Volume and In-Hospital Mortality

Cleveland Clinic physicians performed 135 iliac stent procedures in 2014. 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 Volume
2014 Volume (N = 135)
2010 – 2014

In-Hospital Mortality Rate (N = 135)
2014

Femoral Endarterectomy With Stent, In-Hospital Mortality (N = 104)
2014

In 2014, Cleveland Clinic performed 104 femoral endarterectomy procedures with stenting. This hybrid procedure is used in place of an aortic femoral bypass for patients with complex aorto-iliac occlusive disease.

Femoral Occlusion
Before
After

Source: Data from the UHC Clinical Data Base/Resource Manager™ used by permission of UHC. All rights reserved.
Angioplasty Trends
2014 Volume (N = 190)
2012 – 2014

Tibial angioplasty is the first choice of treatment for patients with rest pain, ulcers, and gangrene. Femoral-popliteal angioplasty along with tibial angioplasty is used to treat patients with claudication. Cleveland Clinic physicians performed 55 tibial and 135 femoral-popliteal angioplasty procedures in 2014.

Tibial Bypass Trends
2014 Volume (N = 72)
2011 – 2014

Patient outcomes are improved through the use of the patient’s own veins (autologous) in bypass surgery instead of using prosthetic conduits (5-year patency, 70% vs 20%; limb-salvage rate, 93%, 73/78). In 2014, 75% of tibial bypass procedures at Cleveland Clinic included autologous veins from all possible sources (saphenous, arm, and femoral).
Carotid artery stenosis is the cause of more than half of all temporary and permanent strokes. Patients with hypertension, coronary artery disease, and peripheral artery disease are at increased risk of developing carotid artery stenosis. This risk can be reduced through early diagnosis with vascular ultrasound and through disease management with medications such as antiplatelet and antihypertensive agents. Cleveland Clinic incorporates the most current technology and methods to care for patients with cerebrovascular disease. These include specialized ultrasound laboratories and advanced medical treatments, such as open carotid surgery and minimally invasive carotid artery stenting procedures.

### Procedural Complications

<table>
<thead>
<tr>
<th>Procedure</th>
<th>N</th>
<th>MI (%)</th>
<th>Stroke (%)</th>
<th>In-Hospital Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carotid stenting</td>
<td>542</td>
<td>1.0</td>
<td>4.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Carotid endarterectomy</td>
<td>868</td>
<td>0.6</td>
<td>3.0</td>
<td>0.7</td>
</tr>
</tbody>
</table>

The in-hospital mortality rates for patients treated for cerebrovascular disease at Cleveland Clinic were below the expected rates (3%, carotid stenting; 0.5%, carotid endarterectomy vs expected rates of 3.4% and 2%, respectively).

### Cerebrovascular Disease Treatment In-Hospital Mortality

The Heart & Vascular Institute is currently enrolling patients in medical, surgical, and endovascular trials involving cerebrovascular disease. These national trials represent the most up-to-date therapies available to patients with atherosclerotic carotid diseases. Ongoing registries are also available for patients who are eligible. In addition, both minimally invasive and open surgeries are performed for cerebrovascular debranching to expand the application of thoracic stent grafting technology in patients with thoracic aneurysms.
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**

*2014 Volume (N = 1492)*

*2010 – 2014*

In 2014, Cleveland Clinic surgeons performed 1492 thoracic procedures. The in-hospital mortality rate was 1.4%.
Cleveland Clinic thoracic surgeons perform a variety of procedures to treat patients with even the most complex diseases. In 2014, the most common procedures were pulmonary operations.

“Other” category includes thymectomies, wedge resections, tumor surgeries, paraesophageal hiatal hernia repairs, and thyroidectomies.

Cleveland Clinic surgeons performed 350 pulmonary resections in 2014. The in-hospital mortality rate was 0.6%.
Many of the procedures Cleveland Clinic thoracic surgeons perform can be done using both open and video-assisted (VATS) techniques. The use of VATS or robotic techniques are associated with less postoperative pain, a shorter length of stay, and faster return to normal activities.

The majority of pulmonary resections performed at Cleveland Clinic in 2014 were open and video-assisted lobectomies. Video-assisted thoracic surgery (VATS) and minimally invasive techniques are used when appropriate to yield the best possible outcomes for each patient.
Cleveland Clinic surgeons use video-assisted/robotic techniques whenever appropriate for patients having lobectomies. These procedures are less invasive than open procedures and can help improve outcomes.

The in-hospital mortality rate for patients who had pulmonary resection procedures at Cleveland Clinic in 2014 was 0.30%, which was lower than the expected rate of 1.30%.

Source: Data from the UHC Clinical Data Base/Resource Manager™ used by permission of UHC. All rights reserved.
Pulmonary Resection for Lung Cancer, Combined Morbidity and Mortality
January 2012 – December 2014

Cleveland Clinic surgeons performed 604 pulmonary resections from 2012 through 2014. The risk-adjusted rates for morbidity and mortality were among the best in the country.

<table>
<thead>
<tr>
<th>Eligible procedures</th>
<th>Unadjusted rate</th>
<th>Risk-adjusted rate (95% CI)</th>
<th>Standardized incidence ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>604</td>
<td>5.0%</td>
<td>4.8% (3.5-6.4)</td>
<td>0.65 (0.46-0.86)</td>
</tr>
</tbody>
</table>

Cleveland Clinic surgeons performed 604 pulmonary resections from 2012 through 2014. The risk-adjusted rates for morbidity and mortality were among the best in the country.

- Min: 0.41
- 25th: 0.88
- Median: 1.03
- 75th: 1.18
- Max: 2.10

Source: Society of Thoracic Surgeons (STS)
General Thoracic Surgery Database, January 2012 – December 2014

● = STS mean participant score

Lobectomy for Lung Cancer, Composite Quality Rating
2014

<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% (97.48, 98.81)</td>
<td>97.0%</td>
<td>⭐⭐⭐</td>
</tr>
</tbody>
</table>

Cleveland Clinic

- Min: 92.14
- 25th: 96.33
- Median: 97.18
- 75th: 97.83
- Max: 99.07

Source: Society of Thoracic Surgeons (STS)
General Thoracic Surgery Database, January 2012 – December 2014

● = STS mean participant score

Lobectomy Length of Stay
2014

The median length of stay was lower among patients who had video-assisted lobectomies compared with those who had open procedures.
Esophageal Surgery Volume and In-Hospital Mortality

2014 Volume (N = 192)
2010 – 2014

Cleveland Clinic thoracic surgeons performed 192 esophageal procedures in 2014 and achieved a lower-than-expected in-hospital mortality rate (1.56% vs 3%).

Both the in-hospital and 30-day mortality rates for esophagectomy were 0% at Cleveland Clinic in 2014. The expected rates were 3.10% and 2.8%, respectively.

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

The majority of esophageal surgeries at Cleveland Clinic in 2014 were to treat patients with esophageal cancer and complex paraesophageal hernias who have had multiple failed operations.
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 last 2 years. The time between visits varied from patient to patient.

### Primary Prevention, Statin-Tolerant Adults

2014 Volume (N = 1329)

2006 – 2014

**LDL Median Value**

- **Baseline**: 122.5 mg/dL
- **2nd follow-up**: 88 mg/dL

### Secondary Prevention, Statin-Tolerant Adults

2014 Volume (N = 979)

2006 – 2014

**LDL Median Value**

- **Baseline**: 88 mg/dL
- **2nd follow-up**: 70.5 mg/dL
**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 last 2 years.

**Primary Prevention, Statin-Intolerant Adults**

2014 Volume (N = 447)

2006 – 2014

**LDL Median Value**

160

140

120

100

80

2006 2007 2008 2009 2010 2011 2012 2013 2014

- **149.5 mg/dL** Baseline
- **107 mg/dL** 2nd follow-up

**Secondary Prevention, Statin-Intolerant Adults**

2014 Volume (N = 442)

2006 – 2014

**LDL Median Value**

140

130

120

110

100

90

80

70

2006 2007 2008 2009 2010 2011 2012 2013 2014

- **120 mg/dL** Baseline
- **85 mg/dL** 2nd follow-up
Impact of Preventive Cardiology on Blood Pressure Among Patients with Diastolic Blood Pressure ≥ 90 mm Hg or Systolic Blood Pressure ≥ 140 mm Hg (N = 743)

2014
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 last year.

Value (mm Hg)

Pediatric Preventive Cardiology and Metabolic Clinic Lipid Levels (N = 170)

2014
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 2014.

Abbreviations: HDL = high-density lipoprotein, LDL = low-density lipoprotein
Impact of Preventive Cardiology on HgbA₁c Levels Among Patients With Diabetes and HgbA₁c ≥ 7 at Baseline
2014 Volume (N = 1442)

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 last year.
**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 = 271)**

*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 20%.

10
4
8
6
2
Change = +2
8
6
9.6
7.6
4
2
Entry
Before Cardiac Rehab
Exit
After Cardiac Rehab

**Improvement in Systolic Blood Pressure (N = 271)**

*Among patients who completed the Cardiac Rehabilitation Program, 94% achieved normal blood pressure (< 140/90 mm Hg). The average improvement in systolic blood pressure was 8 mm Hg.*

140
130
120
122
110
100
90
80
Entry
Before Cardiac Rehab
Exit
After Cardiac Rehab

*Data represent all cardiac rehab patients with entry visit in 2014.*
Cardiac Rehabilitation

Improvement in Weight (N = 271)a

2014

The median weight loss for patients who completed the Cardiac Rehabilitation Program was 13 pounds.

Weight (lbs.)

220

217

215

210

205

200

Entry
Before Cardiac Rehab

Exit
After Cardiac Rehab

aData represent all cardiac rehab patients with entry visit in 2014.
**Improvement in Quality of Life Assessment (N = 271)**

2014

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.

**SF-36 Score**

<table>
<thead>
<tr>
<th>Physical Summary Score</th>
<th>Mental Summary Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>36.9</td>
<td>47.7</td>
</tr>
<tr>
<td>52</td>
<td>52.7</td>
</tr>
</tbody>
</table>

**The Weigh to a Healthy Heart**

2012 – 2014

The Weigh to a Healthy Heart is a comprehensive 10-week weight loss program designed to help prevent cardiovascular disease. The program is guided by a team of dietitians, physicians, exercise physiologists, and behavioral counselors. Patients receive an exercise prescription and participate in private nutrition sessions, group exercise classes, lipid and fasting sugar testing, and weekly group support sessions. They also get help creating a grocery list.

In 2014, patients who attended more than 75% of the classes lost an average of 6.4 pounds.

<table>
<thead>
<tr>
<th>Mean Weight Loss Over 10 Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
</tr>
<tr>
<td>2013</td>
</tr>
<tr>
<td>2014</td>
</tr>
</tbody>
</table>
The Sports Cardiology Center at Cleveland Clinic was established in 2014. The center features a multidisciplinary team of healthcare providers that is dedicated to working with athletes of all levels who are at risk of developing or have been diagnosed with cardiovascular disease. Our comprehensive approach to treatment includes individual and sport-specific cardiovascular assessment; patient-centered counseling related to lifestyle, prevention, nutrition, and training; and state-of-the-art imaging techniques to ensure accurate diagnosis and treatment.

In 2014, Cleveland Clinic partnered with the NFL Player Care Foundation to provide free cardiovascular screenings to more than 500 retired NFL players nationwide.

### Number of Retired NFL Players Screened

<table>
<thead>
<tr>
<th>Screening Location</th>
<th>Number of Retired NFL Players Screened</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York</td>
<td>40</td>
</tr>
<tr>
<td>Orlando</td>
<td>100</td>
</tr>
<tr>
<td>Las Vegas</td>
<td>60</td>
</tr>
<tr>
<td>Dallas</td>
<td>80</td>
</tr>
<tr>
<td>Pittsburgh</td>
<td>40</td>
</tr>
<tr>
<td>Chicago</td>
<td>120</td>
</tr>
<tr>
<td>Canton</td>
<td>20</td>
</tr>
<tr>
<td>Cincinnati</td>
<td>20</td>
</tr>
<tr>
<td>Indianapolis</td>
<td>20</td>
</tr>
<tr>
<td>Phoenix</td>
<td>100</td>
</tr>
</tbody>
</table>
Cardio-Oncology

Advances in chemotherapy and radiation treatment have led to improved cancer survival rates. However, some of these treatments can cause permanent heart disease, especially for patients who are at risk of developing cardiovascular disease. Cleveland Clinic’s Cardio-Oncology Center uses state-of-the-art technology to identify toxicity so these patients can begin immediate treatment without interfering with their cancer therapy.

Our team includes specialists in cardiac imaging, heart failure, electrophysiology, and cardiac surgery, who collaborate with experts in Cleveland Clinic’s Taussig Cancer Institute. This multidisciplinary collaboration affords patients expertise in diagnostic testing, medical management, and interventional and surgical procedures.

Echocardiograms to Monitor Chemotherapy-Induced Cardiotoxicity, Volume (N = 1622)

2011 – 2014

Every patient who is actively receiving or planning to receive chemotherapy has an echocardiogram with quantification of global longitudinal strain. This testing can identify subtle changes in cardiac function and can provide information regarding cardiotoxic effects of chemotherapy before the patient has clinical symptoms. This may allow early identification of high-risk patients who can benefit from additional cardioprotective medications during chemotherapy treatment.
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 419 participating sites.

Vascular Surgery Outcomes

July 2013 – June 2014

<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>282</td>
<td>3.19</td>
<td>2.88</td>
</tr>
<tr>
<td>30-day morbidity</td>
<td>282</td>
<td>17.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>11.11</td>
</tr>
<tr>
<td>Cardiac event</td>
<td>282</td>
<td>2.48</td>
<td>2.52</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>281</td>
<td>2.14</td>
<td>1.56</td>
</tr>
<tr>
<td>Unplanned intubation</td>
<td>282</td>
<td>3.19&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.97</td>
</tr>
<tr>
<td>Ventilator &gt; 48 hours</td>
<td>281</td>
<td>2.85</td>
<td>1.91</td>
</tr>
<tr>
<td>Deep vein thrombosis/pulmonary embolism</td>
<td>282</td>
<td>1.42</td>
<td>0.73</td>
</tr>
<tr>
<td>Renal failure</td>
<td>282</td>
<td>2.13&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.38</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>281</td>
<td>1.42</td>
<td>0.92</td>
</tr>
<tr>
<td>Surgical site infection</td>
<td>281</td>
<td>6.41&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.46</td>
</tr>
<tr>
<td>Sepsis</td>
<td>274</td>
<td>8.03&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.53</td>
</tr>
<tr>
<td>Return to operating room</td>
<td>282</td>
<td>10.64</td>
<td>7.50</td>
</tr>
<tr>
<td>Readmission</td>
<td>282</td>
<td>14.89&lt;sup&gt;a&lt;/sup&gt;</td>
<td>11.62</td>
</tr>
</tbody>
</table>

<sup>a</sup>Identified as a high statistical outlier (higher than expected) by the ACS NSQIP hierarchical model
In addition to overall vascular ACS NSQIP outcomes data, data specific to aortoiliac surgery and lower extremity vascular surgery are provided.

**Open Aortoiliac Surgery Outcomes**
*July 2013 – June 2014*

<table>
<thead>
<tr>
<th>Outcome</th>
<th>N</th>
<th>Observed Rate (%)</th>
<th>Expected Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morbidity</td>
<td>63</td>
<td>26.98</td>
<td>15.88</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>63</td>
<td>3.17</td>
<td>3.45</td>
</tr>
<tr>
<td>Readmission</td>
<td>63</td>
<td>15.87</td>
<td>16.36</td>
</tr>
<tr>
<td>Bleeding</td>
<td>63</td>
<td>33.33&lt;sup&gt;a&lt;/sup&gt;</td>
<td>16.65</td>
</tr>
<tr>
<td>MRTAS</td>
<td>63</td>
<td>1.59</td>
<td>3.22</td>
</tr>
<tr>
<td>Wound</td>
<td>63</td>
<td>22.22&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.65</td>
</tr>
</tbody>
</table>

MRTAS = major reintervention of the treated arterial segment

<sup>a</sup>Identified as a high statistical outlier (higher than expected) by the ACS NSQIP hierarchical model

Open aortoiliac surgery NSQIP outcomes are benchmarked against 57 participating sites.

**Endovascular Aortoiliac Surgery Outcomes**
*July 2013 – June 2014*

<table>
<thead>
<tr>
<th>Outcome</th>
<th>N</th>
<th>Observed Rate (%)</th>
<th>Expected Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Readmission</td>
<td>56</td>
<td>5.36</td>
<td>8.50</td>
</tr>
<tr>
<td>Bleeding</td>
<td>56</td>
<td>8.93</td>
<td>8.70</td>
</tr>
</tbody>
</table>

Endovascular aortoiliac surgery NSQIP outcomes are benchmarked against 37 participating sites.
### Open Lower Extremity Vascular Surgery Outcomes
#### July 2013 – June 2014

<table>
<thead>
<tr>
<th>Outcome</th>
<th>N</th>
<th>Observed Rate (%)</th>
<th>Expected Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morbidity</td>
<td>43</td>
<td>30.23</td>
<td>16.51</td>
</tr>
<tr>
<td>Cardiac event</td>
<td>43</td>
<td>2.33</td>
<td>2.44</td>
</tr>
<tr>
<td>Unplanned intubation</td>
<td>43</td>
<td>0.00</td>
<td>1.61</td>
</tr>
<tr>
<td>Surgical site infection</td>
<td>43</td>
<td>23.26&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.40</td>
</tr>
<tr>
<td>Return to operating room</td>
<td>43</td>
<td>27.91</td>
<td>14.49</td>
</tr>
<tr>
<td>Readmission</td>
<td>43</td>
<td>30.23</td>
<td>18.07</td>
</tr>
<tr>
<td>Amputation</td>
<td>43</td>
<td>4.65</td>
<td>3.92</td>
</tr>
<tr>
<td>Bleeding</td>
<td>43</td>
<td>34.88&lt;sup&gt;a&lt;/sup&gt;</td>
<td>13.21</td>
</tr>
<tr>
<td>Myocardial infarction or stroke</td>
<td>43</td>
<td>2.33</td>
<td>2.17</td>
</tr>
<tr>
<td>Major intervention on the bypass</td>
<td>43</td>
<td>9.30</td>
<td>6.52</td>
</tr>
<tr>
<td>Untreated loss of patency</td>
<td>43</td>
<td>6.98</td>
<td>3.67</td>
</tr>
<tr>
<td>Wound</td>
<td>43</td>
<td>37.21&lt;sup&gt;a&lt;/sup&gt;</td>
<td>14.65</td>
</tr>
</tbody>
</table>

<sup>a</sup>Identified as a high statistical outlier (higher than expected) by the ACS NSQIP hierarchical model

Open lower extremity vascular surgery NSQIP outcomes are benchmarked against 86 participating sites.
### Endovascular Lower Extremity Surgery Outcomes
#### July 2013 – June 2014

<table>
<thead>
<tr>
<th>Outcome</th>
<th>N</th>
<th>Observed Rate (%)</th>
<th>Expected Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morbidity</td>
<td>75</td>
<td>8.00</td>
<td>4.11</td>
</tr>
<tr>
<td>Return to operating room</td>
<td>75</td>
<td>6.67</td>
<td>6.93</td>
</tr>
<tr>
<td>Readmission</td>
<td>75</td>
<td>13.33</td>
<td>10.63</td>
</tr>
<tr>
<td>Amputation</td>
<td>75</td>
<td>5.33</td>
<td>3.28</td>
</tr>
<tr>
<td>Bleeding</td>
<td>75</td>
<td>10.67a</td>
<td>3.87</td>
</tr>
<tr>
<td>MRTAS</td>
<td>75</td>
<td>5.33</td>
<td>3.07</td>
</tr>
<tr>
<td>Wound</td>
<td>75</td>
<td>5.33</td>
<td>1.64</td>
</tr>
</tbody>
</table>

MRTAS = major reintervention of the treated arterial segment

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

Endovascular lower extremity vascular surgery NSQIP outcomes are benchmarked against 45 participating sites.

### Thoracic Surgery Outcomes
#### July 2013 – June 2014

<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>80</td>
<td>1.25</td>
<td>2.29</td>
</tr>
<tr>
<td>30-day morbidity</td>
<td>80</td>
<td>7.50a</td>
<td>14.79</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>79</td>
<td>5.06</td>
<td>4.46</td>
</tr>
<tr>
<td>Unplanned intubation</td>
<td>80</td>
<td>3.75</td>
<td>5.01</td>
</tr>
<tr>
<td>Ventilator &gt; 48 hours</td>
<td>78</td>
<td>3.85</td>
<td>3.86</td>
</tr>
<tr>
<td>Deep vein thrombosis/pulmonary embolism</td>
<td>80</td>
<td>1.25</td>
<td>1.68</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>80</td>
<td>0.00a</td>
<td>0.97</td>
</tr>
<tr>
<td>Return to operating room</td>
<td>80</td>
<td>2.50a</td>
<td>5.64</td>
</tr>
</tbody>
</table>

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

Thoracic surgery outcomes data reflect Cleveland Clinic’s thoracic surgery ACS NSQIP performance benchmarked against 247 participating sites.
Cleveland Clinic is dedicated to delivering excellent clinical outcomes surrounded by the best possible experience for patients and their families. Reported patient experiences are shared with caregivers and used to identify opportunities to improve care. Cleveland Clinic’s Office of Patient Experience supports caregivers through education and guidance to help them deliver consistent, patient-centered care.

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

**CG-CAHPS Assessment**

*2013 – 2014*

**Percent Best Response**

![Bar chart showing percent best response for appointment access, doctor communication, doctor rating, clerical staff, and test results communication.](chart)

*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 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 CG-CAHPS database from 2172 medical practices in 2013.*

*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
2013 – 2014

**Best Response (%)**

<table>
<thead>
<tr>
<th>Domain</th>
<th>2013 (N = 4068)</th>
<th>2014 (N = 3883)</th>
<th>National average all patients^b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital Rating (% 9 or 10)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 – 10 Scale</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recommend Hospital (% Definitely Yes)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharge Information % Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doctor Communication % Always</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nurse Communication % Always</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain Management % Always</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Room Clean % Always</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Medications Communication % Always</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Responsiveness to Needs % Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quiet at Night % Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

^aBased on national survey results of discharged patients, January 2013 – December 2013, from 4067 US hospitals. medicare.gov/hospitalcompare

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

Source: Press Ganey, a national hospital survey vendor
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 2014 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 dashboard 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 Mortality
Observed/Expected Ratio
2013 – 2014

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 in the high-risk critical care population.

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

Cleveland Clinic’s observed/expected (O/E) mortality ratio outperformed its internal target derived from the University HealthSystem Consortium (UHC) 2014 risk model. Ratios less than 1.0 indicate mortality performance “better than expected” in UHC’s risk adjustment model.
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 in 2015.

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.
Cleveland Clinic is dedicated to delivering excellent clinical outcomes surrounded by the best possible experience for patients and their families. Reported patient experiences are shared with caregivers and used to identify opportunities to improve care. Cleveland Clinic’s Office of Patient Experience supports caregivers through education and guidance to help them deliver consistent, patient-centered care.

Outpatient Office Visit Survey — Cleveland Clinic

CG-CAHPS Assessment

2013 – 2014

Best Response (%)

<table>
<thead>
<tr>
<th>Service Area</th>
<th>2013 (N = 64,792)</th>
<th>2014 (N = 124,521)</th>
<th>CG-CAHPS 2013 database average (all practices)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appointment Access (%) Always</td>
<td>60</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Primary Care (%) Always</td>
<td>80</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Specialty Care (%) Always</td>
<td>90</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Doctor Communication (%) Always</td>
<td>60</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Doctor Rating (% 9 or 10)</td>
<td>60</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Clerical Staff (%) Definitely</td>
<td>80</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Test Results Communication (%) Yes</td>
<td>60</td>
<td>80</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 2172 practices in 2013

*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
Inpatient Survey — Cleveland Clinic

HCAHPS Overall Assessment
2013 – 2014

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
2013 – 2014

aBased on national survey results of discharged patients, January 2013 – December 2013, from 4067 US hospitals. medicare.gov/hospitalcompare
bResponse options: Definitely yes, Probably yes, Probably no, Definitely no
Source: Press Ganey, a national hospital survey vendor

aExcept for “Room Clean” and “Quiet at Night,” each bar represents a composite score based on responses to multiple survey questions.
Source: Press Ganey, a national hospital survey vendor
bBased on national survey results of discharged patients, January 2013 – December 2013, from 4067 US hospitals. medicare.gov/hospitalcompare
**Focus on Value**

Cleveland Clinic is developing and implementing 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

**Select Accountable Care Organization Performance Measures**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Cleveland Clinic 2014 Performance (%)</th>
<th>Cleveland Clinic Goala (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumococcal vaccination</td>
<td>84.9</td>
<td>100</td>
</tr>
<tr>
<td>Colorectal cancer screening</td>
<td>72.3</td>
<td>100</td>
</tr>
<tr>
<td>Mammography screening</td>
<td>77.5</td>
<td>≥ 99.6</td>
</tr>
<tr>
<td>Hemoglobin A1c &gt; 9%</td>
<td>20.5</td>
<td>≤ 10b</td>
</tr>
<tr>
<td>Hypertension control</td>
<td>69.3</td>
<td>≥ 79.7</td>
</tr>
</tbody>
</table>

*2015 ACO 90th percentile

bLower is better

As part of Cleveland Clinic’s commitment to population health and in support of its newly certified Accountable Care Organization (ACO), these primary care ACO measures have been prioritized for monitoring and improvement. Cleveland Clinic is improving performance in these measures through enhanced 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 All-Cause 30-Day Readmission Rate to Any Cleveland Clinic Hospital**

2013 – 2014

<table>
<thead>
<tr>
<th>Percent of Discharges</th>
<th>Case Mix Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>3.0</td>
</tr>
<tr>
<td>15</td>
<td>1.5</td>
</tr>
<tr>
<td>9</td>
<td>1.0</td>
</tr>
<tr>
<td>6</td>
<td>0.5</td>
</tr>
<tr>
<td>3</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4

Cleveland Clinic rate
Cleveland Clinic CMI
UHC academic medical centers CMI

CMI = case mix index

*Total discharges

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

Cleveland Clinic monitors 30-day readmission rates for any reason to any of its system hospitals. Unplanned readmissions are actively reviewed for improvement opportunities. Strategies associated with communication, education, and follow-up have been implemented for several high-risk conditions, including heart failure and pneumonia. These practices are being expanded and enhanced to reduce overall avoidable readmissions. Sicker, more complex patients are more susceptible to readmission. Case mix index (CMI) reflects patient severity of illness and resource utilization. Cleveland Clinic’s CMI remains one of the highest among American academic medical centers.
Cleveland Clinic is the home to 2 Centers of Innovation dedicated to the development and commercialization of novel solutions for cardiovascular patient care. The Global Cardiovascular Innovation Center (GCIC) is a multi-institutional consortium founded in 2007, and made possible through a $60 million grant from the State of Ohio's Third Frontier Program. Cleveland Clinic was also recently awarded a $10 million grant from the National Institutes of Health (NIH) National Heart, Lung and Blood Institute (NHLBI) to establish an NIH Center for Accelerated Innovations (NCAI). The NCAI-Cleveland Clinic, also a multi-institutional initiative, is 1 of 3 inaugural NCAIs established with the mission to provide an integrated, systematic, and comprehensive approach to the translation of early stage biomedical innovations from the research laboratory to commercial development and successful use in the treatment of patients. Together the 2 Centers provide a continuum of project funding, expert project management guidance, and programs for educating and mentoring researchers, clinicians, and developers, resulting in successful introduction of innovative cardiovascular technology for the benefit of patients worldwide.
**Micra Transcatheter Pacing System**

Advances in pacemaker technology have recently expanded to include leadless devices. Cleveland Clinic physicians have consistently been at the forefront of this technology to offer patients innovative options to manage their cardiac rhythm disorders. In 2014, our physicians performed one of the first implantations of the Micra™ Transcatheter Pacing System (TPS) in the United States. In total, they successfully implanted 4 of these devices within the year. The Micra™ TPS is used to treat patients with bradycardia who need pacing on 1 side of the heart. The device, which is about the size of a multivitamin, is placed directly into the heart using a catheter.

**Grand Pre Sternal Closure System**

Cleveland Clinic surgeons helped develop a novel sternal closure system for patients who require a sternotomy. The Grand Pre™ Sternal Closure System is manufactured by JACE Medical. The device allows surgeons to attach titanium plates to the sternum before the bone is cut. This allows for a true anatomic and quick closure at the end of surgery, thereby reducing the overall procedure time. The system creates rigid sternal fixation, which has been associated with less pain and improved bone healing.
Innovations (continued)

### iTransmit

Cleveland Clinic researchers found smartphones to be a useful tool to help patients transmit heart rhythm information following an ablation for atrial fibrillation. The iTransmit study collected recordings sent electronically with the use of a specially designed iPhone case that records electrocardiographic tracing. Recordings produced 100% sensitivity and 97% specificity for the detection of atrial fibrillation and atrial flutter (considered as one disease state). The majority (92%) of patients preferred transmission via the case instead of using a traditional transtelephonic monitor.


### WRAP-IT

Cleveland Clinic physicians are leading the Worldwide Randomized Antibiotic Envelope Infection Prevention Trial (WRAP-IT). This is a large international multicenter trial testing the TYRX™ absorbable antibacterial envelope, which was FDA-approved in 2013. The envelope is constructed of mesh designed to hold and stabilize a cardiac implantable electronic device (CIED) after implantation. The envelope also releases the antibiotics minocycline and rifampin over 7 days or longer. These medications are fully absorbed by the body approximately 9 weeks after implantation. Approximately 7,000 patients from 225 sites around the world will participate in the study.

Image courtesy of Medtronic plc.
**Sternal-Sparing Aortic Valve Replacement**

In 2014, Cleveland Clinic surgeons continued perfecting a novel method for performing isolated aortic valve replacement (AVR) procedures through a small incision between the ribs. This procedure allows the surgery to be done without cutting the sternal bone. This technique, which is now being routinely used for isolated AVR procedures at Cleveland Clinic, involves a 2-cm incision. The procedure enables patients to return to normal activities faster and have a less painful recovery than patients who have a sternotomy.

**Chord-X Mitral Valve Chordal Repair System**

The Chord-X™ Mitral Valve Chordal Repair System allows surgeons to adjust the length of artificial chords used in mitral valve repair procedures. The technology was developed by Cleveland Clinic surgeons in conjunction with On-X Life Technologies, Inc. Each year, approximately 60,000 mitral valve procedures are done in the United States. This system allows surgeons to accurately measure chord length, reduce the time spent in the operating room, standardize artificial chord replacement, and adjust and create customized chordal loop lengths.

Used with permission from On-X Life Technologies, Inc.
**PleuraFlow Active Clearance Technology**

Cleveland Clinic physicians were involved in the development and trial of a chest tube system that allows postoperative clots to be cleared without compromising the integrity of the sterile environment inside the tube. The PleuraFlow® Active Clearance Technology® (ACT) is placed between the chest tube and the drainage container tubing. A magnetic drive is used to break up clots and completely clear the tube.

**Mitra-Spacer**

Cleveland Clinic physicians pioneered the use of the Mitra-Spacer™ device in patients. The Mitra-Spacer is used to repair the mitral valve. It consists of a space-occupying element made of a polyurethane-silicone polymer that is anchored in the left ventricular apex through the mitral valve. It is put in place using a transapical or transseptal approach. Early outcomes from the first successful human implant are encouraging, and have resulted in recovery from multiple organ failures and termination of dialysis.
**Cholesterol-Lowering Injections**

Statin medications have effectively been used for more than 20 years to reduce cholesterol levels in patients with heart disease. However, some patients cannot tolerate statins and, therefore, do not benefit from them. A new class of cholesterol-lowering medications called PCSK9 inhibitors provides an alternative treatment that can lower LDL cholesterol by 50% to 70%. These new medications are administered by subcutaneous injection once monthly. Cleveland Clinic physicians are involved in the trials and oversight of the studies related to these drugs.

**ARNI for Patients with Congestive Heart Failure**

A novel medication for patients with congestive heart failure tested by Cleveland Clinic researchers was shown to reduce the risk of death by 20%. The agent, known as an angiotensin receptor-neprilysin inhibitor (ARNI), is on the fast track for approval by the Food and Drug Administration. The treatment was shown to be more effective than traditional therapy with angiotensin-converting enzyme inhibitors in reducing hospitalizations and emergency treatment for congestive heart failure.
Contact Information

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 743 publications in 2014.

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**
702.483.6000

**For address corrections or changes, please call**
800.890.2467
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 3200 Cleveland Clinic staff physicians and scientists in 130 medical specialties and subspecialties care for more than 5.9 million patients across the system, performing more than 192,000 surgeries and conducting more than 497,000 emergency department visits. Patients come to Cleveland Clinic from all 50 states and more than 147 nations.

Cleveland Clinic is an integrated healthcare delivery system with local, national, and international reach. The main campus in midtown Cleveland, Ohio, has a 1400-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 90 northern Ohio outpatient locations, including 18 full-service family health centers, 8 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 42,500 employees. It generates $12.6 billion of economic activity a year.

Cleveland Clinic Global Solutions supports physician education, training and consulting, and patient services around the world through offices in Canada, China, the Dominican Republic, El Salvador, Guatemala, Honduras, Panama, Peru, Saudi Arabia, Turkey, UAE, and the United Kingdom.

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.

The Cleveland Clinic health system began to grow in 1987 with the founding of Cleveland Clinic Florida and expanded in the 1990s with the development of 18 family health centers across Northeast Ohio. Fairview Hospital, Hillcrest Hospital, and 6 other regional hospitals have joined Cleveland Clinic over the past 2 decades, offering Cleveland Clinic institute services in heart and neurological care, physical rehabilitation, and more. Clinical and support services were reorganized into 27 patient-centered institutes beginning in 2007. Institutes combine medical and surgical specialists for specific diseases or organ systems under unified leadership and in a shared location to provide optimal team care for every patient. Institutes work with the Office of Patient Experience to give every patient the best outcome and experience.

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 5400 physician members, both employed 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.
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. Cleveland Clinic is building a 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 2014, nearly 1800 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 is ranked No. 1 in urology and has ranked No. 1 in heart care and heart surgery since 1995. In 2014, 4 of its programs were ranked No. 2 in the nation: diabetes and endocrinology, gastroenterology and GI surgery, nephrology, and rheumatology.

For more information about Cleveland Clinic, please visit clevelandclinic.org.

Cleveland Clinic Physician Ratings

At Cleveland Clinic, we believe in transparency. We also believe in the positive influence of the physician-patient relationship on healthcare outcomes. To continue to meet the highest standards of patient satisfaction, we now publish Cleveland Clinic physician ratings, based on nationally recognized Press Ganey patient satisfaction surveys, online at clevelandclinic.org/staff.
Referring Physician Center and Hotline
Call 24/7 for access to medical services or to schedule patient appointments: 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 eclevelandclinic.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

MyPractice Community (affordable electronic medical records system for physicians in private practice): 866.320.4573

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 2100 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 100 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. Learn more at clevelandclinic.org/executiveeducation.

Consult QD Physician Blog

A singular blog for physicians and healthcare professionals from Cleveland Clinic. Discover the latest research insights, innovations, treatment trends, and more for all specialties. Join the conversation: 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

Follow us on Twitter
@cleclinicMD

Connect with us on LinkedIn
Clevelandclinic.org/Mdlinkedin
Treating the Whole Patient

The 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 light massage therapy, reiki, Healing Touch™ therapies, 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 2014, there were 12,779 visitors to the center and 18,559 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 2014, there were 17,524 total contacts, which included 4612 webmails; 5256 phone, mail, and in-person contacts; and 7656 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 2014, the nurses answered 8037 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

Patients and others have many ways to contact the Heart & Vascular Institute and learn more about their health. The institute’s Twitter account (twitter.com/ClevClinicHeart) has more than 1870 followers and was recently named one of Good Housekeeping’s 14 Most Trusted Health Sites. In 2014, more than 2870 participants took part in the institute’s 31 live webchats and 9 video Spreecasts with experts who answered questions about a variety of topics. Transcripts and a list of upcoming chats are posted at clevelandclinic.org/webchats. In 2014, the institute’s website (www.clevelandclinic.org/heart) received more than 14,479,000 combined visits. The YouTube channel (youtube.com/clevelandclinic) had more than 2.7 million video views, which included 580,000 views related to cardiovascular and thoracic topics. The institute has dedicated Facebook specialty groups, including LVAD, Lung Transplant, and Women’s Cardiovascular Health. Nearly 47,000 subscribers receive a monthly e-newsletter to learn about the latest in heart and vascular disease prevention, treatments, research, and helpful tips, videos, and recipes. To subscribe, visit clevelandclinic.org/heartenews. Health Hub is a blog that explores current topics related to research, Cleveland Clinic expert perspectives on breaking news stories, and more. In 2014, there were more than 4.7 million visits to the heart and vascular section of the blog. Go to clevelandclinic.org/TheBeatingEdge to learn more.