To promote quality improvement, Cleveland Clinic has created a series of Outcomes books similar to this one for many of its institutes. Designed for a physician audience, the Outcomes books contain a summary of our surgical and medical trends and approaches, data on patient volumes and outcomes, and a review of new technologies and innovations.

Although we are unable to report all outcomes for all treatments provided at Cleveland Clinic — omission of outcomes for a particular treatment does not necessarily mean we do not offer that treatment — our goal is to increase outcomes reporting each year. When outcomes for a specific treatment are unavailable, we often report process measures associated with improved outcomes. When process measures are unavailable, we may report volume measures; a volume/outcome relationship has been demonstrated for many treatments, particularly those involving surgical techniques.

In addition to our internal efforts to measure clinical quality, Cleveland Clinic supports transparent public reporting of healthcare quality data and participates in the following public reporting initiatives:

- Joint Commission Performance Measurement Initiative (qualitycheck.org)
- Centers for Medicare & Medicaid Services (CMS) Hospital Compare (hospitalcompare.hhs.gov)
- Ohio Department of Health (ohiohospitalcompare.ohio.gov)
- Cleveland Clinic Quality Performance Report (clevelandclinic.org/QPR)

Our commitment to providing accurate, timely information about patient care also will help patients and referring physicians make informed healthcare decisions.

We hope you find these data valuable, and we invite your feedback. Please send comments and suggestions to us at OutcomesBookFeedback@ccf.org. To view all our Outcomes books, please visit Cleveland Clinic’s Quality and Patient Safety website at clevelandclinic.org/outcomes.
Dear Colleague:

Welcome to Cleveland Clinic’s 2011 Outcomes books. They include data on clinical outcomes, patient volumes, innovations and publications. Cleveland Clinic pioneered the collection and annual publication of outcomes data. This initiative has become part of the national discussion on lowering costs and improving the quality of healthcare.

Cleveland Clinic uses data to manage outcomes across the full continuum of care. Clinical services are delivered through patient-centered institutes, each based around a single disease or organ system. Institutes combine medical and surgical services, along with research and education, under unified leadership. Each institute defines quality benchmarks for its specialty services and reports longitudinal progress.

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 data in advance of national and state public reporting sites in key areas, including heart attack, heart failure, stroke and infection prevention.

We hope you will find this information useful.

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.
Thank you for your interest in the Sydell and Arnold Miller Family Heart & Vascular Institute 2011 Outcomes. This is the 14th edition of our annual publication. We are pleased to provide this resource to physicians throughout the United States.

Rapid changes in healthcare, coupled with mounting economic pressures, are impacting the U.S. healthcare system and creating changes in patient care. In these times, superior outcomes are more important than ever. Scientific evidence supports the assertion that, over time, better outcomes lead to reduced healthcare costs. Outcomes need to be viewed as important not only for the health of our patients, but as a way to provide efficient and value-added care.

As a leader in national healthcare, Cleveland Clinic continues to combine cutting-edge technology with quality improvements to refine and improve the care we deliver to our patients.

The outcomes reflected in this book are not our destination, but an illustration of the continuous journey we are on to improve the everyday health of our patients.

Bruce W. Lytle, MD  
Chairman, Miller Family Heart & Vascular Institute
Cleveland Clinic is the national leader in caring for patients with cardiovascular disease. Cleveland Clinic heart, vascular and thoracic specialists offer established and innovative treatments, research and education. They coordinate care with referring physicians to ensure that every patient has the best outcome and experience.

Heart, vascular and thoracic care at Cleveland Clinic is centered at the Sydell and Arnold Miller Family Pavilion. In this advanced facility, 213 staff physicians, 110 residents and fellows, and 1,200 full-time nurses devote their full energies to cardiovascular medicine, thoracic and cardiovascular surgery, and vascular surgery services. Comprehensive care includes collaboration with 47 cardiothoracic anesthesiologists and the support of Cleveland Clinic’s 2,700 staff physicians in 120 medical and surgical specialties and subspecialties.
## Heart & Vascular Institute Overview

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Visits</td>
<td>404,395</td>
</tr>
<tr>
<td>Admissions</td>
<td>13,131</td>
</tr>
<tr>
<td>Beds</td>
<td>416</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Coronary Intensive Care</td>
<td>24</td>
</tr>
<tr>
<td>Heart Failure Intensive Care</td>
<td>10</td>
</tr>
<tr>
<td>Cardiac, Vascular and Thoracic Surgery Intensive Care</td>
<td>76</td>
</tr>
<tr>
<td>Private Patient Rooms</td>
<td>278</td>
</tr>
<tr>
<td>Same-Day Recovery</td>
<td>28</td>
</tr>
</tbody>
</table>

## Surgical Procedures

### Cardiac Surgery

<table>
<thead>
<tr>
<th>Service</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac Surgeries</td>
<td>4,148</td>
</tr>
<tr>
<td>Valve Surgeries</td>
<td>2,816</td>
</tr>
<tr>
<td>Coronary Artery Bypass Grafting (Isolated and Concomitant)</td>
<td>1,355</td>
</tr>
<tr>
<td>Surgeries for Hypertrophic Cardiomyopathy</td>
<td>183</td>
</tr>
<tr>
<td>Congenital Heart Surgeries (Adult and Pediatric)</td>
<td>757</td>
</tr>
<tr>
<td>Robotically Assisted Cardiac Surgeries</td>
<td>160</td>
</tr>
</tbody>
</table>

### Transplant Surgery

<table>
<thead>
<tr>
<th>Service</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Transplants</td>
<td>54</td>
</tr>
<tr>
<td>Lung Transplants</td>
<td>111</td>
</tr>
</tbody>
</table>

### Thoracic Surgery

<table>
<thead>
<tr>
<th>Service</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Thoracic Surgeries</td>
<td>1,380</td>
</tr>
<tr>
<td>Esophageal Surgeries</td>
<td>247</td>
</tr>
</tbody>
</table>

### Vascular Surgery

<table>
<thead>
<tr>
<th>Service</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vascular Surgeries (Open and Endovascular)</td>
<td>2,729</td>
</tr>
<tr>
<td>Venous Surgeries</td>
<td>302</td>
</tr>
<tr>
<td>Arteriovenous Access Surgeries</td>
<td>228</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. A complete list of these hospitals can be found in the Institute Locations section of this book, which begins on Page 108.
In 2011, patients traveled from all 50 states to Cleveland Clinic for their cardiovascular care.

Patients from 84 countries came to Cleveland Clinic for their cardiovascular care in 2011.

### Aorta Surgery
- Open Ascending Aorta and Aortic Arch Repairs: 816
- Open Descending Aorta and Thoracoabdominal Repairs: 110
- Open Abdominal Aortic Aneurysm Repairs: 59
- Endovascular Descending Aorta and Thoracoabdominal Repairs: 210
- Endovascular Abdominal Aortic Aneurysm Repairs: 87

### Cardiovascular Medicine Procedures
#### Interventional Cardiology
- Diagnostic Cardiac Catheterizations: 8,997
- Interventional Cardiac Procedures: 1,821
- Percutaneous Aortic Valvuloplasties: 202
- Percutaneous Mitral Valvuloplasties: 23
- Percutaneous Atrial Septal Defect and Patent Foramen Ovale Closures: 59

#### Vascular Intervention
- Interventional Carotid Procedures: 97
- Interventional Vascular Procedures: 1,005

#### Electrophysiology
- Electrophysiology Ablations: 1,370
  - Ablations for Atrial Fibrillation: 775
- Device Implants: 1,351
- Leads Extracted: 460

#### Diagnostic and Cardiac Imaging
- Echocardiograms*: 68,157
- Cardiac Computed Tomography (CT) Scans: 7,434
- Cardiac Magnetic Resonance Imaging (MRI) Scans: 4,876
- Nuclear Cardiology Tests
  - Tc-Myoview-Rest: 4,046
  - Tc-Myoview-Stress: 3,932
  - Rubidium Heart (PET): 469
  - FDG Heart (PET): 450
  - MUGA: 128
  - N-13 Ammonia Heart: 214
- Stress Tests: 6,152
Cleveland Clinic surgeons performed 12,169 cardiovascular and thoracic surgical procedures in 2011. This includes procedures at our main campus and Cleveland Clinic hospitals within the greater Cleveland area. For a complete list of these hospitals, please refer to the Institute Locations section that begins on Page 108 of this book.

The majority of surgical procedures performed in 2011 were cardiac surgery at Cleveland Clinic's Miller Family Heart & Vascular Institute at the main campus.
Open Heart Surgery Volume Comparisons (N = 4,740)

2009 – 2011

Cleveland Clinic is the national leader in cardiac surgery volumes. In 2011, Cleveland Clinic performed 32 percent more open heart surgeries than the next leading U.S. hospital.

Source: University HealthSystem Consortium (UHC) Comparative Database, 2011 discharges.

Cardiac Surgery Hospital Mortality (N = 4,148)

Main Campus

2011

Among the top U.S. hospitals for cardiac surgery, Cleveland Clinic's volume was the highest, with the best-quality outcomes (lowest O/E mortality ratio).

Source: University HealthSystem Consortium (UHC) Comparative Database, 2011 discharges.
Hospital Mortality – Isolated Procedures (N = 1,426)

2011

The observed mortality for all isolated procedures in 2011 was lower than the expected mortality, resulting in low O/E mortality ratios. Isolated procedures are those performed without any other surgical procedure.

O/E Ratio = 0.3 0.14 0.23 0


Abbreviations: CABG, coronary artery bypass graft.

Hospital Mortality – Combined Procedures (N = 347)

2011

Combined surgical procedures involve more than one treatment at the time of surgery and are generally more complex than isolated procedures. Despite the increased complexity, Cleveland Clinic had a low O/E mortality ratio in 2011 for combined procedures.

O/E Ratio = 0.09 0.32 0.46


Abbreviations: CABG, coronary artery bypass graft.
Main Campus and Other Cleveland Clinic Hospitals
2002 – 2011

Cleveland Clinic surgeons performed 6,605 vascular surgical procedures in 2011. This includes procedures at our main campus and Cleveland Clinic hospitals within the greater Cleveland area. For a complete list of these hospitals, please refer to the Institute Locations section that begins on Page 108 of this book.

General Thoracic Surgery Volume (N = 1,380)
2007 – 2011

Pulmonary procedures accounted for the majority of major thoracic surgical procedures at Cleveland Clinic in 2011. Our surgeons treat patients with a variety of conditions of varying complexity.

Major Thoracic Surgery by Type (N = 1,380)
2011

In 2011, Cleveland Clinic performed 1,380 thoracic surgeries.

Vascular Surgery Volume (N = 6,605)
Main Campus and Other Cleveland Clinic Hospitals
2002 – 2011
The hospital mortality average for vascular surgery at Cleveland Clinic (CC) from 2007 to 2011 was 2.16 percent. This is nearly three times lower than the adjusted average of 5.96 percent at national teaching hospitals.

The majority of vascular procedures in 2011 were performed using an endovascular approach. The use of endovascular surgery reduces patient morbidity and mortality and results in a shorter recovery time.

Hospital Mortality — Vascular Surgery

The hospital mortality average for vascular surgery at Cleveland Clinic (CC) from 2007 to 2011 was 2.16 percent. This is nearly three times lower than the adjusted average of 5.96 percent at national teaching hospitals.

Source: Solucient
**Cardiac Catheterization Laboratory Procedures (N = 10,818)**

Cleveland Clinic is a regional and national referral center for percutaneous coronary intervention (PCI). In 2011, we performed more than 10,000 procedures for patients with simple and complex ischemic disease.

Data comparisons represent Cleveland Clinic's outcomes with patients at hospitals included in the American College of Cardiology National Cardiovascular Data Registry (ACC-NCDR) Cath-PCI Registry for hospitals that perform > 500 PCIs/year. All comparison data are based on a one-year rolling average. Therefore, there may be differences compared with totals reported elsewhere in this book.

**Risk Factors Among Patients Undergoing PCI Procedures (N = 1,833)**

In many cases, patients who had PCI procedures at Cleveland Clinic in 2011 had more complex medical backgrounds than patients at comparable hospitals.

**Use of Adjunctive Medications Before and After PCI (N = 1,833)**

One of the ACC-NCDR key performance measures is the use of appropriate adjunctive medications before and after PCI procedures. Compared with the average high-volume interventional center, Cleveland Clinic exceeds the rate of administration for all these medications.
Patients who had PCI procedures at Cleveland Clinic in 2011 had fewer complications (mortality, major vascular complications) than patients at comparable hospitals.

The observed rates of mortality for patients who had PCI procedures at Cleveland Clinic in 2011 were lower than expected, resulting in a favorable O/E ratio.

The American College of Cardiology/American Heart Association (ACC/AHA) practice guidelines recommend PCI balloon inflation within 90 minutes of arrival in the emergency department (ED) for patients with ST-elevation myocardial infarction (STEMI). Early reperfusion reduces the risk of morbidity and mortality.
Surgical Treatment for Ischemic Heart Disease

**CABG Volume (N = 1,355)**

**2011**

In 2011, Cleveland Clinic performed 1,355 coronary artery bypass grafting (CABG) procedures. A total of 527 were isolated procedures (performed without any other operation), and 828 were performed in combination with another procedure.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated</td>
<td>527</td>
</tr>
<tr>
<td>CABG + Other</td>
<td>828</td>
</tr>
</tbody>
</table>

**CABG Volume, Primary and Reoperations**

**2011**

Primary procedures (patients’ first CABG) accounted for the majority of all CABG surgeries.

- **77% Primary Operations**
- **23% Reoperations**

**CABG + Other, Mortality**

**2011**

Cleveland Clinic’s mortality rate for patients who had CABG plus another procedure was less than half of the expected rate, despite the fact that nearly one quarter of all these operations were reoperations, which are generally more complex with increased risk.

Source: University HealthSystem Consortium 2011 discharges.
Ischemic Heart Disease (continued)

**Isolated CABG Procedures Mortality**

In 2011, Cleveland Clinic surgeons performed 527 isolated CABG procedures with lower-than-expected mortality.


**Isolated CABG Mortality – Primary and Reoperation**

Because of our expertise, we often receive referrals for reoperations. These are associated with greater morbidity and mortality than are primary procedures. Despite increased risks, overall mortality for isolated CABG remained low.

Source: University HealthSystem Consortium 2011 discharges.

---

**STS CABG Quality Ratings**

- **Overall**
- **Use of Internal Mammary Artery**
- **Medications**
- **Avoidance of Mortality**
- **Avoidance of Morbidity**

Cleveland Clinic is among the 15 percent of hospitals that achieved an overall three-star rating from The Society of Thoracic Surgeons (STS) for CABG surgery. The rating reflects the highest quality of cardiac surgery.

*Based on data comparisons from January 2011 through December 2011.*
Primary Isolated CABG: Age-Related Risk of Mortality

2011

Age contributes to the complexity of CABG surgical cases. The majority of patients who had primary isolated CABG surgery in 2011 at Cleveland Clinic were age 60 and older.

<table>
<thead>
<tr>
<th>Age</th>
<th>Observed Mortality (%)</th>
<th>Expected Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 50 years (N = 50)</td>
<td>0.0</td>
<td>1.0</td>
</tr>
<tr>
<td>50–59 years (N = 113)</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>60–69 years (N = 165)</td>
<td>0.6</td>
<td>1.2</td>
</tr>
<tr>
<td>70–79 years (N = 98)</td>
<td>1.0</td>
<td>2.7</td>
</tr>
<tr>
<td>≥ 80 years (N = 33)</td>
<td>0.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Total (N = 459)</td>
<td><strong>0.6</strong></td>
<td><strong>1.6</strong></td>
</tr>
</tbody>
</table>

Isolated CABG: Additional Outcomes

In addition to mortality, other outcomes for isolated CABG at Cleveland Clinic contributed to the achievement of a Three-Star STS quality rating.

Deep Sternal Wound Infection

2011

Throughout 2011, Cleveland Clinic maintained a 0 percent incidence of deep sternal wound infection following isolated CABG surgery.

**Ventilator Time > 24 Hours**

Cleveland Clinic continues to work toward reducing the number of patients who require a ventilator for more than 24 hours after isolated CABG surgery. Reduced ventilator time leads to better outcomes and increased patient satisfaction.


**In-Hospital Reoperation**

Cleveland Clinic’s rate of in-hospital reoperation after CABG surgery was consistently below the expected rate throughout 2011.


**Postoperative Stroke**

Cleveland Clinic continues to work toward reducing the incidence of stroke after isolated CABG surgery.

Postoperative Renal Failure

In 2011, we improved the rate of postoperative renal failure following CABG surgery.


Process Measures

Cleveland Clinic achieved and maintained 100 percent compliance with all Society of Thoracic Surgeons (STS) process measures in 2011. These include the use of a peri-operative beta blocker; beta blocker, statin, and aspirin at discharge; and use of an internal mammary artery during isolated CABG surgery.


Acute Myocardial Infarction (AMI) Appropriateness of Care – National Hospital Quality Measures

2010 – 2011

This composite metric, based on eight acute myocardial infarction hospital quality process measures developed by the Centers for Medicare and Medicaid Services (CMS), shows the percentage of patients who received all the recommended care for which they were eligible. Cleveland Clinic has set a target of UHC’s 90th percentile.

Source: University HealthSystem Consortium (UHC) Clinical Database. https://www.uhc.edu
Acute Myocardial Infarction (AMI) – National Hospital Quality Measures (continued)

The Centers for Medicare and Medicaid Services (CMS) calculates two AMI outcome measures: all-cause mortality and all-cause readmission rates. Each are based on Medicare claims and enrollment information. Cleveland Clinic’s performance appears below.

AMI All-Cause 30-Day Mortality (N = 385)
July 2008 – June 2011

<table>
<thead>
<tr>
<th>Percent</th>
<th>Cleveland Clinic</th>
<th>National Average*</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.0</td>
<td></td>
<td>15.5</td>
</tr>
</tbody>
</table>

AMI All-Cause 30-Day Readmission (N = 662)
July 2008 – June 2011

<table>
<thead>
<tr>
<th>Percent</th>
<th>Cleveland Clinic</th>
<th>National Average*</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.1</td>
<td></td>
<td>19.7</td>
</tr>
</tbody>
</table>

Source: [www.hospitalcompare.hhs.gov](http://www.hospitalcompare.hhs.gov)

Cleveland Clinic’s AMI risk-adjusted all-cause 30-day mortality rate is slightly below the national average; the difference is not statistically significant. Our AMI risk-adjusted readmission rate is higher than the national average; that difference is statistically significant. To reduce this rate, transition-of-care strategies are being developed and deployed at Cleveland Clinic. These include predischarge needs assessment, improved discharge processes (patient education, relay of discharge information to receiving providers) and postdischarge follow-up, including continued clinical management support.
Cardiac Rhythm Disorders

**EP Laboratory Procedures (N = 4,605)**

*2011*

Cleveland Clinic electrophysiologists use specialized approaches to diagnose and treat a wide variety of arrhythmias. In 2011, we performed more than 4,000 procedures. The total number of procedures includes some that are not detailed in the graph below.*

**Volume**

*Other procedures include EP Study, ICD Testing, Temporary Pacer, Loop Recorders, and EP Specials (endomyocardial biopsy, esophageal pacing, right heart catheterization, venography and other).*

Abbreviations: CRT, cardiac resynchronization therapy; CRT-D, cardiac resynchronization therapy-defibrillator; ICD, implantable cardioverter defibrillator; PVAI, pulmonary vein antrum isolation; VT, ventricular tachycardia.

**Pulmonary Vein Antrum Isolation (PVAI) Procedures**

Pulmonary vein antrum isolation (PVAI) essentially disconnects the pathway of the abnormal heart rhythm and prevents atrial fibrillation. A total of 6,488 ablations for atrial fibrillation were performed at Cleveland Clinic from 2004 through 2011.

**PVAI Volume**

*2011*

| PVAI | 775 |
Cardiac Rhythm Disorders (continued)

Success Rates of PVAI

Success is defined as a restored sinus rhythm without dependency on 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 atrial fibrillation (AF) and the presence or absence of underlying heart disease.

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

The success rate is lower for patients with persistent or long-standing persistent AF (65 percent 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 percent were arrhythmia-free while off AAD. Of the 27 patients who had late-recurrence AF and a repeat ablation, 74.1 percent were arrhythmia-free while off AAD at 17 months post-second ablation.


PVAI Complications

2011

In 2011, the overall risk of serious complications was 1.9 percent.*

<table>
<thead>
<tr>
<th>Complications</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pericardial Tamponade / Pericardiocentesis</td>
<td>4</td>
<td>0.5</td>
</tr>
<tr>
<td>Pericardial Tamponade / Surgical</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Transient Ischemic Attack (TIA)</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Cerebrovascular Accident (CVA)</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Arterial Dissection</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Pseudoaneurysm</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Pulmonary Edema</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Urinary Tract Infection (UTI) / Bacteremia</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Diaphragmatic Paralysis</td>
<td>2</td>
<td>0.3</td>
</tr>
<tr>
<td>Gastroparesis</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Pacemaker Lead Dislodged</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>1.9</td>
</tr>
</tbody>
</table>

The majority of patients who have a PVAI procedure at Cleveland Clinic return within 3 to 4 months for follow-up imaging to assess for PV stenosis. Because of the time from treatment to follow-up, at the time of publication of this book, we are unable to report the 2011 data for rates of PV stenosis. In 2010, we performed 693 PVAI ablation procedures. Three of these patients were treated for PV stenosis, which equates to an incidence of 0.43 percent.

*All percentages were rounded, resulting in a (-.2) difference in the total percentage of complications.
Cleveland Clinic’s Center for Atrial Fibrillation provides customized catheter-based treatment that incorporates comprehensive, state-of-the-art technology to effectively cure atrial fibrillation.

Ablation of Ventricular Tachycardia (N = 115)

2011

| Complete Success Rate* | 79% |

*All ventricular tachycardias were eliminated in 79 percent of patients, and the procedure was partially successful in another 15 percent. Partial success means at least one tachycardia was ablated in patients who had multiple tachycardias. A total of 6 percent of procedures were unsuccessful.

Atrial Fibrillation Surgical Procedure Volume (N = 404)

2011

In 2011, Cleveland Clinic cardiovascular surgeons performed 404 surgical procedures to treat atrial fibrillation (AF). These included minimally invasive “keyhole” and classic Maze procedures. The majority of these procedures were done in combination with other cardiac procedures. Overall hospital mortality was 1.2 percent (N = 5).

- **61%** AF + Valve Surgery (N = 244; Hospital Mortality, N = 1)
- **24%** AF + Valve Surgery + CABG (N = 97; Hospital Mortality, N = 2)
- **7%** AF + CABG (N = 29; Hospital Mortality, N = 0)
- **7%** AF + Other Procedures (N = 30; Hospital Mortality, N = 1)
- **1%** Isolated AF Procedures (N = 4; Hospital Mortality, N = 1)
**Device Implants Volume (N = 1,351)**

2011

<table>
<thead>
<tr>
<th>Year</th>
<th># Extraction Procedures</th>
<th># Leads Extracted</th>
<th>% Clinical Success*</th>
<th>% Major Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>270</td>
<td>460</td>
<td>100</td>
<td>0.0</td>
</tr>
<tr>
<td>2010</td>
<td>241</td>
<td>399</td>
<td>99</td>
<td>0.7</td>
</tr>
<tr>
<td>2009</td>
<td>263</td>
<td>443</td>
<td>98.1</td>
<td>1.1</td>
</tr>
<tr>
<td>2008</td>
<td>250</td>
<td>451</td>
<td>99.1</td>
<td>0.8</td>
</tr>
<tr>
<td>2007</td>
<td>249</td>
<td>445</td>
<td>99.8</td>
<td>0.4</td>
</tr>
<tr>
<td>2006</td>
<td>357</td>
<td>636</td>
<td>99.2</td>
<td>0.0</td>
</tr>
</tbody>
</table>

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

Electrophysiologists at Cleveland Clinic perform the greatest number of lead extractions in the world. Many of our patients have complex conditions that result in referral to our 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.

**Device Clinic Evaluations Volume (N = 30,513)**

2011

<table>
<thead>
<tr>
<th>Evaluation Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pacemaker Evaluations</td>
<td>14,668</td>
</tr>
<tr>
<td>ICD Evaluations</td>
<td>15,845</td>
</tr>
</tbody>
</table>

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

We use the MyChart® function in Epic, Cleveland Clinic’s electronic medical record system, to quickly notify patients of their device status.
Remote Device Evaluations Volume (N = 11,145)

<table>
<thead>
<tr>
<th>Year</th>
<th>Remote Pacemaker Transmissions</th>
<th>Remote ICD Transmissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>3,176</td>
<td>7,969</td>
</tr>
</tbody>
</table>

Evaluation of Patients with Syncope

Cleveland Clinic electrophysiologists and neurologists work collaboratively to evaluate patients with unexplained loss of consciousness (syncope). Evaluation includes blood volume studies, tilt table testing, hemodynamic testing, and heart rate variability (HRV) and autonomic reflex testing.

Volume

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tilt Table</td>
<td>800</td>
</tr>
<tr>
<td>Hemodynamic</td>
<td>600</td>
</tr>
<tr>
<td>Autonomic Reflex/HRV</td>
<td>400</td>
</tr>
<tr>
<td>Blood Volume</td>
<td>200</td>
</tr>
</tbody>
</table>
Valve Disease

In 2011, Cleveland Clinic surgeons performed 2,816 valve surgeries. This includes 2,030 primary operations and 786 reoperations. Cleveland Clinic continues to be the leader in the number of valve surgeries performed in the United States.

### Distribution of Isolated and Combined Valve Operations (N = 2,816) 2011

- **29.5%** Isolated Primary Valve Surgeries (N = 831)
- **42.5%** Combined Primary Valve Surgeries (N = 1,199)
- **11.3%** Isolated Valve Reoperations (N = 317)
- **16.7%** Combined Valve Reoperations (N = 469)

The majority of valve operations performed at Cleveland Clinic in 2011 were combined primary procedures. However, reoperations accounted for 28 percent of all valve surgeries. These procedures are typically more complex and challenging than primary procedures.
Cleveland Clinic recently received The Society of Thoracic Surgeons' (STS) prestigious three-star rating for aortic valve replacement. The rating is awarded to hospitals across the country that demonstrate the highest quality of cardiac surgery. Cleveland Clinic was awarded the rating based on data comparisons from January 2009 through December 2011.

Cleveland Clinic performs the largest number of aortic valve operations in the nation. In 2011, we performed 1,739 aortic valve operations. Ninety-one percent were valve replacements (N = 1,553), 5 percent were valve repairs (N = 101) and 4 percent were valve-sparing operations (N = 85).

Isolated Aortic Valve Replacement Mortality (N = 1,553)

The hospital mortality rate at Cleveland Clinic for patients who had an isolated aortic valve replacement in 2011 was 0.6 percent. This is significantly lower than The Society of Thoracic Surgeons’ (STS) benchmark of 3.5 percent. Hospital mortality rates for all other aortic valve replacement procedures were also lower than the STS benchmark.

Patients who had isolated aortic valve replacement surgery at Cleveland Clinic in 2011 had fewer complications than expected, according to The Society of Thoracic Surgeons’ (STS) benchmarks.

Mitral Valve Surgery Volume (N = 1,286)

Cleveland Clinic is the nation’s leader in mitral valve surgery volume. Our surgeons performed 1,286 mitral valve surgeries in 2011. A total of 870 (68%) were repairs and 416 (32%) were replacements.
Mitral Valve Surgery Volume – Repair vs. Replacement

2007 – 2011

Cleveland Clinic surgeons performed mitral valve repairs before it was the preferred treatment for patients with mitral valve disease. Valve repair, rather than replacement, is associated with better survival, improved lifestyle, better preservation of heart function, and lower risk of stroke and infection (endocarditis), and there is no need for anticoagulation therapy. The majority of mitral valve repairs at Cleveland Clinic are performed using a minimally invasive approach.

Primary Isolated Mitral Valve Surgery Hospital Mortality*

2011

In 2011, Cleveland Clinic had the country’s lowest mortality rate (0%) for primary isolated mitral valve repair. The mortality rate for patients who had a primary isolated mitral valve replacement was also well below The Society of Thoracic Surgeons’ (STS) benchmark.
Infective endocarditis is a life-threatening disease. It causes bacterial or fungal growths on the heart valves that can lead to perforation, rupture and subsequent valve regurgitation. Prompt diagnosis and treatment are critical. Cleveland Clinic surgeons treat a variety of patients with infective endocarditis, including those with advanced disease and prosthetic valve endocarditis.

In 2011, we performed 128 surgical procedures to treat infective endocarditis and maintained low mortality rates.

The majority (92.7%) of valve replacement procedures at Cleveland Clinic in 2011 involved bioprostheses (biologic tissue valves). Bioprostheses are preferred for most aortic and mitral valve procedures because they are durable and help most patients avoid lifelong anticoagulant therapy after surgery.
Many Cleveland Clinic patients with mitral valve stenosis are treated with percutaneous mitral valvuloplasty. The mortality rate is consistently 0 percent with this procedure, and patients experience a shorter recovery than those who have traditional surgery.

Robotically Assisted Valve Surgery (N = 160)

Cleveland Clinic performs more robotically assisted mitral valve surgeries than any major academic hospital in the United States.

Robotically Assisted Mitral Valve Repair Volume
2007 – 2011

Cleveland Clinic surgeons performed 160 robotically assisted mitral valve repairs in 2011.
Valve Disease (continued)

Valve Surgery Mortality

2011

Percent

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Observed</th>
<th>Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated AVR</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>AVR + CABG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolated MVR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MVR + CABG</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Isolated MV Repair</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MV Repair + CABG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Septal Myectomy</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Cleveland Clinic is the nation’s leader in valve surgery volume and quality. Compared with comparable hospitals, mortality rates for valve surgery are far lower.

Source: University HealthSystem Consortium (UHC) Comparative Database, January through November 2011 discharges.

Abbreviations: AVR, aortic valve replacement; CABG, coronary artery bypass grafting; MV, mitral valve; MVR, mitral valve replacement.

Percutaneous Valve Treatments

Cleveland Clinic remains dedicated to developing and using the best possible percutaneous methods to treat patients with valve disease. We are a national leader in these types of procedures.

Transcatheter Aortic Valve Replacement Volume and 30-Day Mortality

2007 – 2011

In 2011, Cleveland Clinic performed 105 percutaneous aortic valve replacements. The procedure, also referred to as transcatheter aortic valve replacement (TAVR), is FDA-approved to treat patients who meet specific criteria. Cleveland Clinic continues to participate in the Placement of Aortic Transcatheter Valves (PARTNER) trial to assess use of this procedure to treat other patient populations.

PARTNER II Trial

Cleveland Clinic is currently recruiting patients for the second arm of the Placement of Aortic Transcatheter Valves (PARTNER II) trial. This phase involves a randomized study of patients who have a moderately high risk associated with traditional surgery to treat severe aortic stenosis. Researchers are studying the use of percutaneous aortic valve replacement in this patient population. The procedure is done through the transfemoral or left subclavian artery or via a transapical approach. Research also includes an approach through the ascending aorta via a mini-J incision.
A total of 1,173 aortic surgeries were performed at Cleveland Clinic in 2011. The majority were open procedures to repair the ascending aorta/arch.

Cleveland Clinic uses a comprehensive, multidisciplinary approach to treat patients with aortic disease. Using conventional, minimally invasive and endovascular techniques, our surgeons treat all sections of the aorta, from the aortic valve to the blood supply to the pelvic vasculature.

In 2011, Cleveland Clinic performed 707 elective and emergency procedures to treat patients with problems of the ascending aorta and arch. Over time, the number of minimally invasive techniques performed has increased.

Cleveland Clinic’s Acute Aortic Treatment Center provides rapid transport, treatment and follow-up for patients with aortic dissection and impending aneurysm rupture. More than 4,500 patients were transported by Cleveland Clinic's Critical Care Transport team in 2011. More than one-third of the patients transported were treated in the Miller Family Heart & Vascular Institute, and many had acute aortic syndromes.

Call 877.379.CODE (2633) to expedite the transfer of patients with acute aortic syndromes.
Aortic Arch Aneurysm Repairs

In 2011, Cleveland Clinic surgeons performed 222 procedures to repair aortic arch aneurysms. Of these, 152 were elective and 70 were emergency surgeries. Aortic arch aneurysms are one of the most complicated conditions to treat. We use open and endovascular procedures that incorporate the use of fenestrations, branches or hybrid techniques. Despite the complexity of these procedures, the rate of death and stroke remained low.

Elective Arch Aneurysm Operations Volume, Stroke and Mortality
2007 – 2011

Emergency and Urgent Arch Aneurysm Operations Volume, Stroke and Mortality
2007 – 2011

3-D reconstruction of aortic arch aneurysm complicating a chronic aortic dissection.

3-D reconstruction of an aortic arch branch graft. There are branches for the innominate and left common carotid arteries. This technique allows treatment of very complex anatomy without opening the chest.
Cleveland Clinic surgeons are internationally recognized as some of the best-trained surgeons to treat patients with extensive thoracic aneurysmal disease. We use a comprehensive, multidisciplinary approach that allows each patient to receive the best possible individual treatment.

**Novel Technique for Chronic Extensive Dissection with Aneurysm**

Patients who survive an acute dissection that involves multiple segments of the aorta often require multiple major operations to eliminate the risk of rupture and death. A novel approach combining open “elephant trunk” repair with a fenestration procedure of the distal aorta provides a dependable endovascular solution to complete the repair in these complex cases.


**Coarctation and Late Complications in Adults and Adolescents**

A growing number of adults and adolescents are diagnosed with aortic coarctation after childhood. The number of patients who have late complications after treatment is also rising. Our multidisciplinary team has extensive experience using open, hybrid and endovascular procedures to treat patients in this population. During a 10-year study of 110 patients treated with these procedures, there was no incidence of hospital mortality.

Advances in the Genetic Understanding of Disease

Understanding rare aortic disease is a major priority for Cleveland Clinic’s Aortic Team. We have demonstrated 100 percent success in treating patients with Takayasu arteritis using an endovascular approach to place stent grafts. The stent grafts remained patent throughout the follow-up period. Newer endovascular techniques have allowed us to use alternate treatment methods that may lead to better outcomes than traditional, open surgery to treat patients with this complex disease.


Descending Thoracic Aortic (DTA) Disease

It is common for aortic dissections or ruptured aneurysms to occur in the descending thoracic aorta (DTA). These conditions require rapid evaluation and treatment. Cleveland Clinic surgeons treat patients with these conditions using both open and endovascular procedures.

DTA Repair Volume and Type (N = 612)

2008 – 2011

<table>
<thead>
<tr>
<th>Type</th>
<th>2008 – 2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Emergency</td>
<td>9% (N = 56)</td>
<td></td>
</tr>
<tr>
<td>Open Elective</td>
<td>22% (N = 137)</td>
<td></td>
</tr>
<tr>
<td>Endo Elective</td>
<td>47% (N = 287)</td>
<td></td>
</tr>
<tr>
<td>Endo Emergency</td>
<td>22% (N = 132)</td>
<td></td>
</tr>
</tbody>
</table>

From 2008 through 2011, Cleveland Clinic performed 612 DTA repairs. The majority of these procedures were endovascular repairs.

DTA Repair Hospital Mortality (N = 612)

2008 – 2011

Extensive experience with both open and endovascular treatment options for patients with descending thoracic aortic disease allows us to offer life-saving therapy to patients. This includes even those who require high-risk emergency treatment. For elective repairs, the mortality was low at 2.4 percent for open repairs and 2.8 percent for endovascular repairs in 2011.

Mortality (%)
Protection of Spinal Function

The repair of thoracoabdominal aneurysms has historically been associated with a risk of spinal cord injury or paralysis. We have worked to evolve our techniques to protect the spinal cord. In cases of thoracoabdominal aneurysm repair, this means frequently staging the repair so the impact on the spinal cord is gradual, rather than sudden. Our results to date show this approach is successful. The rate of spinal cord injury with this technique is 3.38 percent in all cases of thoracoabdominal aneurysms treated with endovascular devices. This rate is lower than that reported by other centers. We have also incorporated advanced techniques to protect the spinal cord during open thoracoabdominal aortic repairs. This includes adding papaverine to the intrathecal space during surgery, which helped reduce the rate of paraplegia to 3.6 percent.

Thoracoabdominal Aortic (TAA) Surgeries

Our surgeons use both open and endovascular procedures to treat patients with diseases of the thoracoabdominal aorta (TAA). These are the most challenging aortic procedures.

TAA Surgeries by Type
2008 – 2011

Crawford Classification of Aortic Aneurysms

Type I
Aneurysms involve most or all of the descending thoracic aorta to the level of the renal arteries.

Type II
Aneurysms involve most or all of the descending thoracic aorta, with abdominal extension to below the renal arteries.

Type III
Aneurysms involve the lower portion of the descending thoracic aorta, extending to the abdominal aorta below the level of the renal arteries.

Type IV
Aneurysms involve the upper half or all of the abdominal aorta.
Despite the complexity of TAAA surgery, the mortality rates at Cleveland Clinic remain low. We continue to make improvements through the use of multimodality approaches. In 2011, the mortality rate for endovascular branch vessel procedures was 2.8 percent. The rate for open elective repairs was 3.13 percent. Emergency repairs require open surgery. The mortality rate for these procedures was 5.26 percent.

Bifurcated-Bifurcated Device
Iliac aneurysms are common in patients with abdominal aortic aneurysms. This condition often limits the use of standard endografts for treatment. The goal of treatment with a bifurcated-bifurcated device is to eliminate the process of placing branched grafts into internal iliac arteries while allowing the preservation of blood flow to the pelvis.

Preserving pelvic blood flow is important because it contributes to spinal cord, buttock muscle and sexual function. Therefore, our patients have an improved quality of life after the repair.

Fewer components are needed to complete complex repairs when the bifurcated-bifurcated device is used. This results in a shorter operation and, ideally, a shorter recovery.
**AAA Screening**

Aneurysms can progress to a very advanced state without any symptoms. Often, they are diagnosed by accident. Because of this, many studies support population-based, one-time ultrasound screening for patients at high risk (usually those over age 65). Screening can detect the condition before it becomes fatal.

Cleveland Clinic’s dedication to the care of patients with aortic disease begins before diagnosis. Our new aneurysm screening program is designed to aid the treatment of patients with aortic aneurysms. In the near future, all patients who are treated at Cleveland Clinic for any medical condition will be screened for aneurysms. This proactive approach to care will help identify disease before it becomes critical and allow us to educate patients about their condition and treatment options.

**Abdominal Aortic Aneurysms (AAA)**

The abdominal aorta is second to the ascending aorta for aneurysm formation. Cleveland Clinic treats patients with AAAs both below and adjacent to the renal arteries. Our surgeons use both open and endovascular repair procedures.

---

**AAA Procedure Volume and Type (N = 800)**

Cleveland Clinic surgeons performed 800 AAA repair surgeries from 2008 through 2011. The majority of the procedures were endovascular repairs (endo and fenestrated grafts).

- **59%** Endovascular (N = 472)
- **41%** Open (N = 328)

---

**Open AAA Repair Volume and Type (N = 328)**

Cleveland Clinic surgeons performed 328 open AAA repairs from 2008 through 2011. Although open repairs are associated with greater risk, we maintain high volumes and excellent outcomes.

- **83%** Elective (N = 273)
- **17%** Emergency (N = 55)
Cleveland Clinic surgeons performed 472 endovascular AAA repair procedures in 2011. A total of 42 fenestrated grafts were used to repair juxtarenal aneurysms.

The mortality rate for elective AAA open repair was 4.35 percent in 2011. The mortality rate for emergency open repair of ruptured AAAs was 0 percent.

The mortality rate for elective endovascular AAA repair was 1.37 percent in 2011. The rate for emergency repairs was 0 percent.

Mortality rate for patients with juxtarenal aneurysms treated with fenestrated graft procedures (N = 42) from 2008 to 2011.
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. We are actively screening patients and their family members for genetic abnormalities associated with the disease.

**Patient Volume**

**2011**

<table>
<thead>
<tr>
<th>Total HOCM Outpatient Visits</th>
<th>1,561</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Patients with HOCM</td>
<td>358</td>
</tr>
</tbody>
</table>

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. We are actively screening patients and their family members for genetic abnormalities associated with the disease.

**Surgical Volume and Outcomes**

**2011**

<table>
<thead>
<tr>
<th>Surgeries for HOCM</th>
<th>183</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital Mortality</td>
<td>0%</td>
</tr>
</tbody>
</table>

Cleveland Clinic is a national leader for HOCM surgery. In 2011, our surgeons performed 183 procedures to treat patients with HOCM. The overall mortality rate was 0 percent.

**HOCM Surgeries**

**2007 – 2011**

During a septal myectomy, the surgeon removes septal muscle to widen the path for blood to leave the heart.
Surgical Procedure Distribution (N = 183)

2011

Septal myectomy is used to treat patients with HOCM. Patients who require this procedure often require additional procedures.

- **39%** Isolated Septal Myectomy (N = 72)
- **38%** Septal Myectomy + Valve +/- Other (N = 70)
- **9%** Septal Myectomy + Coronary Artery Bypass +/- Other (N = 17)
- **9%** Septal Myectomy + Other (N = 16)
- **4%** Septal Myectomy + Valve Surgery + Coronary Artery Bypass +/- Other (N = 7)
- **1%** Valve +/- Other (N = 1)

Septal Myectomy Mortality

2011

Cleveland Clinic has excellent outcomes for patients who have a septal myectomy. In 2011, the expected mortality rate was 2 percent; however, our surgeons achieved a 0 percent mortality rate for this procedure.

Papillary Muscle Reorientation/Realignment

2007 – 2011

Patients with HOCM who have outflow tract obstruction with minimal or mild hypertrophy may also have abnormal papillary muscle function. Cleveland Clinic surgeons use various techniques to repair the mitral valve and correct the condition. One technique, developed at Cleveland Clinic, involves reorienting papillary muscles that are abnormally positioned or excessively mobile.


**Congenital Heart Disease**

About 1 in 120 babies born each year in the United States has a congenital heart defect. One million people in the United States have congenital heart disease. In some cases, the disease is life-threatening at birth. However, some cases are not discovered for years. Cleveland Clinic has expertise in the diagnosis and treatment of patients with all forms of congenital heart disease. The newly opened Special Delivery Unit allows patients diagnosed in utero with complex heart conditions to receive immediate treatment after birth. The department is focused on achieving excellent outcomes in a family-centered care setting.

**Adult Congenital Heart Disease Volume**

**2011**

The Adult Congenital Heart Disease Center offers a collaborative approach to treatment. Cardiologists who specialize in pediatric care, adult care, intervention and cardiovascular surgery work together to create individual, expert treatment plans and care. In 2011, we saw 1,401 patients, including 460 new referrals.

### Percutaneous Interventional Procedures for Adult Congenital Heart Disease

**Volume and Outcomes**

**2011**

A total of 214 adult patients with congenital heart disease received interventional treatment in 2011. Although many of these cases were complex, we achieved a 100 percent success rate and 0 percent mortality.

<table>
<thead>
<tr>
<th>Total Adult Congenital Heart Disease Patient Visits</th>
<th>1,401</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Referral Visits for Adult Congenital Heart Disease</td>
<td>460</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adult Congenital Cases</th>
<th>214</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complex Congenital Cases</td>
<td>119</td>
</tr>
<tr>
<td>Complex Congenital Interventions</td>
<td>37</td>
</tr>
<tr>
<td>Success Rate</td>
<td>100%</td>
</tr>
<tr>
<td>30-Day Mortality</td>
<td>0%</td>
</tr>
</tbody>
</table>

### Percutaneous Closure Procedures

**Volume and Outcomes**

**2011**

In 2011, we performed 77 percutaneous closure procedures. The success rate was 99 percent with 0 percent mortality.

<table>
<thead>
<tr>
<th>Percutaneous ASD Closures</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percutaneous PFO Closures</td>
<td>52</td>
</tr>
<tr>
<td>Successful Repair*</td>
<td>99%</td>
</tr>
<tr>
<td>30-Day Mortality</td>
<td>0%</td>
</tr>
<tr>
<td>Patients Requiring Repeat Procedure</td>
<td>0%</td>
</tr>
</tbody>
</table>

*Based on one complication, including stroke, myocardial infarction or need for surgery. Abbreviations: ASD, atrial septal defect; PFO, patent foramen ovale.
Adult Congenital Heart Surgery Mortality

2011

Cleveland Clinic’s Department of Congenital Heart Surgery offers a full range of comprehensive surgical treatments for adults with congenital defects. In 2011, our mortality rate was 0.2 percent, which is well below the expected rate for these procedures.

Pediatric Congenital Surgery Volume and Type (N = 135)

2011

In 2011, Cleveland Clinic surgeons performed 135 pediatric congenital surgeries of varying complexity. The procedures within the majority “other” category include coarctation repair, truncus arteriosus repair, etc.

We continue our commitment to innovation in heart failure and transplant care. In 2011, we successfully implanted three Berlin Heart EXCOR® ventricular assist devices (Berlin Heart GmbH, Berlin) as a bridge to transplant for children with life-threatening conditions.

Abbreviations: ASD, atrial septal defect; AV, atrioventricular; PDA, patent ductus arteriosus; TOF, tetralogy of Fallot; VSD, ventricular septal defect.
Pediatric Congenital Heart Surgery – Mortality

2011

In 2011, the rates of mortality for pediatric patients with congenital heart disease who had surgery were lower than expected. We continue to strive for the lowest possible mortality rates for all patients.

Source: University HealthSystem Consortium Discharges 2011

Repair of Sinus Venosus ASD with Anomalous Pulmonary Veins

Cleveland Clinic surgeons have developed a new technique to treat patients with sinus venosus atrial septal defect with anomalous pulmonary veins. A total of 32 patients have undergone this procedure since 2000.
Treatment of a Coronary Fistula

Injection to the right coronary artery. This shows blood flow diverted to a fistula just proximal to the opening of the coronary artery from the aorta. It is draining to the pulmonary artery.

A guide wire is advanced into the fistula through a guide catheter.

A telescoping technique is used to maintain a stable position so the occlusion device can be safely deployed.

The AMPLATZER™ Vascular Plug II (arrow) is deployed in the fistula.

Within seconds, the fistula is occluded and no flow is seen beyond the device (arrow).

After the intervention, reinjection of the right coronary artery demonstrates that flow remains normal in the right coronary artery and that blood flow is no longer being diverted in the direction of the fistula.
Pericardial Disease

Pericardial Disease: Patient Volume
2007 – 2011

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 is a multidisciplinary specialty treatment group dedicated to the diagnosis and treatment of patients with acute, recurrent and constrictive pericarditis. In 2011, we saw 1,016 patients.

Pericardial Disease Syndromes in Outpatient Clinic Volume, New and Consult (N = 430)
2011

The majority of patients seen in 2011 at Cleveland Clinic’s Center for the Diagnosis and Treatment of Pericardial Diseases had recurrent pericarditis. A total of 55 percent of pericardial syndromes were associated with pericardial effusion.
Pericardial Disease Etiology

2011

The most common cause for pericarditis in 2011 was idiopathic in nature.

<table>
<thead>
<tr>
<th>Etiology</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idiopathic</td>
<td>67%</td>
<td>298</td>
</tr>
<tr>
<td>Postoperative Cardiac Surgery</td>
<td>22%</td>
<td>93</td>
</tr>
<tr>
<td>Other</td>
<td>5%</td>
<td>21</td>
</tr>
<tr>
<td>Viral</td>
<td>4%</td>
<td>20</td>
</tr>
<tr>
<td>Autoimmune</td>
<td>2%</td>
<td>7</td>
</tr>
</tbody>
</table>

Pericardial Procedures (N = 136)

2011

Pericardial window surgery accounted for the majority of pericardial procedures in 2011. The procedure involves making an opening in the pericardium through a small chest incision. The fluid is drained and a diagnosis can be made. Pericardiectomy is the removal of a portion or all of the pericardium.

Pericardiocentesis is used to drain large pericardial effusions. This percutaneous procedure is used for patients whose condition develops postoperatively or from a viral or idiopathic cause. The procedure is guided by echocardiography, which helps improve outcomes.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Percentage</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Window</td>
<td>43%</td>
<td>58</td>
</tr>
<tr>
<td>Pericardiectomy</td>
<td>29%</td>
<td>40</td>
</tr>
<tr>
<td>Pericardiocentesis</td>
<td>28%</td>
<td>38</td>
</tr>
</tbody>
</table>
The Cardiac Transplant Program at Cleveland Clinic continues to be the leading center in Ohio and among the largest in the United States.

**Heart Transplant Volume**
*July 2007 – June 2011*

Cleveland Clinic performed 54 heart transplants in 2011.

**Heart Transplant Patient Survival**

The survival rates among patients who have heart transplants at Cleveland Clinic exceeds the expected rates. Of the 150 transplant centers in the United States, Cleveland Clinic is one of only three that had better-than-expected one-year survival rates in 2011.

*Expected based on risk adjustment*

Source: Scientific Registry of Transplant Recipients. Center and OPO-Specific Reports, March 2012. Ohio, Heart Centers, Cleveland Clinic. Table 11.

[www.srtr.org](http://www.srtr.org)
**Ventricular Assist Device Volume**  
*2007 – 2011*

Mechanical circulatory support (MCS) devices are used in patients with heart failure to preserve heart function until transplantation (bridge-to-transplant) or as a final treatment option (destination therapy). Cleveland Clinic has more than 20 years of experience with MCS devices for both types of therapy.

**LVAD In-Hospital Mortality**  
*2007 – 2011*

Cleveland Clinic continues to make improvements to reduce mortality rates among patients who are placed on mechanical circulatory support. The mortality rate among patients who have a left ventricular assist device (LVAD) has been drastically reduced over the past five years.

**VAD Mortality**  
*2011*

The mortality rate among Cleveland Clinic patients placed on ventricular assist devices (VADs) was much lower than expected in 2011.

Source: University HealthSystem Consortium (UHC) Comparative Database, January through November 2011 discharges.
Heart Failure – National Hospital Quality Measures

This composite metric, based on four heart failure hospital quality process measures developed by the Centers for Medicare and Medicaid Services (CMS), shows the percentage of patients who received all the recommended care for which they were eligible. Cleveland Clinic has set a target of UHC’s 90th percentile.

Heart Failure Appropriateness of Care

2010 – 2011

<table>
<thead>
<tr>
<th>Percent</th>
<th>Cleveland Clinic, 2010 (N = 1,194)</th>
<th>Cleveland Clinic, 2011 (N = 1,163)</th>
<th>UHC Top Decile, 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>93.9</td>
<td></td>
<td>96.9</td>
<td>99.2</td>
</tr>
</tbody>
</table>

Source: University HealthSystem Consortium (UHC) Clinical Database
[https://www.uhc.edu](https://www.uhc.edu)
Heart Failure – National Hospital Quality Measures (continued)

The Centers for Medicare and Medicaid Services (CMS) calculates two heart failure outcome measures: all-cause mortality and all-cause readmission rates, each based on Medicare claims and enrollment information. Cleveland Clinic’s performance appears below.

Heart Failure All-Cause 30-Day Mortality (N = 762)  
July 2008 – June 2011

Heart Failure All-Cause 30-Day Readmission (N = 1,029)  
July 2008 – June 2011

Cleveland Clinic’s heart failure risk-adjusted 30-day mortality rate is below the national average; the difference is statistically significant. Our heart failure risk-adjusted readmission rate is higher than the national average; that difference is also statistically significant. To further reduce this rate, a multidisciplinary team was tasked with improving transitions from hospital to home or post-acute care facility. Specific initiatives have been implemented in each of these focus areas: communication, education and follow-up.

* Source: hospitalcompare.hhs.gov
Cleveland Clinic surgeons transplanted 111 lungs in 2011. Our Lung and Heart-Lung Transplant Program is the leader in Ohio and among the best programs in the country.

**Lung Transplant Procedures**

**2007 – 2011**

<table>
<thead>
<tr>
<th>Year</th>
<th>Liver-Lung</th>
<th>Heart-Lung</th>
<th>Double Lung</th>
<th>Single Lung</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>40</td>
<td>26</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2008</td>
<td>80</td>
<td>40</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2009</td>
<td>120</td>
<td>80</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2010</td>
<td>120</td>
<td>80</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2011</td>
<td>120</td>
<td>80</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Primary Disease of Lung Transplant Recipients (N = 101)**

**July 2010 – June 2011**

- **53.5%** Idiopathic Pulmonary Fibrosis (N = 54)
- **26.7%** Emphysema/Chronic Obstructive Pulmonary Disease (N = 27)
- **9.9%** Cystic Fibrosis (N = 10)
- **6.9%** Idiopathic Pulmonary Arterial Hypertension (N = 7)
- **3.0%** Other (N = 3)

Source: Scientific Registry of Transplant Recipients. March 2011. Ohio, Lung Centers, Cleveland Clinic. Table 7
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 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 mortality rate among Cleveland Clinic patients waiting for a lung transplantation is lower than expected.

The difference between observed and expected mortality is not statistically significant.

* Expected survival rate based on risk adjustment. Statistically significant. Source: Scientific Registry of Transplant Recipients. March 2012, Ohio, Lung Centers, Cleveland Clinic. Table 3. srtr.org
In 2011, 98% of venous duplex ultrasound studies were read in 24 hours; 100% of all other vascular studies were finalized within 48 hours.

Lower Extremity Interventional Procedures
Cleveland Clinic’s team of vascular surgeons and interventional cardiologists perform a variety of procedures to treat patients with peripheral artery conditions. They are skilled at angioplasty, atherectomy, stenting, thrombectomy and thrombolysis.

<table>
<thead>
<tr>
<th></th>
<th>2011 Volume</th>
<th>2011 30-Day Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Bypass</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thrombectomy</td>
</tr>
<tr>
<td>Angioplasty</td>
<td>451</td>
<td>0%</td>
</tr>
<tr>
<td>Atherectomy</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>Stenting</td>
<td>260</td>
<td></td>
</tr>
<tr>
<td>Thrombolysis</td>
<td>91</td>
<td></td>
</tr>
</tbody>
</table>

Lower Extremity Surgery Volume and Mortality (N = 303)
A total of 229 lower extremity bypass surgeries were performed in 2011. The 30-day mortality rate was 0 percent. Cleveland Clinic’s vascular surgeons have expertise in this area and strive to use autologous vein grafts.

<table>
<thead>
<tr>
<th></th>
<th>2011 Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bypass</td>
<td>229</td>
</tr>
<tr>
<td>Thrombectomy</td>
<td>74</td>
</tr>
</tbody>
</table>

Noninvasive Vascular Lab Ultrasound Study Distribution (N = 36,775)
2011
The Noninvasive Vascular Laboratory provides service seven 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 2011, 36,775 vascular lab studies were performed.

- 47% Venous Duplex (N = 17,284)
- 36% Arterial Duplex (N = 13,239)
- 17% Physiologic Testing (N = 6,252)

All Cleveland Clinic vascular lab technologists are certified registered vascular technologists (RVTs). This exemplifies our commitment to quality patient care. Each year, we perform a high volume of ultrasounds.
Fibromuscular Dysplasia

Fibromuscular dysplasia (FMD) is a vascular condition in which there is abnormal cell growth in the walls of medium- and large-sized 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. We conduct research to better understand the condition and treatment options. In 2011, a total of 209 patients seen in the program had a primary diagnosis of FMD, and 177 patients had a secondary diagnosis of FMD.

Fibromuscular Dysplasia – Patient Volume
2007 – 2011

Lower Extremity Wound Clinic Volume
2007 – 2011

In 2011, a total of 1,381 patients were treated in the Lower Extremity Wound Clinic.

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. In 2011, a total of 1,914 patients with a primary thrombosis diagnosis were seen at Cleveland Clinic’s main campus.
The vascular medicine physicians and vascular surgeons at Cleveland Clinic use a variety of methods to treat patients with venous disease.

**Deep Vein Thrombosis (DVT)**

Patients with deep vein thrombosis (DVT) are usually treated with long-term anticoagulation medication. If patients cannot take Coumadin®, we use newer drugs to prevent clot formation. In cases of recurrent episodes of DVT, our specialists assess for clotting abnormalities. A DVT can cause long-term complications. Studies show that early removal of clots, be it chemical or mechanical, decreases these long-term problems. Cleveland Clinic relies heavily on thrombolysis with or without mechanical thrombectomy to treat patients with DVT and improve outcomes.

**Varicose Veins**

The most common venous disorder is varicose veins. Treating patients with this condition includes conservative therapy with support stockings, skin care and a regular walking program. However, some patients require careful assessment if this therapy is unsuccessful.

Our comprehensive examination helps determine the exact venous abnormalities, which allows for the best plan of care. This assessment includes duplex ultrasound in the Noninvasive Vascular Laboratory. Treatment depends on the underlying pathology and can include sclerotherapy, endovenous ablation with radiofrequency or laser energy sources, stab excision of varicosities and ligation of saphenous veins.

**Endovenous Ablation Procedure**

Endovenous ablation is the preferred treatment for patients with valvular incompetence of the greater saphenous vein. It involves ablation of the diseased vein through the application of radiofrequency or laser energy. The procedure is minimally invasive and causes less pain and bruising than vein stripping. This leads to improved outcomes.

**In 2011,** 96% of venous duplex examinations for DVT were interpreted and posted to the electronic medical record in final form within 24 hours of the study date.

**87%**

The success rate for resolution of DVT among patients with DVT who had a vascular procedure.

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Cerebrovascular Disease

More than half of all temporary and permanent strokes are caused by carotid artery stenosis. The risk of carotid disease is higher in patients who have hypertension, coronary artery disease and peripheral artery disease. Early diagnosis with vascular ultrasound and disease management with medication, including antiplatelet and antihypertensive agents, can reduce this risk. Cleveland Clinic uses the latest technology and methods to care for patients with cerebrovascular disease. We have specialized ultrasound laboratories and offer advanced medical therapy, open carotid surgery and minimally invasive carotid artery stenting (CAS) procedures.

**Cerebrovascular Disease Treatment Mortality**

<table>
<thead>
<tr>
<th>Percent</th>
<th>Carotid Stenting</th>
<th>Endarterectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

The mortality rate for patients treated for cerebrovascular disease at Cleveland Clinic’s main campus was below the expected rate.

Source: University HealthSystem Consortium (UHC) Comparative Database, 2011 discharges.

**Procedural Complications***

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>MI (%)</th>
<th>Stroke (%)</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carotid Stenting</td>
<td>477</td>
<td>0.4</td>
<td>2.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Diagnostic Angiograms</td>
<td>728</td>
<td>0.3</td>
<td>0.7</td>
<td>0.1</td>
</tr>
<tr>
<td>Carotid Endarterectomy</td>
<td>699</td>
<td>1.7</td>
<td>2.1</td>
<td>0.7</td>
</tr>
</tbody>
</table>

*All procedures performed at Cleveland Clinic’s main campus

Cleveland Clinic uses state-of-the-art imaging with 3-D CAT scan angiography and biplanar fluoroscopic imaging to diagnose and treat patients with a wide range of cerebrovascular disease. These include carotid dissections, aneurysms and atherosclerotic disease. We participate in all national clinical trials to evaluate medical, surgical and percutaneous treatment of atherosclerotic and dysplastic diseases of the carotid and subclavian arteries. Our surgeons routinely perform cerebrovascular debranching to enhance the use of minimally invasive treatment of thoracic aortic aneurysms and dissections (Thoracic Endovascular Aortic Repair, or TEVAR).
Cleveland Clinic thoracic surgeons specialize in the diagnosis and surgical treatment of diseases of the lung and esophagus, including lung and esophageal cancer, lung failure, swallowing disorders and airway disease. Our staff offers a broad range of services, from the latest screening techniques to the most advanced minimally invasive surgical procedures.

**General Thoracic Surgery Volume and Mortality**

In 2011, Cleveland Clinic thoracic surgeons performed 1,380 procedures. The mortality rate was 2 percent.
Pulmonary procedures accounted for the majority of major thoracic surgical procedures at Cleveland Clinic in 2011. Our surgeons treat patients with a variety of conditions of varying complexity.

### Major Thoracic Surgery by Type (N = 1,380)

#### 2011

- **39%** Pulmonary (N = 536)
- **18%** Esophagus (N = 248)
- **15%** Pleura (N = 207)
- **10%** Mediastinum/Diaphragm (N = 138)
- **10%** Other (N = 143)
- **8%** Lung Transplant (N = 108)

Cleveland Clinic performed 282 pulmonary resections in 2011 and maintained a low rate of mortality.

### Pulmonary Resection Volume and Mortality

Cleveland Clinic performed 282 pulmonary resections in 2011 and maintained a low rate of mortality.
In 2011, the most common procedure was video-assisted wedge. Our surgeons perform a variety of less invasive, video-assisted procedures, which account for half of our pulmonary resections. They are also performing an increasing number of anatomic lung resections using minimally invasive techniques.

Cleveland Clinic’s multidisciplinary care model results in shorter length of stay for patients.
Stage-Specific Anatomic Resection: Stage I VATS vs. Open
2009 – 2011

Major Pulmonary Resections Operative Mortality
2007 – 2011

Postoperative Length of Stay > 14 days for Lobectomy, July 2008 – June 2011

<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>238</td>
<td>3.4%</td>
<td>4.0% (12.4%, 6.1%)</td>
<td>0.874 (0.44, 1.12)</td>
</tr>
</tbody>
</table>

*University HealthSystem Consortium (UHC) Comparative Database, 2011 discharges.

Major esophageal surgery includes resections for cancer and reoperative surgery for motility and reflux disorders. In 2011, we performed 247 esophageal operations with a low mortality of 2 percent.

When possible, lobectomy is performed using a minimally invasive technique and video assistance to allow patients to leave the hospital sooner and return to work earlier.


<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>137</td>
<td>25.5%</td>
<td>23.6% (17.5%, 30.5%)</td>
<td>0.88 (0.65, 1.13)</td>
</tr>
</tbody>
</table>

Cleveland Clinic

Min 0.47
25th 0.92
Median 1.00
75th 1.23
Max 2.00

= STS standardized incidence ratio


Distribution of Esophageal Surgeries by Indication (N = 247)

2011

32% Cancer (N = 80)
31% Reflux (N = 76)
28% Other (N = 69)
9% Achalasia (N = 22)

Our surgeons manage high volumes of both benign and malignant esophageal conditions.
2011 Volume

<table>
<thead>
<tr>
<th>Prevention Outpatient Visits</th>
<th>7,239</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I Rehab</td>
<td>8,976</td>
</tr>
<tr>
<td>Phase II Rehab</td>
<td>4,215</td>
</tr>
<tr>
<td>Phase III Rehab</td>
<td>3,524</td>
</tr>
</tbody>
</table>

The Center for Preventive Cardiology and Rehabilitation at Cleveland Clinic provides patients with a comprehensive assessment to identify traditional and emerging nontraditional cardiovascular risk factors. We collaborate with referring physicians to create individualized treatment plans. Patients typically have a limited number of visits in the center 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 and had at least two follow-up visits within one year. The time between visits varied from patient to patient.

**Primary Prevention, Statin-Tolerant Adults (N = 715)**

**2006 – 2011**

<table>
<thead>
<tr>
<th>LDL Value</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>111.5 mg/dL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd Follow-up</td>
<td>81 mg/dL</td>
<td>62 mg/dL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Secondary Prevention, Statin-Tolerant Adults (N = 301)**

**2006 – 2011**

<table>
<thead>
<tr>
<th>LDL Value</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>82 mg/dL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd Follow-up</td>
<td>62 mg/dL</td>
<td>50 mg/dL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**LDL Levels Among Statin-Intolerant Adults**

Patients referred to the prevention clinic who could not tolerate statins still experienced reductions in LDL levels. Patients had at least two follow-up visits within a year.

**Primary Prevention, Statin-Intolerant Adults (N = 152)**

2006 – 2011

**LDL Value**

- **Baseline**: 148 mg/dL
- **2nd Follow-up**: 99 mg/dL

**Secondary Prevention, Statin-Intolerant Adults (N = 96)**

2006 – 2011

**LDL Value**

- **Baseline**: 129.5 mg/dL
- **2nd Follow-up**: 82 mg/dL
Preventive Cardiology and Rehabilitation (continued)

Blood Pressure Among Primary and Secondary Prevention Patients (N = 834)

2011

Patients who were seen in the prevention clinic for both primary and secondary prevention experienced reductions in blood pressure. All patients had at least two follow-up visits within a year.

<table>
<thead>
<tr>
<th>Value (mg/dL)</th>
<th>Baseline</th>
<th>2nd Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systolic</td>
<td>124</td>
<td>122</td>
</tr>
<tr>
<td>Diastolic</td>
<td>78</td>
<td>72</td>
</tr>
</tbody>
</table>

The Weigh to a Healthy Heart

The Weigh to a Healthy Heart is a comprehensive 11-week weight loss program designed to help prevent cardiovascular disease. The program includes 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 2011, patients who attended more than 75 percent of the classes lost an average of 7.1 pounds. Those who attended fewer than 75 percent of the classes lost an average of 4 pounds.

Median Weight Loss over 11 Weeks

<table>
<thead>
<tr>
<th>Year</th>
<th>Weight Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>8.2 pounds</td>
</tr>
<tr>
<td>2011</td>
<td>5 pounds</td>
</tr>
</tbody>
</table>

Shared Medical Appointments

include groups of six to eight patients with similar health concerns. The group meets with a dietitian and nurse practitioner during one appointment. The visit addresses multiple needs, and patients receive personalized dietary counseling and group interaction and support.
**HbA₁c Levels Among Patients with Diabetes (N = 239)**

2011

Patients seen in the prevention clinic who had diabetes reduced HbA₁c levels during the course of their treatment. All patients were seen at baseline and had at least two follow-up visits within a year.

---

**Exercise Prescriptions**

2005 – 2011

Cleveland Clinic’s exercise prescriptions are designed to help patients start an exercise program. The prescription is written after the patient’s fitness level is determined. It provides the information about the recommended frequency, intensity, type and length of exercise sessions.
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 = 278)

2011

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 percent. The average predicted reduction in mortality for patients in the program based on improvement in functional capacity (METs) was approximately 15 percent.

Data represent all cardiac rehab patients with both entry and exit visits in 2011.

Improvement in Quality of Life Assessment (N = 278)

2011

Quality of life (QOL) is measured using the 36-item short-form health survey (SF-36®) Health Status Survey. This is a validated QOL measure to track overall wellness of patients in cardiac rehabilitation. Patients who completed the program experienced improved physical and emotional QOL.
**Cardiac Rehabilitation**

**Improvement in Systolic Blood Pressure (SBP) (N = 278)**

2011

Among patients who completed the Cardiac Rehabilitation Program, 86 percent achieved normal blood pressure (< 140/< 90 mm Hg). The average improvement was -10 mm Hg.

Data represent all cardiac rehab patients with both entry and exit visits in 2011.

**Cardiac Rehabilitation**

**Improvement in Weight (N = 278)**

2011

Patients who completed the Cardiac Rehabilitation Program lost an average of 4.5 pounds.

Data represent all cardiac rehab patients with both entry and exit visits in 2011.
Anesthesia

Cardiothoracic anesthesia (CTA) is an integral part of Cleveland Clinic’s open heart surgery program. In 2011, we continued to make improvements that have a positive effect on patient outcomes and the success of the program.

**Time Spent on Ventilator After CABG Surgery**

2010 – 2011

Cleveland Clinic continues to make improvements in the time patients remain on a ventilator after coronary artery bypass grafting (CABG) surgery. Shorter ventilator times are associated with improved quality of care and increased patient comfort and satisfaction.
Postoperative Blood Glucose Levels

We continue to work toward achieving 100 percent compliance with the Joint Commission’s measures for assessing postoperative blood glucose levels.

Postoperative 6 a.m. Glucose Readings

2011 – 2012

Central Line-Associated Bloodstream Infection

2011 – 2012

Our efforts continue to reduce the incidence of central line-associated bloodstream infection (CLABSI), which can contribute to increased length of stay with higher associated medical costs.
National Surgical Quality Improvement Program

The American College of Surgeons’ National Surgical Quality Improvement Program (NSQIP) objectively measures and reports risk-adjusted surgical outcomes based on a defined sampling and abstraction methodology. The outcome data below reflect Cleveland Clinic’s surgical cases between July 1, 2010, and June 30, 2011.

Vascular Surgery 30-Day Mortality and Morbidity (N = 439)

July 2010 – June 2011

Vascular surgery mortality was lower than expected, and morbidity was higher than expected; the differences were not statistically significant.

Vascular Surgery Complications

July 2010 – June 2011

Vascular surgery-associated cardiac events and pneumonia were higher than expected; the difference between observed and expected rates for pneumonia was statistically significant. Vascular surgery surgical site infections and urinary tract infections were lower than expected; the difference between observed and expected rates for urinary tract infections was statistically significant.
Surgical Care Improvement Program (SCIP) – Appropriateness of Care

This composite metric, based on 10 hospital surgical quality process measures developed by the Centers for Medicare and Medicaid Services (CMS), shows the percentage of patients who received all the recommended care for which they were eligible.

Surgical Appropriateness of Care

2010 – 2011

Cleveland Clinic has set a target of UHC’s 90th percentile, and results are trending positively.

* Source: University HealthSystem Consortium (UHC) Clinical Database
https://www.uhc.edu

Cleveland Clinic has set a target of UHC’s 90th percentile, and results are trending positively.
Cleveland Clinic is dedicated to delivering excellent clinical outcomes and the best possible experience for our patients and their families. Patient feedback is critical in driving priorities and assessing results. Based on this feedback, Cleveland Clinic's Office of Patient Experience implements training programs to improve service and communication as well as educational initiatives to help patients understand what to expect when they are in our care.

**Outpatient – Miller Family Heart & Vascular Institute**

**Overall Rating of Outpatient Care and Services**

2010 – 2011

Source: Press Ganey, a national hospital survey vendor
Likelihood of Recommending Outpatient Care Provider
2010 – 2011

Source: Press Ganey, a national hospital survey vendor

Rating of Outpatient Provider
2010 – 2011

Source: Press Ganey, a national hospital survey vendor
The Centers for Medicare and Medicaid Services (CMS) 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 hospitalcompare.hhs.gov.

### HCAHPS Overall Assessment
#### 2010 – 2011

<table>
<thead>
<tr>
<th>Percent</th>
<th>Rate Hospital % 9 or 10 (0 – 10 scale)</th>
<th>Would Recommend % “definitely yes”</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 (N = 4,184)</td>
<td>84%</td>
<td>87%</td>
</tr>
<tr>
<td>2011 (N = 4,079)</td>
<td>87%</td>
<td>90%</td>
</tr>
</tbody>
</table>

Source: Press Ganey, a national hospital survey vendor
HCAHPS Domains of Care
2010 – 2011

Source: Press Ganey, a national hospital survey vendor
In 2011, the Global Cardiovascular Innovation Center (GCIC) awarded $3.3 million in commercialization funding to eight companies. In total, we have awarded more than $18 million to support 54 companies and projects. The GCIC portfolio companies continue to report significant growth. They have created more than 400 jobs and secured more than $300 million in outside funding. The 50,000-square foot GCIC incubator facility (pictured) is home to CCIC and GCIC as well as 24 young companies that are developing innovative healthcare products and services.

Cleveland Clinic Innovation Center

Cleveland Clinic Innovation Center (CCIC) is Cleveland Clinic’s technology commercialization arm. Our mission is to “benefit the sick through the broad and rapid deployment of Cleveland Clinic technology.” The center facilitates innovation, creates spin-off companies, licenses technology, secures resources and establishes strategic collaborations with corporate partners.
Strain Imaging

Strain imaging is a technique used to identify the risk of heart disease in patients who have previously had chemotherapy. The incidence of radiation-induced heart disease has increased in recent years. This sophisticated screening process uses echocardiography to identify the timing and extent of myocardial damage. Imaging specialists in Cleveland Clinic’s Cardio-Oncology Center can focus on specific segments of the heart and identify even subtle changes. The technology also enables physicians to predict damage before it occurs. Initial research is promising, demonstrating prediction of problems up to three months earlier than monitoring ejection fraction alone.

Ventana Device

Cleveland Clinic was the first in the United States to implant the Ventana™ Fenestrated Stent Graft System for endovascular repair of juxtarenal/pararenal abdominal aortic aneurysm. The procedure was performed as part of a multicenter trial led by Cleveland Clinic surgeons. This graft allows for a minimally invasive approach to treating complex abdominal aortic aneurysms. During the procedure, a device is inserted through the femoral artery. This allows preservation of blood flow to the kidney arteries, which are located near the aneurysm.
**A Novel Technique for Hybrid Repair of Extensive Thoracic Aneurysm and Dissection**

Cleveland Clinic surgeons have demonstrated successful endovascular treatment of patients with chronic descending aortic dissection. Historically, this type of treatment has produced inconsistent remodeling of the aorta. However, all 24 patients in this study, which involved first-stage elephant trunk surgery with fenestration of the descending aorta intimal flap, experienced technical success. Most had moderate reductions in the size of the aorta, and there was no retrograde false lumen flow.


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**Ultra-Small Implantable LVAD**

Cleveland Clinic is developing a family of ultra-small implantable left ventricular assist devices (LVADs) for patients with heart failure. The devices will provide the circulatory support needed to restore health. This will dramatically improve patients’ quality of life with minimal impact on their daily activities. This platform technology is designed to provide treatment throughout the patients’ continuum of care — from catheter-based temporary assistance to chronic implants. The ultra-small size allows surgeons to use invasive procedures and those with lower risk. The modular platform is being designed to provide individual therapy tailored to each patient’s needs. This includes use for left-sided or biventricular treatment, which reduces the need for multiple controllers and batteries. These features ultimately improve patient experience and outcomes.
Transitioning Patients from Hospital to Home

Cleveland Clinic is committed to finding ways to ease the transition from the hospital to home. Within the Miller Family Heart & Vascular Institute, patients are given a phone number they can call 24/7 to speak to a registered nurse. The nurses can answer questions and concerns patients or caregivers have once they return home. In addition, our Heart Care at Home program uses a combination of technology monitoring and nurse practitioner visits to assess patients and provide clinical support. This leads to improvements in patient experiences and outcomes. Research into extending care at home through the use of virtual visits via tablet technology is ongoing.

Hybrid Operating Room

Cleveland Clinic remains committed to providing our patients with the most innovative technology and procedures to ensure the best possible outcomes and patient satisfaction. As part of this effort, the Miller Family Heart & Vascular Institute is replacing two operating rooms (ORs) with new ORs equipped with the latest advances in imaging technology and other equipment. The new rooms will allow us to increase our ability to perform endovascular and hybrid procedures. They will also help us expand our use of transcatheter aortic valve applications. Cleveland Clinic is a leader in transcatheter procedures, and securing a dedicated space for these operations will further our ability to extend the use of this technology to other areas.
Advanced Technology in Coronary Guide Wires

Coronary guide wires are essential to percutaneous coronary intervention (PCI). The wires are threaded to areas of blocked vessels and help deliver therapeutic devices, such as percutaneous transluminal coronary angioplasty (PTCA) balloons and stents. In cases of chronic total occlusions, PCI is unsuccessful because the wires cannot penetrate the blockage. Cleveland Clinic has developed guide wires designed for use in even these complex and difficult cases. The technology, which incorporates novel materials and construction, is still in development but proves promising to expand the use of PCI to a greater patient population.

Making the “Good” Cholesterol Better

Researchers at Cleveland Clinic have created an oxidant-resistant apolipoprotein A-1 (apo A-1) that they hope to develop for the treatment of coronary artery disease. Apo A-1 is the major protein in HDL, the carrier of what is commonly known as “good” cholesterol because it can help remove cholesterol from the artery wall and reverse the growth of atherosclerotic plaques. However, apo A-1 can become dysfunctional when oxidized in the artery wall. While current therapies focus primarily on lowering LDL or “bad” cholesterol, this therapy involves the delivery of a novel modified apo A-1 that is resistant to becoming dysfunctional in order to reverse disease progression. Cleveland Clinic researchers are collaborating with a biopharmaceutical company in the preclinical development of this modified apo A-1 with the goal of developing a new therapy to treat at-risk patients.
TMAO: A Predictor of Cardiovascular Risk

Cleveland Clinic researchers are working with an in vitro diagnostics company to develop a diagnostic test for the gut flora metabolite trimethylamine oxide (TMAO). In a study of more than 4,000 patients, it was demonstrated that increased plasma levels of TMAO can indicate the risk of myocardial infarction, stroke or death within three years. Measurement of TMAO levels

Self-Attaching Annuloplasty Ring and Delivery System

Researchers at Cleveland Clinic are developing a cardiac valve repair system for treatment of valve regurgitation to restore valve function. This allows surgeons to re-establish the normal shape and contour of the native valve and simplifies the surgical process of repairing mitral valves. The system includes a delivery device that allows the annuloplasty ring to self-attach to the native annulus with a “single shot” instead of suturing the ring in the valves. In addition, the self-attaching ring is designed in a “saddle” shape to mimic the anatomy of the native valve.
Use of 3-D Imaging to Assess Severity of Aortic Stenosis

Successful transcatheter treatment of patients with aortic stenosis depends on exact assessment of the severity of the disease. This is typically assessed with 2-D echocardiography. While this approach is well-established in the context of conventional surgical aortic valve replacement (SAVR), the emerging transcatheter approaches (TAVR) increasingly rely on 3-D imaging for procedural planning. In order to precisely guide treatment decisions, Cleveland Clinic has incorporated the use of 3-D imaging to determine the extent of disease and the anatomy of the aortic root. This includes detailed measurements and characterization of the device landing zone.
Improvements in Valvular Assessment in Patients with Aortic Regurgitation

The use of echocardiography is the current standard to assess the severity of aortic regurgitation (AR). However, this method can lead to differences in interpretation of the results because there is no hierarchy of the key parameters used to grade the severity. The Cardiovascular Imaging Section has worked to improve the method of assessment by using a left ventricular volume-based consensus strategy. The use of this strategy has improved our ability to accurately assess AR and, thus, tailor the treatment plan for patients with this condition.

Better Consistency in Estimation of Ejection Fraction

Visual assessment of ejection fraction (EF) is a cornerstone of left ventricular (LV) function quantification. Previous studies have shown up to 14 percent variability in interobserver estimations. We have developed a self-directed learning program to address this. In our program, EF misclassification (defined as ± 5% of MRI) was reduced from 51 percent to 43.6 percent ($P = 0.01$). This also resulted in a decrease in the absolute difference between cardiac magnetic resonance and echo EF (median [IQR] from $7[3 – 10.3]$ to $5[3.0 – 9.0]$, $P = 0.02$). This simple, mostly self-directed intervention decreased the misclassification rate and improved the accuracy of EF measurements.

Pivotal-Branch Device

Physicians at Cleveland Clinic continue to lead the way in the development of fenestrated and branched endograft technology to treat aortic aneurysms. To date, our surgeons have performed more than 800 procedures using this technology. This experience has facilitated the development of the pivotal-branch endograft device (Cook Medical, Bloomington, IN), which will allow for an off-the-shelf graft to treat patients with aneurysms in a shorter period of time and in case of emergencies.
Heart & Vascular Institute Selected Publications

This is a representative sample of publications authored by the Miller Family Heart & Vascular Institute in 2011.


Bingham SE, Hachamovitch R. Incremental prognostic significance of combined cardiac magnetic resonance imaging, adenosine stress perfusion, delayed enhancement, and left ventricular function over preimaging information for the prediction of adverse events. *Circulation*. 2011 Apr 12;123(14):1509-1518.


**Clinical Investigations**

Population-centric clinical registries, quality investigations, investigator-initiated observational clinical studies, methodological research and development, and clinical research education are the five interrelated thrusts of the multidisciplinary Clinical Investigations group. Our products include process and outcomes reporting for quality initiatives, marketing statistics, presentations and publications of new knowledge generated from analyses of clinical cohorts, novel advanced clinical data management tools and statistical methodology, and presentations and publications by medical students, residents, fellows and faculty.


Selected Publications


**Emergency Services Institute**


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For a complete list including staff photos, please visit clevelandclinic.org/staff
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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 toll-free 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

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 toll-free 866.289.6911
or email heartcenter@ccf.org

On the Web at clevelandclinic.org/heart

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General Information
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Hospital Transfers
24/7 hospital transfers or physician consults
800.553.5056

Referring Physician Center and Hotline
Cleveland Clinic’s Referring Physician Center has established a 24/7 hotline — 855.REFER.123 (855.733.3712) — to streamline access to our array of medical services. Contact the Referring Physician Hotline for information on our clinical specialties and services, to schedule and confirm patient appointments, for assistance in resolving service-related issues, and to connect with Cleveland Clinic specialists.

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

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

For address corrections or changes, please call
800.890.2467
Institute Locations

Miller Family Heart & Vascular Institute physicians see patients at the locations below. Please inquire about the availability of specific services at each location when calling.

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**Cleveland Clinic Florida**

2950 Cleveland Clinic Blvd.
Weston, FL 33331
954.659.5320
clevelandclinic.org/florida
Cardiovascular medicine, vascular medicine, cardiothoracic surgery, thoracic surgery

**Ashtabula County Medical Center**

2420 Lake Road
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440.994.7622
acmchealth.org
Invasive cardiology

**Beachwood Family Health and Surgery Center**

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216.839.3000 or toll-free 866.318.2491
Cardiovascular medicine, vascular surgery

**Brunswick Family Health Center**

3574 Center Road
Brunswick, OH 44212
330.225.8886
Cardiovascular medicine

**Elyria Family Health and Surgery Center**

303 Chestnut Commons Drive
Elyria, OH 44035
440.366.9444 or 440.204.7900
Vascular surgery

**Euclid Hospital**

18901 Lakeshore Blvd.
Euclid, OH 44119
216.531.9000
euclidhospital.org
Cardiovascular medicine

**Fairview Hospital**

Fairview Physicians’ Center
18101 Lorain Ave.
Cleveland, OH 44111
216.476.7310
fairviewhospital.org
Cardiothoracic surgery, vascular surgery

**Hillcrest Hospital**

Hillcrest Hospital Atrium
6780 Mayfield Road, Suite 400
Mayfield Heights, OH 44124
440.449.9300
hillcresthospital.org
Cardiothoracic surgery, vascular surgery

**Independence Family Health Center**

Crown Centre II
5001 Rockside Road
Independence, OH 44131
216.986.4000
Cardiovascular medicine, vascular surgery
Lorain Family Health and Surgery Center
5700 Cooper Foster Park Road
Lorain, OH 44053
440.204.7400 or 800.272.2676
Pediatric cardiovascular medicine, vascular surgery

Marymount Hospital
12300 McCracken Road
Garfield Heights, OH 44125
216.587.4280
marymount.org
Vascular surgery, thoracic surgery

South Pointe Hospital
20000 Harvard Road
Warrensville Heights, OH 44122
216.491.6000
southpointehospital.org
Cardiovascular medicine, thoracic surgery

Strongsville Family Health and Surgery Center
16761 SouthPark Center
Strongsville, OH 44136
440.878.2500 or 800.239.1098
Cardiovascular medicine, vascular medicine, vascular surgery

Twinsburg Medical Office
8701 Darrow Road
Twinsburg, OH 44087
330.888.4000
Cardiovascular medicine, vascular surgery

Westlake Family Health Center
30033 Clemens Road
Westlake, OH 44145
440.899.5555 or 800.599.7771
Cardiovascular medicine, thoracic and cardiovascular surgery

Willoughby Hills Family Health Center
2570 SOM Center Road
Willoughby Hills, OH 44094
440.943.2500 or 800.807.2888
Cardiovascular medicine, vascular medicine

Wooster Family Health and Surgery Center
1740 Cleveland Road
Wooster, OH 44691
330.287.4500 or 800.451.9870
Adult and pediatric cardiovascular medicine
Additional Locations

Cape Fear Valley Health System
Cardiothoracic Surgery Department
1638 Owen Drive
Fayetteville, NC 28304
910.609.4000
capefearvalley.com
Cardiothoracic surgery

Central DuPage Hospital
25 N. Winfield Road
Winfield, IL 60190
630.933.4234
cdh.org
Cardiothoracic surgery

The Chester County Hospital
Cardiothoracic Surgery Department
701 E. Marshall St., 2nd Floor
West Chester, PA 19380
610.738.2690
cchosp.com
Cardiothoracic surgery

EMH Regional Medical Center
Gates Medical Building, Suite 101
630 E. River St.
Elyria, OH 44035
440.284.1504
emh-healthcare.org
Cardiothoracic surgery

Lake Health
West Medical Center
36100 Euclid Ave, Suite 280
Willoughby, OH 44094
440.918.4640
lakehealth.org
Cardiothoracic surgery

McLeod Health Heart & Vascular Institute
Cardiothoracic Surgery Department
555 E. Cheves St.
Florence, SC 29506
843.777.2000
mcleodhealth.org
Cardiothoracic surgery

MetroHealth Medical Center
Cardiothoracic Surgery Department
2500 MetroHealth Drive
Cleveland, OH 44109
216.778.4304
metrohealth.org
Cardiothoracic surgery

Pikeville Medical Center
911 Bypass Road
Pikeville, KY 41501
606.218.4530
pikevillehospital.org
Cardiothoracic surgery

Rochester General Hospital
Cardiothoracic Surgery Department
1445 Portland Ave.
Rochester, NY 14621
585.544.6550
rochestergeneralhospital.org
Overview

Cleveland Clinic uses a scorecard approach to measure quality, safety and patient experience. In addition, real-time dashboard data are leveraged to drive performance improvement. Although not an exact match to publicly reported data, more timely internal data provide transparency for leaders at all levels of the organization to support improved care in their clinical locations. The following are examples of Cleveland Clinic’s 2011 focus areas and main campus results.

Appropriateness of Care

2011

Cleveland Clinic’s goal is for all patients to receive all the recommended care for which they are eligible. An aggregated “all or nothing” measurement approach to monitoring multiple publicly reported process-of-care measures for heart failure, acute myocardial infarction, pneumonia and surgical patients is trending positively.

Mortality

2011

Cleveland Clinic’s observed/expected (O/E) mortality ratio outperformed the University HealthSystem Consortium (UHC) academic medical center 50th percentile throughout 2011.
Cleveland Clinic established a 2011 target ICU surveillance rate of 1.33 central line-associated bloodstream infections (CLABSIs) per 1,000 central line days with the goal of reducing our rate by an additional 50 percent over the 2010 results. This 2011 target was met by the end of the year.

Cleveland Clinic focused on reducing the incidence of 10 Agency for Healthcare Research and Quality PSIs. Cleveland Clinic achieved a reduction of more than 60 percent in the total number of these PSIs in 2011 through a combination of clinical and documentation improvement activities.
Hospital-acquired pressure ulcers in Cleveland Clinic ICU patients were below the national average in 2010 and 2011.

Falls in Cleveland Clinic stepdown unit patients were below the national average for most of 2010 and 2011. In 2011, Cleveland Clinic supplemented proactive falls reduction strategies with after-event huddles to evaluate causality and develop prevention strategies.
Critical Response Outcomes

Medical Emergency Team Event Volume*
2009 – 2011

Events

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<th>Year</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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<td>*Excluding events originating in ORs and ICUs</td>
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Percent of Medical Emergency Team Events Resulting in ICU Transfer
2009 – 2011

Percent

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<th>Year</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
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Medical Emergency Teams (METs) bring critical care experience to patients across the hospital and provide early intervention that can prevent unplanned transfers to ICUs. As adult MET activations increased from 2009 through 2011, post-event adult ICU transfers decreased.
Overview

Cleveland Clinic is a nonprofit multispecialty academic medical center that integrates clinical and hospital care with research and education. Across the health system, 2,800 Cleveland Clinic physicians and scientists practice in 120 medical specialties and subspecialties, annually recording more than 4.6 million physician visits and nearly 188,000 surgeries. Patients come for treatment from every state and from more than 125 countries annually.

Cleveland Clinic’s main campus, with 50 buildings on 180 acres in Cleveland, Ohio, includes a 1,400-bed hospital, outpatient clinic, specialty institutes, and supporting labs and facilities. The hospital currently has the highest CMS case-mix index in America. Cleveland Clinic also operates 18 family health centers, eight community hospitals, one affiliate hospital, a rehabilitation hospital for children, Cleveland Clinic Florida, Cleveland Clinic Lou Ruvo Center for Brain Health in Las Vegas, Cleveland Clinic Canada, and Sheikh Khalifa Medical City. Cleveland Clinic Abu Dhabi (United Arab Emirates), a multispecialty care hospital and clinic, is scheduled to open in 2013. With 41,000 employees, Cleveland Clinic is the second largest employer in Ohio and is responsible for an estimated $9 billion of economic activity every year.

The Cleveland Clinic Model

Cleveland Clinic was founded in 1921 by four 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.

In 2007, Cleveland Clinic restructured its practice, bundling all clinical specialties into integrated practice units called institutes. An institute combines all the specialties surrounding a specific organ or disease system under a single roof. Each institute has a single leader and focuses the energies of multiple professionals on the patient. Institutes are improving the patient experience at Cleveland Clinic.
Cleveland Clinic Lerner Research Institute

At the Lerner Research Institute, hundreds of principal investigators, project scientists, research associates and postdoctoral fellows are involved in laboratory-based, translational and clinical research. Total research expenditures from external and internal sources exceeded $240 million in 2010. Research programs include cardiovascular, cancer, neuralgic, musculoskeletal, allergic and immunologic, eye, metabolic, and infectious diseases.

Cleveland Clinic Lerner College of Medicine

Celebrating its 10th anniversary in 2012, the Lerner College of Medicine of Case Western Reserve University is known for its small class size, unique curriculum and full-tuition scholarships for all students. The program graduated 31 students as physician investigators in 2011.

Graduate Medical Education

In 2011, nearly 1,800 residents and fellows trained at Cleveland Clinic and Cleveland Clinic Florida, the most ever hosted by Cleveland Clinic and 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, and our heart and heart surgery program has been ranked No. 1 since 1995.

For more information about Cleveland Clinic, please visit clevelandclinic.org.
This project would not have been possible without the commitment and expertise of a team led by Dr. Umesh Khot, Pam Goepfarth, Sandra Hays-Flynn and Vi Huynh.
Referring Physician Center and Hotline

Cleveland Clinic’s Referring Physician Center has established a 24/7 hotline – 855.REFER.123 (855.733.3712) – to streamline access to our array of medical services. Contact the Referring Physician Hotline for information on our clinical specialties and services, to schedule and confirm patient appointments, for assistance in resolving service-related issues, and to connect with Cleveland Clinic specialists.

Remote Consults

Online medical second opinions from Cleveland Clinic’s MyConsult are particularly valuable for patients who wish to avoid the time and expense of travel. Cleveland Clinic offers online medical second opinions for more than 1,000 life-threatening and life-altering diagnoses. For more information, visit clevelandclinic.org/myconsult, email eclelandclinic@ccf.org or call 800.223.2273, ext. 43223.

Request Medical Records

216.444.2640 or 800.223.2273, ext. 42640

Track Your Patient’s Care Online

DrConnect offers referring physicians secure access to their patients’ treatment progress while at Cleveland Clinic. To establish a DrConnect account, visit clevelandclinic.org/drconnect or email drconnect@ccf.org.

Medical Records Online

Cleveland Clinic continues to expand and improve electronic medical records (EMRs) to provide faster, more efficient and accurate care by sharing patient data through a highly secure network. Patients using MyChart can renew prescriptions and review test results and medications from their personal computers. MyChart provides a link to Microsoft HealthVault, a free online service that helps patients securely gather and store health information. It connects to Cleveland Clinic’s social media and Internet site, currently the most visited hospital website in America. For more information, visit clevelandclinic.org/mychart.

Critical Care Transport Worldwide

Cleveland Clinic’s critical care transport team and fleet of mobile ICU vehicles, helicopters and fixed-wing aircraft serve critically ill and highly complex patients across the globe.

To arrange a transfer for STEMI (ST elevated myocardial infarction), acute stroke, ICH (intracerebral hemorrhage), SAH (subarachnoid hemorrhage) or aortic syndrome, call toll-free 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 one of the largest and most successful CME programs in the country. The Center’s website (ccfcmc.com) is an educational resource for healthcare providers and the public. Available 24/7, it houses programs that cover topics in 30 areas – if not from A to Z, at least from Allergy to Wellness – with a worldwide reach. Among other resources, the website contains a virtual textbook of medicine (Disease Management Project) and myCME, a system for physicians to manage their CME portfolios. Live courses, however, remain the backbone of the Center’s CME operation. Most live courses are held in Cleveland, but outreach plans are under way. In 2011, the Center offered 15 simultaneous courses at Arab Health, a major world healthcare forum.
Treating the Whole Patient

The Miller Family Heart & Vascular Institute works together with the Office of Patient Experience, Spiritual Care Department, Healing Services and the Arts & Medicine Institute to provide a full range of complimentary services to our patients and their families.

Services include light massage therapy, Reiki and Healing Touch™ therapies, art and music therapy, and a guided imagery program to help patients relax and prepare for surgery or other procedures.

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

Art programs include art therapy, guided tours and the Cleveland Museum of Art Distance Learning Program — an interactive experience that allows participants to take a virtual tour through some of the world’s best galleries via high-definition video conferencing.

Each day, there are scheduled activities on the rooftop plaza. The space provides a spectacular view of the city. Guests can enjoy yoga, chair massages, labyrinth walk meditation, Reiki, live cooking demonstrations, concerts and tea.

In addition, the Miller Family Pavilion hosts many musical and other performances and events throughout the year.

Patient and Family Health & Education Center

800.223.2273 ext. 43771
healthl@ccf.org

The Patient and Family Health & Education Center has provided resources to patients and visitors since October 2008. The center serves as a library of health and education materials. In addition, patients and guests have access to complimentary computers with Internet access, audio and video education programs, and health education classes and screenings. In 2011, the center had 13,632 visitors.

Miller Family Heart & Vascular Institute

Resource Nurses

866.289.6911
heartcenter@ccf.org

A team of dedicated, experienced nurses staff the Resource Center. They answer thoracic- and cardiovascular-related questions by phone, email and online chat. This service is open to everyone and is especially helpful to those who do not have immediate access to a Cleveland Clinic cardiologist or surgeon. In 2011, there were 17,522 total contacts. This includes 6,308 nurse webchats; 5,178 phone, mail or in-person contacts; and 4,025 emails.

The nurses also staff a 24/7 toll-free inbound call line for all patients discharged from the institute who have questions or concerns after they leave the hospital. In 2011, they answered 2,237 calls. Our effort to improve the patient experience also includes a follow-up phone call from a registered nurse to every patient. Patients are asked about symptoms, complications or concerns they may have once they are home.

Staying in Touch

The Miller Family Heart & Vascular Institute has a variety of ways for patients and others to contact us and learn more about topics related to heart and vascular health. Our Twitter account (twitter.com/ClevClinicHeart) has more than 10,000 followers and was recently named one of Good Housekeeping’s 14 Most Trusted Health Sites. In 2011, we hosted 38 live webchats with institute experts who answered questions about specific thoracic and cardiovascular topics. Transcripts are posted at clevelandclinic.org/heart/webchat. Our website, clevelandclinic.org/heart, had more than 6.4 million visits in 2011. We also host a YouTube channel, youtube.com/ClevelandClinic, that had more than 2.3 million views in 2011, and a blog, thebeatingedge.org, that started in 2011 and has had more than 35,000 visits.