

Respiratory Institute



Measuring Outcomes Promotes Quality Improvement





Measuring and understanding outcomes of medical treatments promotes quality improvement. Cleveland Clinic has created a series of Outcomes books similar to this one for its clinical institutes. Designed for a physician audience, the Outcomes books contain a summary of many of our surgical and medical treatments, with a focus on outcomes data and a review of new technologies and innovations.

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

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

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

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

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

OutcomesBooksFeedback@ccf.org.

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



Dear Colleague:

Welcome to this 2016 Cleveland Clinic Outcomes book. Every year, we publish Outcomes books for 14 clinical institutes with multiple specialty services. These publications are unique in healthcare. Each one provides an overview of medical or surgical trends, innovations, and clinical data for a particular specialty over the past year. We are pleased to make this information available.

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

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

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

Sincerely,

A handwritten signature in white ink, appearing to read 'DMC', set against a dark background.

Delos M. Cosgrove, MD
CEO and President

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Chairman's Letter

Dear Colleagues,

The Respiratory Institute is pleased to present the 13th edition of our Outcomes book. This book provides a concise overview of our clinical activities and programs, with a focus on patient outcomes.

At Cleveland Clinic, patients with respiratory diseases and allergic disorders benefit from the expertise of a multidisciplinary team consisting of clinicians who specialize in pulmonary medicine, critical care medicine, and allergy and clinical immunology, all working in close collaboration with thoracic surgeons, thoracic radiologists, and pulmonary pathologists. In 2016, we experienced continued growth in our clinical programs, research funding, and application of innovative technologies. The collaboration between clinicians and researchers helps close the gap between the laboratory discoveries of today and the patient care of tomorrow.



As described in this book, recent innovations that will be enhancing clinical practice include:

- Balloon angioplasty for inoperable chronic thromboembolic pulmonary hypertension
- Pulmonary embolism response team (PERT)

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

Sincerely,

A handwritten signature in black ink, reading "Herbert P. Wiedemann".

Herbert P. Wiedemann, MD, MBA
Chairman, Respiratory Institute

Institute Overview

The Respiratory Institute is regarded as one of the top respiratory centers in the nation, uniting specialists from the departments of Pulmonary Medicine, Critical Care Medicine, and Allergy and Clinical Immunology in the diagnosis and management of the full spectrum of respiratory and allergic disorders. In 2016, *U.S. News & World Report's* “Best Hospitals” survey ranked Cleveland Clinic No. 3 in the nation for pulmonology services.

At the Respiratory Institute, patients with breathing disorders benefit from the expertise of 121 physicians, 40 fellows, 31 physician assistants, and 25 nurse practitioners. A multidisciplinary team of physicians is available for collaboration, including specialists from Thoracic and Cardiovascular Surgery, Thoracic Imaging, and Pulmonary Pathology.

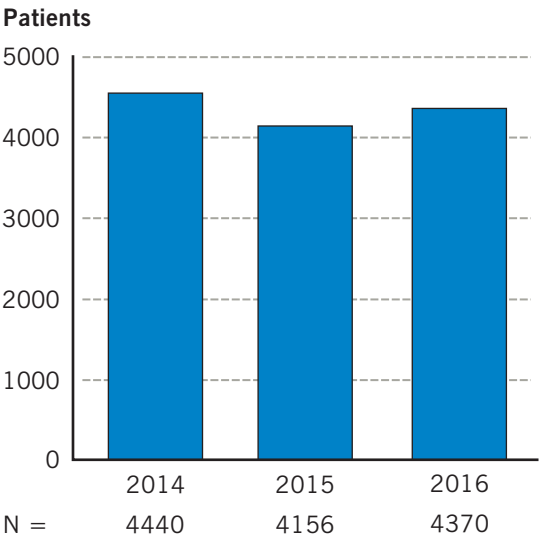
	2016
Total visits	177,511
Interstitial lung disease visits	4391
Pulmonary arterial hypertension visits	3261
Sarcoidosis visits	4559
Lung cancer visits	1084
Chronic obstructive pulmonary disease visits	19,164
Total hospital admissions	2352
Research funding	\$11.1 million
Research grants/contracts	74
Lung transplants (includes heart/lung and liver/lung)	110
Bronchoscopies	4492

Critical Care Medicine

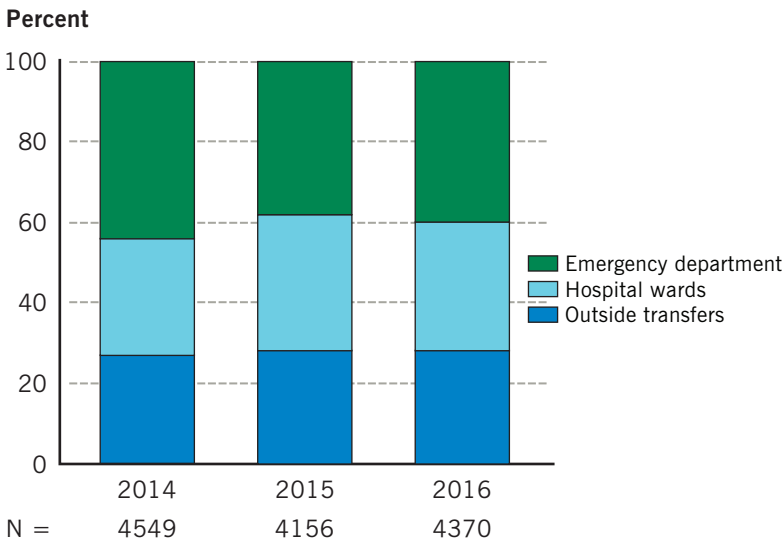
The Respiratory Institute manages and staffs the Medical Intensive Care Unit (MICU) at Cleveland Clinic. With a total of 64 beds across 5 nursing units and > 4000 admissions per year, it is one of the largest ICUs in the United States. The unit is staffed by board-certified intensivists who provide in-house coverage 24 hours a day.

Total admissions to the MICU at Cleveland Clinic main campus did not change significantly between 2014 and 2016. An average of 12 critically ill patients were admitted every day, with 28% of patients being transferred from outside hospitals to receive advanced critical care at the MICU. Cleveland Clinic’s critical care transport team is capable of bringing the sickest of patients from anywhere in the world.

MICU Admissions — Main Campus
2014 – 2016

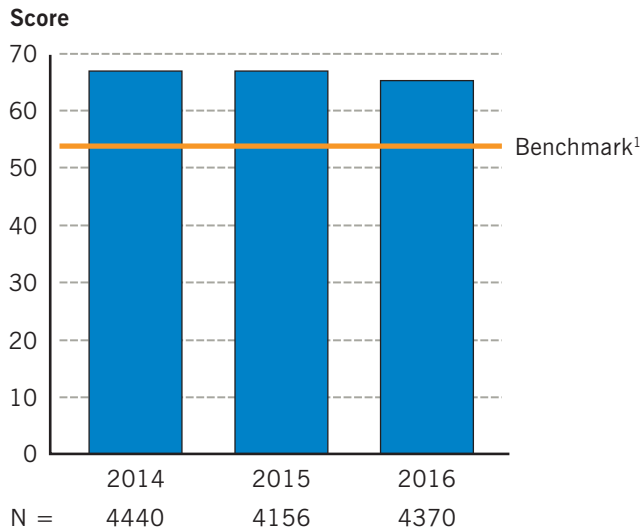


MICU Admissions by Source — Main Campus
2014 – 2016



Mean MICU APACHE® IV Score

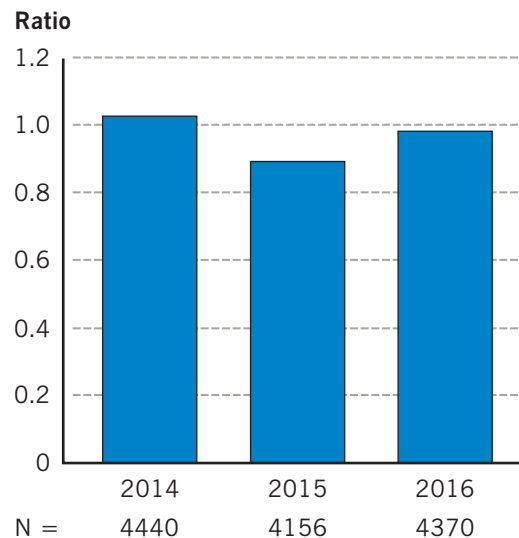
2014 – 2016



APACHE IV = Acute Physiology, Age, and Chronic Health Evaluation system

MICU Standardized ICU Mortality Ratio (Observed to Expected)

2014 – 2016



The acuity and complexity of the patient population remains high as demonstrated by the overall APACHE IV acuity score. Cleveland Clinic's APACHE IV mean score is 65, which is well above the reported benchmark for MICU patients.¹ Cleveland Clinic continues to have lower patient mortality rates than the risk-adjusted predicted values. The 2016 readmission rate was only 2.1%, similar to prior years.

Reference

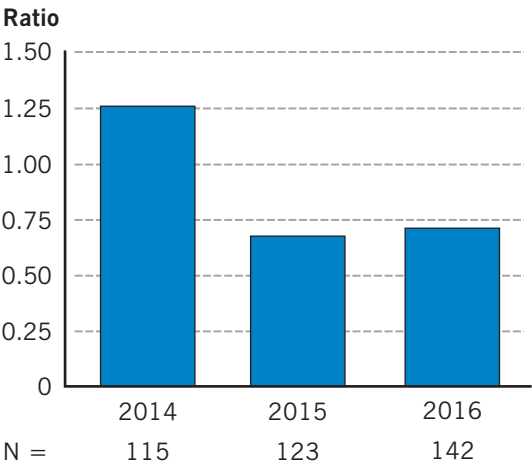
1. Lilly C, Zuckerman I, Badawi O, Riker R. Benchmark data from more than 240,000 adults that reflect the current practice of critical care in the United States. *Chest*. 2011 Nov;140(5):1232-1242.

Critical Care Medicine

Sepsis and acute respiratory distress syndrome (ARDS) are 2 critical conditions that highlight the multidisciplinary and institutional approach to care at Cleveland Clinic. Patients treated at Cleveland Clinic who have ARDS have significantly lower than expected ICU and hospital mortality rates. More importantly, the proportion of patients being discharged home (with rehabilitation) has steadily increased. Similarly, patients with sepsis also have lower than expected ICU and hospital mortality rates. Their discharge disposition has not changed over time.

ARDS Standardized Mortality Ratio (Observed to Expected)

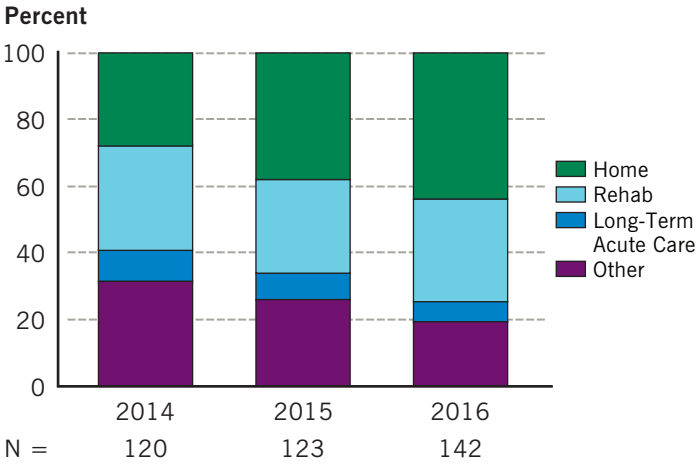
2014 – 2016



ARDS = acute respiratory distress syndrome

ARDS Hospital Discharge Disposition

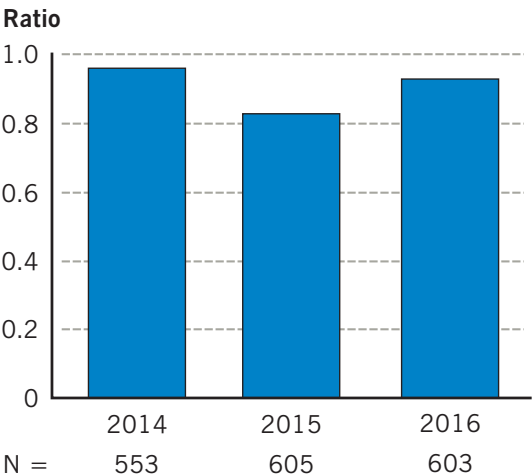
2014 – 2016



ARDS = acute respiratory distress syndrome

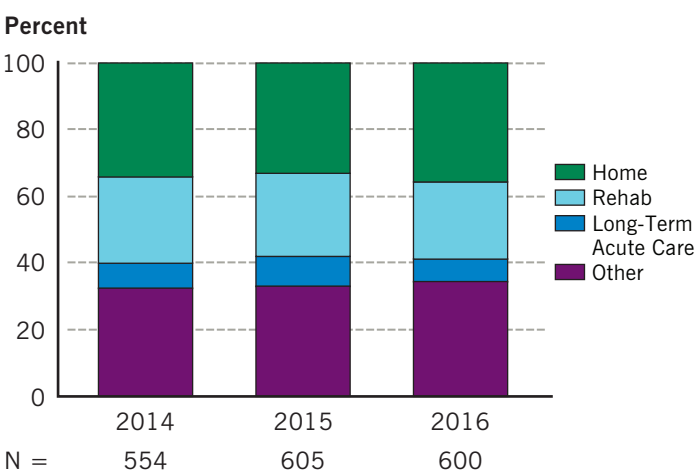
Sepsis Standardized Mortality Ratio (Observed to Expected)

2014 – 2016



Sepsis Hospital Discharge Disposition

2014 – 2016

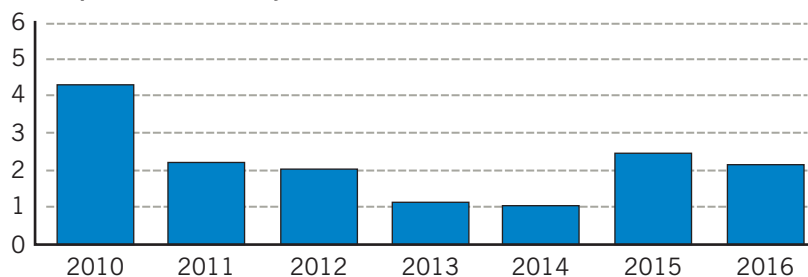


In 2015, the reporting criteria for central line-associated bloodstream infections (CLABSI) were changed, leading to more cases being adjudicated as CLABSI. The MICU rate has continued to decrease, from 2.45 in 2015 to 2.13 in 2016. There was an increase in *Clostridium difficile* infections during 2016 compared with prior years. The Respiratory Institute's goal is to have no hospital-acquired infections. The institute's quality team leads a multidisciplinary process to analyze and refine patient care to achieve that goal. This approach led to an impressive decrease in rates of catheter-associated urinary tract infections.

MICU Central Line-Associated Bloodstream Infections (N = 4370)

2010 – 2016

Rate (per 1000 Line Days)

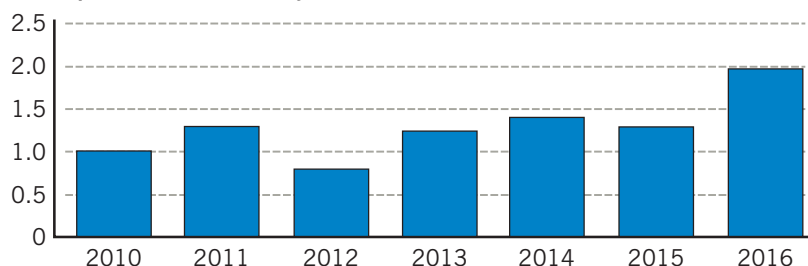


No acceptable benchmark for CLABSI currently exists after the 2015 change in definition.

MICU Nosocomial *C. difficile* Infections

2010 – 2016

Rate (per 1000 Patient Days)

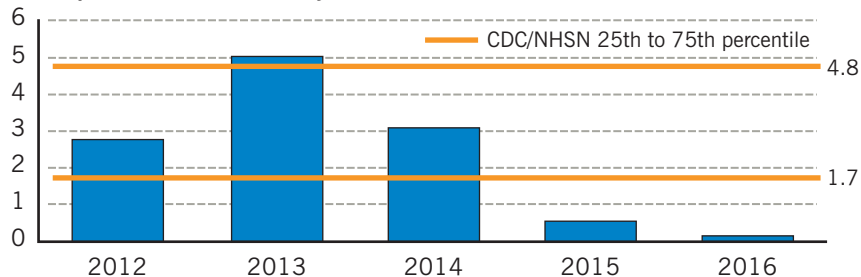


No acceptable benchmark for unit-acquired *C. difficile* currently exists.

MICU Catheter-Associated Urinary Tract Infections

2010 – 2016

Rate (per 1000 Catheter Days)



CDC/NHSN = Centers for Disease Control and Prevention's National Healthcare Safety Network

Cleveland Clinic's Respiratory Institute provides a full range of advanced diagnostic and interventional bronchoscopy techniques. The institute has some of the world's most extensive experience with:

- Electromagnetic navigation
- Endobronchial ultrasound (EBUS)
- Lung transplant-related airway disease
- Airway stenting
- Management of airway complications due to histoplasmosis
- Benign airway diseases
- Metallic stent removal

Staff physicians performed 4492 bronchoscopies during 2016, a 13.2% increase over 2015. Notably, complication rates remain low.

Selected Procedure Volumes in 2016 Based on CPT Codes	
Transbronchial lung biopsy	1308
Transbronchial needle aspiration	284 ^a
EBUS — linear and peripheral	1263
Electrocautery/laser/cryoablation	433
Electromagnetic navigation	152
Balloon/rigid airway dilation	432
Bronchial/tracheal stenting/T-tube	364
Bronchial thermoplasty	12

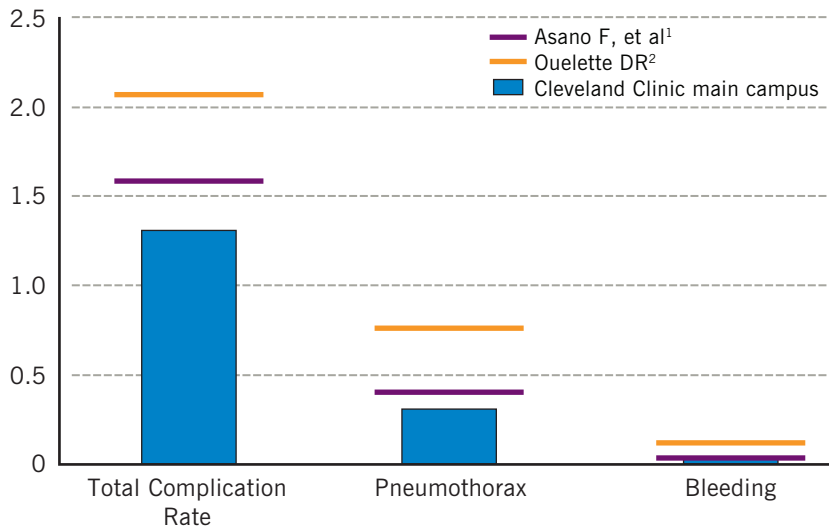
EBUS = endobronchial ultrasound.

^aIncludes transbronchial needle aspiration with or without EBUS.

Postbronchoscopy Complication Rate (N = 3533)

2016

Percent



The aggregate postbronchoscopy complication rate in 2016 was lower than expected compared with published data.^{1,2} With respect to 2 of the most commonly reported complications, the institute's pneumothorax and significant bleeding rates were either below or on par with published data.

References

1. Asano F, Aoe M, Ohsaki Y, Sasada S, Sato S, Suzuki E, Senba H, Fujino S, Ohmori K. Deaths and complications associated with respiratory endoscopy: a survey by the Japan Society for Respiratory Endoscopy in 2010. *Respirology*. 2012 Apr;17(3):478-485.
2. Ouellette DR. The safety of bronchoscopy in a pulmonary fellowship program. *Chest*. 2006 Oct;130(4):1185-1190.

EBUS procedures allow the capability not only to sample enlarged nodes for diagnostic purposes but also to systematically stage the mediastinum of patients with known or suspected lung cancer. EBUS is routinely used for the concomitant diagnosis and staging of lung cancer in a single session, obviating the need for a second bronchoscopy or a mediastinoscopy.¹ Sampling adequacy during staging and diagnostic procedures adequacy (defined as a final cytologic diagnosis of lymphoid or malignant cells, or granulomas) is better at the Respiratory Institute when compared with benchmarks from published literature.^{2,3} The number of evaluated lymph node stations also exceeds the evaluation of 2 to 3 nodal stations documented in published EBUS studies^{2,3} and approaches benchmarks recommended for surgical mediastinoscopy.

Endobronchial Ultrasound: Lymph Node Stations Evaluated During Staging Procedure and Sample Adequacy (N = 1045)
2016

	Cleveland Clinic	National Studies ^{2,3}
Nodal stations evaluated (average)	3.4	2-3
Sample adequacy	95.2%	83-87%

The average lymph node size biopsied during staging procedures was 8.2 mm; 87% of biopsied nodes were < 10 mm in size. Again, this outperforms standards published in the medical literature on EBUS staging. The ability to routinely and accurately access lymph nodes of < 10 mm is extremely important given that PET scanning is less sensitive for nodes < 7 to 10 mm. In addition, published guidelines call for invasive sampling of normal sized nodes in instances where risk of nodal involvement is high.⁴

References

1. Almeida FA, Casal RF, Jimenez CA, Eapen GA, Uzbek M, Sarkiss M, Rice D, Morice RC, Ost DE. Quality gaps and comparative effectiveness in lung cancer staging: the impact of test sequencing on outcomes. *Chest*. 2013 Dec;144(6):1776-1782.

2. Yasufuku K, Pierre A, Darling G, de Perrot M, Waddell T, Johnston M, da Cunha Santos G, Geddie W, Boerner S, Le LW, Keshavjee S. A prospective controlled trial of endobronchial ultrasound-guided transbronchial needle aspiration compared with mediastinoscopy for mediastinal lymph node staging of lung cancer. *J Thorac Cardiovasc Surg*. 2011 Dec;142(6):1393-1400.

3. Liberman M, Sampalis J, Duranceau A, Thiffault V, Hadjeres R, Ferraro P. Endosonographic mediastinal lymph node staging of lung cancer. *Chest*. 2014 Aug;146(2):389-397.

4. Silvestri G, Gonzalez A, Jantz M, Margolis ML, Gould MK, Tanoue LT, Harris LJ, Detterbeck FC. Methods for staging non-small cell lung cancer: Diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest*. 2013 May;143(5 Suppl):e211S-e250S.

An important aspect of EBUS with transbronchial needle aspiration (EBUS-TBNA) is the ability not only to obtain accurate diagnosis and staging information, but also to acquire enough tissue to run molecular testing on adenocarcinoma cells. At Cleveland Clinic, molecular testing is done in-house and routinely performed on bronchoscopically generated small samples, such as those acquired from EBUS-TBNA. Additionally, with the advent of anti-PD-1 immunotherapy for non-small cell lung cancer, testing for PD-L1 has become a critical component of cancer diagnostics. PD-L1 testing typically requires surgical specimens; however, in October 2016 a collaborative effort of bronchoscopy and pathology resulted in a testing protocol for bronchoscopy-derived biopsy and core needle samples. Yield for molecular testing is defined by a “resulted” sample.

Outcomes of Bronchoscopy-Derived Samples for Molecular and PD-L1 Testing
2016

	Samples Tested	Samples Resulted (%)
EGFR mutation	258	258 (100%)
ALK rearrangement	279	279 (100%)
PD-L1 IHC	60	54 (90%)

EGFR = epidermal growth factor receptor, IHC = immunohistochemistry.

Epidermal growth factor receptor (EGFR) testing was done using both next-generation sequencing (NGS) and TheraScreen allele-specific polymerase chain reaction (ASPCR). In 21 samples, TheraScreen ASPCR for EGFR was performed due to DNA thresholds in samples being below the level recommended for NGS. All 21 samples tested using TheraScreen ASPCR were resulted.

ALK gene testing performance of EBUS-TBNA node samples was performed using ThinPrep® fluorescence in situ hybridization (FISH).

PD-L1 testing was performed on both forceps biopsy (transbronchial and endobronchial) and EBUS-TBNA core needle samples. PD-L1 testing began in October 2016.

Asthma Control Test Scores During Visits in 2016

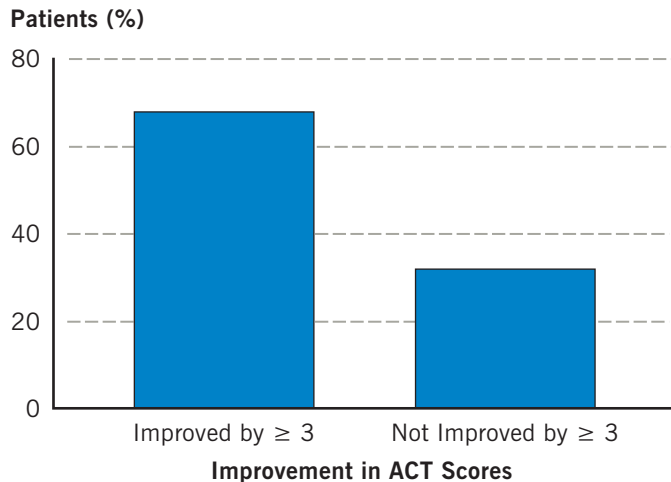
Asthma control can be assessed by using validated instruments, including the Asthma Control Test™ (ACT). The ACT includes 5 questions that assess daytime symptoms, nighttime symptoms, reliance on as-needed “rescue” medication, the effect of asthma on everyday functioning, and patient assessment of control, with each of these 5 responses scored on a 1 to 5 scale. Higher scores reflect improved asthma control, a major objective of asthma management.

The ACT has been routinely used at Cleveland Clinic's Asthma Center for more than a decade. All asthma patients complete the ACT when seen at initial and follow-up visits.

The 2016 data are being reported in the context of a quality measure. The American Academy of Allergy, Asthma, and Immunology Qualified Clinical Data Registry,^{1,2} which has been approved by the Centers for Medicare and Medicaid Services, qualifies as a reporting tool for the Merit-based Incentive Payment System reporting program under the Medicare Access and CHIP Reauthorization Act of 2015.¹ The measure addresses the proportion of asthma patients whose asthma was either poorly or not well controlled, as indicated by an ACT score < 20 at baseline, who achieve an improvement of ≥ 3 at a subsequent visit during a 12-month period. An increase of 3 has been shown to be the minimal important difference for the ACT.³

Improvement in ACT Scores for Patients With Poorly or Not Well Controlled Asthma (N = 467)

2016



ACT = Asthma Control Test

Of 573 asthma patients who completed the ACT at initial and follow-up visits in 2016, 81.5% (467) were poorly or not well controlled at initial visit. Of these, 68% demonstrated an improvement in ACT scores of at least 3.

These data offer evidence that care at Cleveland Clinic's Asthma Center provides value and leads to improved asthma outcomes.⁴

References

1. American Academy of Allergy, Asthma, and Immunology. The AAAAI QCDR. aaaai.org/practice-resources/practice-tools/qcdr.aspx. Accessed March 30, 2016.
2. Dinakar C, Lang DM. Quality measures in allergy, asthma, and immunology. *Ann Allergy Asthma Immunol*. 2015 Jun;114(6):435-439.
3. Schatz M, Kosinski M, Yarlas AS, Hanlon J, Watson ME, Jhingran P. The minimally important difference of the Asthma Control Test. *J Allergy Clin Immunol*. 2009 Oct;124(4):719-723.
4. Williams SA, Wagner S, Kannan H, Bolge SC. The association between asthma control and health care utilization, work productivity loss and health-related quality of life. *J Occup Environ Med*. 2009 Jul;51(7):780-785.

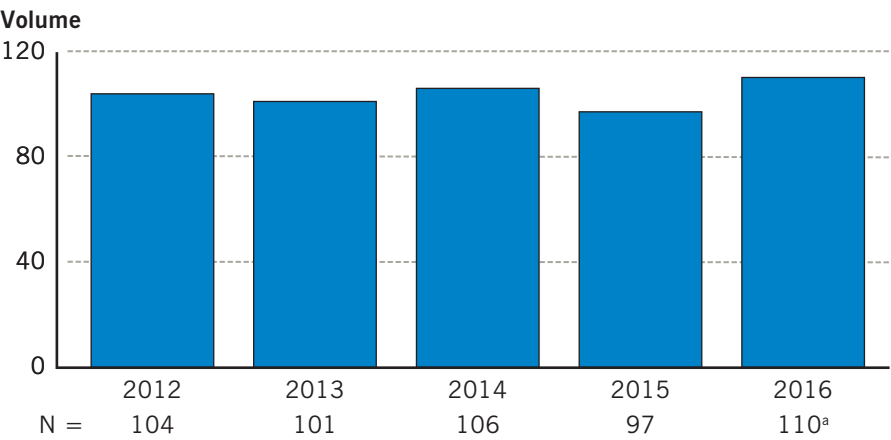
Lung and Heart/Lung Transplantation



Cleveland Clinic performed 518 lung transplants from 2012 through 2016.
Cleveland Clinic surgeons performed 110 lung transplants in 2016.

Lung Transplant Procedure Volume

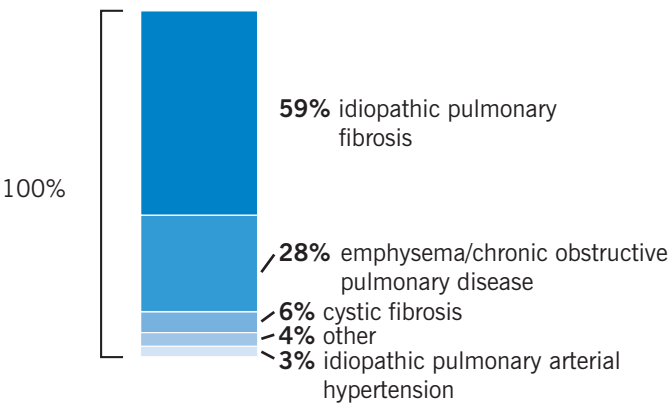
2012 – 2016



^aIncludes multiple-organ transplants

Primary Disease of Lung Transplant Recipients

July 2015 – June 2016



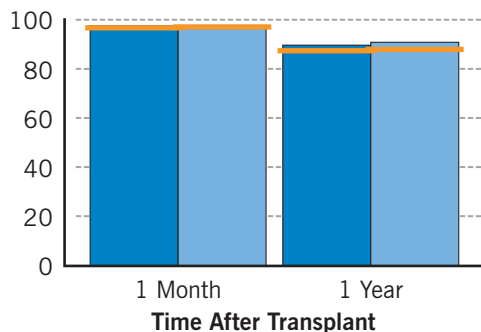
Idiopathic pulmonary fibrosis was the most common primary disease among patients who had lung transplant procedures at Cleveland Clinic in 2016.

Source: Scientific Registry of Transplant Recipients, December 2016. srtr.org

Lung Transplant 1-Month and 1-Year Survival

July 2013 – December 2015

Percent



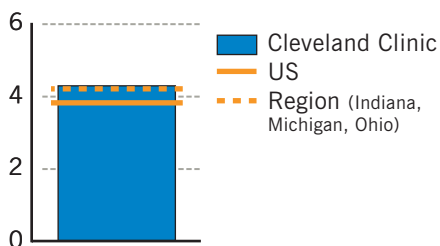
The 1-month graft survival and 1-year graft and patient survival rates at Cleveland Clinic were in keeping with expected survival rates calculated by the SRTR using a risk-adjusted model for the period from July 2013 through December 2015.

Source: Scientific Registry of Transplant Recipients, January 2017. srtr.org

Waiting Time for Lung Transplant

July 2010 – December 2015

Months (Median)



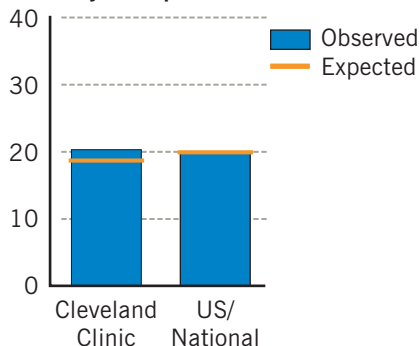
The wait time for a lung transplant at Cleveland Clinic was slightly higher than other programs in the region (4.3 vs 4.2 months) and the US as a whole (3.8 months). Most patients receive a transplant very quickly, but many patients at Cleveland Clinic have conditions that make it difficult to find suitable organs, thereby increasing the median wait time.

Source: Scientific Registry of Transplant Recipients, January 2017. srtr.org

Wait-List Mortality

July 2015 – December 2016

Mortality Rate per 100 Person Years (%)

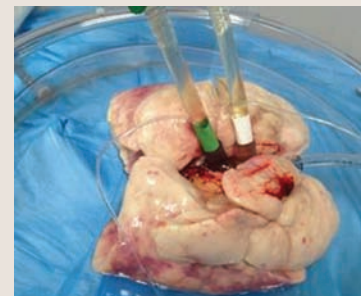


Cleveland Clinic strives to offer life-saving lung transplantation to as many patients as possible, and to achieve the best outcomes possible for patients waiting for the procedure. Cleveland Clinic's observed wait list mortality was similar to the national average and in keeping with the expected wait-list mortality rate calculated by the SRTR using a risk-adjusted model.

Source: Scientific Registry of Transplant Recipients, January 2017. srtr.org

Ex Vivo Lung Perfusion

The majority (about 80%) of lungs donated for transplant are not usable due to infection, damage, or excess fluid. However, ex vivo lung perfusion allows many of these lungs to be converted to lungs that are transplantable, allowing more lives to be saved. Ex vivo perfusion involves attaching the lungs outside of the body to a machine that perfuses them with a solution that helps remove excess water while they are being ventilated. If lung function improves, the lungs can be transplanted.¹



Reference

1. Cypel M, Yeung JC, Liu M, et al. Normothermic ex vivo lung perfusion in clinical lung transplantation. *N Engl J Med*. 2011 Apr 14;364(15):1431-1440.

Lung Cancer Screening Program

Lung Cancer Screening

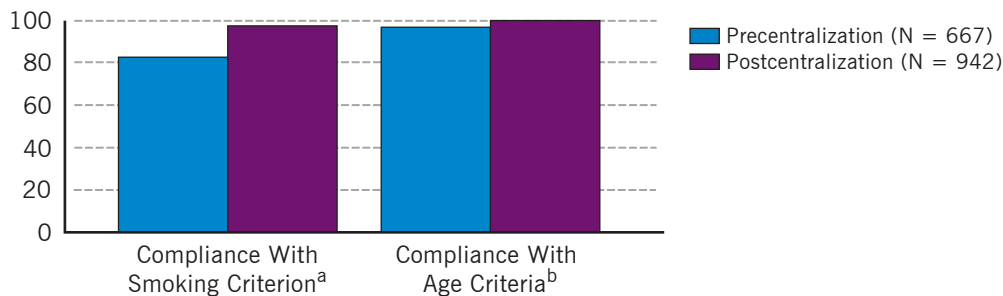
The primary goal of low dose computed tomography (LDCT) lung cancer screening is to detect lung cancer at curable stages while minimizing harm to those without lung cancer. In the past 5 years, Cleveland Clinic's lung cancer screening program has screened > 1600 patients, diagnosing 14 lung cancers while performing only 4 procedures on patients with benign lung nodules.

Prior to 2015, the provider ordering LDCT was responsible for managing the screening results. Management of the LDCT screening program was centralized to lung cancer specialists in April 2015. Rather than ordering the screening themselves, providers instead order a consult to the screening program, which then decides whether the patient is eligible.

Improvement in Compliance With Screening Guidelines Following Centralization (N = 1609)

2012 – 2016

Compliance (%)



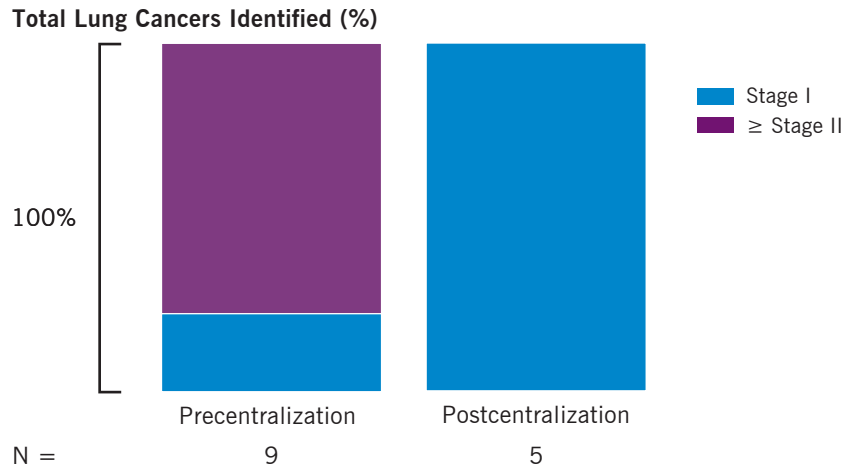
^aEligible smoking criterion is tobacco smoking history of at least 30 pack years

^bEligible age range for LDCT screening is 55-77 for current smokers or those who have quit smoking within the past 15 years

Following centralization, compliance with the criteria set forth by the Centers for Medicare & Medicaid Services increased.

Early Stage Cancers Diagnosed as a Percentage of Total Lung Cancers Identified (N = 14)

2012 – 2016



Following centralization, the percentage of stage I cancers discovered increased to 100%.

An important aspect of Cleveland Clinic's lung cancer screening program is its centralized counseling and shared decision making visit, which includes patient education about screening eligibility criteria related to age and smoking status, and the benefits and harms of lung cancer screening. Surveys were administered before the shared decision making visit, immediately following the visit, and after 1 month to evaluate the amount of information retained.¹

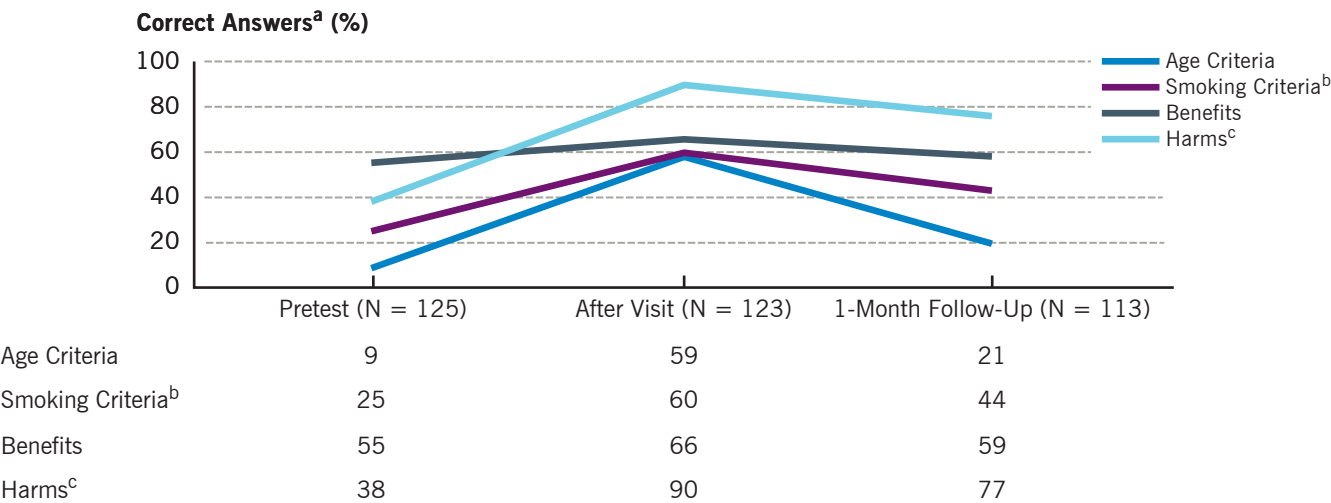
Reference

1. Mazzone PJ, Tenenbaum A, Seeley M, Petersen H, Lyon C, Han X, Wang XF. Impact of a Lung Cancer Screening Counseling and Shared Decision-Making Visit. *Chest*. 2017 Mar;151(3):572-578.

Lung Cancer Screening Program

Change in Knowledge of Lung Cancer Screening Following Shared Decision Making Visit

2015 – 2016



^aPercentages rounded to the nearest whole number

^bPercentage of those surveyed who gave partially correct or correct answers

^cPercentage of those surveyed who were able to identify at least 1 potential harm of lung cancer screening

These results indicate a substantial increase in knowledge about lung cancer screening eligibility and the knowledge of benefits and harms. Knowledge levels waned at the 1-month follow-up survey; however, they remained significantly higher than at the initial visit.

Cystic Fibrosis

Cleveland Clinic's Adult Cystic Fibrosis Program provides multidisciplinary patient- and family-centered care for patients living with cystic fibrosis (CF), from maintaining health for those with early-stage lung disease to supporting patients through and after lung transplant. The Adult CF Program at Cleveland Clinic partners with individuals and their families living with CF to deliver high-quality care that respects patient preferences, needs, and values.

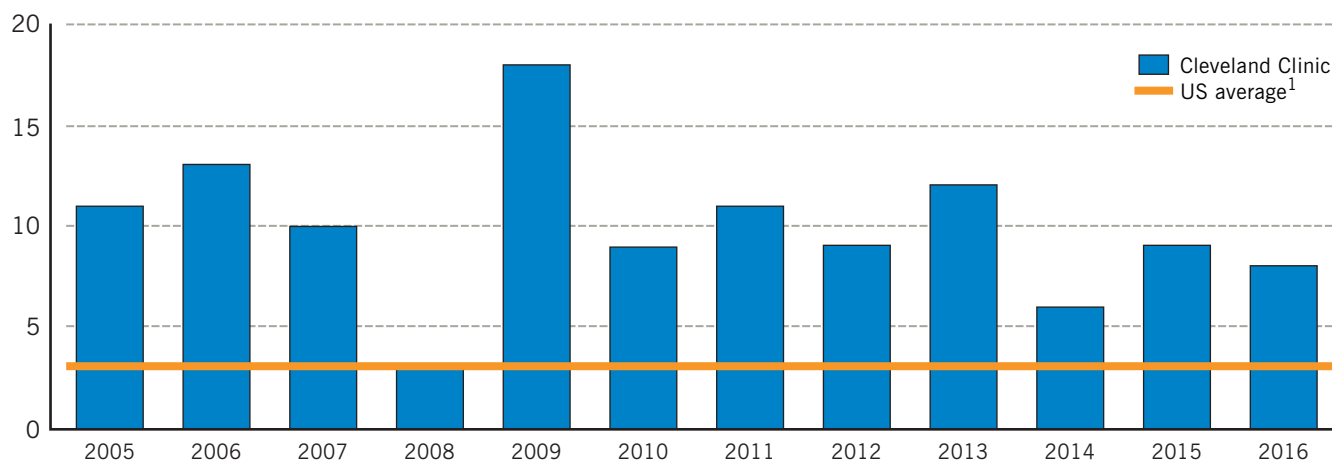
Cleveland Clinic Cystic Fibrosis Lung Transplant Experience

Cleveland Clinic is a national leader in transplantation for individuals living with CF. As a member of the Cystic Fibrosis Foundation Lung Transplant Consortium, Cleveland Clinic's main goal is to improve access, clinical care, and long-term outcomes of individuals with CF who undergo lung transplant.

Lung Transplants for Cystic Fibrosis Patients Performed at Cleveland Clinic (N = 119)

2005 – 2016

Number of Patients



Cleveland Clinic has averaged 10 CF transplants per year over the past decade, compared with the national median volume of 3 per year (interquartile range, 2–6). Long-term patient survival after transplant is associated with the volume of CF patients transplanted at an individual center.¹

Reference

1. Hayes D Jr, Sweet SC, Benden C, Kopp BT, Goldfarb SB, Visner GA, Mallory GB, Tobias JD, Tumin D. Transplant center volume and outcomes in lung transplantation for cystic fibrosis. *Transpl Int*. 2017 Apr;30(4):371-377.

Cystic Fibrosis

Lung Function at Cleveland Clinic Adult Cystic Fibrosis Clinic

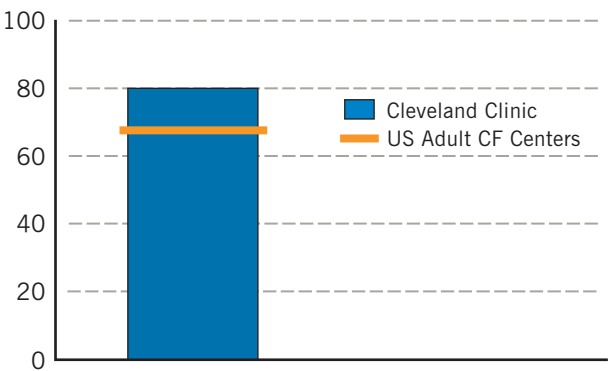
In addition to caring for individuals with CF who require lung transplantation, the Adult CF Program provides patient-centered, multidisciplinary care to adults with earlier stages of CF lung disease. A major focus of the team is a culture of consistent quality improvement.

Spirometry measurements are an important indicator of the lung health of individuals living with CF. Among individuals aged 18 years and older who have not undergone lung transplant and are followed in the CF Foundation patient registry (N = 12,879), the median forced expiratory volume in 1 second (FEV₁) is 67.1% predicted.¹ At Cleveland Clinic, the median FEV₁ among similar individuals is 80.3%.

Median FEV₁ Percent Predicted Among Pretransplant Adult Cystic Fibrosis Patients (N = 39)

2016

FEV₁ % Predicted



CF = cystic fibrosis, FEV₁ = forced expiratory volume in 1 second

Source: Cystic Fibrosis Foundation Patient Registry. 2015 Annual Data Report

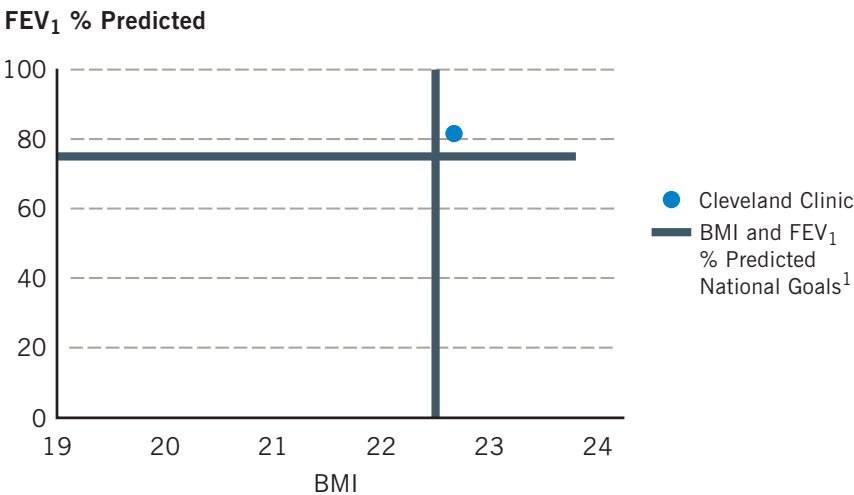
Reference

1. Cystic Fibrosis Foundation Patient Registry. 2015 Annual Data Report. Bethesda, MD. ©2016 Cystic Fibrosis Foundation. Available at <https://www.cff.org/Our-Research/CF-Patient-Registry/2015-Patient-Registry-Annual-Data-Report.pdf>.

Body Mass Index of Adult Cystic Fibrosis Patients

Pulmonary and nutritional outcomes in CF are closely linked and a key focus of the Adult CF Program at Cleveland Clinic. The CF Foundation has stated the following pulmonary and nutritional goals for adults: FEV₁ % predicted ≥ 75 and BMI ≥ 22 for females and ≥ 23 for males.¹

Median FEV₁ Percent Predicted vs Median BMI Among Pretransplant Adult Cystic Fibrosis Patients (N = 39) 2016



BMI = body mass index, FEV₁ = forced expiratory volume in 1 second

Source: Cystic Fibrosis Foundation Patient Registry. 2015 Annual Data Report

Cleveland Clinic’s Adult CF Program exceeds both pulmonary and nutritional national goals.

Reference

1. Cystic Fibrosis Foundation Patient Registry. 2015 Annual Data Report. Bethesda, MD. ©2016 Cystic Fibrosis Foundation. Available at <https://www.cff.org/Our-Research/CF-Patient-Registry/2015-Patient-Registry-Annual-Data-Report.pdf>.

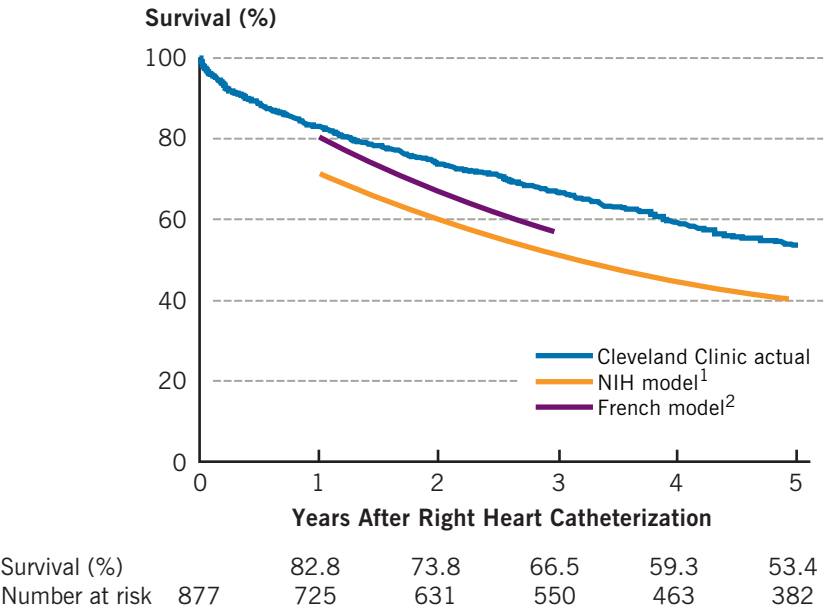
Pulmonary Vascular Program

The Pulmonary Vascular Program at Cleveland Clinic consists of a team of 5 pulmonologists, 2 cardiologists, an advanced practice nurse, a nurse, a patient care coordinator, 2 research nurse coordinators, and clinical and research fellows. Additionally, as part of Cleveland Clinic, the program draws on expertise in cardiothoracic surgery, lung transplantation, hepatology, liver transplantation, sleep medicine, and rheumatology to provide a comprehensive and multidisciplinary approach to patient care. Active clinical and research programs are offered for all types of pulmonary hypertension, including idiopathic pulmonary arterial hypertension, chronic thromboembolic pulmonary hypertension, hereditary hemorrhagic telangiectasia, portopulmonary hypertension, congenital heart disease, and pulmonary hypertension associated with the scleroderma spectrum of diseases and other connective tissue diseases. The surgical thromboendarterectomy program for patients with chronic thromboembolic pulmonary hypertension is currently one of the most active in the United States.

The Pulmonary Vascular Program is involved in a wide range of research activities, from NIH-funded basic research and translational research to clinical trials of the latest therapies. Many patients referred to the Pulmonary Vascular Program benefit from enrollment in one or more of these ongoing clinical trials and research studies.

Actual and Predicted Survival of Patients With Category 1 Pulmonary Arterial Hypertension (N = 877)

2016



The graph shows the survival curve for patients with category 1 pulmonary arterial hypertension enrolled in Cleveland Clinic's Pulmonary Hypertension Registry, compared with their predicted survival based on the NIH registry equation¹ and with survival in a large French registry.² For both comparisons, Cleveland Clinic patients had better than expected survival. For example, actual 3-year survival for Cleveland Clinic patients was 66.5%, compared with 51.5% predicted by the NIH equation and 56.7% in the French registry.

References

1. D'Alonzo GE, Barst RJ, Ayres SM, Bergofsky EH, Brundage BH, Detre KM, Fishman AP, Goldring RM, Groves BM, Kernis JT. Survival in patients with primary pulmonary hypertension; results from a national prospective registry. *Ann Intern Med.* 1991 Sep 1;115(5):343-349.
2. Humbert M, Sitbon O, Chaouat A, et al. Pulmonary arterial hypertension in France: results from a national registry. *Am J Respir Crit Care Med.* 2006 May 1;173(9):1023-1030.

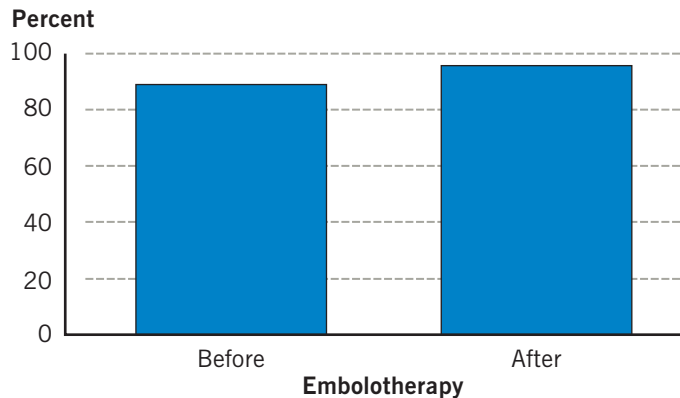
Hereditary Hemorrhagic Telangiectasia

Among the numerous manifestations of hereditary hemorrhagic telangiectasia (HHT), pulmonary arteriovenous malformations contribute significantly to morbidity and mortality by causing hypoxemia and increasing the risk of stroke, brain abscess, and hemoptysis. Physicians at Cleveland Clinic's HHT Center of Excellence have expertise in evaluating patients who have pulmonary arteriovenous malformations and in minimally invasive techniques to embolize these lesions.

For a cohort of 36 HHT patients who underwent embolization at Cleveland Clinic, room air oxygen saturation increased from 89.8% to 96.5%. Shunt fraction was measured in a subset of 18 patients, and the mean value decreased from 8.4% to 4.4%.

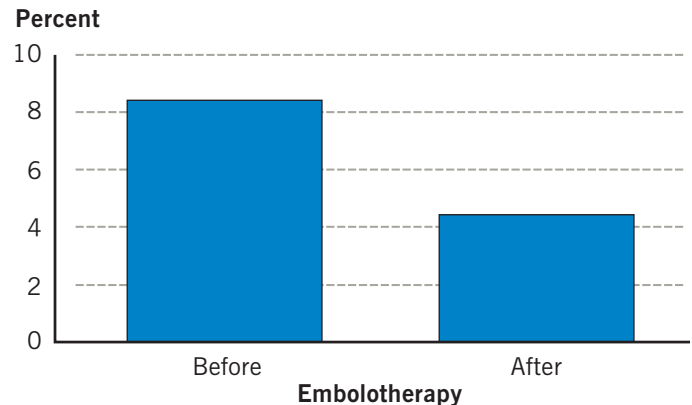
**Measured Pulse Oximetry Before and After Embolotherapy
(N = 36)**

2016



**Shunt Fraction Before and After Embolotherapy
(N = 18)**

2016



Chronic Thromboembolic Pulmonary Hypertension

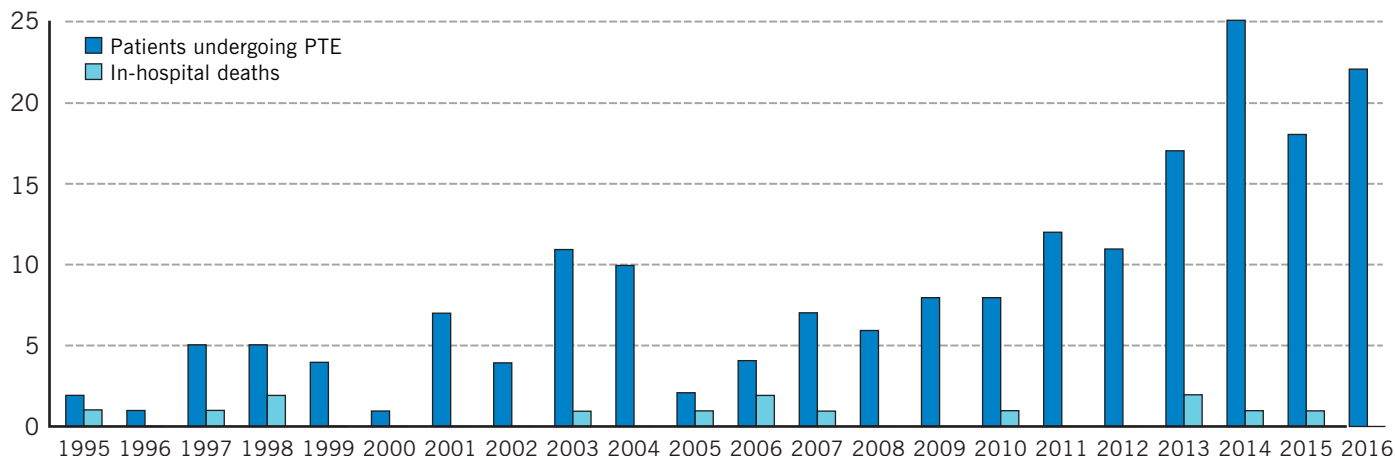
Pulmonary hypertension due to unresolved pulmonary emboli that narrow pulmonary arteries, also known as chronic thromboembolic pulmonary hypertension (CTEPH), is a deadly disease that can be effectively treated with a complex surgical procedure called pulmonary thromboendarterectomy (PTE). Cleveland Clinic has a multidisciplinary team dedicated to the evaluation and treatment of CTEPH patients. The team includes clinicians from Pulmonary Medicine, Cardiothoracic Surgery, Nuclear Medicine, Chest Radiology, Interventional Radiology, Cardiovascular Medicine, Anesthesiology, and Critical Care Medicine.

Over the past 22 years, 190 PTE surgeries have been performed at Cleveland Clinic. Between 1995 and 2010, operative mortality (i.e., in-hospital deaths) was 11.6%. Between 2011 and 2016, surgical volume nearly quadrupled and the operative mortality decreased to 3.8%, a rate comparable to or better than current published literature.^{1,2}

Pulmonary Thromboendarterectomy Experience (N = 190)

1995 – 2016

Number of Patients



For the 96 patients operated on between 2011 and 2016 (excluding patients with missing data and those with normal resting pulmonary artery pressure), hemodynamic data show marked improvement in pulmonary artery pressure, pulmonary vascular resistance, and cardiac index.

References

1. Mayer E, Jenkins D, Lindner J, D'Armini A, Kloek J, Meyns B, Ilkjaer LB, Klepetko W, Delcroix M, Lang I, Pepke-Zaba J, Simonneau G, Darteville P. Surgical management and outcome of patients with chronic thromboembolic pulmonary hypertension: results from an international prospective registry. *J Thorac Cardiovasc Surg.* 2011;141(3):702-710.
2. Madani MM, Auger WR, Pretorius V, Sakakibara N, Kerr KM, Kim NH, Fedullo PF, Jamieson SW. Pulmonary endarterectomy: recent changes in a single institution's experience of more than 2,700 patients. *Ann Thorac Surg.* 2012;94(1):97-103; discussion 103.

Hemodynamics Before and After Pulmonary Thromboendarterectomy (N = 96)

2011 – 2016

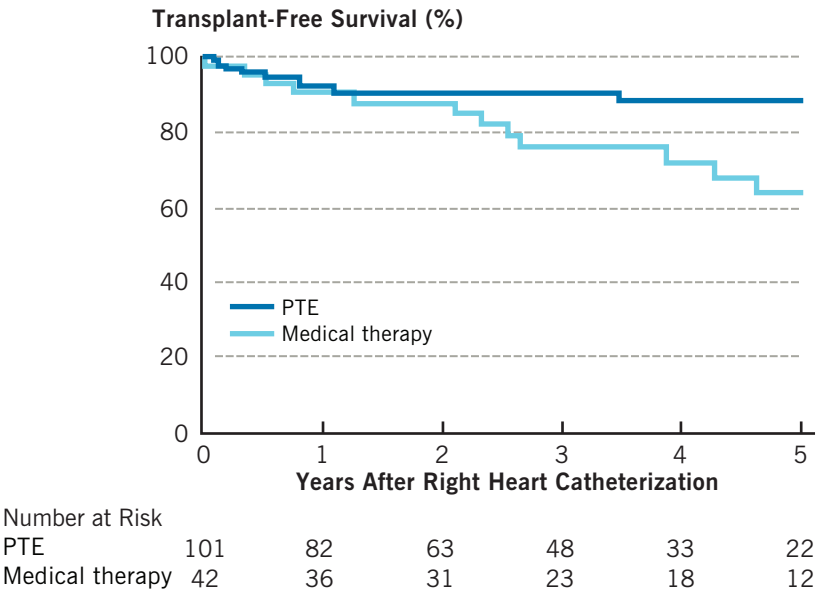
	Preoperative Median (25th, 75th percentiles)	Postoperative Median (25th, 75th percentiles)
Mean PAP, mm Hg	46 (40, 54)	25 (22, 31)
CI, L/min/m ²	2.2 (1.7, 2.6)	2.8 (2.4, 3.3)
PVR, Wood units	6.7 (5, 10.0)	2.4 (2.0, 3.3)

CI = cardiac index, PAP = pulmonary artery pressure, PVR = pulmonary vascular resistance

Not only are hemodynamic results remarkable and operative mortality low, but long-term outcomes are excellent, with a 3-year survival rate of 88.3%, compared with 63.9% for patients treated with medical therapies (*P* = 0.02) between 2009 and 2016.

Pulmonary Thromboendarterectomy vs Medical Therapy (N = 143)

2009 – 2016



PTE = pulmonary thromboendarterectomy

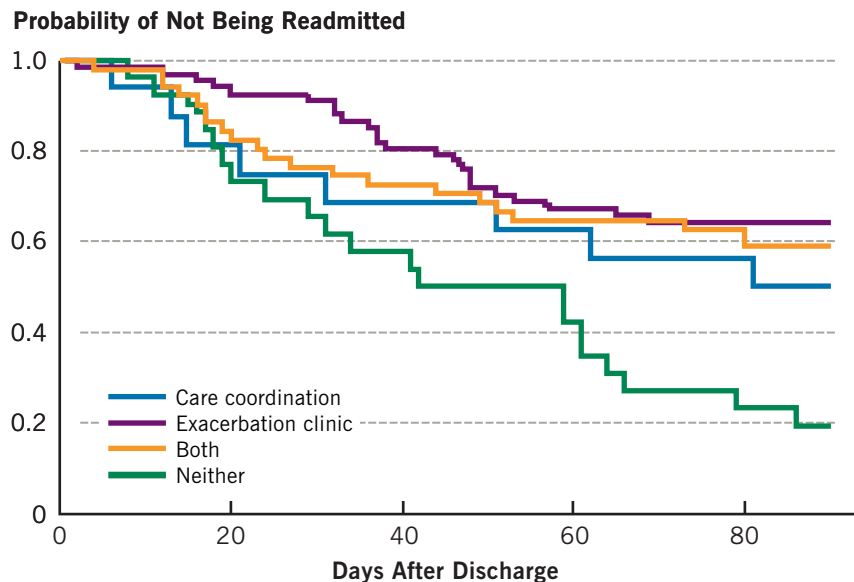
Chronic Obstructive Pulmonary Disease

The Center for Comprehensive Care in Chronic Obstructive Pulmonary Disease (COPD Center) was established to provide comprehensive, multidisciplinary care to COPD patients evaluated and managed at Cleveland Clinic's Respiratory Institute. In addition to optimizing medical management, COPD Center physicians have extensive experience in assessing patients for advanced surgical procedures such as lung volume reduction surgery and lung transplantation. The COPD Center maintains a referral clinic and integrated disease management program, which consists of a COPD exacerbation clinic (for early follow-up of those patients recently discharged from the hospital) and a care coordination program that provides telephonic follow-up.

Outcomes for Different Components of the COPD Integrated Disease Management Program

(N = 160)

April 2014 – May 2015



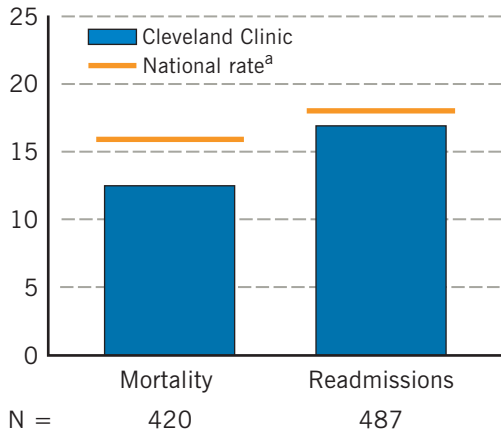
Between April 2014 and May 2015, 160 patients recently discharged after hospitalization for COPD exacerbation were referred to the integrated disease management program. The 90-day readmission rate was 35.8% for patients who attended the exacerbation clinic (N = 67), 50% for those who received care coordination (N = 16), 41.2% for those who received both (N = 51), and 80.8% for those who received neither (N = 26). Receiving either or both components of the program reduced the likelihood of 90-day readmissions compared with receiving no intervention.

National Hospital Quality Measures

Pneumonia All-Cause 30-Day Mortality and All-Cause 30-Day Readmissions

July 2013 – June 2016

Percent



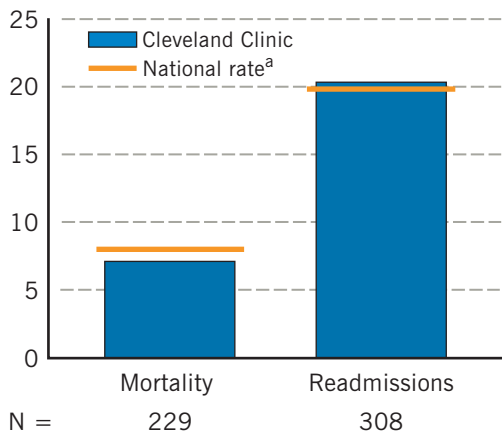
^aSource: [medicare.gov/hospitalcompare](https://www.medicare.gov/hospitalcompare)

CMS calculates 2 pneumonia outcomes measures based on Medicare claims and enrollment information. The most recent risk-adjusted data available from CMS are shown. Cleveland Clinic's pneumonia patient mortality rate is ranked "better than" the US national rate. Cleveland Clinic's pneumonia readmissions rate is ranked "no different than" the US national rate. To further reduce avoidable readmissions, Cleveland Clinic is focused on optimizing transitions from hospital to home or postacute facility. Specific initiatives have been implemented to ensure effective communication, education, and follow-up.

COPD All-Cause 30-Day Mortality and All-Cause 30-Day Readmissions

July 2013 – June 2016

Percent



COPD = chronic obstructive pulmonary disease

^aSource: [medicare.gov/hospitalcompare](https://www.medicare.gov/hospitalcompare)

CMS calculates 2 COPD outcomes measures based on Medicare claims and enrollment information. The most recent risk-adjusted data available from CMS are shown. Although Cleveland Clinic's COPD patient mortality rate is lower than the US national rate, CMS ranks Cleveland Clinic's performance as "no different than" the US national rate. Cleveland Clinic's COPD readmissions rate is slightly higher than the US national rate and also ranked by CMS as "no different than" the US national rate. To further reduce avoidable readmissions, Cleveland Clinic is focused on optimizing transitions from hospital to home or postacute facility. Specific initiatives have been implemented to ensure effective communication, education, and follow-up.

Patient Experience — Respiratory Institute

Keeping patients at the center of all that Cleveland Clinic does is critical. Patients First is the guiding principle at Cleveland Clinic. Patients First is safe care, high-quality care, in the context of patient satisfaction, and high value. Ultimately, caregivers have the power to impact every touch point of a patient's journey, including their clinical, physical, and emotional experience.

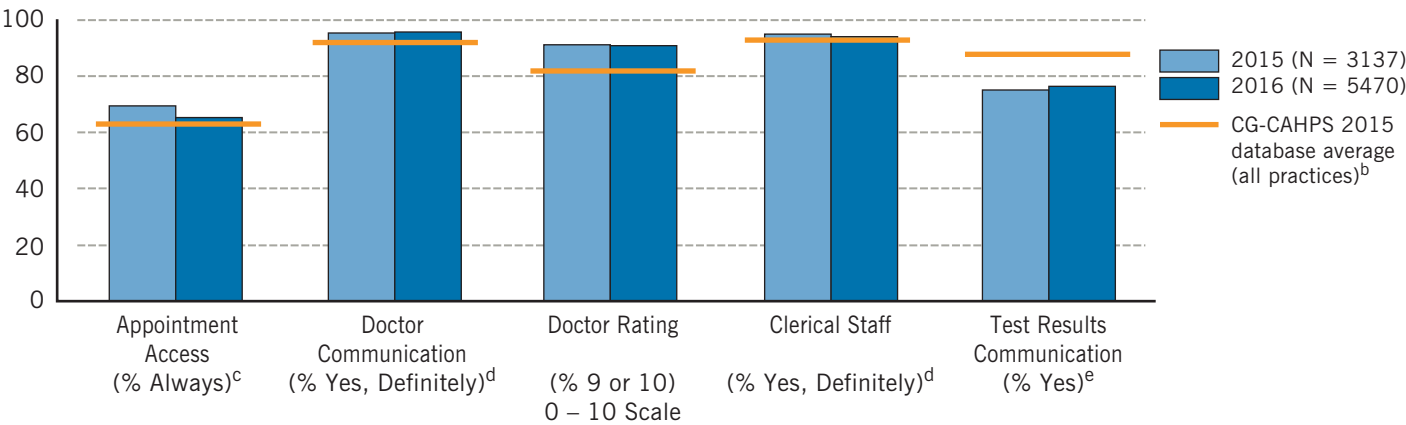
Cleveland Clinic recognizes that patient experience goes well beyond patient satisfaction surveys. Nonetheless, sharing the survey results with caregivers and the public affords opportunities to improve how Cleveland Clinic delivers exceptional care.

Outpatient Office Visit Survey — Respiratory Institute

CG-CAHPS Assessment^a

2015 – 2016

Percent Best Response



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

^bBased on results submitted to the AHRQ CG-CAHPS database from 2829 practices in 2015

^cResponse options: Always, Usually, Sometimes, Never

^dResponse options: Yes, definitely; Yes, somewhat; No

^eResponse options: Yes, No

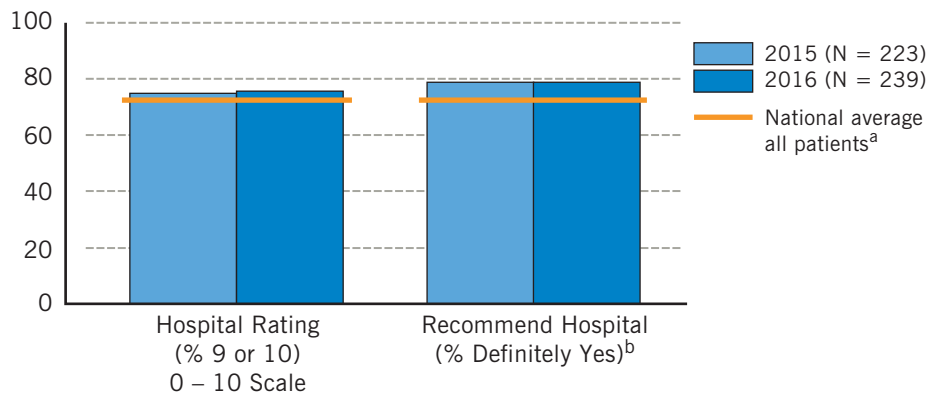
Source: Press Ganey, a national hospital survey vendor

Inpatient Survey — Respiratory Institute

HCAHPS Overall Assessment

2015 – 2016

Best Response (%)



^aBased on national survey results of discharged patients, January 2015 – December 2015, from 4172 US hospitals. medicare.gov/hospitalcompare

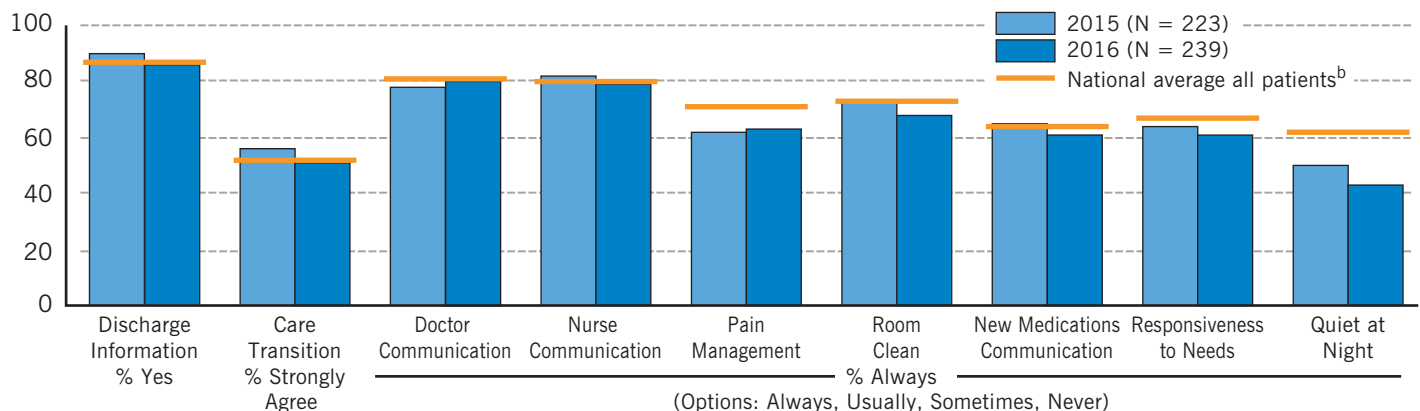
^bResponse options: Definitely yes, Probably yes, Probably no, Definitely no

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

HCAHPS Domains of Care^a

2015 – 2016

Best Response (%)



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

^bBased on national survey results of discharged patients, January 2015 – December 2015, from 4172 US hospitals. medicare.gov/hospitalcompare

Source: Press Ganey, a national hospital survey vendor, 2016

Cleveland Clinic — Implementing Value-Based Care

Overview

Cleveland Clinic health system uses a systematic approach to performance improvement while simultaneously pursuing 3 goals: improving the patient experience of care (including quality and satisfaction), improving population health, and reducing the cost of healthcare. The following measures are examples of 2016 focus areas in pursuit of this 3-part aim. Throughout this section, “Cleveland Clinic” refers to the academic medical center or “main campus,” and those results are shown.

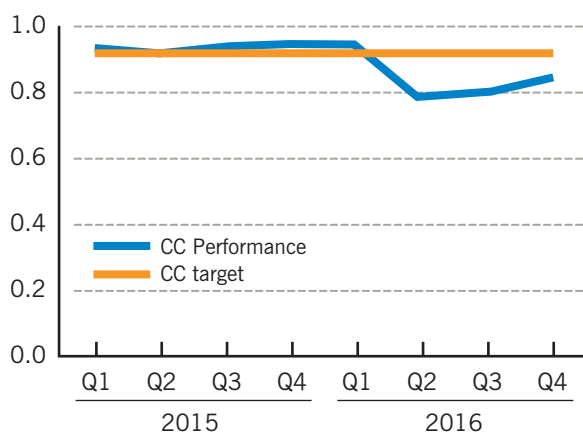
Real-time data are leveraged in each Cleveland Clinic location to drive performance improvement. Although not an exact match to publicly reported data, more timely internal data create transparency at all organizational levels and support improved care in all clinical locations.

Improve the Patient Experience of Care

Cleveland Clinic Overall Mortality Ratio

2015 – 2016

O/E Ratio



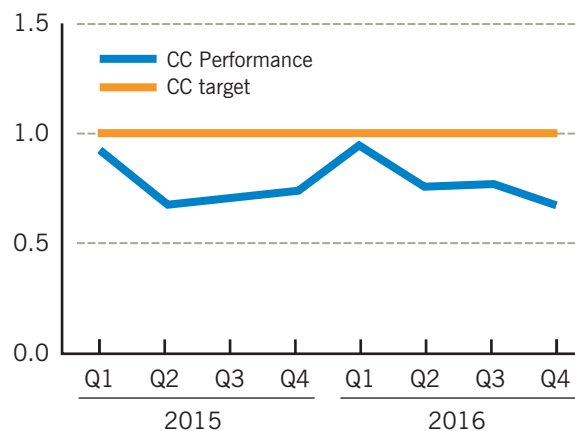
Source: Data from the Vizient Clinical Data Base/Resource Manager™ used by permission of Vizient. All rights reserved.

Cleveland Clinic’s observed/expected (O/E) mortality ratio outperformed its internal target derived from the Vizient 2016 risk model. Ratios less than 1.0 indicate mortality performance “better than expected” in Vizient’s risk adjustment model.

Cleveland Clinic Central Line-Associated Bloodstream Infection, reported as Standardized Infection Ratio (SIR)

2015 – 2016

Rate per 1000 Line Days

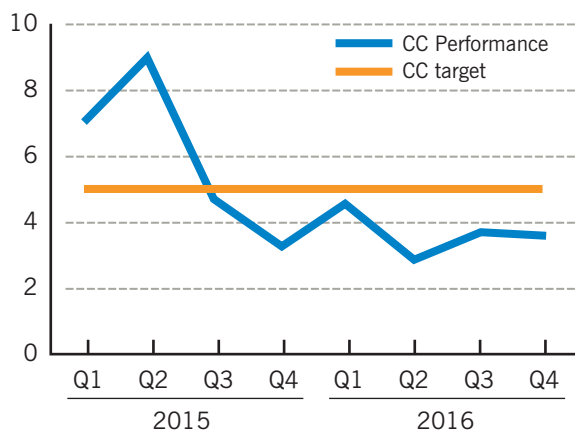


Cleveland Clinic has implemented several strategies to reduce central line-associated bloodstream infections (CLABSIs), including a central-line bundle of insertion, maintenance, and removal best practices. Focused reviews of every CLABSI occurrence support reductions in CLABSI rates in the high-risk critical care population.

Cleveland Clinic Postoperative Respiratory Failure Risk-Adjusted Rate

2015 – 2016

Rate per 1000 Eligible Patients



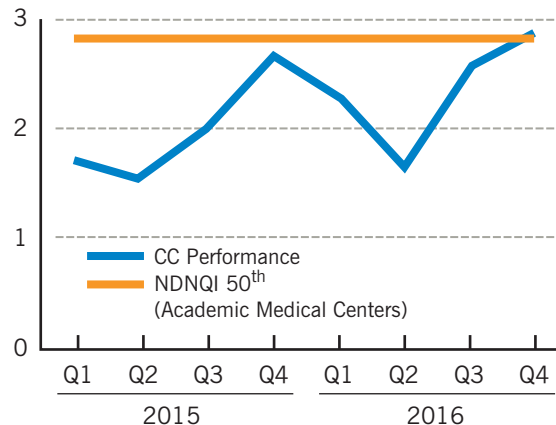
Source: Data from the Vizient Clinical Data Base/Resource Manager™ used by permission of Vizient. All rights reserved.

Efforts continue toward reducing intubation time, assessing readiness for extubation, and preventing the need for reintubation. Cleveland Clinic has leveraged the technology within the electronic medical record to support ongoing improvement efforts in reducing postoperative respiratory failure (AHRQ Patient Safety Indicator 11). Prevention of respiratory failure remains a safety priority for Cleveland Clinic.

Cleveland Clinic Hospital-Acquired Pressure Ulcer Prevalence (Adult)

2015 – 2016

Percent



Source: Data reported from the National Database for Nursing Quality Indicators® (NDNQI®) with permission from Press Ganey.

A pressure ulcer is an injury to the skin that can be caused by pressure, moisture, or friction. These sometimes occur when patients have difficulty changing position on their own. Cleveland Clinic caregivers have been trained to provide appropriate skin care and regular repositioning while taking advantage of special devices and mattresses to reduce pressure for high-risk patients. In addition, they actively look for hospital-acquired pressure ulcers and treat them quickly if they occur.

Cleveland Clinic strategies to mitigate the risk of these pressure injuries include routine rounding to accurately stage pressure injuries, monthly multidisciplinary wound care meetings, and ongoing nursing education, both in the classroom and at the bedside.

Cleveland Clinic — Implementing Value-Based Care

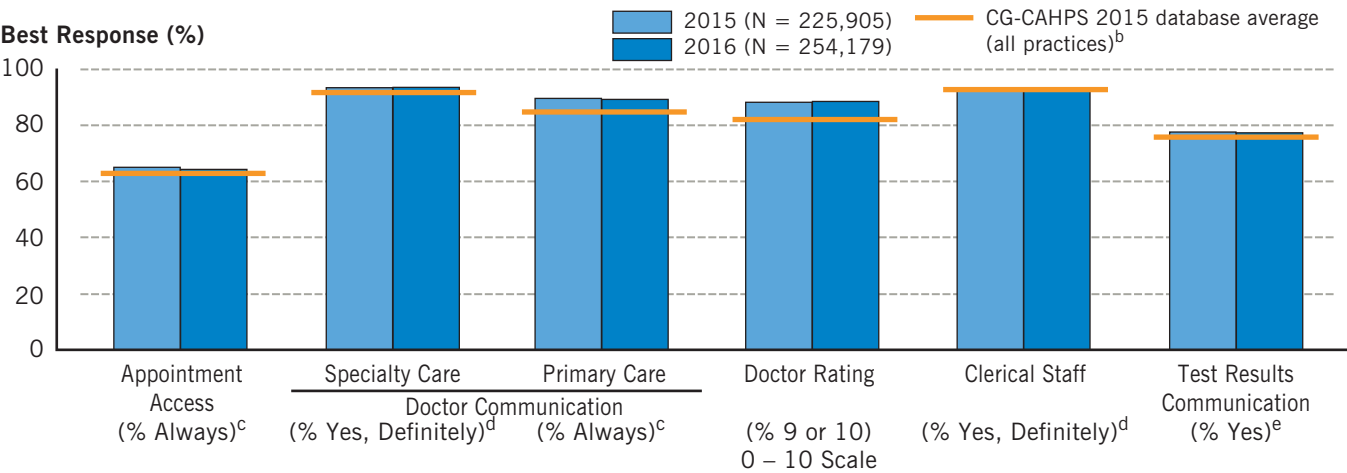
Keeping patients at the center of all that we do is critical. Patients First is the guiding principle at Cleveland Clinic. Patients First is safe care, high-quality care, in the context of patient satisfaction, and high value. Ultimately, our caregivers have the power to impact every touch point of a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

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

Outpatient Office Visit Survey — Cleveland Clinic

CG-CAHPS Assessment^a

2015 – 2016



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

^bBased on results submitted to the AHRQ CG-CAHPS database from 2829 practices in 2015

^cResponse options: Always, Usually, Sometimes, Never

^dResponse options: Yes, definitely; Yes, somewhat; No

^eResponse options: Yes, No

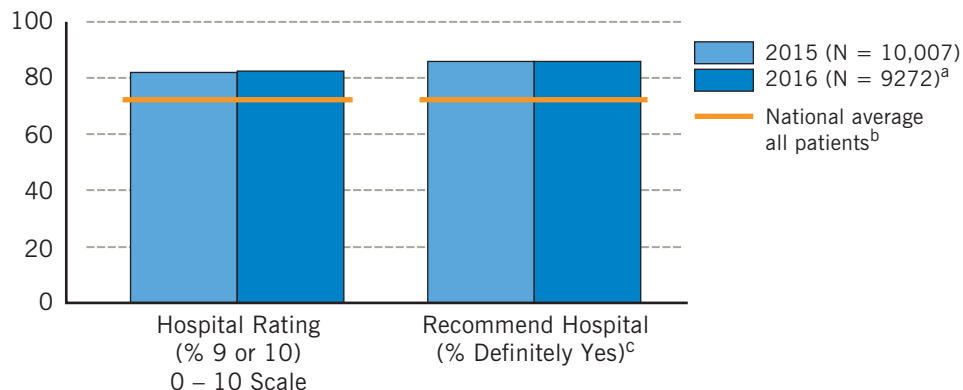
Source: Press Ganey, a national hospital survey vendor

Inpatient Survey — Cleveland Clinic

HCAHPS Overall Assessment

2015 – 2016

Best Response (%)



^aAt the time of publication, 2016 ratings have not been reported by the Centers for Medicare & Medicaid Services and ratings are not adjusted for patient mix.

^bBased on national survey results of discharged patients, January 2015 – December 2015, from 4172 US hospitals. medicare.gov/hospitalcompare

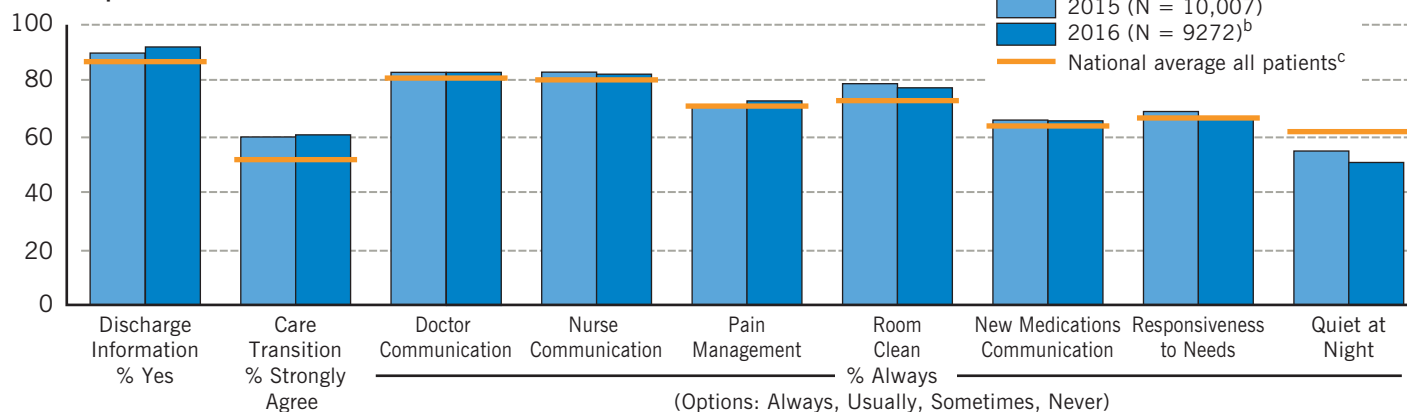
^cResponse options: Definitely yes, Probably yes, Probably no, Definitely no

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

HCAHPS Domains of Care^a

2015 – 2016

Best Response (%)



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

^bAt the time of publication, 2016 ratings have not been reported by the Centers for Medicare & Medicaid Services and ratings are not adjusted for patient mix.

^cBased on national survey results of discharged patients, January 2015 – December 2015, from 4172 US hospitals. medicare.gov/hospitalcompare

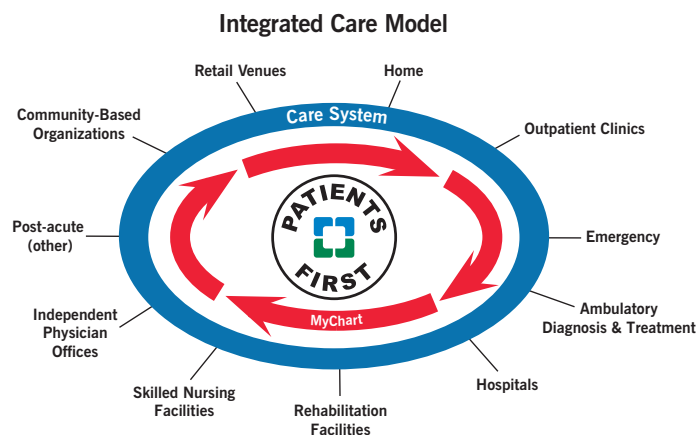
Source: Centers for Medicare & Medicaid Services, 2015; Press Ganey, a national hospital survey vendor, 2016

Cleveland Clinic — Implementing Value-Based Care

Focus on Value

Cleveland Clinic has developed and implemented new models of care that focus on “Patients First” and aim to deliver on the Institute of Medicine goal of **S**afe, **T**imely, **E**ffective, **E**fficient, **E**quitable, **P**atient-centered care. Creating new models of Value-Based Care is a strategic priority for Cleveland Clinic. As care delivery shifts from fee-for-service to a population health and bundled payment delivery system, Cleveland Clinic is focused on concurrently improving patient safety, outcomes, and experience.

What does this new model of care look like?



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

- The patient remains at the heart of the CCICM.
- The blue band represents the care system, which is a seamless pathway that patients move along as they receive care in different settings. The care system represents integration of care across the continuum.
- Critical competencies are required to build this new care system. Cleveland Clinic is creating disease- and condition-specific care paths for a variety of procedures and chronic diseases. Another facet is implementing comprehensive care coordination for high-risk patients to prevent unnecessary hospitalizations and emergency department visits. Efforts include managing transitions in care, optimizing access and flow for patients through the CCICM, and developing novel tactics to engage patients and caregivers in this work.
- Measuring performance around quality, safety, utilization, cost, appropriateness of care, and patient and caregiver experience is an essential component of this work.

Improve Population Health

Cleveland Clinic Accountable Care Organization Measure Performance

2016

National Percentile Ranking

90th	<ul style="list-style-type: none">• Falls Screening• Heart Failure• Ischemic Vascular Disease• BMI Screening• Tobacco Screening
80th	<ul style="list-style-type: none">• Coronary Artery Disease• Diabetes• Breast Cancer Screening• Pneumonia Vaccination
70th	<ul style="list-style-type: none">• Colorectal Cancer Screening• Influenza Vaccination• Blood Pressure Screening• Hypertension
50th	<ul style="list-style-type: none">• Depression Screening

Higher percentiles are better

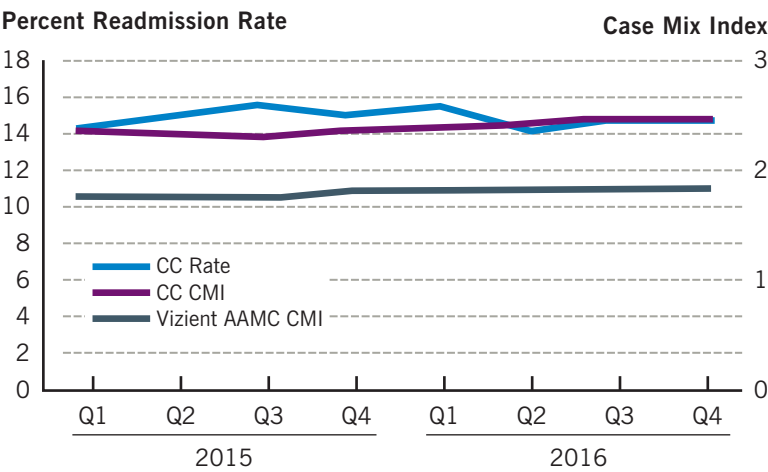
As part of Cleveland Clinic's commitment to population health and in support of its Accountable Care Organization (ACO), these ACO measures have been prioritized for monitoring and improvement. Cleveland Clinic is improving performance in these measures by enhancing care coordination, optimizing technology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

Cleveland Clinic — Implementing Value-Based Care

Reduce the Cost of Care

Cleveland Clinic All-Cause 30-Day Readmission Rate to Any Cleveland Clinic Hospital

2015 – 2016

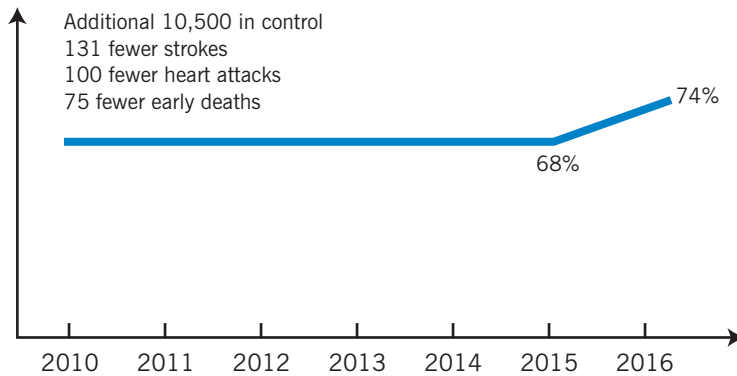


CMI = case mix index

Source: Data from the Vizient Clinical Data Base/Resource Manager™ used by permission of Vizient.
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Cleveland Clinic monitors 30-day readmission rates for any reason to any of its system hospitals. Unplanned readmissions are actively reviewed for improvement opportunities. Comprehensive care coordination and care management for high-risk patients has been initiated in an effort to prevent unnecessary hospitalizations and emergency department visits. Sicker, more complex patients are more susceptible to readmission. Case mix index (CMI) reflects patient severity of illness and resource utilization. Cleveland Clinic's CMI remains one of the highest among American academic medical centers.

Accountable Care Organization (ACO) Improving Outcomes and Reducing Costs

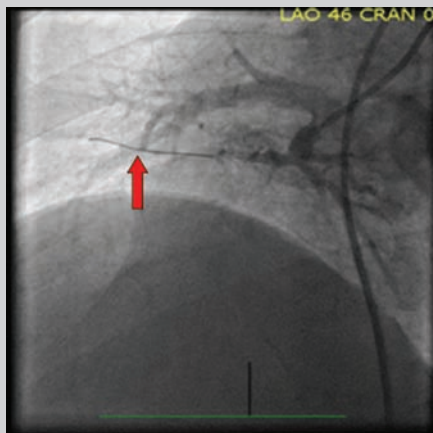


Cleveland Clinic was one of the top performing new ACOs in the United States (for 2015 performance as determined in 2016) due to efficiency, cost reduction, and improvements in effectiveness of chronic disease management such as treating hypertension, reducing preventable hospitalizations through care coordination, and optimizing the care at skilled nursing facilities through its Connected Care program.

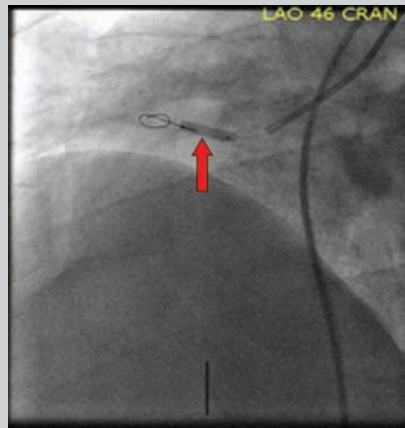
For example, a system-wide effort to improve the control of blood pressure for patients with hypertension was begun in 2016 and resulted in an additional 10,500 patients with blood pressure controlled. This will translate to many fewer strokes, heart attacks, and preventable deaths.

Balloon Pulmonary Angioplasty for Inoperable Chronic Thromboembolic Pulmonary Hypertension

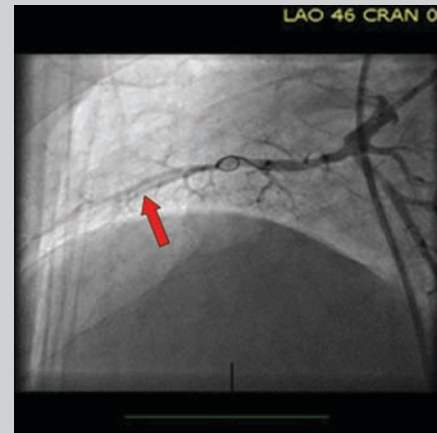
Left untreated, chronic thromboembolic pulmonary hypertension (CTEPH) leads to right heart failure and death. Pulmonary thromboendarterectomy is the gold-standard curative treatment. However, surgery is not an option for up to 35% of CTEPH patients for a variety of reasons. For those patients, a new option is balloon pulmonary angioplasty, a catheter-based procedure well established in its application for treating blocked arteries in the heart and brain. Clinicians at the Respiratory Institute are now using this procedure in inoperable CTEPH and have observed immediate radiographic improvement in pulmonary blood flow, as well as dramatic improvements in symptoms and pulmonary pressures.



Before angioplasty — no flow in occluded right antero-basal segmental artery.



Balloon inflated.



After angioplasty — flow restored to artery.

Pulmonary Embolism Response Team

In patients with acute pulmonary embolism, clinicians face the difficult task of assessing the risk of death and balancing that against the risk of bleeding to identify patients who might benefit from early reperfusion therapies, including systemic thrombolysis, catheter-directed therapies, or surgical embolectomy. At Cleveland Clinic, a multidisciplinary pulmonary embolism response team (PERT) has been assembled to provide rapid evaluation, risk stratification, and management recommendations for patients with acute pulmonary embolism. PERT members — representing pulmonary and critical care medicine, vascular medicine, interventional radiology, interventional cardiology, emergency medicine, and cardiothoracic surgery — provide this consultative service around-the-clock to ensure that patients receive appropriate therapy in an expedited fashion.

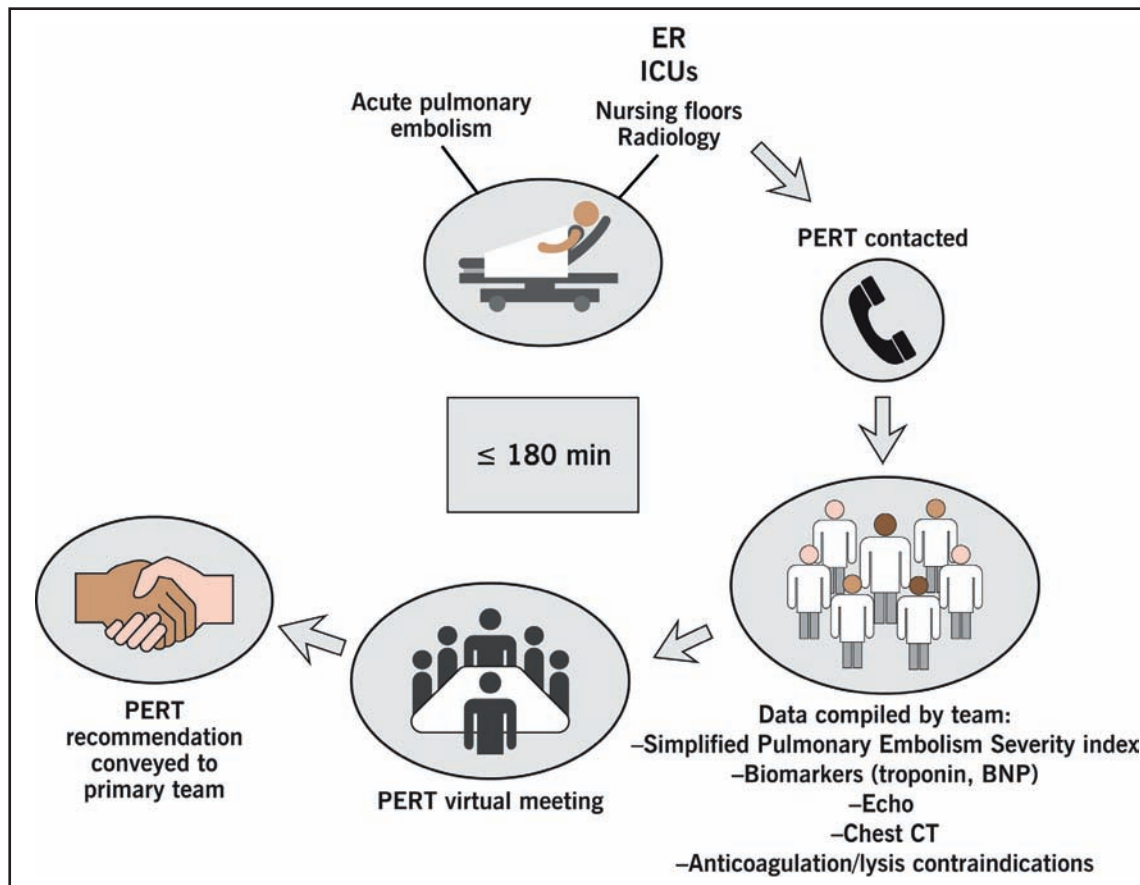


Illustration of PERT workflow

Contact Information

Department of Pulmonary Medicine

216.444.6503 or 800.223.2273,
ext.46503

Department of Allergy and Clinical Immunology Appointments/Referrals

216.444.3386 or 800.223.2273,
ext. 43386

On the Web at
clevelandclinic.org/pulmonary

Staff Listing

For a complete listing of Cleveland Clinic's Respiratory Institute staff, please visit clevelandclinic.org/staff.

Publications

Respiratory Institute staff authored **99** publications in 2016 as indexed within Web of Science.

Locations

For a complete listing of Respiratory Institute locations, please visit clevelandclinic.org/resplocations.





Additional Contact Information

General Patient Referral

24/7 hospital transfers or
physician consults
800.553.5056

General Information

216.444.2200

Hospital Patient Information

216.444.2000

General Patient Appointments

216.444.2273 or 800.223.2273

Referring Physician Center and Hotline

855.REFER.123 (855.733.3712)

Or email refdr@ccf.org or visit
clevelandclinic.org/refer123

Request for Medical Records

216.444.2640 or
800.223.2273, ext. 42640

Same-Day Appointments

216.444.CARE (2273)

Global Patient Services/ International Center

Complimentary assistance for international
patients and families

001.216.444.8184 or visit
clevelandclinic.org/gps

Medical Concierge

Complimentary assistance for out-of-state
patients and families

800.223.2273, ext. 55580, or
email medicalconcierge@ccf.org

Cleveland Clinic Abu Dhabi

clevelandclinicabudhabi.ae

Cleveland Clinic Canada

888.507.6885

Cleveland Clinic Florida

866.293.7866

Cleveland Clinic Nevada

702.483.6000

**For address corrections or changes,
please call**

800.890.2467

About Cleveland Clinic

Overview

Cleveland Clinic is an academic medical center offering patient care services supported by research and education in a nonprofit group practice setting. More than 3500 Cleveland Clinic staff physicians and scientists in 140 medical specialties and subspecialties care for more than 7.1 million patients across the system annually, performing nearly 208,000 surgeries and conducting more than 652,000 emergency department visits. Patients come to Cleveland Clinic from all 50 states and 185 nations. Cleveland Clinic's CMS case-mix index is the second-highest in the nation.

Cleveland Clinic is an integrated healthcare delivery system with local, national, and international reach. The main campus in midtown Cleveland, Ohio, has a 1400-bed hospital, outpatient clinic, specialty institutes, labs, classrooms, and research facilities in 44 buildings on 167 acres. Cleveland Clinic has more than 150 northern Ohio outpatient locations, including 10 regional hospitals, 18 full-service family health centers, 3 health and wellness centers, an affiliate hospital, and a rehabilitation hospital for children. Cleveland Clinic also includes Cleveland Clinic Florida; Cleveland Clinic Nevada; Cleveland Clinic Canada; Cleveland Clinic Abu Dhabi, UAE; Sheikh Khalifa Medical City (management contract), UAE; and Cleveland Clinic London (opening in 2020). Cleveland Clinic is the largest employer in Ohio, with more than 51,000 employees. It generates \$12.6 billion of economic activity a year.

Cleveland Clinic supports physician education, training, consulting, and patient services around the world through representatives in the Dominican Republic, Guatemala, India, Panama, Peru, Saudi Arabia, and the United Arab Emirates. Dedicated Global Patient Services offices are located at Cleveland Clinic's main campus, Cleveland Clinic Abu Dhabi, Cleveland Clinic Canada, and Cleveland Clinic Florida.

The Cleveland Clinic Model

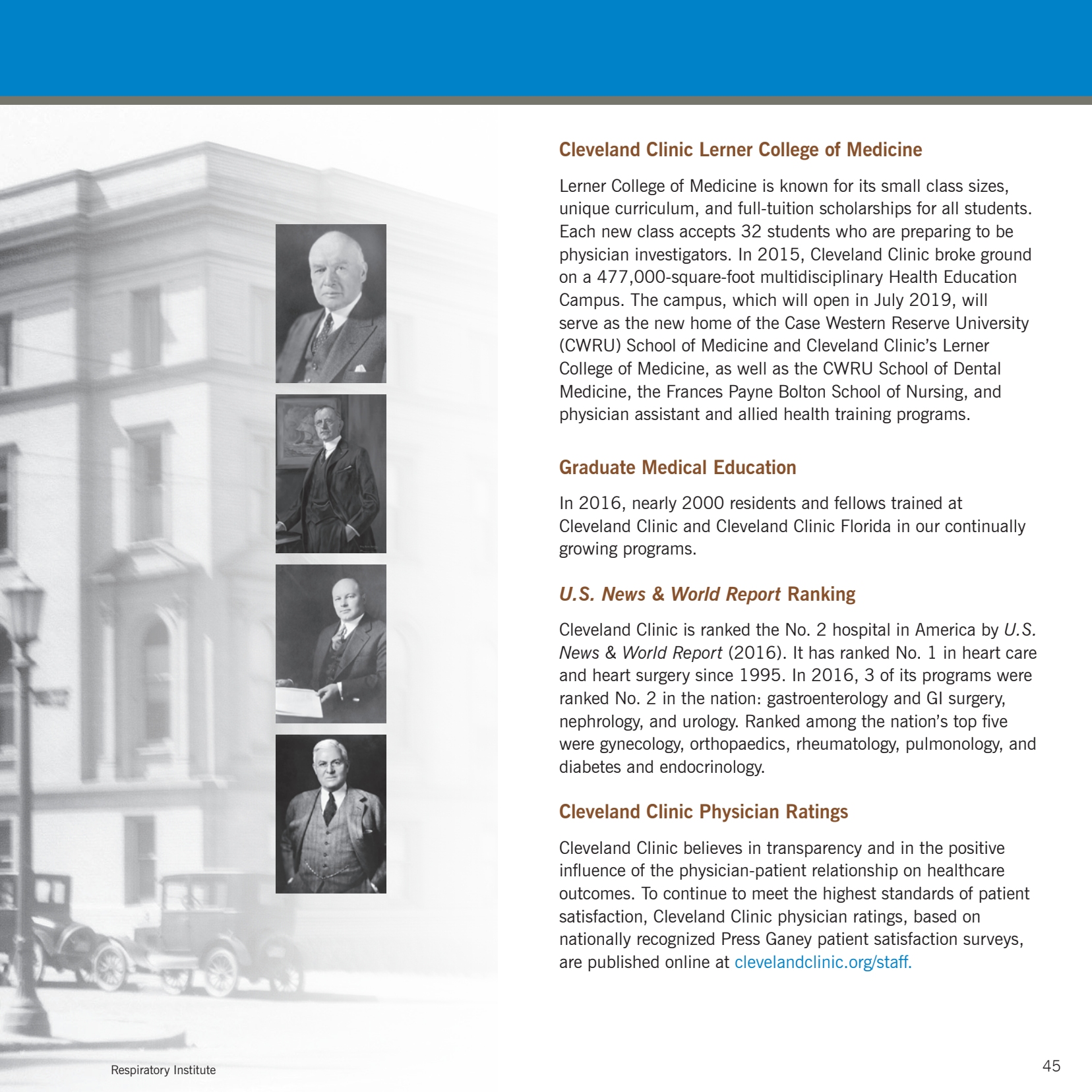
Cleveland Clinic was founded in 1921 by 4 physicians who had served in World War I and hoped to replicate the organizational efficiency of military medicine. The organization has grown through the years by adhering to the nonprofit, multispecialty group practice they established. All Cleveland Clinic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

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

Internally, Cleveland Clinic services are organized into patient-centered integrated practice units called institutes, each institute combining medical and surgical care for a specific disease or body system. Cleveland Clinic was among the first academic medical centers to establish an Office of Patient Experience, to promote comfort, courtesy, and empathy across all patient care services.

A Clinically Integrated Network

Cleveland Clinic is committed to providing value-based care, and it has grown the Cleveland Clinic Quality Alliance into the nation's second-largest, and northeast Ohio's largest, clinically integrated network. The network comprises more than 6300 physician members, including both Cleveland Clinic staff and independent physicians from the community. Led by its physician members, the Quality Alliance strives to improve quality and consistency of care; reduce costs and increase efficiency; and provide access to expertise, data, and experience.



Cleveland Clinic Lerner College of Medicine

Lerner College of Medicine is known for its small class sizes, unique curriculum, and full-tuition scholarships for all students. Each new class accepts 32 students who are preparing to be physician investigators. In 2015, Cleveland Clinic broke ground on a 477,000-square-foot multidisciplinary Health Education Campus. The campus, which will open in July 2019, will serve as the new home of the Case Western Reserve University (CWRU) School of Medicine and Cleveland Clinic's Lerner College of Medicine, as well as the CWRU School of Dental Medicine, the Frances Payne Bolton School of Nursing, and physician assistant and allied health training programs.

Graduate Medical Education

In 2016, nearly 2000 residents and fellows trained at Cleveland Clinic and Cleveland Clinic Florida in our continually growing programs.

U.S. News & World Report Ranking

Cleveland Clinic is ranked the No. 2 hospital in America by *U.S. News & World Report* (2016). It has ranked No. 1 in heart care and heart surgery since 1995. In 2016, 3 of its programs were ranked No. 2 in the nation: gastroenterology and GI surgery, nephrology, and urology. Ranked among the nation's top five were gynecology, orthopaedics, rheumatology, pulmonology, and diabetes and endocrinology.

Cleveland Clinic Physician Ratings

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

Referring Physician Center and Hotline

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

Remote Consults

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

Request Medical Records

216.444.2640 or 800.223.2273, ext. 42640

Track Your Patients' Care Online

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

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

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

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

Medical Records Online

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

Access

Cleveland Clinic is committed to convenient access, offering virtual visits, shared medical appointments, and walk-in urgent care for your patients. clevelandclinic.org/access

Critical Care Transport Worldwide

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

CME Opportunities: Live and Online

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

Clinical Trials

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

Healthcare Executive Education

Cleveland Clinic has programs to share its expertise in operating a successful major medical center. The Executive Visitors' Program is an intensive, 3-day behind-the-scenes view of the Cleveland Clinic organization for the busy executive. The Samson Global Leadership Academy is a 2-week immersion in challenges of leadership, management, and innovation taught by Cleveland Clinic leaders, administrators, and clinicians. Curriculum includes coaching and a personalized 3-year leadership development plan. clevelandclinic.org/executiveeducation

Consult QD Physician Blog

A website from Cleveland Clinic for physicians and healthcare professionals. Discover the latest research insights, innovations, treatment trends, and more for all specialties. consultqd.clevelandclinic.org

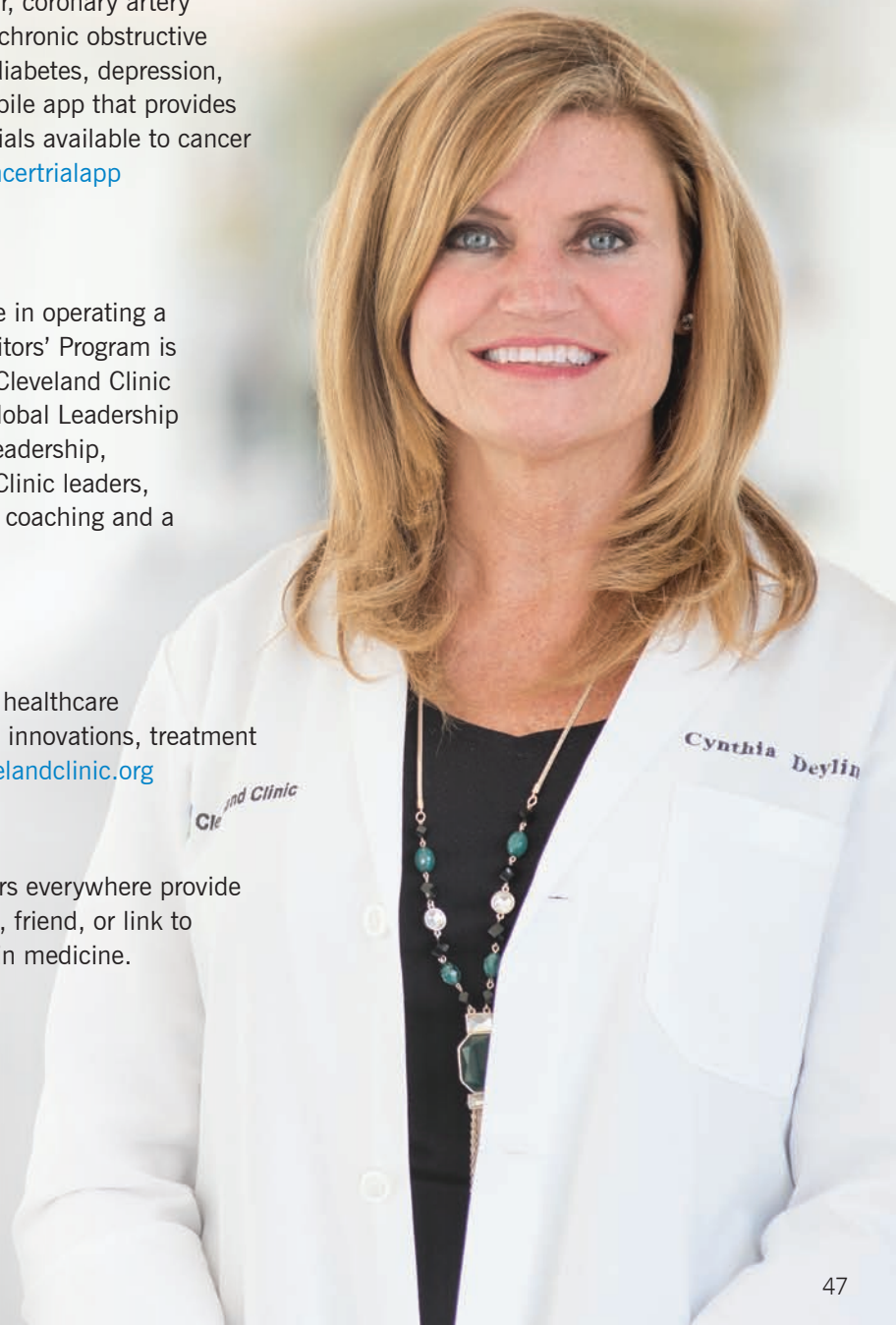
Social Media

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

Facebook for Medical Professionals
facebook.com/CMEclevelandclinic

Follow us on Twitter
[@cleclinicMD](https://twitter.com/cleclinicMD)

Connect with us on LinkedIn
clevelandclinic.org/MDlinkedin



This image shows a full-page view of a digital note-taking application. At the top, there is a solid blue horizontal bar. Inside this bar, the word "Notes" is written in a white, sans-serif font, positioned towards the left side. Below the blue bar, the rest of the page is white and filled with horizontal grey lines, mimicking the appearance of a standard notebook or ledger. The lines are evenly spaced and extend across the entire width of the page.

This project would not have been possible without the commitment and expertise of a team led by Herbert Wiedemann, MD, Robert Kotloff, MD, and Marianne Mitri, MBA.

Graphic design was provided by Ken Celebucki, BA of Cleveland Clinic's Center for Medical Art and Photography.





Every life deserves world class care.

9500 Euclid Avenue, Cleveland, OH 44195

clevelandclinic.org