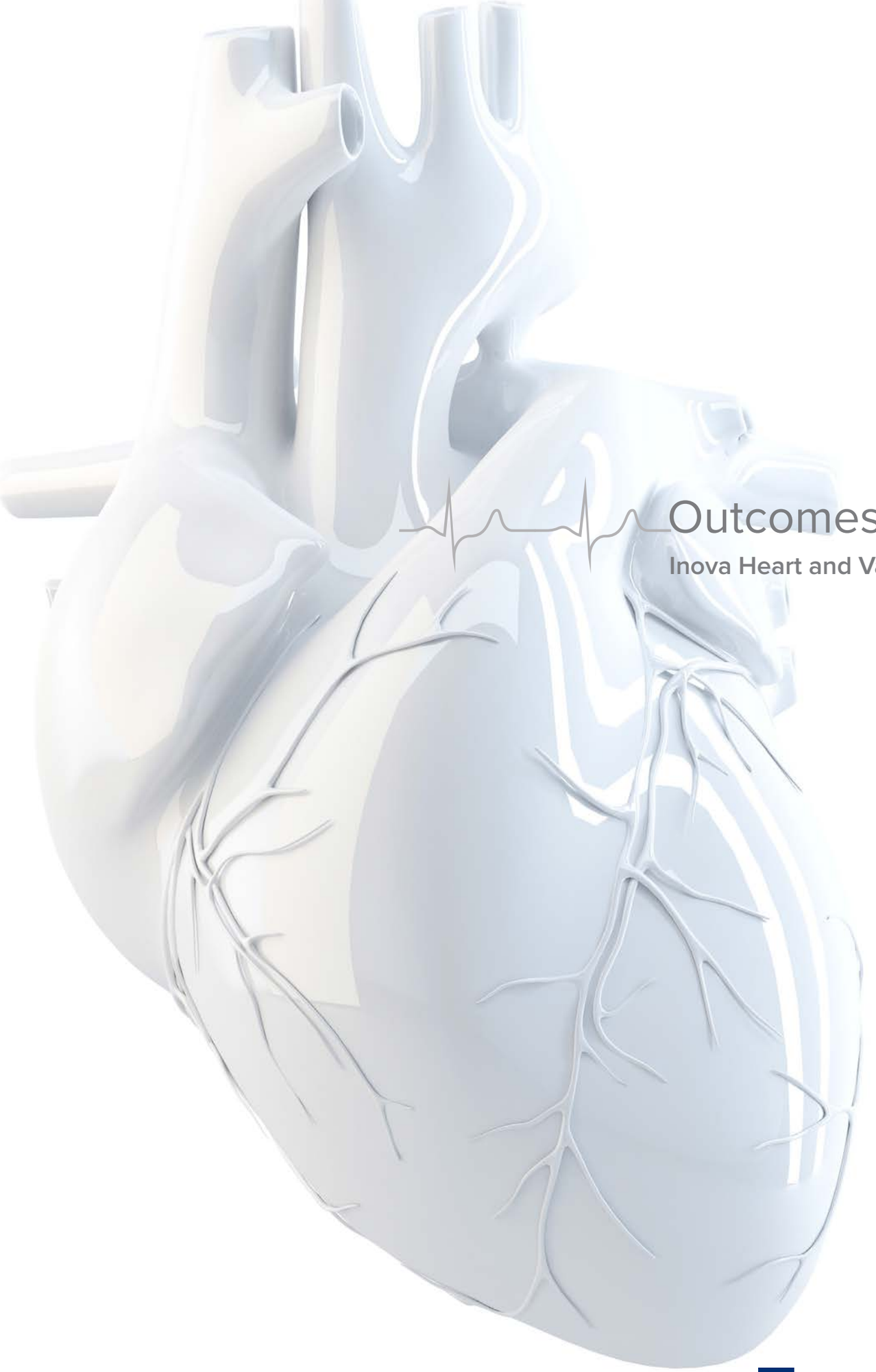


Outcomes 2017

Inova Heart and Vascular Institute

INOVA®

Heart and Vascular Institute

Outcomes 2017

Patrick Christiansen

"Inova Heart and Vascular Institute integrates vital complex heart, vascular and pulmonary services in providing care for patients throughout our region and beyond. Their research and thought leadership is also helping guide the future of medicine within these specialties."

Patrick Christiansen, PhD
Chief Executive Officer, Inova Fairfax Medical Campus
Executive Vice President, Inova

Heather Russell

"These are exciting times for Inova Heart and Vascular Institute. Our growth and development continues at a rapid pace while still providing exceptional patient care and service every day."

Heather Russell, RN, MS, FABC
Administrator, Inova Heart and Vascular Institute
Vice President, Inova Fairfax Medical Campus

Inova Heart and Vascular Institute

Christopher O'Connor, MD

Growth and development of Inova Heart and Vascular Institute continues on many fronts. We've added several outstanding physicians and staff, expanding our service capacity in vascular surgery, heart failure, pediatric cardiology, thoracic surgery, pulmonology and international research.

Much of our program development has focused on integrating expertise across multi-disciplinary teams to assure we are utilizing the full scope and depth of our medical specialties and talents. Innovations such as our Cardiogenic Shock, ECMO and PERT teams have had a positive impact in providing consistent, timely and expert care that is saving lives.

Our journey as a High-Reliability Organization continues, creating a safety culture where we are meticulous in our measurement of a wide range of quality and safety indicators. I am pleased to report performance system-wide has often exceeded goals this year. These clinical measures of success are complemented with exceptional patient experience scores.

IHVI's list of awards and accreditations continues to grow, further validating the exceptional care provided – accolades include recognition at the highest level of performance by ACC/NCDR, STS and AHA. We've earned multiple program-specific accreditations through The Joint Commission as well as many professional associations that provide in-depth operational reviews. Our US News and World Report Rankings recognized Inova Fairfax, Inova Loudoun and Inova Fair Oaks in the top 10 Best Regional Hospitals. We also received recognition as "High Performing" at IHVI's Fairfax Medical Campus for Aortic Valve Surgery, Heart Bypass Surgery, and Heart Failure and at both Inova Loudoun and Inova Fair Oaks hospitals for Heart Failure and COPD. Our Inova Fairfax Medical Campus also enjoys a four-star rating from CMS for Overall Hospital Quality.

We continue to introduce innovations in patient care. We were the first hospital in the northeast to offer point- of-care testing for clopidogrel resistance to cath lab patients at our flagship Fairfax Medical Campus and the first in the DC metro area to implant the Micra™ leadless pacemaker.

We also continue to strengthen our academic, research and industry partnerships to further advance care and improve patient outcomes. Our physicians are active at the national and international level, giving presentations on state-of-the-art research at major meetings in the US and around the world, as well as through invited lectures and visiting professorships. They author book chapters, serve on editorial boards and scientific advisory boards, and publish extensively in top tier scientific medical journals.

This is all possible thanks to the dedication and hard work of our IHVI medical, nursing and professional staff. Working alongside Patrick Christiansen, PhD, CEO, Inova Fairfax Medical Campus and Executive Vice President of Inova; Heather Russell, Administrator, IHVI and Vice President, Inova Fairfax Medical Campus; as well as the medical and nursing administrative leadership at each of our Inova hospitals, tremendous progress has been achieved.

All of these accomplishments reflect the exceptional efforts of a highly collaborative team. I look forward to even greater results in the coming years as we continue our commitment to excellence and achieving the highest quality patient care.

Christopher O'Connor, MD, FACC, FESC, FHFSA
Chief Executive Officer
Inova Heart and Vascular Institute

Table of Contents

Inova Heart and Vascular Institute Service Sites

Inova Fairfax Medical Campus

3300 Gallows Road
Falls Church, VA 22042

Inova Fairfax Medical Campus (IFMC) houses IHVI's dedicated heart hospital and serves as the hub of the system's cardiac, vascular, and pulmonary research activities. Two unique programs include the Inova Cardiovascular Genomics Center and Inova Thrombosis Research and Drug Development Center which includes a dedicated 24-bed Clinical Trials Unit for Phase I – IV studies. Clinical capabilities cover the full spectrum of complex cardiovascular and pulmonary care from diagnostics, medical management and minimally invasive procedures to complex surgeries, including lung and heart transplantation.

5-star Quality Rating from The Centers for Medicare and Medicaid Services

Healthgrades

- 2018 Distinguished Hospital Award for Clinical Excellence™
- 2018 America's 50 Best Hospitals for Cardiac Surgery Award™
- 2018 America's 100 Best Hospitals for Cardiac Care Award™
- 2018 America's 100 Best Hospitals for Critical Care Award™
- 2018 America's 100 Best Hospitals for Pulmonary Care Award™
- 2018, 2017, 2016 - America's 100 Best Hospitals for Stroke Care Award™

US News and World Report Rankings - 2017/18

- Ranked as a Best Regional Hospital in Washington Metro Area and in Virginia
- High Performing for Aortic Valve Surgery
- High Performing for Heart Bypass Surgery
- High Performing for Heart Failure

Inova Alexandria Hospital

4320 Seminary Road
Alexandria, VA 22304

Capabilities include vascular and interventional radiology, cardiac catheterization, electrophysiology, cardiovascular magnetic resonance imaging and cardiac surgery. In addition to procedural areas with six interventional labs, we offer non-invasive vascular and cardiac diagnostic services together with a long-standing cardiopulmonary rehabilitation program.

Healthgrades

- 2018 Distinguished Hospital Award for Clinical Excellence™
- 2018, 2017 Pulmonary Care Excellence Award™
- 2018 America's 100 Best Hospitals for Stroke Care Award™
- 2018 Critical Care Excellence Award™

Inova Fair Oaks Hospital

3600 Joseph Siewick Drive
Fairfax, VA 22033

Capabilities include vascular and interventional radiology (IR), non-invasive vascular and cardiac diagnostic services including echocardiography, cardiac stress testing and peripheral vascular ultrasound.

5-star Quality Rating from The Centers for Medicare and Medicaid Services

Healthgrades

2018 Distinguished Hospital Award for Clinical Excellence™
2018, 2017, 2016 - America's 100 Best Hospitals for Pulmonary Care Award™

US News and World Report Rankings - 2017/18

Ranked as a Best Regional Hospital in Washington Metro Area and in Virginia
High Performing for Heart Failure
High Performing for COPD

Schaufeld Family Heart Center - Inova Loudoun Hospital

44045 Riverside Parkway
Leesburg, VA 20176

Cardiovascular capabilities include the full spectrum of interventional radiology, vascular services and surgery, cardiac catheterization, electrophysiology, diagnostic testing and imaging including cardiac CT, cardiac nuclear medicine, echocardiography, and ultrasound. In addition to the procedural areas with three interventional labs, we also offer non-invasive cardiac diagnostic services and cardiac and pulmonary rehabilitation programs.

Healthgrades

2018 Distinguished Hospital Award for Clinical Excellence™
2018, 2017, 2016 - Pulmonary Care Excellence Award™
2018 Critical Care Excellence Award™

US News and World Report Rankings - 2017/18

Ranked as a Best Regional Hospital in Washington Metro Area and in Virginia
High Performing for Heart Failure
High Performing for COPD

Inova Mount Vernon Hospital

2501 Parkers Lane
Alexandria, VA 22306

Capabilities include vascular surgery and interventional radiology (IR), cardiovascular magnetic resonance imaging, and emergent pacemaker placement. In addition to procedural areas and interventional labs, we offer non-invasive vascular and cardiac diagnostic services and a cardiopulmonary rehabilitation program. Other inpatient and outpatient diagnostic services include echocardiography and stress testing.

5-star Quality Rating from The Centers for Medicare and Medicaid Services

About Us

71,987
2017 Patient Visits

6
Cardiac Surgery ORs

23
Catheterization EP/IR Labs

1
Hybrid OR

5
Hospitals

209
Dedicated Cardiac Beds

30+

Inova Medical Group cardiology, arrhythmia, cardiac and thoracic surgery and vascular practices in the Northern Virginia and Maryland area.
inova.org/IMG

5-STAR QUALITY RATING

Inova's hospitals are the first and only in the DC metropolitan area to receive 5 Stars for Quality Care from the Centers for Medicare and Medicaid Services, the federal government's top health agency.

HEALTHGRADES

identifies hospitals that have superior clinical performance and patient outcomes

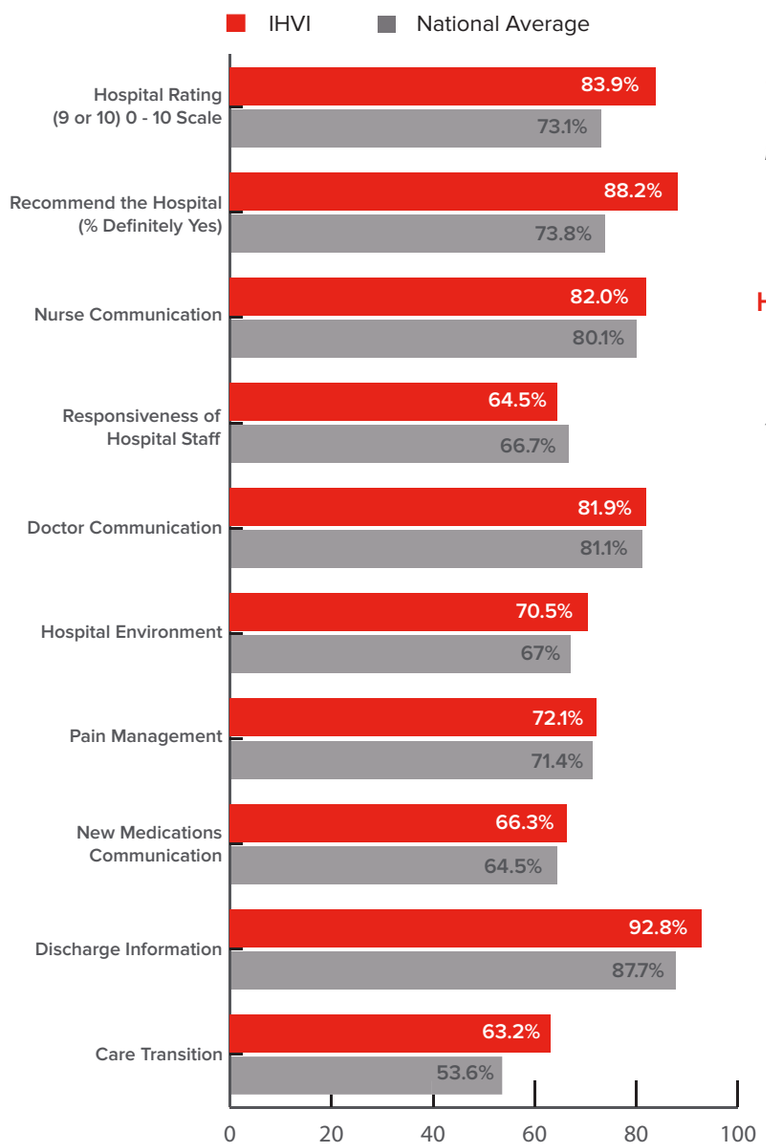
For a complete list of awards and recognition, see page 44.

Patient Experience, Outcomes and Safety

The Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) is a nationwide patient satisfaction survey required of all hospitals that treat Medicare patients.

We are proud to note our 2017 year-to-date **results place IHVI's overall satisfaction rating at the 91st percentile nationally and the likelihood to recommend the hospital at the 94th percentile nationally.**

HCAHPS Domains of Care



2017 IHVI survey period showing 1/1/17 - 9/30/17
Benchmark period 6/1/17 - 8/31/17

Percentile ranking as determined by the Press Ganey Survey Vendor from the All Press Ganey Database of Hospitals in the United States. Database contains n = ~2300 hospitals nationwide.

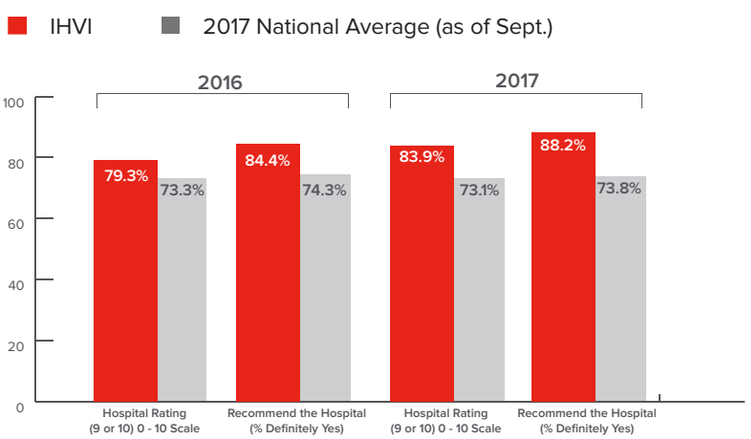
Patient and Family Advisory Council (PFAC)

Past patients and family members advise and provide perspective on IHVI programs, services and other issues that impact care through our Patient and Family Advisory Council.

- Partners former patients and families with members of the care team to help improve patient and family experience.
- Integrates the patient perspective into service and quality improvements to ensure high-quality, patient-centered care is delivered every time, every touch.

For a list of PFAC Council members, see page 41.

HCAHPS Top Box Ratings



2017 IHVI survey period showing 1/1/17 - 9/30/17
Benchmark period 6/1/17 - 8/31/17

Quality Outcomes and Patient Safety

IHVI embraces continuous monitoring of quality outcomes and patient safety. We utilize internal data and national registries to provide benchmark comparisons for our performance data.

- Every patient care unit has identified specific performance metrics.
- Progress and performance is clearly displayed to keep staff focused on the indicators and current results.

Multispeciality teams comprised of nurses, physicians, IT specialists, finance experts and data analysts work to monitor performance and to redesign processes to improve patient care for patients. IHVI's results in 2017 showed:

- 30% year-over-year reduction in harm event rates for each of the past two years.
- 40% reduction in falls.
- Multiple units have achieved zero harm rates during the past year.

For a list of outcomes team members, see page 41.

Charles Murphy, MD

"We have focused on team training for the entire organization. Better teamwork and communication are foundational to everything we do and are essential for patient safety."

Charles E. Murphy, MD, CPPS
Chief Patient Safety Officer, IHVI

Harvey Sherber, MD

"IHVI devotes a staff of data abstractors, analysts, registry coordinators and outcome specialists to collect and disseminate information to multiple registries. This ultimately is used to benchmark key clinical programs, profile physician performance and support the Virginia Quality Initiative."

Harvey Sherber, MD, FACC
Medical Director, IHVI

BELIEVE IN INOVA FAIRFAX MEDICAL CAMPUS ZEROHARM
ZEROHARM BY 2020

Scott Betzelos, MD

In 2017, I can report even better improvements in infection rates from last year, with an expected reduction in the CAUTI, CLABSI and C diff > 30%, a > 20% reduction in VTE, and an additional reduction in falls with injury by 10%. Our Harm Rate/1000 patient discharges is out-performing 2016 at 10/1000 patients discharged. This consistent reliable improvement in morbidity, mortality and outcomes is a result of the sustained methodical commitment to our harm reduction plan. This includes clinical variation reduction and process standardization using Standard Work, Leader Rounding and the four teachable skills of TeamSTEPPS: Communication, Leadership, Mutual Support and Situational Monitoring. We are now on track to have taught all providers in the organization by the end of 2017.

In our commitment to Highly Reliable Outcomes, we have evolved our Root Cause Analysis (RCA) process to RCA^2. RCA^2 stands for **Root Cause Analysis and Actions**. This strengthens our standard work and tools to identify vulnerabilities, develop strong systems-based corrective actions, objectively evaluate the impact of those actions and ensure cross-collaboration of functional work teams eliminating silos.

In 2017, IFMC was once again re-certified by The Joint Commission. The campus underwent a rigorous 5-day assessment with six surveyors evaluating the care we provide, safety programs and proactive prevention. They were extremely complimentary of our patient safety systems, outcomes, commitment to resilience and sensitivity to operations.

Our continued focus on readmission reduction has led to improvement across the continuum of care with eliminating "patient discharge" and educating to a "transition" of care. We have concentrated our resources toward (1) Teach-back education, (2) 48 Hour Follow-up, (3) Pharmacy delivery and education, and (4) A shared mental model of inpatient/outpatient being a transition from prevention to wellness. The transition process complexity reduction has led to system-wide improvement in our Observed/Expected (O/E) outcomes and improved patient satisfaction.

Although we are excited about our past performance, our entire staff is even more engaged and motivated to commit to better outcomes. Through a Just Culture transformation process, we will have greater sustainability and improvement in patient satisfaction, affordability, staff retention and quality. We remain resolute in our commitment to HRO, Just Culture and TeamSTEPPS to achieve *ZeroHarm*.

Scott Betzelos, MD, MS, MBA
Vice President, Chief Medical Officer, Inova Fairfax Medical Campus
Associate System Chief Medical Officer, Care Coordination, Inova

Research - Leading Edge Care

Inova Heart and Vascular physicians are active in cardiac, vascular and pulmonary research. We are dedicated to staying on the leading edge of new methods to diagnose and treat various conditions. IHVI physicians published over 180 peer-reviewed journal articles, multiple abstracts, contributed book chapters and presented numerous papers and posters at national and international meetings this past year. For a list of published articles, visit inovaheart.org/publications.

Inova has established a national reputation for the study of platelet and thrombosis directed therapies and risk stratification as well as cardiovascular proteomics and is gaining rapid recognition in the area of cardiac genomics.

Clinical Trials

Pioneering Therapies for Inpatients and Outpatients

Trials for both inpatients and outpatients are conducted by attending physicians on staff at Inova Heart and Vascular Institute. A detailed list of current studies, eligibility and background information and locations is available at inovaheart.org/trials.

In addition to the trials based on IHVI's Inova Fairfax Medical Campus, outpatient research clinics are also located at in Manassas, Mount Vernon and Fairfax County.

Areas of Study:

- Advanced Heart Failure
- Blood and Tissue Biobanking/Precision Medicine
- Cardiovascular Disease
- Cardiovascular Surgery
- Electrophysiology/Heart Rhythm
- Interventional Cardiology/Structural Heart Disease
- Proteomics
- Pulmonary Disease and Transplant
  - Idiopathic Pulmonary Fibrosis
  - Interstitial Lung Disease
  - Interventional Pulmonology
  - Lung and Heart Transplant
  - Pulmonary Hypertension
  - Sarcoidosis
  - Scleroderma and Interstitial Lung Disease
  - Other Advanced Lung Diseases
- Thrombosis
- Vascular
  - Aortic Aneurysm
  - Carotid Stenosis
  - Critical Limb Ischemia/Peripheral Vascular Disease

For a complete list of currently enrolling studies and locations, visit inovaheart.org/trials

Christopher deFilippi, MD

"The past year has represented further progress for cardiovascular research with the addition of more research-oriented faculty, the development of a proteomics laboratory, leadership roles in multiple multi-center clinical research studies, and a growing reputation as a health system committed to innovation through research."

Christopher deFilippi, MD, FACC
Vice Chairman, Academic Affairs, Inova Heart and Vascular Insitute

Paul A. Gurbel, MD

"Providing rapid, on-demand genetic and platelet function testing is an important component in our ongoing quest for more personalized antithrombotic therapy. We are excited about utilizing our expertise and novel technologies to advance our efforts and improve outcomes in high risk patients."

Paul A. Gurbel, MD
Director, Inova Thrombosis Research and Drug Development Center
Director, Interventional Cardiology and Cardiovascular Medicine Research, IHVI
Professor of Medicine, Johns Hopkins School of Medicine
Adjunct Professor of Medicine, Duke University School of Medicine

Inova Thrombosis Research and Drug Development Center

Industry Partnerships Yield Advances in Care

Through partnerships with pharmaceutical and medical device companies, Inova investigates novel therapies likely to guide the future of medical advances and improved outcomes.

Under the direction of Paul A. Gurbel, MD, an expert in the field of cardiovascular research and antithrombotic therapy, the center focuses on pharmacodynamics, pharmacokinetic and genetic studies with an emphasis on antiplatelet and anticoagulant drug and device development.

Housed within IHVI, on the Inova Fairfax Medical Campus, the center is equipped with a state-of-the-art research laboratory, located in close proximity to the cardiac catheterization labs and a dedicated 24-bed Clinical Trials Unit. These unique characteristics grant the center the capacity to conduct the most intricate investigations of platelet physiology and coagulation in a diverse population of patients and to collectively manage clinical trials in all Phases, I - IV, for both inpatients and outpatients.

Some of the pioneering work conducted by this team included development of the point-of-care testing used at IHVI's flagship hospital on the Inova Fairfax Medical Campus to provide results within one hour for CYP2C19 for patients undergoing cardiac catheterization. The test identifies common genetic variations that affect an individual's ability to appropriately metabolize clopidogrel (Plavix®). Based on the test result, the patient's cardiologist is given targeted recommendations on the choice of pharmacotherapy to reduce the risk of complications.

inovaheart.org/trialswebvideo

Thrombosis Lab

- 4,000 sq. ft. lab meets GLCP standards
- Pharmacodynamic, pharmacokinetic and genetic studies
- Antiplatelet and anticoagulant drug development
- Device studies for 510K approval
- Device development to facilitate personalized therapy
- Biobanking capabilities
- On-site processing for ready analysis, 24/7 stat results

Clinical Trials Unit

- 24-bed unit offering all private rooms located at IHVI - IFMC
  - Acute care availability for emergencies
  - Adjacent to cath labs and thrombosis clinic
- Research pharmacy based on the unit, capable of IV and oral preparations
- Hospital nurses and staff with specialized research training
- Experienced clinical research coordinators and research staff, including a regulatory specialist
- Capable of using local or central IRBs
- Inova Translational Medicine Institute and Inova Cardiovascular Genomics Center
- Biobanking repository for oncology, liver, heart and lung
- Active heart and lung transplant programs

Inova Thrombosis Research and Drug Development Center
Current Research and Trials 2017

"Blueprinting" hemostasis pathway activity to assess thrombosis, bleeding risk, and anti-thrombotic drug response (TARGET Trials)

1. Stroke patients (Haemonetics)
2. Patients receiving WATCHMAN device (BSCI)
3. Patients on Left Ventricular Assist Device (Haemonetics)
4. Adults and pediatric patients on Extracorporeal Membrane Oxygenation (Inova Seed Grant)
5. Patients receiving Transcatheter Aortic Valve Replacement (Inova)

Mechanistic Studies/Investigator Initiated Studies

1. Antiplatelet Effects of Evolocumab in Patients with Peripheral Arterial Disease (Amgen)
2. Antiplatelet Effects of Evolocumab in DM/PCI Patients (Amgen)
3. Tirofaban vs. Cangrelor in NSTEMI (Medicure)
4. PD Interaction: Aspirin + Celecoxib vs. naproxen in Rheumatoid /Osteoarthritis Patients (Bayer)
5. The Effects of Acute Normovolemic Hemodilution on Perioperative Hemostasis in Cardiac Surgery (Instrumentation Labs)
6. Rivaroxaban in Peripheral Artery Disease Patients (Janssen)
7. Influence of Vorapaxar on Thrombin Generation and Coagulability (MERCK)

Laboratory Diagnostics and Biomarker Development

1. Validation of DOAC Assay/TEG 6S System for 510K approval (Haemonetics)
2. Validation of the AggreGuide A-100 P2Y12 Assay (Aggredyne)
3. Validation of Hemochron® MCS 7000 Microcoagulation System (Instrumentation Laboratories)
4. Performance evaluation of ACL Top DOAC assays (Instrumentation Laboratories)
5. Development of POC Familial Hypercholesterolemia genetic test
6. Identification of circulating RCN2 as a novel predictive biomarker of CAD (UVA/Inova)
7. Validation of T-TAS Quick PL-Chip 510K approval (Fujimori Kogyo, Co., Ltd)

Drug Development

1. Phase II: ASO drug targeted to Apo(a) in Patients with HyperLp(a) and CVD (Ionis Pharmaceuticals)
2. Phase II MAD: fIX antibody (IgG4 mimic) vs Apixiban in Low risk AF (Janssen Pharmaceuticals)
3. Phase II: Subcutaneous potent/reversible P2Y12 inhibitor in stable CAD Pts (Actelion Pharmaceuticals)
4. Phase II: PZ128- PD and safety in Cardiac Catheterization Patients (NIH/TUFTS)

Research Related Registries and Retrospective Data Collection Studies

1. CYP2C19 Genotype Guided Antiplatelet Therapy and Clinical Outcomes at Inova
2. PERT (Multi-center)
3. TAVR (Multi-center)
4. CV SHOCK
5. WATCHMAN (multi-center)
6. LINQ Insertion Post Ablation
7. Diagnostic Yield of Noninvasive Testing Post NSVT

Contact Us I Refer a Patient
1.877.654.6682 • thrombosisresearch@inova.org

Cardiovascular Genomics

Inova Cardiovascular Genomics Center

Improving Management of Cardiovascular Disease through Precision Medicine

Integrating precise diagnostics and therapeutics into the routine care of cardiovascular patients is essential to personalized medicine.

Our center exists to assist cardiologists or primary care physicians in diagnosing, educating and managing patients with genetic cardiovascular disorders and to help explore alternative pioneering genomic approaches that could improve outcomes.

Inherited Cardiac Genetics

Many cardiovascular conditions have an autosomal dominant inheritance pattern, with up to 50% of family members affected. We take a family approach to managing patients that includes pre-test counseling that outlines the implications of testing. Results are provided in an easy to understand format to the patient, family and referring physician along with detailed management recommendations. In families who choose not to be tested, we outline a plan for non-genetic screening consistent with clinical practice guidelines.

Our service acts as a partner to the patient's cardiologist or primary care physician. Consultations provide detailed clinical recommendations about genetic findings to help establish the best course of action.

We evaluate genetic abnormalities associated with common cardiovascular conditions such as:

- Amyloidosis
- Dilated Cardiomyopathy
- Familial Hypercholesterolemia
- Hypertrophic Cardiomyopathy
- Long QT syndrome
- Marfan's Syndrome
- Sudden Cardiac Arrest

Our program is truly a multidisciplinary clinic of cardiologists, genetic counselors, and researchers. Additionally our team of medical geneticists, molecular biologists, and bioinformaticists help distinguish variants of undetermined significance to make more precise genetic calls for our patients.

Expertise in Adult and Pediatric Cardiology

The Inova Cardiovascular Genomics Center offers comprehensive care from infants to adults and has recently begun evaluating fetuses for potential cardiovascular conditions. By providing a continuum of care across ages, we can understand disease progression and offer the latest genetic testing and counseling to all family members potentially impacted with inherited cardiovascular disease.

Palak Shah, MD

"In the genomic era of medicine, we are using cutting-edge diagnostics to manage patients and families with cardiovascular disease more precisely."

Palak Shah, MD, MS, FACC
Director, Inova Cardiovascular Genomics Center

Contact Us | Refer a Patient
Inova Cardiovascular Genomics Center
1.855.5CVGENES (1.855.528.4363)
Inovaheart.org/cvgenomics

Pharmacogenomics Testing

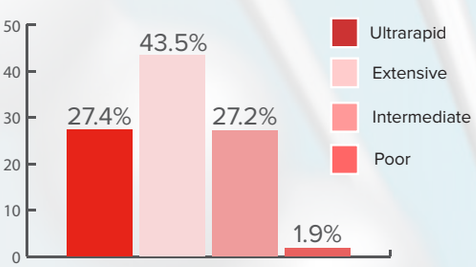
This dimension of care allows for a personalized roadmap for pharmacotherapy through the identification of genes that result in abnormal absorption, distribution, metabolism or excretion of commonly prescribed cardiovascular drugs.

MediMap® Clopidogrel STAT

Inova Heart and Vascular Institute's Fairfax Medical Campus is the first in the northeast to offer this test in the Cath Lab. Results are provided within one hour for CYP2C19. The patient's genetic polymorphisms at CYP2C19 (a common genetic variation that affects drug metabolism) are identified, and their ability to appropriately metabolize clopidogrel (Plavix®) to the active compound is determined.

The patient and cardiologist are then given targeted recommendations about the choice of pharmacotherapy to decrease the risk of complications.

Clopidogrel Metabolizer Status



Test Volumes 2017: 860

Based on actual data Feb - Oct, annualized.

MediMap® Heart

We now offer a comprehensive test for pharmacogenomic variants associated with abnormal metabolism/efficacy of commonly prescribed cardiovascular drugs:

- Warfarin
- Statins
- Clopidogrel
- Beta-Blockers
- Anti-arrhythmics

For more information or to refer a patient for pharmacogenomic testing, contact us at **703.776.8200** or **medimap@inova.org**.

Pamela Sears-Rogan, MD

"Our level of staff expertise combined with an integrated approach working alongside other cardiothoracic services assures the highest quality of imaging and interpretations for our patients."

Pamela Sears-Rogan, MD
Medical Director, Cardiac Imaging

Non-invasive Cardiovascular Imaging and Diagnostics

Cardiac Diagnostics

IHVI offers advanced cardiac and vascular non-invasive diagnostic and imaging services on-site at every Inova hospital as well as in 16 outpatient settings located throughout Northern Virginia and in one Maryland location. The program is staffed by imaging experts offering in-depth knowledge of all major modalities.

Highly specialized diagnostic and imaging support focused on structural heart problems and unique needs is available for the following patient populations:

- Transplant patients - cardiac, pulmonary and renal
- Pulmonary hypertension – both chronic lung disease and acute pulmonary embolism
- Advanced heart failure
- Valvular Heart Disease – particularly for aortic stenosis, mitral stenosis and mitral regurgitation
- Adult Congenital Heart Disease
- Prosthetic Valve Problems – including stenosis and perivalvular regurgitation
- Research

Our outpatient settings can accommodate same-day urgent cases, pending insurance approval.
For a complete list of locations and services available at each site, visit **inovaheart.org/CvDx**

Outpatient Cardiac Diagnostics Volume

	Nuclear Stress Test	TTE	Peripheral Vascular Imaging - Aortic and Carotid	Total
2016	13,127	42,772	4,807	60,706
2017	13,588	49,509	4,836	67,933

2017 is based on actual data through September 2017, annualized.

Cardiac Diagnostic Procedures - 2017

Facility	Transesophageal Echocardiogram (TEE)	Transthoracic Echo (TTE)	Cardiac Nuclear Studies	Graded Exercise Test (GXT)
IFMC	1,522	15,372	1,148	480
IAH	284	11,832	1,056	1,118
ILH	198	3,729	179	185
IMVH	N/A	2,096	726	916
IFOH	102	5,300	262	N/A
IHVI Total	2,106	38,329	3,371	2,699

2017 is annualized data based on actual YTD volumes through June 2017.

Warren Levy, MD

"We provide the highest quality, state-of-the-art diagnostic testing in all of our outpatient facilities. We are able to achieve this by applying the right technology to the right patient at the right time."

Warren Levy, MD, FACC
President and Chief Medical Officer, Virginia Heart

Contact Us I Refer a Patient:
Cardiac Access
703.776.5905

ACCREDITED FACILITY · IAC INTERSOCIETAL ACCREDITATION COMMISSION · ECHOCARDIOGRAPHY

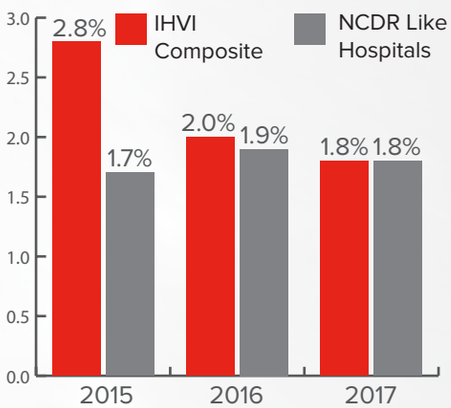
ACCREDITED FACILITY · IAC INTERSOCIETAL ACCREDITATION COMMISSION · NUCLEAR CARDIOLOGY

ACCREDITED FACILITY · IAC INTERSOCIETAL ACCREDITATION COMMISSION · VASCULAR TESTING

Diagnostic Cardiac Catheterization

Our outpatient cardiac catheterization program remains one of the busiest in the region, offering multidisciplinary expertise and convenient patient access in three locations.

Diagnostic Cardiac Catheterization Any Adverse Event



2017 = rolling 4Qtrs ending Q1 '17

Diagnostic Cardiac Catheterization 2017

Facility	2015	2016	2017
IFMC	3,262	3,404	3,403
IAH	939	1,046	1,178
ILH	621	665	709
IHVI Combined	4,822	5,115	5,290

2017 = annualized

Interventional Cardiology

Acute Myocardial Infarction (AMI)

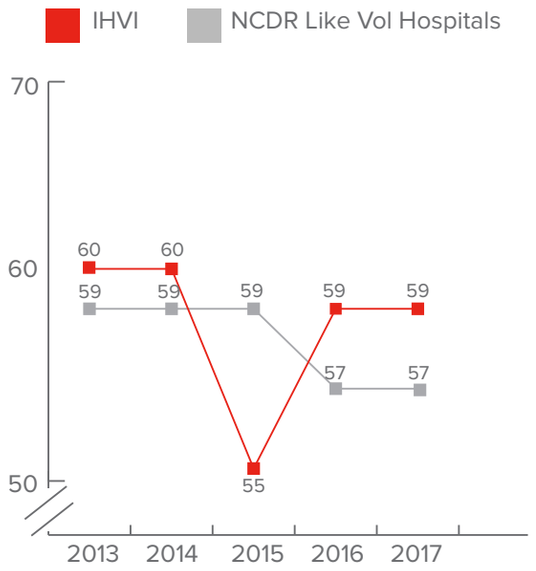
Sustained Achievement of Performance Measures

IHVI provides consistent high performance for Acute Myocardial Infarction patients.

The program's success has been repeatedly recognized by both the American Heart Association and the American College of Cardiology – the most trusted sources for outcomes-based, continuous quality improvement metrics for in-hospital clinical performance and process-of-care measures.

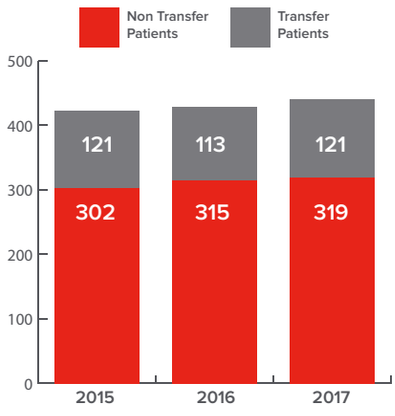
At IHVI-IFMC, 2017 marks a milestone not only in once again attaining the ACC/NCDR's Platinum Performance Achievement Award for Care of Acute MI Patients, but also being awarded the Gold Plus Quality Achievement Award from the American Heart Association's Mission Lifeline Program for excellence in care of STEMI patients as well as the Bronze Award for the care on non-STEMI patients. The Platinum and Gold Plus awards are the **highest level of performance awarded by NCDR as well as AHA**. These awards reflect the caliber of care provided by a highly collaborative team of physicians, nurses and technical staff – encompassing every aspect of care.

Door-to-Balloon Median Time for Non-Transfer Patients 2013 - 2017



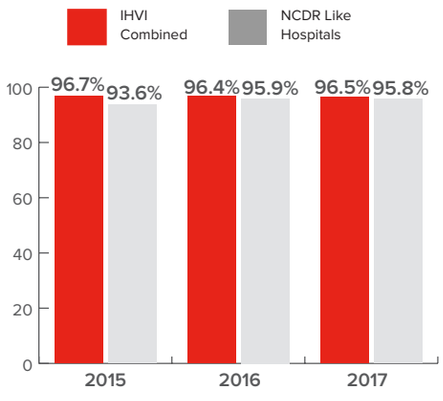
2017 = rolling 4 Qtrs ending Q1
Benchmark based on rolling 4Q ending Q1 '17

STEMI Volume Combined



2017 = rolling 4 Qtrs ending Q2 '17

Primary PCI Received Within 90 Minutes



2017 = rolling 4Qtrs ending Q1 '17
Outcomes Benchmark based on rolling 4Qtrs ending Q1 '17

★★★★

4-Star rating: ACC/NCDR Cath/PCI Registry

2015 Platinum Performance Achievement Award ACTION Registry – GWTG NCDR

2016 Platinum Performance Achievement Award ACTION Registry – GWTG NCDR

2017 Platinum Performance Achievement Award ACTION Registry NCDR

Nicholas Cossa, MD

"Coordination with our EMS partners to activate Cath labs for STEMI patients prior to their arrival streamlines responsiveness and supports being able to have a patient's artery opened less than 90 minutes from first medical contact. For cardiogenic shock, with a single call to ACCESS, a multidisciplinary team is activated to provide immediate consultation from experts in advanced heart failure, cardiac surgery, interventional cardiology, emergency medicine and critical care who review the case and determine the need for advanced life support and additional interventions for this critically ill group of patients. Many in our community have benefitted from this high level of care."

Nicholas Cossa, MD, FACC
Medical Director, Cardiac Cath Lab and Level 1 Emergency Cardiac Care

PCI Volume - IHVI Combined

2015	2016	2017
1,816	1,900	2,011

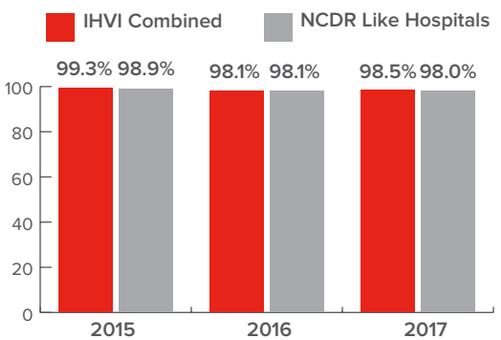
2017 = rolling 4 Qtrs ending Q2 '17

Appropriate Medications Upon Discharge

	2015	2016	2017
IHVI Combined	97.6%	98.1%	98.1%
All Hospitals	94.2%	95.1%	95.3%

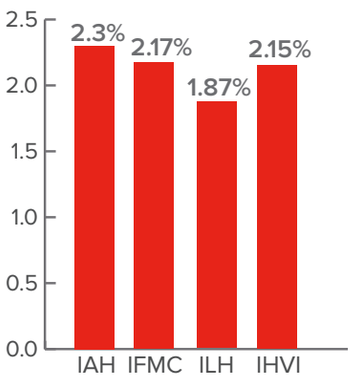
2017 = rolling 4 Qtrs ending Q1'17

PCI Success



2017 = rolling 4 Qtrs ending Q1 '17
Benchmark based on rolling 4 Qtrs ending Q1 '17

PCI Risk Adjusted Mortality for All Patients - 2017

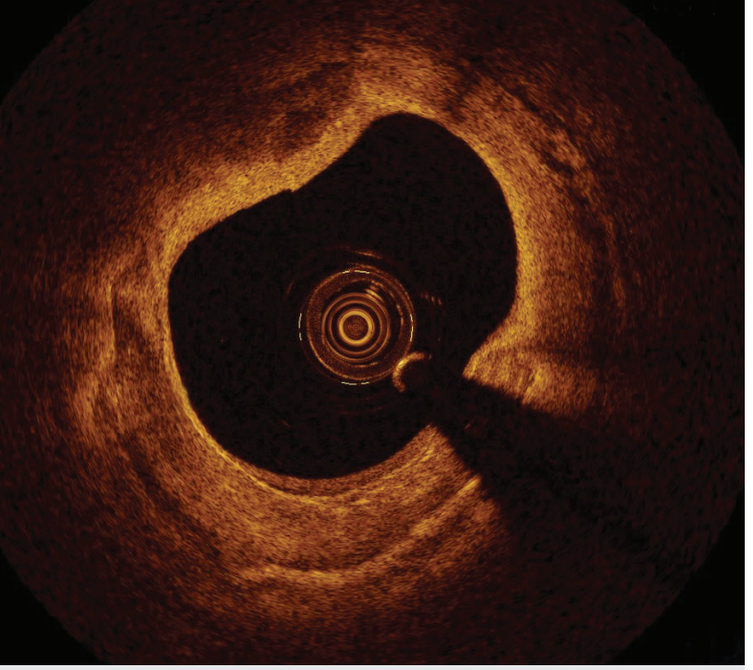


(Weighted)

2017 = rolling 4 Qtrs ending Q1'17

STEMI: IHVI - IFMC | STEMI: IAH | NSTEMI: IAH | STEMI: ILH | NSTEMI: IHVI - IFMC, ILH

Contact Us I Refer a Patient
Adult Patients: 703.776-5905
Pediatric Patients: 877.900.9543



Chronic Total Occlusion (CTO)

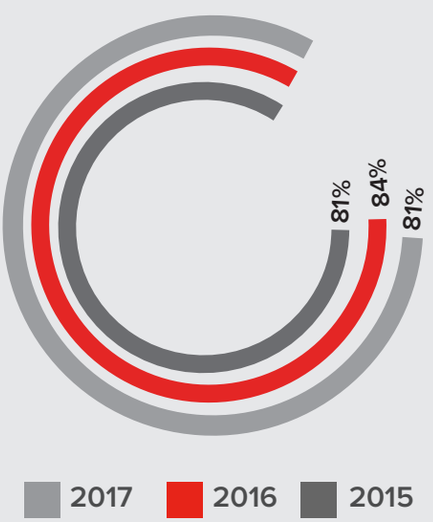
Symptomatic Relief thru PCI

One of the main reasons patients are referred for coronary bypass surgery is Chronic Total Occlusion yet almost a third do not achieve re-vascularization. Chronic Total Occlusion affects 15 to 30 percent of patients undergoing coronary angiography.

IHVI is at the forefront of successfully treating CTO through PCI – a complex technique where our physicians have proven expertise. We remain one of the largest CTO programs in the Mid-Atlantic region.

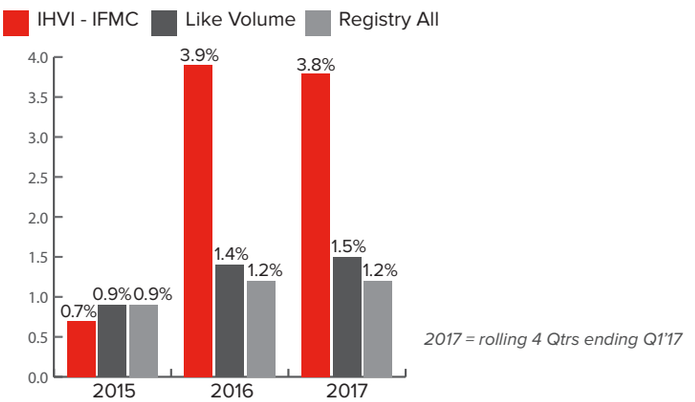
Successful CTO intervention in the appropriate patient alleviates the need for open heart surgery and can offer significant relief of angina symptoms and improvement in left ventricular function.

CTO Success



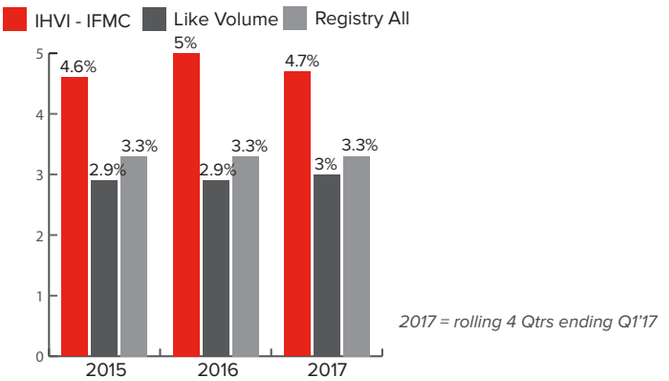
Complexity of IHVI Patients

PCI - Percentage of Patients with Impella



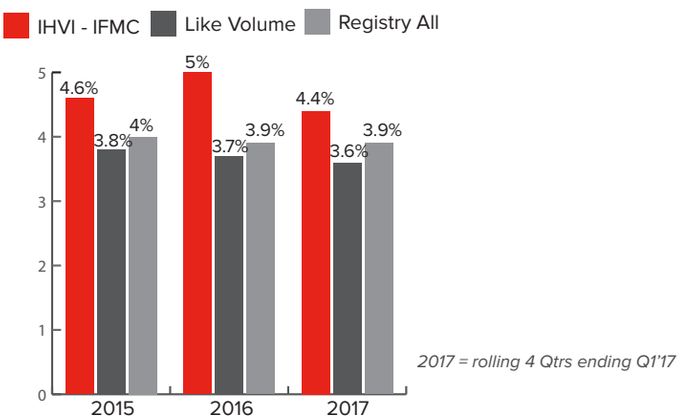
2017 = rolling 4 Qtrs ending Q1'17

PCI - Percentage of Patients Presenting with Cardiogenic Shock



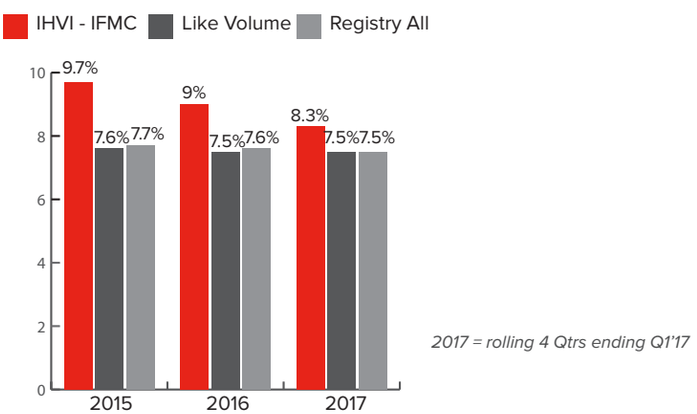
2017 = rolling 4 Qtrs ending Q1'17

Cardiac Arrest - Percentage of Total AMI Patients (Non-STEMI/STEMI)



2017 = rolling 4 Qtrs ending Q1'17

Cardiac Arrest - Percentage of STEMI Only



2017 = rolling 4 Qtrs ending Q1'17

He Lives History Every Day

Arnald D. Gabriel

World War II veteran Col. Arnald D. Gabriel, 91, had somewhere very important to be on December 7, 2016. A combat machine gunner with the United States Army's famed 29th Infantry Division and Conductor Emeritus of the U.S. Air Force Band Symphony Orchestra, Col. Gabriel was due in Hawaii to conduct three separate musical events for the 75th anniversary ceremony commemorating the attack on Pearl Harbor. Col. Gabriel's military career spanned 36 years, including his part in the D-Day invasion on Omaha Beach and Commander/Conductor of the Air Force Orchestra. He is known worldwide for his innovative musical leadership and genius.

A few months before the anniversary, Col. Gabriel, who lives in Alexandria, Virginia, was feeling unusually fatigued. His cardiologist recommended Inova, where he discovered he has severe aortic stenosis and needed a new aortic valve. Heart surgery, thought Gabriel, sounded serious and scary, and worse, it meant he might miss the milestone anniversary. *"There was no way I was going to miss that,"* says the colonel. Meanwhile, his doctors decided he was a perfect candidate for the minimally invasive transcatheter aortic valve replacement (TAVR) as an alternative to traditional open heart surgery. With TAVR a surgeon uses a catheter to implant a bioprosthetic device within the original aortic valve. In Col. Gabriel's case, the valve was inserted through an artery in his groin. *"I was so surprised they could do that,"* says Col. Gabriel. *"It was like going into the auto shop and having spark plugs replaced."*

Arnald D. Gabriel

"Col. Gabriel had some risk factors that made him a good candidate for a less invasive procedure," says Dr. Matthew Sherwood, an Inova interventional cardiologist who worked on the case. *"Plus, he wanted to get back to the things he enjoys."* Open heart surgery usually entails a five to seven day hospital stay and then potentially an extended stay in rehab, *"where you don't feel normal at all,"* says Dr. Sherwood. *"But I tell my TAVR patients you'll be up and walking the next day and recovered in a week or two. They get back to their lives in a much fuller sense and much more quickly,"* Dr. Sherwood explains.

Sure enough, Col. Gabriel was released from the hospital just a couple of days after the procedure. He recovered comfortably at home with the help of his five children then headed for Hawaii with much more energy than he had before the TAVR. These days, he shows little sign of slowing down. He travelled to an important musical event in Florida last January then conducted three or four concerts in March. He's also busy promoting his recently released biography, ***The Force of Destiny: The Life and Times of Arnald D. Gabriel***, written by his son, Michael A. Gabriel.

"I'm very pleased with the whole operation," says Col. Gabriel. *"I have more energy than before and I plan to do 20 gigs this year. If I hadn't done it, I wouldn't have much more of a lifespan. Everyone at Inova is just wonderful."*

Matthew Sherwood, MD

"At Inova Heart and Vascular we are offering our patients the most advanced catheter-based techniques for the treatment of structural heart disease."

Matthew Sherwood, MD, MHS, FACC
Director of Research, Inova Structural Heart Program

Structural Heart: Valve Disease and Minimally-Invasive Surgical Options

Less Invasive Techniques for All Risk Levels

Transcatheter Aortic Valve Replacement (TAVR)

Treatment of aortic stenosis has been revolutionized by TAVR – a minimally invasive alternative to open aortic valve replacement surgery. IHVI's program is one of the busiest in the state of Virginia and in the Washington, DC metropolitan area.

- One of the most experienced sites regionally in utilizing new modes of alternative access in patients who are not suitable for transfemoral access - including transcaval and transcarotid accesses.
- Multiple valves to treat almost all patients regardless of anatomy.

TAVR Procedures:	2015	2016	2017
	63	170	218

Rolling 4 Qtrs ending Q2 '17

- Robust involvement in research to treat different patient populations.

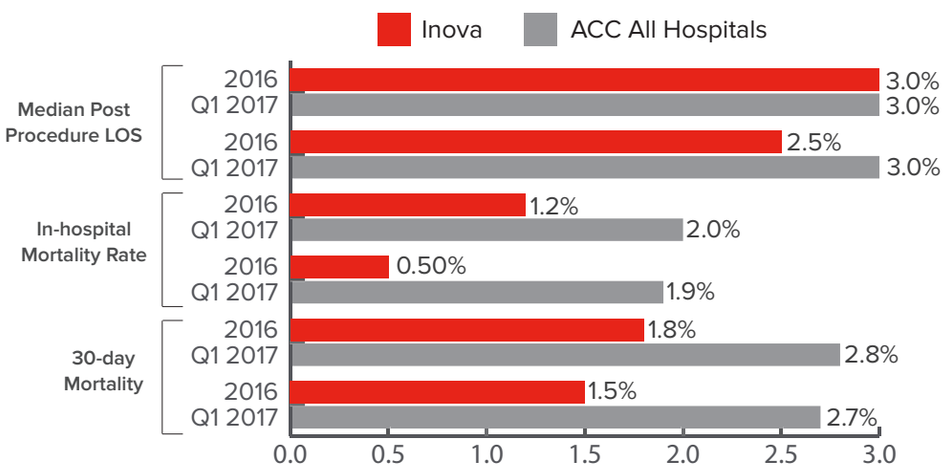
  PARTNER III Trial – for treatment of low-risk heart surgery patients with severe symptomatic aortic stenosis.

  EARLY TAVR Trial – for patients who are asymptomatic with severe aortic stenosis.

  GALILEO Trial – to optimize therapy post-TAVR comparing anticoagulation vs antiplatelet therapy.

- Only program in DC Metro area that is part of a multi-center trial comparing TAVR to surgical aortic valve replacement (SAVR) in low risk patients.
- Dedicated coordinators and mid-level practitioners to help patients navigate through pre-procedural work-up and post-procedural follow-up.

TAVR, TMVR, Mitral Clip - Performance Data



2017 = rolling 4 Qtrs ending Q2

Catheter-based Aortic Valve Treatments

Stroke Risk Reduction

Watchman® Left Atrial Appendage Closure Device

This procedure is indicated for non-valvular atrial fibrillation patients who are not candidates for chronic anticoagulation due to noncompliance, occupational restrictions, long-term bleeding risk or a strong preference not to take anti-coagulants.

Following placement, which is performed in a catheterization or electrophysiology lab, and an overnight stay, patients can be discharged home. Anticoagulation medication permanently discontinued after 45 days.

FDA approval of the Watchman Implant is based on long-term data from numerous clinical trials involving more than 2,400 patients. For more information on mortality risk, hemorrhagic stroke, and long-term follow-up, visit inovaheart.org/watchman

2017 Watchman Procedures: 35

Transcatheter Mitral Valve Repair

MitraClip®

Mitral regurgitation (MR) is a prevalent and progressive disease. Until recently, mitral valve surgery had been the only option to reliably reduce MR. Now, in select high surgical-risk patients with significant symptomatic degenerative mitral regurgitation (MR≥3+), MitraClip® can offer a solution.

Placed using a minimally invasive catheter-based approach and real-time imaging, MitraClip® grasps and coapts the mitral valve leaflets, resulting in fixed approximation of the leaflets throughout the cardiac cycle. The procedure allows for real-time MR reduction assessment and repositioning, if necessary, to ensure the best possible outcome.

- Low procedural mortality rate
- Provides a reduction in heart failure-related symptoms and hospitalizations

For safety data from the STS/ACC TVT Registry on MitraClip's performance nationwide, visit inovaheart.org/mc

2017 MitraClip Procedures: 8

2017 = rolling 4 Qtrs, ending Q2 '17

Transcatheter Mitral Valve Replacement – An Emerging Technology

Application of TAVR principles to high-risk/ prohibitive surgical patients with mitral disease (TMVR)

- IHVI is one of the most experienced centers regionally in TMVR
- Transcatheter mitral valve-in-valve procedures recently approved by the FDA
- Transcatheter mitral valve-in-MAC as well as valve-in-ring procedures
- Will start the APOLLO trial evaluating the new Medtronic Intrepid transcatheter mitral valve replacement device (January 2018) for patients at high risk for surgery

Eric Sarin, MD

"Our ability to treat complex heart disease with minimally invasive procedures is rapidly expanding and our clinical outcomes are among the best in the country."

Eric Sarin, MD
Co-director, Inova Structural Heart Program

Contact Us I Refer a Patient
703.776.3135
valve@inova.org

Micra™

IHVI was the first in the Washington DC metro area to offer Micra™ for select cases in patients who need a single chamber pacemaker. It is the first leadless pacemaker to obtain FDA approval and is completely self-contained within the heart. The vitamin-sized device is 93% smaller than traditional pacemakers and is delivered via catheter directly into the right ventricle of the heart.

There is no chest scar, no bump, and the device offers a 12-year battery life. Complication rates compare favorably to what is seen with transvenous pacemakers.

"HVI offers state-of-the-art treatment for arrhythmias, whether atrial, ventricular, endocardial, or epicardial, device-based or catheter based. We are the only center in the region to be accredited in all areas of EP."

Adam Strickberger, MD, FACC
Co-Director Watchman Program
Inova Heart and Vascular Institute

Adam Strickberger, MD

Marc Wish, MD, FACC, FHRS
Acting Director, Electrophysiology
Inova Heart and Vascular Institute

Marc Wish, MD

Electrophysiology

Atrial Fibrillation (AF)

Advances in ablative techniques have transformed care for patients with Atrial Fibrillation. IHVI remains in the forefront of developing the best treatment options for patients and offers a wide range of services – allowing us to address the unique needs of each patient. We provide our patients access to the latest innovative techniques, personalized medication, and less invasive treatment options. We serve as a research partner in a number of clinical trials.

- Ablative techniques
- Pulmonary vein isolation

  IHVI remains the busiest center in the US for Cryoablation and was part of the pre-FDA approval study for this technique.
- Ablation of other foci that participate in how AF sustains using FIRM rotor mapping for difficult patients who may have drug refractory AFib or who may have failed a previous procedure.

  FIRM Ablation – allows electrophysiologists to look for areas to treat which are not visible using standard mapping procedures.

  Temporal Dispersion – used alongside FIRM, can further improve outcomes in patients with chronic, longstanding persistent AF.

FIRM Ablation and Temporal Dispersion are performed only at select referral centers nationwide. No center in the DC metropolitan area has performed more of these procedures than IHVI.

Cardiac Rhythms Disorders

Our program is accredited by the Intersocietal Accreditation Commission (IAC) for Cardiac Electrophysiology in the areas of testing and ablation, device implantation and chronic lead extraction. We are the only facility in the DC metropolitan region to carry this designation in all three areas.

- Hybrid OR for procedures that require advanced mapping and electrical recording capabilities of an EP lab with the resources of a cardiac OR.
- Epicardial Ablation

Device Implant Volumes

IHVI Combined

	2015	2016	2017
Pacemaker	898	926	912
ICD's	613	559	566
Biventricular	256	254	244
Dual and Single Chamber	357	305	322
Loop Recorder	293	400	456

2017 = annualized

Electrophysiology Data

IHVI Combined

	2015	2016	2017
Electrophysiology Studies	887	840	1380
Ablation Procedures (Total)	1024	1314	1296
AV node Ablation	126	82	164
SVT Ablation	504	582	444
VT Ablation	55	86	88
Afib (including Radiofrequency and Cryo)	286	464	532
Laser Device Lead Extraction Procedures	42	51	76

2017 = annualized

Accredited for
- Testing and Ablation
- Device Implantation
- Chronic Lead Extraction

Cardiothoracic Surgery and Services

Coronary Artery Bypass Grafting

Alan Speir, MD

"Our cardiac surgery service experienced its busiest year in the history of the program in 2017. Tremendous growth in the areas of structural heart disease, complex aortic pathology, as well as shock and heart failure has been at the forefront of this expansion. The shared commitment of our staff to clinical excellence is reflected by our outstanding outcomes, which are the best they have ever been. As our clinical programs continue to grow, they will all be guided by our unwavering dedication to provide the best possible cardiac surgical care to our patients."

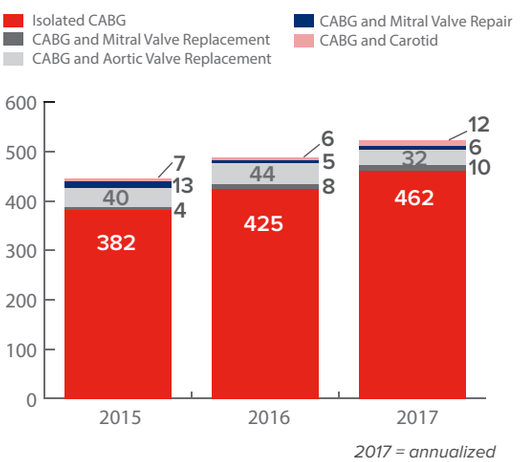
Alan Speir, MD
Senior Associate Director, IHVI
Medical Director, Cardiac Surgical Service

Inova has a long history of providing outstanding cardiothoracic surgical services with exceptional outcomes and quality indicators which demonstrate our expertise. Both the scope and breadth of services continue to evolve and remain on the leading edge of patient care.

The Society of Thoracic Surgeons once again awarded IHVI its highest rating for the quality of Coronary Artery Bypass Surgery as well as for Aortic Valve Replacement+CABG in the current analysis of 2016 national data. Isolated AVR received a two-star rating.

CABG Mortality 2010 - 2017

CABG and CABG Combined Volume 2015 - 2017



2017 = annualized

	IHVI	STS Benchmark
CABG Post-Op LOS - Q1 2017	4	6

STS National Database™ Participant 2016

★ ★ ★
STS highest rating for quality of Coronary Artery Bypass Surgery 2016, 2017

★ ★ ★
STS highest rating for quality of Aortic Valve Replacement + CABG 2017

Valve Disease Surgery

All Valve Procedures (Isolated and Combined)

	2015	2016	2017
Isolated Aortic Valve Replacement	103	91	58
Isolated Mitral Valve Replacement	21	17	14
Isolated Mitral Repair	78	31	34

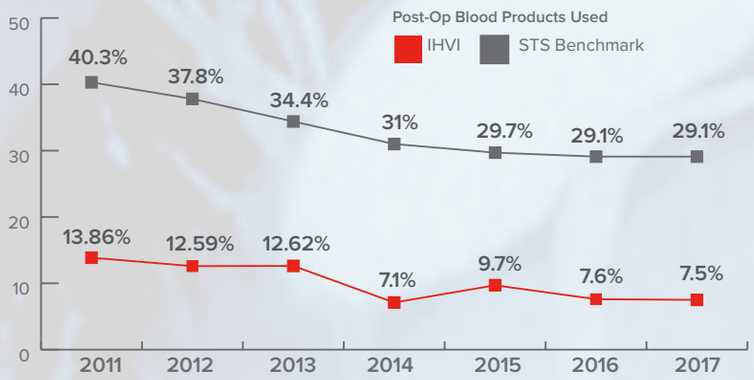
2017 = annualized

Isolated Valve Surgery Mortality

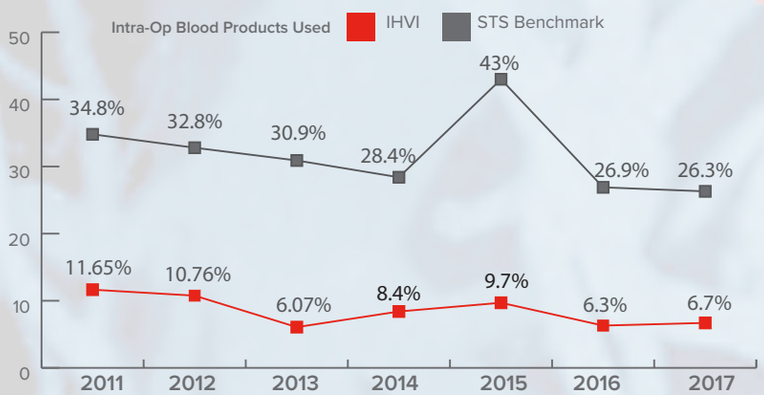
	2015	2016	2017
Total Valve Surgeries	202	139	53
Mortalities	1	1	1

YTD Q2 2017

Post-Op Blood Products Used - Isolated CABG Patients



Intra-Op Blood Products Used



Congenital Heart Disease

Pediatric Congenital Heart Program

The Congenital Heart Program at Inova Children's Hospital has been caring for the region's tiniest patients for over 25 years. Led by Dr. Lucas Collazo, the team works together to provide the highest level of care to each patient, every day. A dedicated, 8-bed Pediatric Cardiovascular Intensive Care Unit and a 22-bed Pediatric Cardiac and Intermediate Care unit, each ECMO capable, allow for patients to receive care in a private, family-centered space. In addition, our on-site family lounges allow a more home-like setting for parents, grandparents and siblings.

Inova Children's Hospital also houses Northern Virginia's largest Neonatal Intensive Care Unit. The 108-bed NICU where most of the cardiac patients spend their first few days - or months - of life, has again been recognized by U.S. News & World Report among the top 50 neonatology programs in the country for the fifth year in a row.

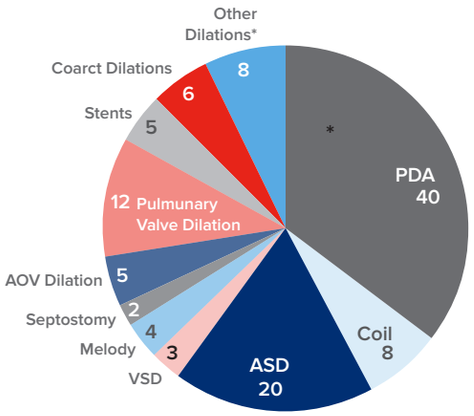
Lucas Collazo, MD

"The Congenital Heart Program at Inova Children's Hospital provides total cardiac care for the region's children. The coordination of care with Inova Women's Hospital and Inova Heart and Vascular Institute allows us to provide care to a patient for their entire life – from birth to adulthood. This allows patients and their families the peace of mind that they will be provided with the highest level of care, no matter where they are in their journey."

Lucas Collazo, MD
Medical Director
Pediatric and Congenital Cardiac Surgery

2016 Pediatric Diagnostic Catheterizations: 51

Pediatric Interventional Catheterizations by Type - 2016



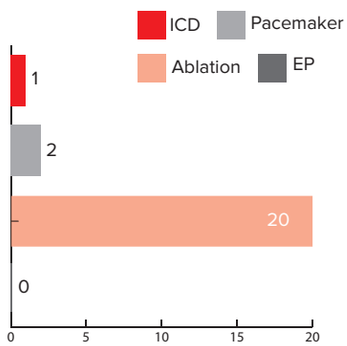
** Other Dilations such as RPA, LPA, SVC*

Volume and Survival by Surgical Procedure 2010 - 2016

ICH Pediatric Surgical Procedure	Volume	Survival
Ventricular Septal Defect (VSD)	115	100%
Tetralogy of Fallot (TOF)	54	99%
Atrial Septal Defect (ASD)	45	100%
Arterial Switch for TGA	38	95%
Valves/Conduits	127	99%
Atrioventricular Canal Repair (AVC)	46	98%
Total Anomalous Pulmonary Venous Return (TAPVR)	21	95%
Partial Anomalous Pulmonary Venous Return (PAPVR)	21	100%
Caval Pulmonary Connections (Glenn and Fontan)	80	90%
Coarctation of the Aorta	72	100%
Systemic-Pulmonary Shunt	37	78%
Pacemakers and ICDs (primary and replacements)	78	100%
ECMO Support	47	50%

Multiple Procedures in One Cath: 113

Pediatric Electrophysiology Procedures by Type - 2016



INOVA Children's Hospital

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One Call
24/7 Admission. Transfer. Specialized Transport.
1.877.900.9543

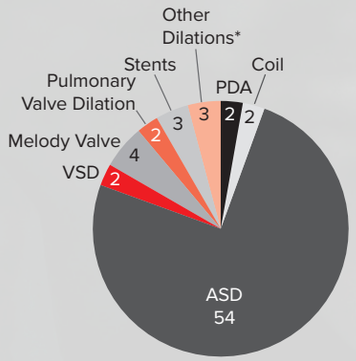
BEST CHILDREN'S HOSPITALS U.S.News & WORLD REPORT NEONATOLOGY 2017-18

Adult Congenital Heart Program

Many patients have survived to adulthood following complex childhood cardiac surgery. These individuals require lifelong specialized care. Others grow up with undiscovered congenital heart disease and require surgical or catheter-based intervention as adults.

Coordination of services for this unique population is a collaborative effort of both adult and pediatric physicians in our clinic. These patients have access to the full breadth of cardiovascular services, including our pulmonary hypertension, advanced heart failure, cardiac surgery and transplant programs.

Adult Interventional Catheterizations by Type - 2016



*Other Dialations: RPA, LPA, SVC

Multiple Procedures in One Cath: 72

Adult Congenital Operations - 2016 (due to congenital heart disease)

Adult Congenital Operations	Volume	Survival
VSD	115	100%
TOF	54	99%
ASD	45	100%
ASO/TGA	38	95%
Valve/Conduits	127	99%
AVC	46	98%
TAPVR	21	95%

Pradeep Nayak, MD

"Our collaborative approach is especially helpful to our unique population, who benefit from the input from pediatric and adult cardiologists along with the cardiac surgery team as time passes. Many of our patients are now decades out from lifesaving surgery performed when they were infants born with heart defects. Now most are living full and active lives but require ongoing care."

Pradeep Nayak, MD, FACC, FASE
Medical Co-Director
Inova Adult Congenital Heart Program

Thoracic Services

Sandeep Khandhar, MD

"Few programs integrate interventional pulmonology and thoracic surgery to the degree we do at IHVI - Fairfax. This collaboration offers optimal diagnostic and therapeutic options to patients with lung disease."

Sandeep Khandhar, MD, FACS
Medical Director, Thoracic Surgery

Our sub-specialized experts offer an integrated approach that generates exceptional patient outcomes and employs the latest minimally invasive therapies and surgical techniques.

The team's involvement with industry for device and process development assures highly personalized and leading-edge care management options.

Innovations in Thoracic Care

Our innovative T-ERAS (Thoracic Enhanced Recovery with Ambulation after Surgery) garnered international attention for bringing a multidisciplinary approach to early ambulation after thoracic surgery. The first six years' data, presented to IASLC, revealed that aggressive early ambulation is effective in reducing post-operative complications and shortening length of stay.

Diagnosis and Treatment of Complex Airway and Pleural Disease

A multidisciplinary approach to the treatment of complex airway and pleural disease, including lung cancer as well as non-malignant diseases of the chest, is possible through the collaborative work of thoracic surgeons, oncologists, radiation oncologists, an interventional pulmonologist and respiratory therapists. We also collaborate with industry partners on pioneering the use of leading-edge technologies for addressing complex airway, lung and pleural disease.

Thoracic Services Procedure Total

2015	2016	2017
1,529	1,686	2,176

2017 = annualized

Thoracic Surgery Procedures 2016 - 2017

Procedure Type	2016	2017
Dx/Rx non-anatomic	229	294
Lobectomy	85	146
Pneumonectomy	3	4
Chest Wall Resection	2	4
Tracheal resection	1	0
Esophagectomy	8	12
Other Esophageal	28	60
Mediastinal	39	14
Minor	22	4
Total	**417**	**538**

2017 = annualized

Interventional Pulmonology Patients and Procedures: 2016 - 2017

	2016	2017
Patients treated	932	1092
Procedures:		
Rigid bronchoscopy	111	124
Flexible bronchoscopy	312	434
Endobronchial ultrasound bronchoscopy	279	462
Electromagnetic navigation bronchoscopy	114	138
Airway stent placement	46	54
Endobronchial laser/electrocautery	57	44
Endobronchial cryotherapy/cryodebridement	38	56
Chest tube	83	76
Thoracentesis	87	96
Tunneled pleural catheter placement	45	20
Fiducial placement	27	54
Percutaneous tracheostomy	25	18
Intrabronchial valve	8	10
Endobronchial balloon dilation	37	52
Total	**1,269**	**1,638**

2017 = annualized

Conditions treated:

- Airway obstructions
- Airway stenosis
- Airway malacia
- Complications following lung transplant
- Enlarged lymph nodes
- Foreign body removal
- Lung cancer
- Lung nodules
- Pleural effusions (cancerous and non-cancerous)

Amit Mahajan, MD

"We have revolutionized how we approach complex airway, pleural disease and especially lung cancer through minimally invasive diagnostic and therapeutic techniques."

Amit "Bobby" Mahajan, MD, FCCP, DAABIP
Medical Director, Interventional Pulmonology

Contact Us I Refer a Patient:
Thoracic Services
703.280.5858

Vascular Services

Richard Neville, MD

"Now that our foundation is firmly established, we are fully focused on optimizing quality and outcomes across our services"

Richard Neville, MD, FACS
Associate Director, IHVI
Director, Vascular Services
Vice Chairman, Department of Surgery

IHVI is a referral center for total vascular care focused on diseases of the arterial, venous, and lymphatic systems.

This past year, we implemented internal initiatives to create a more integrated and team-oriented approach to vascular services across Inova. In addition to our team of eight vascular surgeons and fifteen vascular and interventional radiologists, we enjoy multidisciplinary support from specialists in cardiology, plastic and reconstructive surgery, podiatry, physical medicine, wound care, infectious disease, hyperbaric medicine and physical/occupational therapy. This structure forms a vital web of support for our patients.

We have added several talented physicians to our faculty and implemented a strong focus on quality initiatives and clinical pathways – which are already yielding positive results reducing complications and mortality.

Specialized Programs

- Carotid endarterectomy
- Lower limb revascularization and preservation
- Abdominal aortic aneurysm

Excellence in Wound Care

Specialized wound care services are available at Inova Fairfax Medical Campus, Inova Mount Vernon Hospital, Inova Fair Oaks Hospital and Inova Loudoun Hospital. We are also working with industry to pioneer new approaches to wound care management with remote monitoring.

Outpatient Offices and Non-Invasive Imaging Sites

We offer a total of 11 outpatient vascular offices located throughout northern Virginia. Five of the locations provide vascular imaging on-site.

Vascular Research

- A prospective, randomized analysis of carotid disease (CREST2) and lower extremity revascularization (BEST_CLI) as well as several clinical trials on new aortic endografts for aneurysms and dissections
- Unique Phase 1 studies for a variety of pharmacologic and device-related clinical trials, including on-site genetic testing for clopidogrel response and other thrombotic assessments
- Partnering with industry on device development and remote monitoring including for both revascularization and wound care.
- Our faculty remain active nationally and internationally presenting and publishing on a wide range of vascular topics

Education

Inova is one of only a handful of institutions to offer a formal limb preservation fellowship program and is actively pursuing development of a fellowship training program in vascular surgery.

We conduct a monthly multidisciplinary limb preservation conference as well as sponsoring an annual conference.

Contact Us I Refer A Patient
IHVI Vascular Services
703.207.7007

Limb Preservation CME Seminar
From Wound Care to Revascularization
Saturday, April 21, 2018
inova.org/limbpreservationcme

Conditions:

- Abdominal aortic aneurysm
- Acute limb ischemia
- Amputation prevention
- Aortic dissection
- Carotid artery disease
- Claudication
- Critical limb ischemia
- Deep vein thrombosis (DVT)
- Diabetic foot
- Iliac aneurysms
- Lymphedema
- Mesenteric ischemia
- Peripheral aneurysms
- Peripheral artery disease
- Renal artery disease
- Thoracic aortic aneurysm
- Varicose veins
- Venous insufficiency
- Visceral aneurysms

Treatments:

- Aortic aneurysm
  - Open (conventional) aneurysm repair
  - Endovascular repair (EVAR)
  - Thoracic endovascular aneurysm repair (TEVAR)
- Atherectomy
- Carotid disease
  - Carotid endarterectomy
  - Carotid stent angioplasty
- Lower extremity revascularization
  - Endovascular therapy
    - Angioplasty
    - Stenting (drug elution technology)
  - Bypass surgery
    - Traditional
    - Minimally invasive
- Thrombolytic therapy
- Dialysis access
- Venous disease
  - Endovenous ablation
  - Surgical vein stripping

Vascular Surgery - 2017

Procedure	Procedure Detail	IFMC	IFOH	IAH	IMVH	ILH	IHVI Total
Carotid	Carotid Artery Stent	26		8			34
	Carotid Endarterectomy	118	56	8	8	6	196
Carotid Total		144	56	16	8	6	230
Aneurysm	Endovascular AAA Repair	52	16	12		-	80
	Open AAA Repair	8	-	-	-		8
	Thoracic Endovascular Aneurysm Repair	24					24
Aneurysm Total		84	16	12	-	-	112
Peripheral Arterial Disease	Peripheral Vascular Intervention	362	30	80	18	84	574
	Bypass (comb. Supra and Infra)	106	16	12	2	-	136
Peripheral Arterial Disease Total		468	46	92	20	84	710
Other Vascular	Hemodialysis Access	102	214	8	6	2	332
	IVC Filter	180	30	28	26	36	300
	Lower Extremity Amputation	52	6	4	2	4	68
Other Vascular Total		334	250	40	34	42	700
Vascular Total		**1,030**	**368**	**160**	**62**	**132**	**1,752**

2017 = actual data through August, annualized

Pulmonary Disease

Advanced Lung Disease and Transplant Program

A Leader In Lung Disease Treatment And Transplantation

IHVI offers comprehensive care for patients with any form of advanced lung disease.

Lung Transplantation

Inova pioneered lung and lung-heart transplants in 1991 in the Washington DC metropolitan area and remains the region's only provider of lung transplantation.

Lung Transplant Volume

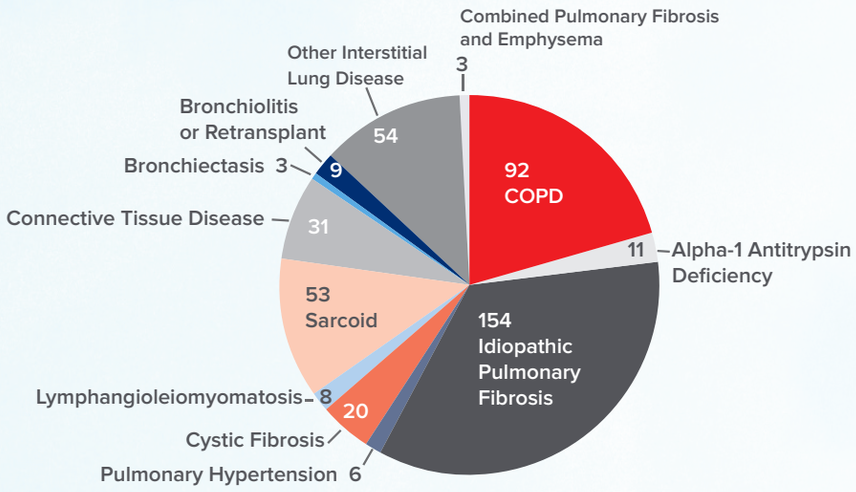
2015	2016	2017
19	21	24

2017 = actual data through July, annualized

Lung Transplant Survival

	Inova Fairfax Hospital	USA	Hazard Ratio (confidence intervals)
1 month survival (1/14 – 6/15) (N=61)	98.36%	96.83%	0.75 (0.15-1.81)
1 year graft survival (1/1/14 – 6/30/16) (N=61)	89.1%	87.47%	0.86 (0.37-1.56)
3 year survival 7/1/11 – 12/31/2013 (N=57)	70.18%	71.9%	1.14 (0.68-1.7)

Types of Lung Diseases Transplanted



Contact Us I Refer A Patient
703.776.6168

Steven Nathan, MD

"The Inova Advanced Lung Disease and Transplant Program incorporates a broad spectrum of treatment options, including novel research approaches, and thereby offers renewed hope for patients with many forms of advanced lung disease."

Steven Nathan, MD, FCCP
Medical Director, Advanced Lung Disease and Lung Transplant Program

Advanced Lung Disease Program

Our integrated program offers a unique paradigm for highly specialized treatment of patients with diverse forms of advanced lung disease, some, but not all, of whom may require lung transplantation in the future. This model of care enables the cross fertilization of expertise and personnel across clinics which differentiates Inova's program from most others. It is the largest such program in both the DC metropolitan area and the state of Virginia.

The blend of clinical expertise, outstanding education and robust research productivity has resulted in multiple recognitions and designations, signifying top-level outcomes and experience:

- Pulmonary Fibrosis Foundation Care Center Network Site
- Pulmonary Hypertension Association Accredited Comprehensive Care Center
- Alpha-1 Antitrypsin Deficiency Clinical Resource Center as designated by the Alpha-1 Foundation
- Cystic Fibrosis Foundation CF Care Center
- CMS Accredited Lung Transplant Center

The clinical care team is comprised of physicians, nurses, pharmacists and respiratory therapists. Pulmonary fellows from all academic institutions in the DC metro area and southern Virginia rotate through the program. We also offer a robust pulmonary rehabilitation program.

New advances underway include:

- Clinical research biorepository
- Early drug development especially for Idiopathic Pulmonary Fibrosis (IPF), other interstitial lung diseases and pulmonary hypertension protocols
- Establishment of a dedicated Chronic Thromboembolic Disease Pulmonary Hypertension Program (CTEPH)

Patients Followed - 2016

** Patients qualified as being followed if they were seen twice in a 12-month span.*

Interstitial lung disease	606
COPD	107
Pulmonary hypertension	356
Bronchiectasis	92
Lung transplant	125

	2015	2016	2017
Lung Listing:	27	34	20

2017 = actual data through September, annualized

	2015	2016	2017
Referrals:	558	540	596
Evaluations:	373	335	288

2017 = actual data through September, annualized

Transplant Wait time for Patients

	Inova Fairfax Hospital	USA
Median wait time	3.2 months	3.8 months

Hospitalization at Time of Transplant

	Inova Fairfax Hospital	USA
Hospitalized at time of transplant	29%	14%

1 of 14 centers in U.S. to hold all 4 designations

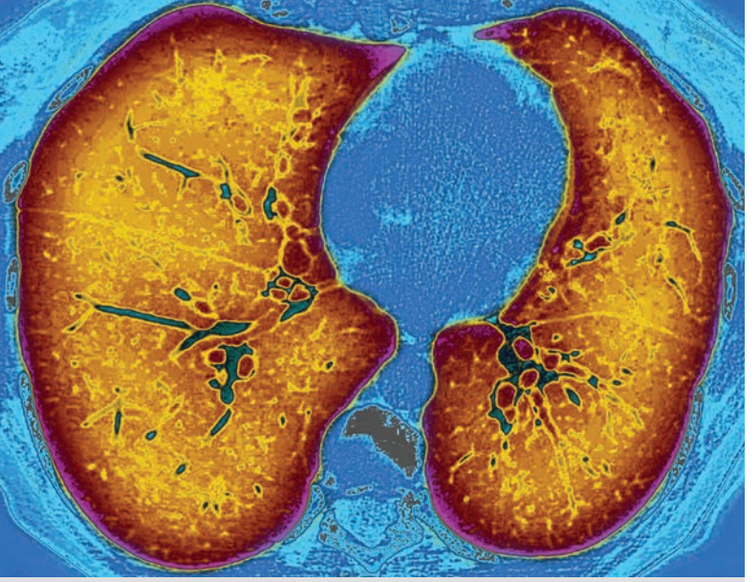
PHA Center of Comprehensive Care 2014-2017

CMS Accredited Lung Transplant Center

Pulmonary Fibrosis Foundation

Cystic Fibrosis Foundation CF Care Center

ALPHA-1 FOUNDATION



Inova Children's Hospital Pediatric Cystic Fibrosis Care

Each year more than 1,000 new cases of cystic fibrosis are diagnosed in the U.S., the majority of which occur in children under the age of 2. Because of advances in treatment driven by the Cystic Fibrosis Foundation, the life expectancy for children diagnosed with CF has drastically increased in recent decades. Today, more than half of those living with CF are over the age of 18.

The Cystic Fibrosis Center at IFMC is a combined effort of the Advanced Lung Disease Program and Inova Children's Hospital, in partnership with The Pediatric Lung and Allergy Center.

Inova Children's Hospital offers a team approach to the care of cystic fibrosis patients. While most care occurs outside the hospital, inpatient care is provided in the Inova Children's Hospital Level IV NICU, PICU and pediatric inpatient units. Outpatient services for children are provided at the Pediatric Lung and Allergy Center, a division of Fairfax Neonatal Associates, P.C. The Pediatric Lung and Allergy Center has been an affiliate site of the Cystic Fibrosis Foundation for the past several years and, as of 2017, is designated as a CF Care Center by the Cystic Fibrosis Foundation.

Jackie Price

Lung transplantation can provide a cure for Cystic Fibrosis

Our Miracle Story

Jackie Price

It doesn't get more critical than the situation Jackie Price, 25, faced in June 2016. Born at Inova, Jackie has been treated for advanced cystic fibrosis since 2014 when she also began evaluation for a lung transplant. That day in June, Jackie was admitted for a fairly routine sinus surgery. She figured she'd be out of the hospital in a week or so and soon back at her job in the finance department of a European grocery chain.

"Instead I was in the hospital 136 days," Jackie says. A few days after her surgery, she had increasing difficulty breathing and required transfer to the ICU. She was intubated, sedated and suffering from respiratory failure. Her lungs continued to deteriorate and she was placed on an ECMO machine, which provides cardiac and respiratory support to persons whose heart and lungs are unable to sustain life. Doctors worried she wouldn't survive a much-needed lung transplant, but with youth on her side, they decided to take the risk. Jackie underwent the transplant on June 21.

"It has been a long, long recovery," Jackie says. Her lung function continues to improve significantly, effectively curing the cystic fibrosis in her lungs.

When I woke up I could only move my fingers," Jackie recalls. *"I had hours of physical therapy to get moving again."* Despite the setbacks, she is walking, albeit with a walker, and she recently celebrated her graduation from weekly visits to the transplant center to once every two weeks.

The important technologies available at Inova are at the heart of what Jackie and her doctors call her miracle story. But all agree that Jackie's spirit, strength and ability to stay positive are also key. *"Jackie's fighting spirit, abounding family support, and ability to handle a complex medical regimen have allowed her to survive this toughest of situations,"* says Dr. A. Whitney Brown, Director of the Inova Adult Cystic Fibrosis Program and Director of Clinical Operations for Advanced Lung Disease and Lung Transplant Program.

Jackie responds that her outlook wouldn't have been possible without the caring gestures —big and small — from Inova staff. Jackie's mom couldn't always be with her at night because she also cares for Jackie's dad, who has severe muscular dystrophy. On those nights it wasn't unusual for a nurse to stay with her, rubbing her arm until she got comfortable enough to fall asleep. Then there was the ICU team and her doctors who conspired to find a corner in the back of the unit where Jackie could celebrate her 25th birthday with a group of loving and supportive friends, all dressed in their pajamas. *"That was one of my best days at Inova,"* Jackie recalls.

"I've been in the hospital with Jackie and my husband for days on end, but I have never seen anything like this," says Jan Price, Jackie's mom. "*The level of care Jackie received — I'm talking about skill, the ability to sustain concentration and performance to keep someone alive, well, we just had to step back and let these people do what they do best."*

In addition to follow-up treatments and regular dialysis, Jackie makes a point of getting out once a week to see friends -- doctor's orders! *"Recovery is a slow process but I am feeling better every day. I'm so grateful my parents, and the doctors and nurses at Inova have gotten me to the other side of this."*

Cardiac and Respiratory Failure

Cardiogenic Shock Service

Improving Survival

Given the increasing number and acuity of patients being cared for with refractory cardiogenic shock, timely decision-making and intervention are critical to patient survival. Physicians from across our health system were tasked with initiating an innovative multidisciplinary (interventional cardiology, cardiac surgery, advanced heart failure, critical care, emergency medicine) cardiogenic shock consultation service. The program formally got underway in January 2017 and we anticipate having completed over 150 activations in 2017. It is a one-call process to engage our multidisciplinary team in collaborative decision-making for our most complex and critically ill patients.

Our cardiogenic shock algorithms focus on:

- Rapid diagnosis
- Immediate collaborative decision making
- Early hemodynamic assessment and expedited initiation of mechanical circulatory support
- Minimization of vasopressor and inotrope use
- Meaningful patient recovery and survival

Emphasis is placed on a formalized and mandatory shock team activation and on-going care process. We believe in strict adherence to care protocols and team-based decision models as they can reduce practice variation and standardize care, thereby improving outcomes.

Patients are co-managed by an intensivist and a cardiologist or cardiac surgeon providing 24-hour care in the cardiac or cardiothoracic surgery intensive care unit. Joint rounds are conducted daily in conjunction with house staff, nurses, pharmacists, and other multispecialty consultants.

ECMO (Extracorporeal Membrane Oxygenation)

Neonatal, Pediatric and Adult Services

ECMO is a modified form of cardiopulmonary bypass which provides temporary support of lungs, heart and other organs for patients who are failing conventional treatments.

In its first 18 months, the program has supported nearly 120 patients and provided over 30,000 hours of support to critically ill children and adults. IHVI patients with cardiac arrest and/or myocardial infarction have been resuscitated with ECMO for recovery or bridged to heart transplant or a longer-term mechanical device. Patients with lung blood clots, pulmonary embolus, postoperative complications, shock from infection, trauma, heat stroke or poisoning have all been treated. Lung failure patients from pneumonia, cystic fibrosis, chronic lung disease, and other causes of poor oxygenation from newborns to adults have also been ECMO recipients.

A fully dedicated on-site team of specialists are in-house 24/7 to provide immediate coverage of ECMO patients. Specialized transport to Inova for, or even on, ECMO is available for patients from throughout the Mid-Atlantic region.

ECMO 2015 - 2017

	2015	2016	2017
Days of Support	86	605	725
Hours of Support	2,064	14,323	16,442

	2015	2016	2017
Pediatric ECMO Runs	1	9	8
Adult ECMO Runs	18	57	71
Total ECMO Runs	19	66	79

2017 = actual data through August, annualized

Ramesh Singh, MD

"Inova is committed to providing the best care to all who seek it at our door. We will continue to be leaders in the field of heart failure and cardiogenic shock through continued innovation and team work."

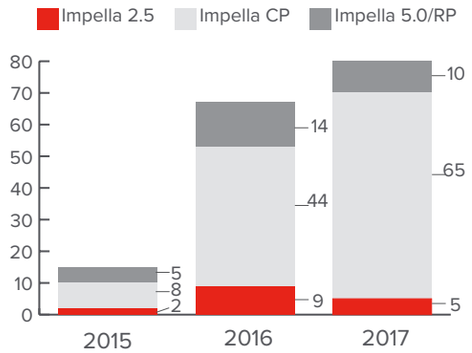
Ramesh Singh, MD, FACC, FACS

Impella®

These minimally-invasive heart pumps are used for temporary ventricular and circulatory support in patients with depressed heart function and complex coronary anatomy. The Impella® device supports the heart during elective high-risk and complex cardiac interventional procedures in the cardiac catheterization lab and the operating room and is used emergently for those suffering life-threatening cardiogenic shock.

- Maintains hemodynamic stability
- Directly unloads the left ventricle
- Facilitates native heart recovery
- Improves quality of life

Impella® Volume



2017 = actual data through July, annualized.

Contact Us I Refer a Patient:
Cardiac Access Line
Adult Patients: 703.776.5905
Neonatal or Pediatric: 877.900.9543
Transport of patients on ECMO is available.

PERT: Pulmonary Embolism

Multi-disciplinary emergency response

For cases of suspected or known PE, Inova Heart and Vascular has created a Pulmonary Embolism Response Team (PERT). When activated, which most often is through the emergency room but also can be done by any attending physician, PERT provides an immediate, integrated team-based response for evaluation to determine a course of intervention and treatment. Initially, specialists from vascular and interventional radiology, pulmonology and critical care medicine consult with the attending physician. As warranted, specialists with expertise in interpreting cardiovascular diagnostic imaging, cardiovascular surgery as well as ECMO are involved. Additional resources from nephrology, hematology, pulmonary hypertension and advanced heart failure are integrated, as indicated. This approach expedites diagnostic testing and creates a coordinated care plan.

The PERT committee meets monthly for case and data review to inform continued process improvement and quantify the results of PERT intervention. IHVI was amongst the first institutions to join the Pulmonary Embolism Response Consortium, an initiative of Mass General Hospital, to improve the national knowledge base surrounding care of PE.

PERT Committee co-chairs:

Mark Granada, MD
Critical Care Medicine/Pulmonary Disease

Natanyah Siegel, MD
Critical Care Medicine/Pulmonary Disease

"We recognized treatment of pulmonary embolism was often fragmented. PERT enables us to address this deadly condition in a more comprehensive and timely manner. We're still gathering data but, we anticipate this will significantly improve patient outcomes."

Alain Drooz, MD
Vascular and Interventional Radiologist

Advanced Heart Failure

Shashank Desai, MD

"The 2017 American Heart Association statistics show that the number of people with heart failure is increasing and is projected to rise by 46% by 2030. This is the reason Inova has invested heavily into advanced heart failure services. The breadth and depth of heart failure services and the expertise of the physicians at Inova have grown tremendously with the needs of our patients."

Shashank Desai, MD, MBA
Medical Director, Advanced Heart Failure/Transplant Program, Inova Heart and Vascular Institute

IHVI's physicians have remained at the forefront of medical advances in treating heart failure, offering medical management of symptoms, specialized testing, surgical interventions, on-going monitoring, and mechanical circulatory support, whether as a bridge to heart transplantation or as a permanent therapy providing improved quality of life and increased time to live.

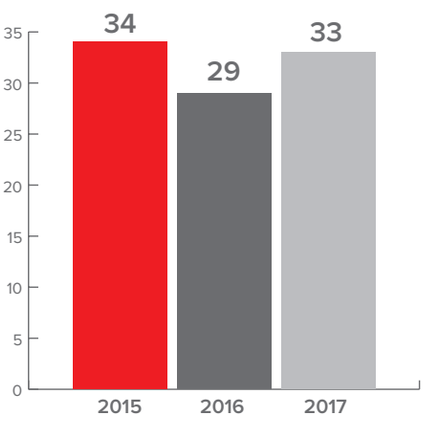
Participation in a variety of clinical trials assures the latest pharmaceutical and technological advances are available to our patients. Our goal is to increase access to advanced therapies for patients throughout our region by educating and involving referring physicians in the care of these patients.

The program's physician leaders hold teaching appointments at both Medical College of Virginia and The George Washington University.

Research studies:
inovaheart.org/trials

Certification for
Ventricular Assist Device

VAD Volumes - Durable Devices



2017 = actual data through August, annualized

Ventricular Assist Devices

Expertise in VAD/LVAD

Our VAD/LVAD program remains one of the busiest in the Mid-Atlantic and has again earned The Joint Commission's Advanced Certification for exemplary quality care and service. We are leaders in development and use of VAD/LVAD for patients living with end-stage heart failure.
For more than 20 years, Inova has participated in research to develop improved devices for both bridge-to-transplant and as a destination therapy.

Our staff also participate as part of the multidisciplinary team overseeing other forms of cardiac support such as ECMO and Impella®.

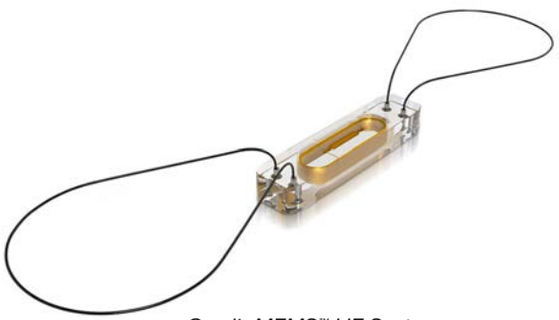
The program's research activity continues with an expanding list of studies – visit **inovaheart.org/trials**.

Remote Monitoring

Home-based Monitoring Enables More Precise Medication Management

Intermittent office visits for outpatient management have proven to be a challenge for heart failure patients as they frequently experience complications, such as fluid backing up in their lungs, which result in repeated hospitalizations. Inova offers implantable technologies that continuously monitor patients at home.

The sensor, which is about the size of a paperclip, is inserted into the pulmonary artery using a minimally invasive catheter-based outpatient procedure. The device continuously measures pressure inside the artery and automatically sends results to the patient's physician. This allows prompt medication adjustments to help prevent heart failure decompensation and urgent admissions to the hospital.



CardioMEMS™ HF System
(Photo courtesy of St. Jude Medical Inc.)

Lauren Cooper, MD

"Inova is committed to improving the quality of complex heart failure care across the region with cutting-edge approaches and therapies."

Lauren Cooper, MD, MHS, FACC, FHFSA
Director of Heart Failure Disease Management
Director of Phase 2/3 Heart Failure Research
Associate Director of Heart Failure Research

Contact Us I Refer A Patient
Cardiac Access
Adult: 703.776.5905
Pediatric: 877.900.9543

Heart Transplantation

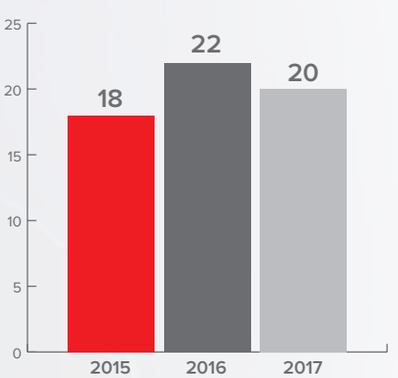
Linda J. Bogar, MD

"The Inova heart transplant team is a multi-disciplinary group of health care specialists who evaluate and treat patients in need of a lifesaving heart transplant. We work together to ensure that every aspect of the patient is considered. We strive to remain active in research and innovation so that our patients may receive the best care possible."

Linda J. Bogar, MD FACS, FACC
Surgical Director, Heart and Lung Transplant Programs

Our program is one of the busiest in the region. Our success is due to multiple expert specialists involved in each patient's care as well as the depth of support options available through our advanced heart failure program.

Heart Transplant Volumes



One Year Patient Survival

July 2017 SRTR data

	Observed	Expected
Graft Survival	90.59%	88.41%
Patient Survival	90.59%	88.70%

LVAD (Left Ventricular Assist Device) and Heart Transplant: State-of-the-art Lifesaving Therapies

Judge Lee Satterfield

For Lee Satterfield, Chief Judge of Washington D.C. Superior Court, the two most dramatic moments in his life happened outside the courtroom. The first was October 29, 2015, the day he underwent heart transplantation at Inova Fairfax Hospital. The second was a little more than a year later when he met the parents of the 23-year-old man whose heart he had received.

As a teenager, Judge Satterfield had been treated for osteosarcoma, and his heart had been damaged by the chemotherapy used to treat the cancer. By 2013, his heart was so weak that it was no longer able to maintain adequate cardiac output, and Satterfield was dying from refractory heart failure. He underwent surgery to implant a left ventricular assist device to normalize cardiac output. The plan was to keep Judge Satterfield alive on the LVAD until a suitable donor heart became available. In time, Satterfield recovered and returned to work, with few people in the courtroom aware of the small controller, and two lithium batteries hidden under his court robe, keeping him alive.

By 2015, Satterfield's heart was failing again, this time due to progressive weakening of the right side of his heart. *"We were all concerned that if a heart didn't become available soon, he would be too sick to survive transplant,"* says Dr. Christopher May of the Heart Failure/Transplant Program at Inova Heart and Vascular Institute. Fortune was on his side, as a suitable donor heart became available the night of admission to the hospital. Surgery took 11 hours. The transplant was a success and Satterfield was released two weeks later.

"Judge Satterfield is an excellent example of the success of current therapies for patients with end-stage heart failure," says Dr. May.

During his recovery, Satterfield often wondered about the person who died and donated the heart that has kept him alive. Shortly after his one-year transplant anniversary, the parents of Satterfield's donor, Christopher Canales, a handsome and caring aspiring musician who died of an acute asthma attack, reached out to the Judge. Satterfield, his wife and Christopher's parents met and discovered that the courtroom was part of their collective story. Christopher's stepmother, Robin Gill Bright, a judge on the District Court in Prince George's County, Maryland realized when she met Judge Satterfield that she had attended a swearing-in ceremony he had presided over just a few months earlier. Although the two did not meet at the ceremony and Judge Bright did not know at that time that Judge Satterfield was the recipient of her stepson's heart, having careers, experiences and many acquaintances in common helped to relieve the apprehension both sides were feeling.

It was Vince Canale, Christopher's father, who first broke the ice when the two couples met. *"When he saw me walking toward them looking so well, he broke out in a big smile,"* Satterfield recalls. *"They told me about Christopher and I was so glad I could express my gratitude to them. Judge Bright and I keep in touch. Overall, meeting Christopher's parents was a tremendous experience."*

"When I got the call for the heart, the nurses started applauding,"

Lee Satterfield

Inova Heart and Vascular Institute Center for Learning and Innovation

IHVI delivers state-of-the-art, high quality continuing education programs, with world renowned faculty presenting clinically relevant updates on the latest findings and best practices in all areas of diagnosis, treatment and management of cardiovascular disease. Our Center for Learning and Innovation addresses the educational needs of all healthcare providers who care for patients with cardiovascular disease. It has created a forum for healthcare providers and leaders from around the world to share and discuss new developments and advanced clinical practices. We strive to provide the most interactive and innovative educational opportunities possible.

Some of the areas covered in 2017 included:

- Advanced Heart Failure
- ECMO
- Heart Recovery and Protected PCI
- Prevention, Diagnosis and Treatment of Cardiovascular Disease
- Advanced Electrophysiology
- Vascular Interventions and Wound Healing
- Novel Technologies in Cardiac Imaging
- Genomics and Precision Medicine
- Patient Safety and the Patient Experience

2016 – 2017

24 Educational offerings
2,100 learners
22 States represented by registrants

For information on upcoming programs or to register, visit **inovaheart.org/education**

Cardiac Rehab

Patients have access to personalized, complete heart-disease management programs close to home as IHVI offers medically supervised exercise and education for adults at four of our hospital locations – Alexandria, Fairfax, Loudoun and Mount Vernon. It is a three-part program that begins in the hospital and continues on an outpatient basis. A doctor's order is required to enroll in the program and our staff verifies insurance benefits and out-of-pocket expenses prior to participation.

Referring physicians are informed of progress through letters and phone calls throughout the program.

The rehab team includes certified cardiopulmonary clinicians, dietitians, pharmacists, exercise physiologists, rehabilitation therapists, respiratory therapists and specially-trained registered nurses.

Inova Fairfax Medical Campus's program has been certified by the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) since 1995. Inova Mount Vernon and Inova Loudoun hospitals are also certified. This peer-review accreditation process recognizes leaders in the field of cardiovascular and pulmonary rehabilitation offering the most advanced practices with adherence to rigorous national standards and guidelines.

Cardiac Rehabilitation

	Patients	Excercise Sessions
2015	3,771	24,576
2016	4,189	27,722
2017	4,502	30,233

2017 = actual data through July, annualized.

Robert Shor, MD

"Cardiac Rehabilitation remains the cornerstone of recovery for many cardiac patients by facilitating a more rapid and complete recovery, leading to a return to a future full of possibilities. Lifestyle modification, including diet, exercise and developing coping skills, provide the tools for each patient as they navigate their future."

Robert Shor, MD, FACC
Medical Director, Cardiac Rehabilitation

Learn about cardiac rehabilitation from a patient's perspective, visit **Inovaheart.org/PatriciaVideo**

Women and Heart Disease

Comprehensive Care, Prevention and Research

Causes and symptoms of heart disease can be strikingly different between the sexes. As a result, women are more vulnerable to slower diagnosis and inadequate treatment. Inova's Center for Women's Cardiovascular Health focuses on assessing and managing the unique cardiovascular needs of women.

Recent data from the American Heart Association show heart attacks strike more women than men in this country and death rates from cardiovascular disease remain higher among women than men. Women who suffer heart attacks also tend to have longer hospital stays and more complications than the average male patient.

More than one in three female adults has some form of cardiovascular disease.

IHVI's specialized services focused on women include coordinated, multi-disciplinary care for a wide range of cardiovascular conditions:

- Prevention cardiology
- Pregnancy and heart disease
- Ischemic heart disease
- Structural heart disease
- Cardio-oncology

Another aspect of the Center's mission is to actively recruit women to participate in cardiovascular clinical trials, as they are under-represented, comprising only 30% of study participants. Expanded participation in research will help improve outcomes for women with heart disease.

Kelly Epps, MD

"The Department of Health and Human Services Office of Women's Health has shown that dedicated women's heart programs consisting of heart health counseling and treatment can have a 'dramatic and lasting impact on the health of women'. At Inova, we have created a multi-disciplinary team focused on personalized cardiovascular risk assessment, education, and disease management throughout the lifespan of a woman."

Kelly Epps, MD, MSHP, FACC
Interventional Cardiologist
Director, Women's Cardiovascular Health Center; Inova Women's Comprehensive Health Center

Contact Us I Refer A Patient
Inova Women's Comprehensive Health Center
571.665.6430

Special Acknowledgement

PFAC members
Antonio Benedi
Marc Busman
Kevin Houlihan
Tom Karl
Chet Kessler, MD
Joe Knotts
Michael Kolansky
Steve Koth
Cindy McElroy
Elicia Pierno
Patricia Schwartz
Christopher Thayer

IHVI PFAC Committee Leadership
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Leila Elliott, MHA
Cynthia Mowery, RN, BSN, MHA
Charles Murphy, MD, CPPS

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Paul Gentile
Linda Halpin, RN, MSN
Marian Hartle, RN, CCRN
Mary Proctor, RN, BSN, RCES
Shirley Riggsbee, RN, BS
Donna Soper, RN, BSN, CCRN
Julia Streich, BS

Additional Outcomes Support
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Christy Mazzaroti
Mark McDowell, MBA
Nancy Morrissey, RNC, PhD
Pat Murphy, RN, CCRN, BA, BSN
Christy Schatz, RN, MSN, FNP-BC, CRNFA
Pam West, RN, MSC, CEPS

Publications and Research

For a list of published articles, visit inovaheart.org/publications

IHVI Physician Leadership Development Program

Developing physician leaders is an important priority for IHVI in order to cultivate a dyad leadership and decision model for the Institute. Working through the American Association for Physician Leadership, and under the direction of Christopher O'Connor, MD, and Warren Levy, MD, a leadership development program that includes didactic sessions, group discussions, individual mentoring and a capstone project is now underway. To date, fifteen physicians have completed the program and seventeen are actively participating. Recent sessions have focused on personal leadership growth, communication, physician engagement, finance, quality and organizational leadership.

The next cohort will begin enrollment in the Spring of 2018. For more information, contact Dr. Warren Levy at **warren.levy@inova.org**

Awards and Recognition

Inova Fairfax Medical Campus

5-star Quality Rating from The Centers for Medicare and Medicaid Services

Healthgrades

2018 Distinguished Hospital Award for Clinical Excellence™

2018 America's 50 Best Hospitals for Cardiac Surgery Award™

2018 America's 100 Best Hospitals for Cardiac Care Award™

2018 America's Best Hospitals for Critical Care Award™

2018 America's 100 Best Hospitals for Pulmonary Care Award™

2018, 2017, 2016 America's 100 Best Hospitals for Stroke Care Award™

US News Rankings - 2017/18

Best Regional Hospital
- #3 in Washington Metro Area
- #7 in Virginia

High Performing for Aortic Valve Surgery
High Performing for Heart Bypass Surgery
High Performing for Heart Failure

Consumer Choice Award – National Research Corporation - 2018

#1 ranking as "Washington's Most Preferred Hospital – Overall Quality & Image" (IFMC has been awarded this honor 18 times)

ACC/NCDR Action Registry Platinum Performance Achievement Award 2017, 2016, 2015 (Highest Level of Performance)

2017, 2016, 2015 4-Star Rating ACC/NCDR Cath/PCI Registry

- For use of all recommended medications, to reduce the chance of blood clots and decrease cholesterol after PCI/ Angioplasty (Highest Level of Performance)

American Heart Association 2017 Mission: Lifeline® Gold Plus Quality Achievement Award for care of STEMI patients (Highest Level of Performance)

American Heart Association 2016 Mission: Lifeline® Silver Plus Quality Achievement Award for care of STEMI patients

American Heart Association 2017 Mission: Lifeline® Bronze Quality Achievement Award for care of NSTEMI patients

The Joint Commission (TJC) Gold Seal Certification

- Ventricular Assist Device

2017 Society of Thoracic Surgeons 3-Star Rating for the quality of Coronary Artery Bypass Surgery

- Based on 2016 data (Highest Level of Performance)

Designated as a **Comprehensive Care Center for Pulmonary Hypertension** by the Pulmonary Hypertension Association

Designated as a **Pulmonary Fibrosis Foundation Care Center** by the Pulmonary Fibrosis Foundation

Designated as an **Alpha-1 Antitrypsin Deficiency Clinical Resource Center** by the Alpha-1 Foundation

Designated as a **Cystic Fibrosis Foundation CF Care Center**

American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) Certified Program for Cardiac Rehabilitation, since 1995.

Intersocietal Accreditation Commission (IAC) Accreditations

Cardiac Electrophysiology - Testing and Ablation, Device Implantation, Chronic Lead Extraction
Nuclear Cardiology
Echocardiography
Vascular Testing

American Heart Association/American Stroke Association

Stroke Award Gold Plus
Target: Stroke Elite Plus Honor Roll

The Joint Commission/American Heart Association/American Stroke Association

- Primary Stroke Center

Inova Alexandria Hospital

Healthgrades:

2018 Distinguished Hospital Award for Clinical Excellence™

2018 Critical Care Excellence Award™

2018, 2017 Pulmonary Care Excellence Award™

2018 America's 100 Best Hospitals for Stroke Award™

American Heart Association 2017 Mission: Lifeline® NSTEMI – Silver Achievement Award

American Heart Association 2017 Mission: Lifeline® STEMI Receiving Center Silver Plus Achievement Award

American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) Certified Program for Pulmonary Rehabilitation

US News Rankings 2017/18
High Performing for Heart Failure

ACC/NCDR Action Registry Platinum Performance Achievement Award 2017, 2016 (Highest Level of Performance)

American Heart Association/American Stroke Association
Stroke Award Gold Plus
Target:Stroke Elite Plus Honor Roll

The Joint Commission/American Heart Association/American Stroke Association
- Primary Stroke Center

Inova Fair Oaks Hospital

5-star Quality Rating from The Centers for Medicare and Medicaid Services

Healthgrades
2018 Distinguished Hospital Award for Clinical Excellence™

2018, 2017, 2016 America's 100 Best Hospitals for Pulmonary Care Award™

US News Rankings 2017/18
Best Regional Hospital
#6 in Washington Metro Area
#14 in Virginia
High Performing for Heart Failure
High Performing for COPD

Leapfrog Hospital Safety Grade – Straight A's since 2012
American Heart Association/American Stroke Association
Stroke Award Gold Plus
Target: Stroke Elite Plus Honor Roll

The Joint Commission/American Heart Association/American Stroke Association
- Primary Stroke Center

Inova Loudoun Hospital

Healthgrades:
2018 Distinguished Hospital Award for Clinical Excellence™

2018, 2017, 2016 America's 100 Best Hospitals for Pulmonary Care Award™

2018 Critical Care Excellence Award™

US News Rankings 2017/18
Best Regional Hospital
#7 in Washington Metro Area
#15 in Virginia
High Performing for Heart Failure
High Performing for COPD

Leapfrog Hospital Safety Grade – Straight A's since 2012

ACC/NCDR Action Registry Platinum Performance Achievement Award 2017, 2016, 2015 (Highest Level of Performance)

American Heart Association 2017 Mission: Lifeline® Bronze Plus Quality Achievement Award for care of STEMI patients Receiving Center (Highest Level of Performance)

American Heart Association 2017 Mission: Lifeline® Bronze Quality Achievement Award for care of NSTEMI patients

Only regional dual Accredited Vascular Lab - IAC (Intersocietal Accreditation Commission) and ACR (American College of Radiology) - Vascular Testing and Ultrasound since 2004

Intersocietal Accreditation Commission (IAC) Accredited Echocardiography since 2004

American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) Certified Program for Cardiac Rehabilitation, since 2008.

American Heart Association/American Stroke Association
Stroke Award Gold Plus
Target: Stroke Elite Plus Honor Roll

The Joint Commission/American Heart Association/American Stroke Association
- Primary Stroke Center

Acute Stroke Ready Hospitals (ASRH)
Inova Emergency Department - Leesburg and Inova Emergency Room - Ashburn were certified as Acute Stroke Ready Hospitals (ASRH), the 2nd and 3rd in the state of the VA to achieve this designation. (June 2017)

Inova Mount Vernon Hospital

5-star Quality Rating from The Centers for Medicare and Medicaid Services

Healthgrades
2017 Patient Safety Excellence Award

American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) Certified Program for Cardiac Rehabilitation

Leapfrog Hospital Safety Grade – Straight A's since 2015

Inova's hospitals are the first and only in the DC metropolitan area to receive 5 stars for quality care from CMS, the federal government's top health agency.

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INOVA®
Heart and Vascular Institute