We are pleased to provide for your review, the second edition of Novant Health’s Cardiology and Cardiovascular Surgery Outcomes book. This publication reflects the clinical performance at Novant Health Heart & Vascular Institute’s tertiary facilities in 2013 and is a demonstration of our unrelenting commitment to transparent clinical quality, leading-edge medical research and best practice process improvement.

Consistent with Novant Health’s readiness plan for population health management, our efforts at creating high quality outcomes and containing costs remain prioritized. Our physicians, nurses, caregivers and administrative leadership are coordinated in our commitment to providing the highest quality clinical product at the lowest cost by implementing processes to achieve clinical standardization and operational efficiencies at all Novant Health Heart & Vascular Institute facilities. By so doing, we strive to bring value to our patients, referring physicians and communities, positioning us as this region’s industry leader in the population management of cardiovascular disease.

This outcomes booklet is published in collaboration with the Cleveland Clinic with whom we have been an affiliate since September 2012. This relationship continues to demonstrate a joint organizational partnership of similar values and a strong commitment to achieving best practice clinical outcomes metrics in cardiovascular medicine and surgery.

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WELCOME TO THE
2013 OUTCOMES BOOK

Measuring and understanding outcomes of medical treatments promote quality improvement. Created by Cleveland Clinic, this Outcomes book is designed for the physician audience and contains a summary of surgical and medical treatments, with data on patient volumes and outcomes and a review of new technologies and innovations.
We are proud to present the Novant Health Heart & Vascular Institute’s cardiology and cardiovascular surgery program’s 2013 Outcomes book. This overview of outcomes, volumes and quality metrics reflects the collaboration of Cleveland Clinic Heart & Vascular staff and the physicians, administration and support personnel of Novant Health Heart & Vascular Institute. It refers to national benchmarks established by the American College of Cardiology and Society of Thoracic Surgeons and records our earnest efforts to give every patient the best outcome and experience. We believe that this kind of transparency is essential to improving quality and efficiency as we transition to the era of value-based medicine.

We are gratified by the success of our collaborations. Our goal is to develop relationships with providers nationwide to enhance the value of healthcare in our communities. Your comments and feedback are most welcome. Thank you for your interest.

Bruce W. Lytle, MD
Chairman, Miller Family Heart & Vascular Institute
Novant Health is on a journey to transform the patient experience so that its patients can focus on what really matters – getting better and staying healthy. As one of the nation’s top not-for-profit integrated health systems, Novant Health has created a cohesive and consistent experience across its 14 medical centers, 350 physician clinic locations, as well as numerous outpatient surgery centers, medical plazas, rehabilitation programs, diagnostic imaging centers and community health outreach programs.

Novant Health’s 24,400 employees and physician partners are working to make healthcare simpler and more convenient for the communities it serves in North Carolina, Virginia, South Carolina and Georgia, providing unparalleled access through technology and points of care that are seamlessly integrated into one system.

It strives to bring its mission, vision and values to life by delivering the most remarkable patient experience, in every dimension, every time. Here are just some of the ways Novant Health is making a difference:

- Maintaining an active community health outreach program.
- Demonstrating superior outcomes for many health conditions as indicated by Novant Health’s state and national quality scores.
- Creating innovative programs that address important health issues. Many of its programs and services are recognized nationally.
- Transforming patient care at the bedside.
- Believing in its role as a good corporate citizen, working with community agencies and organizations to make its communities better places to live and work.

In 2012, Novant Health partnered with the Cleveland Clinic at its flagship facilities – Novant Health Forsyth Medical Center and Novant Health Presbyterian Medical Center. Accredited by The Joint Commission and members of the American Hospital Association, Forsyth Medical Center and Presbyterian Medical Center provide remarkable care not only through sophisticated, high-tech diagnostic, surgical and therapeutic care, but through a warm and compassionate staff, as well. Both facilities show their commitment to the leading edge of medicine by investing resources into new technology, programs and services for their hospitals and their communities.
Novant Health Forsyth Medical Center

As one of the largest medical centers in the state, Forsyth Medical Center has more than 91,500 annual visits to its emergency department. Coupled with Novant Health Medical Park Hospital, a 22-bed surgical facility located nearby, close to 35,000 surgical procedures, including 3,663 general surgery cases, 8,815 orthopedic and neurological procedures, and 1,132 cardiac and vascular surgeries, were performed at the Forsyth medical campus in 2013.

Novant Health Presbyterian Medical Center

Founded in 1903, Presbyterian Medical Center provides leading-edge health services ranging from prevention and early detection to advanced treatments in cancer, stroke and heart disease and routinely receives more than 90,900 emergency department visits each year. Combined with nearby Novant Health Charlotte Orthopedic Hospital, Presbyterian Medical Center performs more than 28,000 surgical procedures a year, including 3,826 general surgery cases, 7,384 orthopedic and neurological procedures, and 1,000 cardiac and vascular surgeries in 2013.
# WHAT’S INSIDE

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ACCOMPLISHMENTS

STEMI care: Novant Health Heart & Vascular Institute (NHHVI) continues its comprehensive commitment to improving care provided to the ST segment elevating myocardial infarction (STEMI) patient population. Risk-adjusted data for the fourth quarter of 2013 was remarkable for NHHVI, with an average 45 minute door to balloon time for STEMI patients receiving percutaneous coronary intervention (PCI). Compared to national averages, programs in the 90th percentile average 48 minutes for door to balloon times. Unpublished data on this topic is even more impressive, with the institute achieving an average of 44 minutes door to balloon time in the second quarter of 2014, compared to the national average of 60 minutes for programs in the 50th percentile.

Novant Health Forsyth Medical Center and Novant Health Presbyterian Medical Center recently received the ACTION Registry-GWTG Platinum Performance Achievement Award by the National Cardiovascular Data Registry. The award recognizes ACTION Registry-GWTG Premier participating hospitals that have sustained performance measure score composites of 90 percent or higher in the treatment of acute myocardial infarction (AMI) patients for eight consecutive quarters, ending with the fourth quarter of 2013.

These exemplary times were acknowledged nationally when the American Heart Association awarded Presbyterian Medical Center its highest ranking as a Mission: Lifeline STEMI Receiving Center Gold Plus Performance Achievement Hospital and Forsyth Medical Center as Mission: Lifeline STEMI Receiving Center Silver Plus Performance Achievement Hospital. Novant Health Huntersville Medical Center and Novant Health Matthews Medical Center received the Gold Performance Achievement Award, which is the highest award given to referral hospitals.

In keeping with its promise to improve care for STEMI patients, NHHVI is involved with RACE CARS (cardiac arrest resuscitation system). This unique initiative fosters collaboration among regionalized systems, EMS agencies and hospitals to create and maintain a smooth process for STEMI and cardiac arrest treatment.

Novant Health cardiologists continue to perform and to promote radial artery catheterizations at all catheterization facilities in the system. Radial artery catheterizations can increase patient convenience and decrease procedure-related complications. Matthews Medical Center is the largest radial access laboratory in the Novant Health system. Between 90 and 100 percent of catheterizations that occur there are done radially. Additionally, a zero percent radial reoclusion rate and same-day discharge for radial PCI procedures have been achieved.

Recently, Matthews Medical Center became the first STEMI program in Mecklenburg County, NC, at a facility without on-site cardiovascular surgery. This program provides additional access for acute MI patients within Mecklenburg County and more timely ground transportation access to patients from Union County, NC, and Anson County, NC.

Structural heart care: Novant Health valve interventionalists continue to lead the region in performance of transcatheter aortic valve replacement (TAVR) for patients with prohibitive or high surgical risk. Its valve teams provide interdisciplinary collaboration among cardiovascular surgery, cardiovascular medicine, advanced cardiovascular imaging and cardiac anesthesia to triage patients appropriately for surgical or transcatheter interventions.
Heart failure care: Forsyth Medical Center and Presbyterian Medical Center received Advanced Heart Certification from The Joint Commission. This certification recognizes programs that demonstrate a commitment to quality care through the use of evidence-based practices and performance improvements. Its shared left ventricular assist program provides temporary mechanical cardiac support as bridge therapy or destination therapy, and its shared pulmonary hypertension program provides a standardized approach for the management of this patient population. Positioning its medical community for population health management through its heart failure clinics has led to a realignment of its congestive heart failure (CHF) programs for a more consistent, standardized system-wide performance, thus enabling more efficient management of the post-acute care HF patient.

Cardiovascular surgery care: Cardiac surgeons at NHHVI have recognized expertise in high risk valve surgery and mitral valve repair. The institute’s surgical repair of myxomatous mitral valves exceeds the national average and, through its interdisciplinary valve clinics, NHHVI cardiac surgeons provide second opinions for high risk valve surgery, minimally invasive valve surgery and percutaneous options for aortic valve interventions. Its cardiac surgeons perform complex and high risk open surgical repair of aortic arch dissections and aneurysms. Novant Health vascular surgeons are participating in a number of research trials evaluating the efficacy of endovascular treatment of similar aortic disorders. Its surgeons are enrolling patients in:

- Prospective non-randomized trials to determine the safety and efficacy of thoracic endoprosthesis devices and thoracic stent grafts for acute complicated type B aortic dissection.
- Trials evaluating endoprosthesis device placement in patients with descending thoracic aortic aneurysms, infrarenal abdominal aortic and aortoiliac aneurysms respectively.

Arrhythmia care: Cardiologists at NHHVI have implemented system-wide management of arrhythmias including a structured approach in referral patterns for medical management, device and ablative therapies for atrial fibrillation, ventricular tachycardia and supraventricular tachycardias. Cardiologists at Presbyterian Medical Center and Forsyth Medical Center pioneered pre-market clinical trials and commercial clinical utilization of the subcutaneous implantable cardiac defibrillator. At Presbyterian Medical Center, 2013 has shown a doubling of atrial fibrillation ablations, with increased patient satisfaction (94 percent are happy to have had the procedure), improved outcomes (87 percent symptomatic improvement, 43 percent off antiarrhythmics and 19 percent off anticoagulation) and low incidence of complications (1.8 percent acute complications, 4.7 percent readmission in the first 30 days – both under the national average). At Forsyth Medical Center, cardiologists have provided the industry with key consultant insight on applications for remote device interrogation of pacemakers, defibrillators and implantable loop recorders in the acute care setting, as well as insight on remote monitoring databases to identify patients with unprogrammed defibrillators according to current practice recommendations. This database analysis approach to patient populations will be important in improving patient outcomes in the future.
2013 SURGICAL OUTCOMES

Novant Health total cases = 6,184

Novant Health Forsyth Medical Center total cases = 3,319
   Total surgery cases = 1,985
   Total cardiology cases = 1,334

Novant Health Presbyterian Medical Center total cases = 2,865
   Total surgery cases = 1,591
   Total cardiology cases = 1,274
Novant Health Case Distribution

- **33%** Cath PCI
- **20%** Vascular
- **7%** Thoracic
- **10%** ICD
- **17%** Cardiac
- **13%** Pacemaker

Source: Administrative case volumes

Novant Health Cardiac Case Distribution

- **54%** CABG
- **15%** Valve
- **8%** CABG & Valve
- **23%** *Other

Forsyth Medical Center

- **31%** Cath PCI
- **19%** Vascular
- **9%** Thoracic
- **9%** ICD
- **14%** Pacemaker
- **18%** Cardiac

Presbyterian Medical Center

- **34%** Cath PCI
- **23%** Vascular
- **5%** Thoracic
- **10%** ICD
- **16%** Cardiac
- **12%** Pacemaker

*COther includes complex procedures such as aortic aneurysms, double valve procedures, etc.

Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database, 2013

CABG = coronary artery bypass graft
ICD = implantable cardioverter defibrillator

Cardiology and Cardiovascular Surgery/Novant Health | 11
2013 ISOLATED CORONARY ARTERY BYPASS GRAFT OUTCOMES

Risk-Adjusted Operative Mortality

Source: STS Harvest Report period ending 12/31/2013

Cardiac Presentation on Admission

Source: STS Harvest Report period ending 12/31/2013
CABG Primary and Reoperations

Forsyth Medical Center

- 95% Primary Operations
- 5% Reoperations

Presbyterian Medical Center

- 99% Primary Operations
- 1% Reoperations

Source: STS Harvest Report period ending 12/31/2013

Age Distribution – Age ≥ 65 years old

Novant Health treats a large number of elderly patients. Advanced age and associated medical conditions are known risk factors that can adversely affect cardiac surgical outcomes.

Source: STS Harvest Report period ending 12/31/2013
2013 ISOLATED CORONARY ARTERY BYPASS GRAFT OUTCOMES

CABG Risk Factors

Although advanced age and female gender are known risks factors affecting outcomes, other factors may also have an adverse effect. Patient risk factors are shown here.

Forsyth Medical Center

Hypertension
Dyslipidemia
Pulmonary Hypertension
Chronic Lung Disease*
Diabetes Mellitus
Left Main Disease (>50 Stenosis)
Cerebrovascular Disease
Congestive Heart Failure
Peripheral Arterial Disease
Family History of CAD
Immunosuppressive Treatment
Dialysis-Dependent

Presbyterian Medical Center

Hypertension
Dyslipidemia
Pulmonary Hypertension
Diabetes Mellitus
Left Main Disease (>50 Stenosis)
Chronic Lung Disease*
Cerebrovascular Disease
Peripheral Arterial Disease
Congestive Heart Failure
Family History of CAD
Immunosuppressive Treatment
Dialysis-Dependent

Source: STS Harvest Report period ending 12/31/2013
*Chronic Lung Disease contains Mild, Moderate and Severe CAD = coronary artery disease
**Internal Mammary Artery Used**

Arterial grafts are known for their excellent long-term patency and are the conduits of choice for coronary revascularization. In 2013, 100 percent of patients undergoing primary isolated revascularization procedures received at least one arterial graft.

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**On-Pump Coronary Bypass Surgery**

**Forsyth Medical Center**

**Presbyterian Medical Center**

Source: STS Harvest Report period ending 12/31/2013

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**Off-Pump Coronary Bypass Surgery**

**Forsyth Medical Center**

**Presbyterian Medical Center**

Source: STS Harvest Report period ending 12/31/2013
2013 ISOLATED CORONARY ARTERY BYPASS GRAFT OUTCOMES

Perioperative Medications

- Preoperative Beta Blockers
- Aspirin
- Beta Blockers
- Lipid-Lowering Agents

<table>
<thead>
<tr>
<th>Percent of Patients</th>
<th>Forsyth</th>
<th>Presbyterian</th>
<th>STS Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative Beta Blockers</td>
<td>80%</td>
<td>85%</td>
<td>90%</td>
</tr>
<tr>
<td>Aspirin</td>
<td>95%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Beta Blockers</td>
<td>90%</td>
<td>95%</td>
<td></td>
</tr>
<tr>
<td>Lipid-Lowering Agents</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Risk-Adjusted Postoperative Complications

- Prolonged Ventilation
- Reoperation Any (NQF Definition)
- Renal Failure
- Permanent Stroke
- Deep Sternal Infection/Mediastinitis

<table>
<thead>
<tr>
<th>Percent of Patients</th>
<th>Forsyth</th>
<th>Presbyterian</th>
<th>STS Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolonged Ventilation</td>
<td>0%</td>
<td>6%</td>
<td>9%</td>
</tr>
<tr>
<td>Reoperation Any (NQF Definition)</td>
<td>3%</td>
<td>3%</td>
<td>12%</td>
</tr>
<tr>
<td>Renal Failure</td>
<td>3%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Permanent Stroke</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Deep Sternal Infection/Mediastinitis</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: STS Harvest Report period ending 12/31/2013
2013 VALVE SURGERY OUTCOMES

Novant Health Valve Case Distribution

- 38% AVR
- 24% AVR & CABG
- 12% MVR & CABG
- 26% MVR

Forsyth Medical Center
- 32% AVR
- 23% AVR & CABG
- 14% MVR & CABG
- 31% MVR

Presbyterian Medical Center
- 44% AVR
- 9% MVR & CABG
- 26% AVR & CABG
- 21% MVR

MVR = mitral valve replacement/repair
AVR = aortic valve replacement
Source: Society of Thoracic Surgeons (STS) National Adult Cardiac Surgery Database, 2013
PATIENT EXPERIENCE

Patricia Jones, 66, of Lincolnton, NC, found herself struggling to get through her day-to-day routine. Simple tasks such as walking and cleaning were leaving her utterly exhausted. Jones’ active lifestyle had come to a complete standstill.

“I didn’t realize how bad it was because I had lived through it every day for so long,” Jones says.

At the time, Jones was told her aortic valve was slowly going bad. Having previously undergone three open heart surgeries, she was used to this kind of news. Her primary care physician expressed the possibility of a new procedure, transcatheter aortic valve replacement (TAVR), which was en route to be approved by the Federal Drug Administration.

To pursue information about the procedure, Jones was referred to Yele Aluko, MD, at Novant Health Heart & Vascular Institute in Charlotte. Aware of her hesitation to try a new treatment, Dr. Aluko used diagrams to clarify the details of the procedure and to help take the pressure off of Jones. His reassuring attitude persuaded Jones to have the procedure at Novant Health Presbyterian Medical Center, one of the first facilities in the country to offer TAVR and the first in the Charlotte region to perform the procedure.

Performed transapically or transfemorally, TAVR is a catheter-based approach to valve replacement for patients with severe aortic stenosis who can either not endure or who are at very high risk with traditional open-heart surgery. The transapical approach involves a left-sided mini-thoracotomy and the replacement valve is inserted directly into the heart using a catheter/guide wire system placed through the left ventricular apex. With the transfemoral approach, the replacement valve is delivered using a similar catheter/guide wire system via a small incision in the groin. Due to the procedure’s minimally invasive nature, patients experience faster recovery time than with traditional open-heart surgery.
Novant Health’s TAVR team, made up of cardiothoracic surgeons, interventional cardiologists, cardiac imagers, anesthesiologists, nurses and operating room technologists, chose to perform Jones’ procedure transfemorally. After a five day recovery period, Jones was released from the hospital and noticed an almost immediate difference in her overall quality of life.

Today, Jones enjoys the freedom a healthier heart has given her. Simple tasks no longer feel overwhelming to her and she finds enjoyment in being able to once again clean her own home. She even has the energy to go dancing, a favorite pastime for her. Her husband states that she now outpaces him when walking in the mall!

“I have never felt better,” Jones says. “I am running circles around myself.”
2013 INTERVENTIONAL CARDIOLOGY OUTCOMES

Cardiac Catheterization Laboratory Procedures

Forsyth Medical Center

Presbyterian Medical Center

PCI Risk Adjusted Mortality

Source: NCDR CathPCI Outcomes Report 4Q 2013

Source: Novant Health Clinical Improvement

Source: NCDR CathPCI Outcomes Report 4Q 2013
Risk Factors among Patients Undergoing PCI Procedure

Discharge Medications after PCI Procedure

Source: NCDR CathPCI Outcomes Report 4Q 2013
2013 INTERVENTIONAL CARDIOLOGY OUTCOMES

Post Procedure PCI Complications

<table>
<thead>
<tr>
<th>Condition</th>
<th>Forsyth</th>
<th>Presbyterian</th>
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<tbody>
<tr>
<td>Death, Emergency CABG, Stroke or Repeat Target Vessel Revascularization</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td>New Requirement for Dialysis</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>CVA/Stroke</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Cardiac Tamponade</td>
<td>0%</td>
<td>0%</td>
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</table>

Source: NCDR CathPCI Outcomes Report 4Q 2013

Door to Balloon Times (Percentage of STEMI Patients within 90 Minutes)

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Door to Balloon Time</th>
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</thead>
<tbody>
<tr>
<td>Forsyth</td>
<td>98%</td>
</tr>
<tr>
<td>Presbyterian</td>
<td>96%</td>
</tr>
</tbody>
</table>

ACC 50th Percentile: 94%

Source: NCDR CathPCI Outcomes Report 4Q 2013
2013 ELECTROPHYSIOLOGY OUTCOMES

Novant Health Electrophysiology Distribution

34% Pacemakers
28% Ablations
13% EP Study
25% ICD

Forsyth Medical Center

32% Pacemakers
28.5% Ablations
17% EP Study
22.5% ICD

Presbyterian Medical Center

38% Pacemakers
8% EP Study
26% Ablations
28% ICD

Electrocardiogram Procedures

Number of Procedures

Source: Novant Health Internal Report
2013 ELECTROPHYSIOLOGY OUTCOMES

ICD Clinical Outcomes

<table>
<thead>
<tr>
<th>Event</th>
<th>Forsyth</th>
<th>Presbyterian</th>
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</thead>
<tbody>
<tr>
<td>Incidence of Death or Major Adverse Event</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Cardiac Perforation</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Lead Dislodgment</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Pneumothorax</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>TIA or Stroke (CVA)</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Myocardial Infarction</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Pericardial Tamponade</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

TIA = transient ischemic attack
Source: NCDR ICD Outcomes Report 4Q 2013

ICD Mean Length of Stay

Source: NCDR ICD Outcomes Report 4Q 2013
In order to achieve superior clinical outcomes, Novant Health uses multiple metrics to assess best practice in patients with heart failure. The information below displays compliance performance at Novant Health.

**Forsyth Medical Center**

- Anticoagulation for Atrial Fibrillation or Atrial Flutter
- DVT Prophylaxis
- Influenza Vaccination During Flu Season
- Pneumococcal Vaccination
- ACEI/ARB at Discharge
- Evidence-Based Specific Beta Blockers
- Measure LV Function
- Discharge Instructions

**Presbyterian Medical Center**

- Anticoagulation for Atrial Fibrillation or Atrial Flutter
- DVT Prophylaxis
- Influenza Vaccination During Flu Season
- Pneumococcal Vaccination
- ACEI/ARB at Discharge
- Evidence-Based Specific Beta Blockers
- Measure LV Function
- Discharge Instructions

Source: Novant Health Internal Report

DVT = deep vein thrombosis
ACEI = angiotensin converting enzyme inhibitor
ArB = angiotensin receptor blocker
LV = left ventricular
The affiliation between the Cleveland Clinic and Novant Health enhances opportunities to provide new treatments and therapies to patients as well as accelerate mutual accomplishments in cardiac care. Clinical research remains a core value at Novant Health Heart & Vascular Institute. In 2013, Novant Health physicians were involved in an average of 35 active trials, some of which are still ongoing.

The following trials highlight some of the latest clinical research being investigated at Novant Health Heart & Vascular Institute locations at Novant Health Forsyth Medical Center and Novant Health Presbyterian Medical Center.
PCSK-9 trial: Recognizing the importance of furthering preventative care, Novant Health Heart & Vascular Institute has partnered with three leading pharmaceutical companies to study the safety and efficacy of an entirely new drug class of cholesterol medications, PCSK-9. PCSK-9 is the principal enzyme that, in previous research, has shown unprecedented improvements in LDL levels. This revolutionary LDL lowering molecule is believed to be the future of lipid lowering therapy.

Respicardia trial: To broaden the scope of cardiovascular research endeavors, Novant Health Heart & Vascular Institute partnered with Novant Health Sleep on the execution of the Respicardia study. This clinical trial focused on stimulation of the phrenic nerve to treat central sleep apnea. This partnership combines the expertise of both sleep medicine and cardiac electrophysiology and is a truly innovative approach to system-focused patient care.
**RESPOND CRT trial:** The objective of this study is to assess the safety and effectiveness of the automatic atrioventricular delay and interventricular delay optimization algorithm used in the PARADYM RF SONR cardiac resynchronization therapy with defibrillation (CRT-D) device (Model 9770) in combination with the SonRtip Lead, which includes a SonR sensor in the tip of the atrial pacing lead, and compatible SmartView programming software. This study will evaluate the effectiveness of the automatic optimization algorithm in increasing the rate of patients responding to the therapy as compared to an echocardiographic optimization method and will also evaluate the safety and effectiveness of the SonRtip atrial pacing lead.

**Sonar clinical trial (Sorin):** Patients are being enrolled in this trial, which uses a novel biofeedback mechanism to auto-optimize timing intervals on biventricular pacemaker defibrillators in order to improve heart failure patient outcomes. This study is being conducted at Novant Health Heart & Vascular Institute.

**Chronic heart failure trials:** The Chronic Heart Failure (CHF) in which Novant Health Heart & Vascular Institute is involved utilize a number of novel treatment approaches for the management of a challenging patient population. The GUIDE-IT clinical trial is a management focused study in which cardiologists and other heart failure providers dictate a patient’s current heart failure regimen based on neuropeptide lab values. The Commander trial hypothesizes that utilization of rivaroxaban as an anticoagulant can reduce the risk of decompensation events and improve overall mortality rates in patients with both chronic heart failure and significant coronary artery disease. The Relax HF trial focuses on treatment of acute heart failure presentations that will be treated with a continuous 48 hour intravenous drip of Serelaxin, a peptide hormone believed to provide improvement in hemodynamic profiles.
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