Our electrophysiology (EP) team was one of the first in Virginia to offer the world’s smallest leadless (wire-free) pacemaker that is implanted directly into the heart with a catheter. Our team of electrophysiologists and cardiothoracic surgeons continue to provide a unique comprehensive program to address cardiac rhythm disorders, such as atrial fibrillation. Our EP program is among the busiest in the country.

Our structural heart program remains one of the nation’s most successful transcatheter aortic valve replacement (TAVR) centers.

The cardiothoracic surgery program reached an important milestone with 50,000 open heart cases.

Cardiac research also continues to be an important focus. Our heart experts are actively participating in numerous studies. This gives patients access to the latest emerging technologies while simultaneously improving cardiac care.

We are committed to the provision of safe, effective and quality cardiac care for the best value. As we move toward the alignment of cardiac and vascular services within Sentara Healthcare, we will continue to provide comprehensive and innovative care to this unique population of patients.

We encourage you to learn more about our nationally recognized innovative programs and services highlighted in this year’s annual report.

Sincerely,

It is with great pleasure that we share the 2016 Sentara Heart Annual Report with you. We are exceptionally proud to highlight some of the accomplishments of cardiac services across all Sentara Heart locations.

In 2016, we marked the 10-year anniversary of the opening of Sentara Heart Hospital, the region’s only dedicated heart hospital. For the 16th consecutive year, Sentara Heart was listed as a top 50 heart program by U.S. News & World Report. We are proud of this achievement as our cardiac program vies against more than 5,000 hospital programs nationwide for this recognition, including the most prestigious academic medical centers in the country.

The Sentara Heart network of hospitals and cardiac services impacts all of the communities that we serve. The care we provide wouldn’t be possible without the collaborative efforts of our 28,000-plus team members. Our world-class heart specialists strive for excellence in quality, customer care and safety every day. Each Sentara Heart service continues to uphold our long-standing reputation for clinical distinction with a proven record of exceptional patient outcomes. Ten of our hospitals have been recognized by the American College of Cardiology Foundation National Cardiovascular Data Registry and the American Heart Association for their outstanding treatment of patients with acute myocardial infarction.

Our two regional councils ensure exceptional quality at more than 100 care sites across our health system. The councils’ oversight and national benchmarking allow our care teams to identify areas of improvement, implement timely action plans and share standardized best practices across all Sentara Heart locations. This focus fosters the highest possible care processes and appropriates cardiac programs at our hospitals and cardiac service sites.

In 2016, we expanded the successes of some of our most respected and sought-after cardiac care programs and innovations. These successes include, but are not limited to, the following:

Sentara Heart’s non-invasive testing program partnered with IBM Watson to analyze structured and unstructured medical information. This involvement put Sentara Heart at the leading edge of a digital revolution to seek innovative ways to improve patient care.

Cardiac research also continues to be an important focus. Our heart experts are actively participating in numerous studies. This gives patients access to the latest emerging technologies while simultaneously improving cardiac care.

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Sincerely,

Karen Armstrong
Senior Divisional Vice President
Sentara Cardiovascular Services

Theresa L. Kinnard, MD
Medical Director
Sentara Heart

Audrey Douglas-Cooke
Vice President
Sentara Heart Hospital

To view this report online, go to AnnualReport.SentaraHeart.com

Sentara Heart 2016 Annual Report

2016
One healthcare system with many doors, but a shared commitment to quality care and creating an extraordinary healthcare experience.

- 28,000+ Members of the Team
- More than 1,000 Quality Physicians and Advanced Practice Clinicians
- 12 Acute Care Hospitals
- Advanced Imaging and Diagnostic Centers
- Nursing and Assisted-Living Centers
- Outpatient Care Centers
- Physical Therapy Centers
- Home Care and Hospice
- Optima Health Plan
- Serving 450,000 Members
- Sentara College of Health Sciences
- A Clinically Integrated Network

Sentara Healthcare

**Acute Care Hospitals**

- 7 in Hampton Roads
- 1 in Northern Virginia
- 2 in the Blue Ridge Region
- 1 in South Boston
- 1 in Northeastern North Carolina

- **Sentara Albemarle Medical Center**
  - Elizabeth City, NC
  - 112 Beds

- **Sentara Heart Hospital**
  - Norfolk, VA
  - 112 Beds (included in Sentara Norfolk General Hospital license)

- **Sentara CarePlex Hospital**
  - Hampton, VA
  - 224 Beds

- **Orthopaedic Hospital at Sentara CarePlex Hospital**
  - Hampton, VA
  - 48 Beds (included in Sentara CarePlex Hospital license)

- **Sentara Halifax Regional Hospital**
  - South Boston, VA
  - 132 Beds

- **Sentara Heart Hospital**
  - Norfolk, VA
  - 250 Beds

- **Sentara Martha Jefferson Hospital**
  - Charlottesville, VA
  - 176 Beds

- **Sentara Princess Anne Hospital**
  - Virginia Beach, VA
  - 100 Beds

- **Sentara Northern Virginia Medical Center**
  - Woodbridge, VA
  - 181 Beds

- **Sentara Virginia Medical Center**
  - Virginia Beach, VA
  - 276 Beds

- **Sentara Williamsburg Regional Medical Center**
  - Williamsburg, VA
  - 145 Beds

**Sentara Healthcare AT A GLANCE**

**VIRGINIA**

- **Hampton Roads**
  - Blue Ridge
  - Northern Virginia
  - South Boston

- **Norfolk**
  - Suffolk

- **South Boston Virginia Beach**
  - Hampton Roads
  - Blue Ridge
  - Northern Virginia
  - South Boston

- **Elizabeth City, NC**

**NORTH CAROLINA**

- **Virginia Beach**
  - Norfolk
  - Suffolk
  - Virginia Beach

- **South Boston**
  - Hampton Roads
  - Blue Ridge
  - Northern Virginia
  - South Boston
Our goal at Sentara is to be among the best healthcare providers in the country. We strive for top 10 percent rankings in all areas where care, quality and service are considered.

We’re proud that we have been recognized by many state and national organizations for our work, because it means that we are giving our patients the attention and help they deserve. From hybrid ORs to innovative physicians and advanced practice clinicians to new models of care, we’ve always been ahead of the curve.

Sentara provided $341,145,000 in Community Benefits in 2016

$310,123,000 Uncompensated Patient Care
$18,923,000 Teaching & Training of Healthcare Professionals
$12,099,000 Health & Prevention Programs
$341,145,000 Total Community Benefit Provided

Our world-class heart specialists strive for excellence in clinical quality, customer centricity and medical innovation. Each Sentara Heart service continues to uphold our long-standing reputation for clinical distinction with a proven record of exceptional patient outcomes.”

— Ken Armstrong
Senior Divisional Vice President, Sentara Cardiac Service Line

Sentara Heart includes more than 140 board-certified cardiologists, cardiothoracic surgeons and anesthesiologists. From diagnostic testing to emergency heart attack care, Sentara Hospitals provide quality heart care to the residents of our service area and beyond. Because each Sentara Hospital is part of the Sentara Heart network, each local heart program shares innovative procedures, cutting-edge technologies and best practices.

Our programs are accessible, located in convenient locations and welcoming facilities throughout the community. This remarkable delivery system is made possible through a sophisticated technology infrastructure and a commitment to blending clinical teams with the common goal of advancing patient care.
Sentara Heart boasts a strong network of cardiac care throughout its integrated system. With the exception of heart surgery, all Sentara community hospitals provide a range of heart services. Patients from throughout Virginia and North Carolina can receive emergency heart care in the Sentara location closest to them and be transferred by ground or air ambulance to Sentara Heart Hospital, Sentara Virginia Beach General Hospital or Sentara RMH Medical Center for open heart surgery, should they need this advanced care. The other Sentara hospitals offer a range of heart services, from comprehensive diagnostic testing and diagnostic catheterization to emergency interventional cardiology and rehabilitation, within the fully integrated network of Sentara hospitals.

Cardiac Departments
- Cardiac Medicine
- Non-Invasive Cardiology
- Diagnostic Cardiovascular Imaging: MR/CT
- Preventive Cardiology & Rehabilitation
- Clinical Cardiology
- Invasive & Interventional Cardiology
- Cardiac Electrophysiology and Pacing
- Heart Arrhythmia

Team Members
- Electrophysiologists
- Diagnostic Cardiologists
- General Cardiologists
- Interventional Cardiologists
- Cardiothoracic Surgeons
- Vascular Surgeons
- Cardiac Anesthesiologists
- Advanced Practice Clinicians
- Nurses
- Infectious Disease Specialists
- Intensivists
- Pulmonologists
- Endocrinologists
- Nephrologists

Multispecialty Centers
- Sentara Heart Valve and Structural Disease Center
- Sentara Heart Arrhythmia Center
- Sentara Aortic Center
- Sentara Cardiac Diabetes Center
- Sentara Advanced Heart Failure Center (includes specialization in pulmonary arterial hypertension)

Hospital Abbreviation Key
- SAMC - Sentara Albemarle Medical Center
- SCR - Sentara CarePlex Hospital
- SHH - Sentara Heart Hospital
- SHBF - Sentara Halifax Regional Hospital
- SHLG - Sentara Leigh Hospital
- SMJH - Sentara Martha Jefferson Hospital
- SNVMC - Sentara Northern Virginia Medical Center
- SOH - Sentara Obici Hospital
- SPAH - Sentara Princess Anne Hospital
- SRMH - Sentara RMH Medical Center
- SVBGH - Sentara Virginia Beach General Hospital
- SWRMC - Sentara Williamsburg Regional Medical Center

Outpatient Campuses and Physician Offices
As an integrated healthcare system throughout Virginia and North Carolina, we operate more than 100 sites of care and partner with local providers.

Cardiovascular Research Institute
SCRI works collaboratively with local institutions, government agencies and biomedical companies on nationally and internationally recognized clinical research trials.

Group Members
- Neurologists
- Hospitalists
- Primary Care Physicians
- RCE/NCIC Certified Clinicians
- Quality Coordinators
- Researcher
- Navigator
- Education Specialist
- Transplant Coordinators
- Perfusionists
- CVT Technicians
- Imaging Specialists
- Cardiovascular Technologists
- Transplant Coordinators
- Pulmonologists
- Hypertension

Aortic Disease
- Heart Failure, MCS & Transplantation
- Structural Heart Disease
- Thoracic Surgery
- Cardiothoracic Surgery
- Pulmonary Hypertension
- Cardiac Observation

Neurologists
- Hospitals
- Primary Care Physicians
- RCE/NCIC Certified Clinicians
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- CVT Technicians
- Imaging Specialists
- Cardiovascular Technologists

Samc - Sentara Albemarle Medical Center
SRH - Sentara Heart Hospital
SRRH - Sentara Halifax Regional Hospital
SLH - Sentara Leigh Hospital
SMJH - Sentara Martha Jefferson Hospital
SNVMC - Sentara Northern Virginia Medical Center
SOH - Sentara Obici Hospital
SPAH - Sentara Princess Anne Hospital
SRMH - Sentara RMH Medical Center
SVBGH - Sentara Virginia Beach General Hospital
SWRMC - Sentara Williamsburg Regional Medical Center

Full Integrated System of Heart Care
## 2016 Sentara Heart Volumes

<table>
<thead>
<tr>
<th>Procedure Type</th>
<th>Volume</th>
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<tbody>
<tr>
<td>Cardiothoracic Surgeries</td>
<td>2,267</td>
</tr>
<tr>
<td>Interventional Cath Procedures</td>
<td>4,133</td>
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<tr>
<td>Electrophysiology Procedures (Ablation, AICDs and Pacers)</td>
<td>5,312</td>
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<tr>
<td>Diagnostic Cath Procedures</td>
<td>13,432</td>
</tr>
<tr>
<td>Non-Invasive Diagnostic Testing</td>
<td>102,473</td>
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### Sentara Albemarle Medical Center

Sentara Albemarle Medical Center (SAMC) in Elizabeth City, NC, joined Sentara Healthcare in 2014. Sentara has provided care for North Carolina residents at our hospitals in Virginia, but SAMC is the first Sentara hospital actually located in the state.

In 2016, the hospital’s cardiac rehabilitation program saw a 40 percent increase in patient usage. This increase is attributed to the rehab team’s dedication to educating patients about the importance of making healthy lifestyle changes to improve heart health. Cardiac rehab patients recovering from heart events and heart procedures participate in physical activity under the close supervision of medical experts. SAMC staff also reworked scheduling to open up more early morning and weekday appointments often requested by older heart patients.

The cardiac rehab program at SAMC is accredited by the American Association of Cardiovascular and Pulmonary Rehabilitation. The 182-bed hospital also has echocardiography accreditation from the Intersocietal Accreditation Commission and nuclear cardiology accreditation from the American College of Radiology.

In 2016, the hospital welcomed the services of its first electrophysiologist. Since then, more than 50 heart patients have received automatic implantable cardioverter defibrillators (AICDs). These devices are similar to pacemakers, delivering electrical shocks to the heart when needed. Approximately 130 other patients received different types of implantable devices in 2016.

The hospital excels at providing timely emergency cardiac care with an average door-to-needle time of 28 minutes. This time refers to how long...
For more than 60 years, Sentara Halifax Regional Hospital (SHRH) in South Boston, VA, has provided exceptional care to residents of Virginia’s south central region and residents of the bordering state of North Carolina. The Halifax hospital joined Sentara Healthcare in 2013.

In 2016, SHRH received the Quality Innovation Award given by the Virginia Health Quality Center, a nonprofit health quality consulting company that conducts studies of exemplary infection control and customer service. Only hospitals that score in the top 10 percent of a Centers for Disease Control and Prevention (CDC) assessment for infection prevention receive this award.

The skilled cardiac team at SHRH provides state-of-the-art diagnostic testing, including heart catheterizations, electrocardiography (EKG), exercise and pharmacologic stress tests, Doppler echo studies, nuclear imaging, tilt table testing, and Holter and event monitoring. Additional cardiac services include interventional cardiology, implantable devices and cardiac rehabilitation.

The cardiac rehabilitation program at SHRH is accredited by the American Association of Cardiovascular and Pulmonary Rehabilitation. The 192-bed hospital also has echocardiography accreditation and nuclear cardiology accreditation from the Intersocietal Accreditation Commission (IAC).

SHRH is a leader in providing timely emergency cardiac care and boasts an average door-to-balloon time of 54 minutes. This time refers to how long it takes cardiac catheterization lab staff to perform a coronary interventional procedure, such as angioplasty, on a heart attack patient after they enter the ED. In 2016, the hospital performed more than 700 cardiac procedures, including 539 diagnostic cath procedures, 105 interventional cath procedures and 95 implantable devices such as pacemakers.

Cardiac experts at SHRH are active in a variety of community outreach programs. Members of the community can sign up for a free Pocket EKG cardiac screening. Cardiac teams use EKGs, bloodwork and vital signs testing to screen members of the community for heart disease. Participants receive pocket-size, laminated cards with the screening results that they can carry in their wallets. Should a participant develop a heart problem in the future, doctors can compare this baseline EKG with future EKGs to aid in a timely diagnosis.

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The energy or strength to do many of her heart rate. In the meantime, Julie didn’t have medication proved ineffective in regulating her medication management. However, the first plan of treatment for Julie was monitoring Julie’s heart led Dr. Fischer to refer Jefferson Hospital Device Clinic for a Holter monitor. Results from two weeks of constantly monitoring, she became.

Although Julie had suffered from SVT (what many describe as “heart flutters”) for more than 20 years, she had never experienced anything that frightening. She called her primary care physician, Dr. Renee Fischer, who referred her to the Sentara Martha Jefferson Hospital Device Clinic for a Holter monitor. Results from two weeks of constantly monitoring, she became.

As the Holter monitor recorded one day, a single beat continued for nearly four hours and the longer it lasted the more intensely fatigued she became.

From treatment to cure:

The first plan of treatment for Julie was medication management. However, the medication proved ineffective in regulating her heart rate and heart. In the meantime, Julie didn’t have the energy or strength to do many of her normal activities and hadn’t gardened for weeks. Dr. Freedman referred Julie to Dr. John Zakaib. Having just moved his practice from the Cleveland Clinic to Charlottesville, Dr. Zakaib was Martha Jefferson’s newest electrophysiology (EP) cardiologist. He has advanced training in the treatment of atrial fibrillation.

After additional testing, Dr. Zakaib offered Julie the answer to her heart problem: She could take various medications for the rest of her life to try and control it—or he could cure it with a procedure called ablation.

“I was nervous but my family offered me a lot of support,” said Julie. “We decided that if this procedure could cure me, I had to have it done.”

On October 10, 2008, Julie underwent treatment in the Sentara Martha Jefferson EP procedural lab. With Julie relaxed under the mild sedation of Versed and Fentanyl, Dr. Zakaib conducted diagnostic tests to determine the cause of her irregular heart rhythms. He pinpointed a focal location in the electrical system of Julie’s heart that caused her arrhythmia. He performed ablation, effectively stopping the harmful impulses and terminating the arrhythmia.

“I don’t have enough kind words to say about Dr. Zakaib and the staff,” said Julie. “I was emotional going into the surgery, but they kept me as comfortable as possible. One nurse even held my hand throughout the entire procedure. I’d refer anyone having a procedure called ablation.

Program Leads

Senta Heart Promise offers a one-of-a-kind support system that provides coordinated care for better health before, during and after heart surgery. Developed at Sentara Heart for coronary artery bypass and valve replacement surgery patients, Sentara Heart Promise provides:

- Pre-surgical screening, evaluation and heart team approach to care
- Patient and family individualized plans of care
- Post-surgery follow-up care
- Preventive services and counseling

The program’s centerpiece is a unique, pre-surgery assessment tool administered by nurse practitioners to evaluate a patient’s health prior to surgery. This clinical checklist is designed to identify underlying conditions that could disrupt scheduled surgery or complicate recovery. Since the pilot was created in 2012, the program has eliminated day of surgery cancellations for cardiothoracic surgery patients and has significantly reduced readmission rates.

Other major successes include:

- Streamlined, same-day appointments with the Promise team and cardiac surgeons
- Identification of underlying conditions prior to surgery, preventing complications or surgery delays
- Collaboration with Endocrinology to provide both pre- and postoperative diabetes care
- Decreases in postoperative atrial fibrillation, prolonged vent and postoperative renal failure rates
- Decreased patient length of stay
- Decreased surgical cancellation rates
- Heart team approach, individualized risk assessment shared with each patient
- Deliver medical approaches or other alternative therapies to patients too high risk for surgery
- Streamlined pre- and post-surgical education to ensure patients are well-informed about their procedure without overwhelming them with excessive materials
- Improved outcomes with a postoperative recovery checklist that patients can easily follow during their admission and at home

Sentara Heart Promise is led by advanced practice clinicians who work with our elective, outpatient population and our inpatient preoperative population. Through this program, every surgical patient has a point of contact for the entire surgical timeline: preoperatively, postoperatively and up to 30 to 90 days post discharge.

Sentara Heart Promise

Melissa Connolly, MSN, RN, ACNP-C
Amy Shannon, MSN, RN, FNP-C

Identification of underlying conditions prior to surgery, preventing complications or surgery delays
Collaboration with Endocrinology to provide both pre- and postoperative diabetes care
Decreases in postoperative atrial fibrillation, prolonged vent and postoperative renal failure rates
Decreased patient length of stay
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Advanced Cardiovascular Imaging

Heart diagnosis has traditionally required catheterization, a procedure that increases both cost and patient risk. Over the last decade, pressure has mounted for faster and cheaper diagnoses, with less aggravation to patients. The healthcare community responded with dramatic improvements. Most notable is advanced coronary computed tomography (CT) scanning, an innovative tool doctors now use to non-invasively detect or rule out heart problems in patients.

Advanced cardiovascular imaging at Sentara Heart Hospital, Sentara Virginia Beach General Hospital and Sentara Williamsburg Regional Medical Center perform the most complex cardiovascular imaging within 150 miles. Our highly skilled, subspecialized doctors are using world-class technology to usher in a new era in imaging characterized by incredibly fast and accurate diagnosis of cardiovascular disease, chest pain, stroke, and other life-threatening illnesses.

As enthusiastic supporters of a wide array of cardiac clinical research studies, our echo team is perennially at the technological forefront of cardiac imaging. Throughout the Sentara Heart Network, all echo labs are fully accredited by ICAEL. Our accomplishments in echocardiography—together with rapidly growing areas such as percutaneous transcatheter aortic valve replacement and atrial fibrillation ablation—are essential to the Sentara mission of improving health every day.

To contact the Advanced Cardiovascular Imaging Program, call (757) 388-8870.
IBM Watson Health

Sentara Heart continues to be a forerunner in the use of innovative technologies to improve the health of cardiovascular patients. In 2016, our non-invasive cardiology program contributed data from more than 3,000 echocardiograms to IBM Watson Imaging Clinical Review, a $4 billion health technology initiative spearheaded by IBM Health.

IBM Watson made a splash in 2011 when the computing system bested some well-known Jeopardy champions on television, taking home the $1 million first-place prize. The system understands natural language and reasoning and is able to learn over time.

Sentara Heart is a founding member and lead contributor to a worldwide group of 24 health institutions collaborating with IBM Health on this project. For our first endeavor, IBM Health used the information we provided to teach a computing system, known as IBM Watson Health, how to read echocardiograms and identify signs of a common heart condition called aortic stenosis.

Up to 1.5 million Americans have aortic stenosis, a condition that occurs when calcium deposits build up on the heart’s aortic valve. The valve becomes stiff and doesn’t open properly, restricting blood flow to the body and causing fatigue, shortness of breath, chest pain, dizziness or fainting. The number of people with aortic stenosis continues to rise as people live longer.

Currently, one of IBM Watson Health’s main contributions is ensuring that diagnostic test information makes its way into a patient’s medical records. IBM Watson Health minimizes the risk of this oversight by reading every single file in a heart patient’s medical record to identify new information that represents a change between a cardiologist’s report and data that should carry through to other records, such as electronic medical records, billing and insurance reports.

At present, IBM Watson Health allows for retrospective analysis only, confirming and recording cases of aortic stenosis already diagnosed by a cardiologist and ensuring the diagnosis is captured in appropriate records. In the future, the goal is to improve the accuracy of heart disease diagnosis by using artificial intelligence as a first set of eyes on diagnostic imaging tests to identify what is normal and what is not.

For instance, IBM Watson Health will read an echocardiogram and document any signs of aortic stenosis. A technician reviews the echocardiogram and the computer system’s findings, noting any additional problems. A cardiologist now has more information to ensure an accurate reading of the study. The addition of IBM Watson Health as a first step in imaging reading should improve accuracies and efficiencies while allowing doctors to spend less time on clerical paperwork and more time treating patients.

As IBM Watson becomes more proficient in reading echocardiograms, it could be used to promote best practices in following early stage aortic stenosis patients by identifying those patients who were overdue for clinical follow-up or imaging studies and alerting the clinician, patient or both. The system will be able to pull from a vast array of data, including medical imaging, electronic medical records, radiology and pathology reports, lab results, medical journals, research studies and clinical care guidelines to identify potential problems and predict outcomes.

Sentara Heart will continue to collaborate with IBM Watson Health to provide data that can teach the system how to identify signs of other cardiovascular conditions, such as heart attacks, valve disorders, cardiomyopathy (disease of the heart muscle) and deep vein thrombosis. IBM Health also has plans to teach the system to read breast and lung imaging for cancer detection.
Cardiac and Pulmonary Rehabilitation

Cardiac rehabilitation (rehab) at Sentara Heart is instrumental in a patient’s recovery following a cardiac event, such as a heart attack, valve surgery or heart transplant. All 12 Sentara hospitals offer cardiac rehab, while nine locations also offer pulmonary rehab for patients with chronic lung problems, such as emphysema, interstitial lung disease and chronic obstructive pulmonary disease (COPD). These programs help thousands of patients every year.

The Sentara cardiac rehab team, comprised of a medical director, cardiac nurses, exercise physiologists, registered dietitians and other health experts, guides patients through physical fitness programs and provides counseling and education on a range of topics, such as a heart-healthy diet, tobacco cessation and stress management. Specialists work one-on-one to help patients build endurance and stamina so they can return to the activities they love and improve their heart health.

The cardic rehab programs at 10 Sentara hospitals are certified by the American Association of Cardiovascular and Pulmonary Rehabilitation. Two locations currently are seeking certification. In 2016, Sentara cardiac and pulmonary rehab programs expanded their service offerings to include:

- **Tobacco cessation program:** In 2016, the registered nurses and exercise physiologists on the cardiac rehab team at Sentara Heart Hospital completed training to become certified tobacco cessation counselors. These experts are taking part in a pilot program aimed at reducing hospital readmissions for patients with congestive heart failure and heart disease by helping them to quit smoking. Tobacco cessation training and certification will expand to cardiac rehab team members at other hospital locations.

- **Yoga for a stronger heart:** The cardiac rehab programs at Sentara Heart Hospital, Sentara Leigh Hospital and Sentara CarePlex Hospital added cardiac yoga to their service offerings. The classes are taught by a yoga instructor who has special training and is certified to work with cardiac patients. Research suggests that yoga-based programs help those with heart disease by lowering blood pressure, reducing stress and improving respiratory function and heart rate.

- **Music for better breathing:** Music therapy is now part of the pulmonary rehab service offerings at Sentara Heart. Patients use deep breathing techniques while singing and humming to improve respiratory function. Studies show that music therapy, in conjunction with traditional therapies, reduces disease symptoms and improves quality of life and mental well-being in patients with chronic lung diseases.

Ornish Lifestyle Medicine™ Program for Reversing Heart Disease

In 2016, on the campus of Sentara Princess Anne in Virginia Beach, Sentara became the first and only provider in the state to offer patients a clinically proven way to reverse heart disease. Nearly four decades of research show that those who complete and stick with the Ornish Lifestyle Medicine™ program can reverse the progression of coronary artery disease and other chronic conditions. Program participants can reduce their risk of heart attack, lower their need for medication and avoid the need for serious cardiac interventions like bypass surgery.

**Program Overview—** Over nine weeks, the Ornish Lifestyle Medicine™ program focuses on four core lifestyle components:

1. **A whole foods, plant-based diet** that’s naturally low in fat and refined carbohydrates
2. **Moderate aerobic activity**
3. **Stress management**
4. **Psychosocial encouragement via support groups**
Participants experienced a 300% improvement in blood flow to the heart.

After three years, 77% of people who had undergone coronary intervention procedures avoided revascularization with no increased frequency of cardiac events.

After one year, participants experienced a significant decrease in the frequency of angina, or chest pain, with almost 3/4 of participants having no chest pain, a result comparable to what is typically achieved through revascularization procedures like coronary artery bypass.

Low-density lipoprotein (LDL, or bad) cholesterol numbers dropped by almost 40%.

Participants lost an average of 24 pounds.

Ornish Lifestyle Medicine at Sentara Princess Anne
For more information, call (757) 507-8820 or go to Ornish.SentaraHeart.com.
Interventional Cardiology

Sentara Heart Hospital provides a wide range of cardiac interventional procedures to treat coronary artery disease. The sooner a patient suffering from heart defects and disease gets interventional care, the better their chances of survival and complete recovery.

Each year, Sentara Heart performs more than 4,000 interventional procedures across 22 catheterization laboratories (cath labs) throughout the state of Virginia. These state-of-the-art cath labs significantly reduce radiation exposure.

Our cardiac teams provide specialized interventional catheterization for defects that have historically required open surgery, such as:

- Atrial septal defects
- Ventricular septal defects (VSD)—including implantation of a muscular VSD device
- Patent foramen ovale
- Intracoronary stents
- Drug-eluting stents
- Atrial, valvuloplasty, and percutaneous coronary interventions
- Chronic total occlusion

STEMI Program

Sentara Heart is a recognized leader for expedited treatment of ST-elevation myocardial infarction (STEMI) patients. American College of Cardiology and American Heart Association national guidelines state that hospitals treating STEMI patients with emergency PCI should reliably achieve a door-to-balloon time of 90 minutes or less. As a participating hospital in D2B: An Alliance for Quality™, Sentara Heart’s median time of 60 minutes for door-to-balloon was well below average in 2015.

[Graph showing the observed-to-expected mortality ratio]

What does the O/E mortality ratio mean?

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Sentara Heart Hospital has one of the country’s leading electrophysiology (EP) programs, featuring four EP labs with advanced 3D mapping systems and a separate Hybrid Cardiac Operating Suite. Our board-certified electrophysiologists treat heart rhythm disturbances using the latest devices and advanced procedures that take place inside the heart without the need for open surgery.

In 2016, Sentara Heart electrophysiologists performed more than 900 catheter ablations to treat cardiac arrhythmias, including atrial fibrillation, ventricular tachycardia and supraventricular tachycardia. This minimally invasive procedure targets areas of the heart causing the arrhythmia.

We also have a number of clinical research opportunities that give patients access to the latest cardiac care technologies.

Leadless Device Therapy

As one of the busiest electrophysiology programs in Virginia, the sophisticated device therapy program at Sentara Heart performs more than 1,600 device procedures each year.

In 2016, Sentara Heart Hospital became one of the first hospitals in Virginia to offer the world’s smallest leadless (wire-free) pacemaker, the Micra® Transcatheter Pacing System. This device regulates heart rhythm for patients with bradycardia, a slow or irregular heartbeat of fewer than 60 beats per minute.

Traditional pacemakers rely on leads, or wires, to provide an electrical connection between the device and heart. If these leads malfunction or an infection develops in surrounding tissue, patients must undergo another surgery to replace the device and leads.

Micra is about the size of a large vitamin and weighs the same as a penny. Sentara electrophysiologists use a transcatheter procedure to implant the wire-free device directly into the heart’s right ventricle chamber where it delivers electrical stimulation to the heart.

- Automatic pacing: Micra automatically adjusts the heart’s pacing based on a patient’s activity level.
- MRI compatibility: Traditional pacemakers contain metals that can’t undergo magnetic resonance imaging (MRI). Micra doesn’t contain these metals, which means patients can get advanced imaging diagnostic procedures.
- Permanent placement: Should a patient need more than one heart device, doctors can turn off Micra and implant a new device—while Micra stays in the heart—without risk of electrical interaction.

Permanent His Bundle Pacing

Sentara electrophysiologists also are among a select few in the region with the expertise to perform a pacemaker technique known as permanent His bundle pacing (PHBP). The bundle of His is a group of heart muscle cells that transmit electrical impulses from the atrioventricular node to the left and right ventricles.

Patients with congestive heart failure and bundle branch disease traditionally require cardiac resynchronization therapy (CRT) to treat heart rhythm problems. CRT involves placing leads, or wires, into the right and left ventricles to generate simultaneous pacing of the two ventricles.

With PHBP, our electrophysiologists position the pacemaker leads to directly engage the bundle of His. This alternative therapy enables patients to maintain a regular heart rhythm with less risk of heart muscle damage than traditional right ventricular pacing.

In July 2016, Sentara Heart Hospital became one of the first hospitals in the area to implant the world’s smallest pacemaker in patients with bradycardia. The Micra® Transcatheter Pacing System (TPS) is a new device that provides patients with the most advanced pacing technology at one-tenth the size of a traditional pacemaker. Micra is the only leadless pacemaker approved for use in the U.S. The device is small enough to be delivered through a catheter and implanted directly into the heart with small tines, providing a safe alternative to conventional pacemakers without the complications associated with leads—all while being cosmetically invisible.

The Micra TPS is also designed to automatically adjust pacing therapy based on a patient’s activity levels. The Micra TPS is the first and only transcatheter pacing system to be approved for both 1.5 and 3 Tesla (T) full-body magnetic resonance imaging (MRI) scans, providing patients with access to the most advanced imaging diagnostic procedures available, if and when they need one. Subcutaneous Defibrillator
Emergency staff goes the extra mile—literally

Dale Hoak, a 74-year-old retired William and Mary history professor, remembers only a few parts of the late spring evening that started with him in his kitchen and ended with emergency surgery.

“I felt some constricting in my throat muscles,” Dale says. “I went to put water on my face, and it didn’t help. I had to crawl about 20 feet to my sofa.”

Dale’s wife called for an ambulance, and the couple soon arrived at Sentara Williamsburg Regional Medical Center. Dale believes he went in and out of consciousness as nurses monitored him and doctors ordered tests.

“I heard Dr. (Paul) Cash say, ‘It’s what I hoped it wasn’t,'” Dale recalls. He had experienced an aortic rupture, with the interior lining of his aorta coming loose, and needed surgery immediately to repair it.

Sentara Nightingale Regional Air Ambulance often transports patients such as Dale to another facility under these circumstances. However, on that June evening, fog grounded Nightingale. Dr. Cash and Janet McClurg, an emergency department nurse whose shift was ending, arranged for an ambulance to transport Dale to Sentara Heart Hospital, about an hour away in Norfolk.

“They actually got in the ambulance with me,” says Dale. “That’s not what usually happens. They kept me alive. They wanted to watch my blood pressure and try to keep it as low as possible.”

A few hours later, Dr. John Sirak at Sentara Heart Hospital repaired Dale’s aortic tear and inserted a valve to keep the aorta functioning.

“I learned that what happened to me is caused by an aortic aneurysm,” Dale shares. “It’s a 9.5/10. They didn’t know if I would survive; after nine hours of surgery, I woke up OK.”

Dale stayed in the hospital for 15 days and then headed home, with a promise to monitor his health. The aortic aneurysm he had faced is a condition that can be detected with screenings conducted at Sentara Aortic Center and then treated.

Dale also attended cardiac rehabilitation at Sentara Williamsburg Regional Medical Center. About a month later, Dale saw Dr. Cash and Janet in the lobby of Sentara Williamsburg, where he was attending his rehab classes every Monday, Wednesday and Friday for 10 weeks.

“Dr. Cash told me he’s never seen anyone so dire as me,” Dale says. “I thanked them both profusely and asked that they give my thanks to several other Sentara Williamsburg nurses who helped me.”

“They actually got in the ambulance with me,” says Dale. “That’s not what usually happens.”
Cardiothoracic Surgery

Cardiothoracic surgery at Sentara Heart is a highly regarded program with nationally recognized surgeons, superior quality and complex cases. Much like that of an academic center, this is a deep and diverse program that continues to treat increasingly acute cases. It is also a program that can serve the many needs of patients in one place, sometimes in a single visit with multidisciplinary approaches offered in many programs for structural heart, thoracic oncology and aortic patients.

In 2016, the cardiothoracic surgery program reached an important milestone with 50,000 open heart cases being performed by the MACTS surgeons and Sentara Heart surgery team. Last year alone, the surgeons from Mid-Atlantic Cardiothoracic Surgeons (MACTS) and Sentara RMH Cardiothoracic Surgery managed more than 2,200 cases at Sentara Heart Hospital, Sentara Virginia Beach General Hospital and Sentara RMH Medical Center. The cardiothoracic program brought innovative procedures new to the Mid-Atlantic region and complex cases. Much like that of an academic center, this is a deep and diverse program that continues to treat increasingly acute cases. It is also a program that can serve the many needs of patients in one place, sometimes in a single visit with multidisciplinary approaches offered in many programs for structural heart, thoracic oncology and aortic patients.

Most common thoracic procedures include:

- Minimally invasive lung or mediastinal mass resection for diagnostic and therapeutic purposes
- Metastatectomy for advanced cancers
- Decortication, manual and chemical pleurodesis and lung volume reduction surgery
- Resection of Cardiac Tumor
- Repair Atrial Septal Defect
- Repair Patent Foramen Ovale
- Repair Ventricular Septal Defect
- Repair Ventricular Anusomy
- Transmyocardial Revascularization
- Tricuspid Valve Repair/Replacement
- Ventricular Assist Device Placement
- Endovascular Repair of Thoracic Aneurysm (TEVAR)

Procedures performed at Sentara Heart include:

- Coronary Artery Bypass
- Ablation Procedures
- Aortic Root Replacement
- Aortic Valve Replacement
- Heart Transplant
- Minimally Invasive Mitral Valve Surgery
- Mitral Valve Repair/Replacement
- Open Pericardectomy
- Open Repair Aortic Anusomy/Dissection (Ascending & Descending)
- Resection of Aneurism
- Repair Ventricular Aneurism/Dissection
- Repair Ventricular Septal Defect
- Repair Patent Foramen Ovale
- Repair Atrial Septal Defect
- Repair Ventricular Anusomy
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Atrial Fibrillation Reduction in the Post-Surgical CABG Patient

Presence of Afb is known to contribute to an extended length of stay and stroke complications for the hospitalized patient. A clinical workgroup sought to address this issue by developing and standardizing a process to implement Afb prophylaxis utilizing an antiarrhythmic medication, Amiodarone, for all CABG patients, perioperatively. The implementation of this clinical initiative resulted in a decreased hospital stay by 3.8 days and an overall decrease in Afb occurrence.

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Occurrence of Atrial Fibrillation Post-Cardiac Surgery

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Cardiac Anesthesiology

With 10 board-certified cardiothoracic anesthesiologists, Sentara Heart provides 100 percent physician-staffed anesthesiology services. The physicians of Anesthesia Specialists work exclusively with the cardiothoracic surgeons and cardiologists, allowing patients to benefit from a dedicated and collaborative team of physician experts who perform high volumes of innovative procedures. Each one has completed a full residency in general anesthesia as well as advanced fellowship training in cardiothoracic anesthesiology and critical care.

Cardiothoracic anesthesiologists are exclusively dedicated to the care of patients undergoing surgery of the heart and lungs. They assist in the following cases:

- Coronary artery bypass surgeries
- Valve repairs and replacements
- Open aortic procedures
- Thoracic and lung surgery
- Heart transplant
- Ventricular assist devices
- High-risk interventions in the cath lab
- Transcatheter aortic valve replacement (TAVR)
- MitraClip
- WATCHMAN left atrial appendage closure device
- EP Lab procedures, ablations, pacemakers, and implantable cardioverter defibrillators (ICD)
- Extracorporeal life support (ECLS), including extracorporeal membrane oxygenation (ECMO)

Cardiothoracic anesthesiologists at Sentara Heart immerse themselves in advanced training and technologies. They collaborate on innovative procedures such as MitraClip, WATCHMAN, and TAVR. Many of the cardiothoracic anesthesiologists are actively involved in hospital leadership committees focusing on patient safety, clinical quality, root cause analysis, best practices, ethics, and more.

The dedicated, skilled and experienced cardiothoracic anesthesiology team contributes to the ability of Sentara Heart to provide services that would otherwise not be available in the community. They play a crucial role in producing excellent morbidity and mortality rates, especially given the acuity level of the population we serve.
In 2016, Sentara Heart and Sentara Vascular Specialists initiated efforts to more closely align our nationally recognized cardiac and vascular programs. It’s estimated that two-thirds of Americans with vascular disorders also have heart problems. Sentara Vascular Specialists is comprised of 17 vascular surgeons and two transplant surgeons. This group of experts performs more than 9,000 vascular procedures every year and has deep expertise in treating patients with simple to extremely complex circulatory disorders.

Vascular Interventional Center

The Vascular Interventional Center at Sentara Norfolk General Hospital (SNGH) is one of the country’s most technologically advanced and comprehensive centers of its kind. The center features a dedicated preoperative area and intensive care unit specifically for patients undergoing vascular procedures. Sentara Vascular Specialists work closely with cardiology, radiology and oncology experts to provide a multidisciplinary approach to vascular and endovascular surgery. The center’s hybrid operating room has top-of-the-line imaging technology found only at a select few hospitals nationwide. Here, our vascular surgeons use advanced endovascular techniques to perform complex procedures, such as abdominal and thoracic aortic aneurysm repair. We began work on a second hybrid operating room in 2016, to be open in the fall of 2017.

Vascular Services

Endovascular suites at each Sentara hospital allow our physicians to use the newest technology to treat a range of vein and artery disorders, including deep vein thrombosis (DVT), blockages, tears, aneurysms and abnormal narrowing of arteries. Sentara Vascular Specialists treat all disorders involving the circulatory system, peripheral arteries and veins. Vascular services include:

- Balloon angioplasty and stenting
- Treatment of peripheral artery disease (PAD), carotid artery disease, kidney disease, diabetic vascular disease and venous disease
- Vein access for dialysis and chemotherapy
- Limb amputation prevention and rehabilitation
Vascular Center Achievements
Our vascular specialists are internationally recognized for superior quality and innovation in treating increasingly complex cases. The team’s achievements include:

- One of the first participants in the Vascular Quality Initiative. This team’s achievements include:
  - Stewardship of best practices. Our vascular experts share expertise and best practices with other medical professionals every year at the Current Concepts in Vascular Therapies Mid-Atlantic Conference hosted by Sentara and EVMS.
  - Transplant experts. Sentara Vascular Specialists is the only group in Virginia to use AngioVac to remove a blood clot, which is done by suctioning with the AngioVac cannula.
  - Vein specialists. Our vascular experts treat varicose veins, spider veins and other vein diseases at four Vein Center of Virginia locations statewide.

Central Venous Program
According to the American Heart Association, venous thromboembolism (VTE), blood clots that originate in a vein, are the third leading cause of cardiovascular death after heart attack and stroke. VTEs affect between 600,000 and 1 million Americans every year. Types of VTEs include deep vein thrombosis (DVT), a blood clot in a deep vein in the leg or arm, and pulmonary embolism (PE), a blood clot that breaks free from a vein and travels to the lungs.

Sentara Vascular Specialists are national leaders in the use of an innovative surgical technology called the AngioVac Cannula and Circuit System to remove difficult-to-access clots. Previously, removal of certain clots in the heart or abdomen required open surgery, which often resulted in significant blood loss. With the AngioVac System, our surgeons often perform the procedure percutaneously through the skin.

The circuit part of the AngioVac System creates an extracorporeal bypass that filters blood outside of the body during the removal of the clot, which is done by suctioning with the AngioVac cannula.

During surgery, a reinfusion cannula sends filtered blood back into the body, minimizing blood loss.

Using this technology, Sentara vascular surgeons have successfully removed clots from the heart’s right atrium, inferior vena cava and superior vena cava. In 2016, Sentara surgeons were among the first in the country to use AngioVac to remove a blood clot in a pediatric patient’s right atrium. As a high-volume center for AngioVac procedures, Sentara surgeons perform about two procedures per month and are sought after to share their expertise at conferences worldwide.

Advanced Aortic Program
The aortic experts at Sentara Vascular Specialists are internationally recognized for their skill at treating the most complicated aortic disease problems. Our surgeons provide a complete range of diagnostic and treatment services for abdominal aortic aneurysms, thoracic aortic aneurysms, aortic dissection and other types of aortic disease.

Since 2009, the Advanced Aortic Program has seen a 40 percent increase in patient cases. This program is a high-volume center for AngioVac procedures, which has pre-made holes, or fenestrations. The Sentara program is among a select handful of centers nationwide asked to participate in two procedures per month and are sought after to share their expertise at conferences worldwide.

In Situ Fenestration: We are a world leader in an innovative TEVAR procedure called in situ fenestration to revascularize aortic branches during aortic emergencies. During complex surgical situations, our vascular surgeons use lasers to make holes (fenestrations) in stent grafts to accommodate brachiocephalic or visceral arteries. The stent grafts are used to reconstruct the aorta and its major branches.

Fenestrated Endovascular Aortic Repair (FEVAR): Our doctors are among the most experienced in the region at performing FEVAR procedures to treat complex abdominal aortic aneurysms once considered inoperable. Our vascular surgeons use computed tomography (CT) imaging scans to custom design a graft that has pre-made holes, or fenestrations. The fenestrated graft is positioned using fusion imaging technology to reconstruct the aorta and the arteries that branch off from the aorta to the kidneys, liver and small bowel.

Thoracic EndoAnchors®: Using an innovative technology called thoracic endovascular aortic repair (TEVAR) to repair the aorta, the body’s major blood vessel. Thanks to our success at performing hundreds of TEVAR procedures, Sentara is among a select handful of centers nationwide asked to participate in two landmark device studies. Our involvement in aortic clinical trials has increased by nearly 50 percent since 2000, a true reflection of our program’s excellence.
Sentara Heart Arrhythmia Center Offers:

- A hybrid team approach toward patient care—both a cardiothoracic surgeon and cardiac electrophysiologist review every option with patients to determine the best treatment plan
- Comprehensive Afib treatment program that includes an advanced heart mapping system, advanced diagnostic testing and leading-edge procedures not available anywhere else in the region
- The only advanced hybrid EP cardiovascular operating room in Southeastern Virginia
- Services tailored to referring doctors, ranging from one-time recommendations for medical management to invasive interventions

Areas of Growth

The SHAC is continuing its development of integrated services and use of the Hybrid Cardiac Operating Suite. Cardiothoracic surgeons, cardiac electrophysiologists and cardiothoracic anesthesiologists work closely together to handle complex treatments and surgeries for patients requiring more in-depth procedures. The increasing efficacy and success of these complex procedures is a testament to the benefits of a highly collaborative and hybrid approach to care.

The SHAC also dramatically increased its community outreach efforts and coverage for patients who require arrhythmia management, providing ablation procedures and standard of care therapy for flutter and fibrillation to underserved and under-resourced areas of the Hampton Roads community. In 2015, the SHAC worked with Sentara Heart Cardiac lead removal continues to be an area of growth for the SHAC. There is a growing need for doctors at the SHAC to perform cardiac lead removal procedures as part of the normal course of management of implantable devices such as cardiac resynchronization therapy defibrillators (CRT-Ds), implantable cardioverter defibrillators (ICDs), and pacemakers.

To contact the Sentara Heart Arrhythmia Center, call (757) 388-8020 or go online to sentara.com/Afib.

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Sentara Advanced Heart Failure Center

Medical Director, John Herre, MD, Advanced Heart Failure Cardiologist
Surgical Director, Christopher Barreiro, MD, Cardiothoracic Surgeon

The number of people being diagnosed with heart failure continues to increase with nearly 6 million Americans currently affected. To serve the needs of this burgeoning population, Sentara Heart expanded the Sentara Advanced Heart Failure Center in 2014—doubling its capacity.

The center has four subspecialized programs, each with its own distinct specialists and clinics.

1,100 patient treatments

More than 1,100 patients receive treatments—ranging from medication management to the latest innovative technologies—through this cutting-edge program.

CardioMEMs™

On October 30, 2015, center physicians implanted CardioMEMs™, a new, miniaturized, wireless heart failure monitor, into the pulmonary arteries of eight patients. Sentara Heart was the first in Southeastern Virginia to perform this procedure.

The CardioMEMs™ system has no wires or batteries, allowing for greater ease of mobility. Daily pulmonary pressure readings taken at a patient’s home and transmitted to the center enable specialists to detect warning signs of heart failure up to 45 days before the onset of symptoms. Clinicians can immediately alter a patient’s treatment to prevent problems from worsening. This proactive step decreases the chances of hospitalization, improves quality of life and reduces healthcare costs.

In clinical trials, CardioMEMs™ reduced hospital admissions by 37 percent.

Ventricular Assist Devices (VADs)

Sentara Heart is among select U.S. hospitals chosen by manufacturer Thoratec to participate in a clinical trial to evaluate the effectiveness and safety of a new ventricular assist device, or VAD, called HeartMate III. The center’s surgical director, Michael McGrath, MD, is leading the Momentum 3 trial at Sentara Heart.

The HeartMate III incorporates advanced technology that makes surgical placement easier. Single-sided cables enable patients to discreetly slip the external portions of the device into a front pocket and enjoy a more active lifestyle. In 2015, Sentara Heart surgeons implanted the HeartMate III into three patients.

LVADs help the heart’s left ventricle (the main pumping chamber of the heart) deliver blood to the rest of the body. Long-term VADs may serve as bridges to transplantation, stabilizing heart failure patients until a heart transplant is possible, or as destination therapy for those with more advanced heart failure who are not transplant candidates.

In 2016, Sentara Heart provided:

- 12 Heart Transplants
- 35 Long-Term VADs
- 30 Short-Term VADs

A ventricular assist device (VAD) is a mechanical pump that is used to support heart function and blood flow in people who have weakened hearts. It is used to stabilize a patient for up to a few days (short-term VAD) or as a bridge to heart transplantation to help prepare a patient for a long-term (long-term VAD) to help a heart work better.
Milton Hugate has always been an active person. At age 83, he still likes to mow his yard and his neighbor’s. Living in a rural area of Virginia with large lawns, the mowing is no easy task. Yet, he has always taken on the challenge with no problems—except when he started to have trouble breathing. “For about eight months starting in late 2015, Milton struggled even walking from the living room to the bathroom,” shares his wife, Margaret. “He couldn’t do it without losing his breath.”

But Milton wouldn’t stop his usual activities. In May 2016, he spent a day working with a chain saw and walking up and down stairs. When he came inside and finally sat in the kitchen, he collapsed into his daughter’s arm. He was rushed to a non-Sentara Healthcare hospital, diagnosed with severe aortic stenosis (a narrowing of the heart’s aortic valve opening), and asked to undergo a valve replacement at another non-Sentara facility.

Milton’s daughter, Donna, had another idea. As a nurse practitioner, she wanted to investigate all of the treatment possibilities. A call to a friend led her to the Sentara structural heart team and evaluations for her father at Sentara Heart Hospital. “The staff worked it so we could have a lot of the pre-testing done at one time, so we didn’t need to do much driving back and forth. The testing and the operation were scheduled quickly, and it all went fast. Milton had his procedure on a Wednesday and left the hospital that Friday,” Margaret said. “He had great care.”

Milton had a TAVR, a transcatheter aortic valve replacement, a minimally invasive procedure that can sometimes be used as an alternative to open heart surgery. It is also known as TAVI, a transcatheter aortic valve implantation. Sentara Heart Hospital is one of a select group of heart centers across the country that pioneered the method.

TAVR allows doctors to replace a damaged valve without removing it. Working with a catheter, they deliver a collapsible replacement valve to the site. When they expand the new valve, the old valve leaflets are pushed out of the way. Within a few days of returning home, Milton met with an in-home physical therapist. She set up a walker for him and said they would go at his pace. Little did she know that the pace would be fast. When she turned around to check on something, Milton was up and walking down the hall. “He felt great almost right away,” says Margaret. “He’s doing anything he wants—working in his shop and cutting the grass. Anything that needs fixing, he tries to take care of it.”

Milton Hugate PATIENT

A fast recovery after a quick fix
Pulmonary Arterial Hypertension (PAH)

For more than a decade, Sentara Heart has been a pioneer in the specialized diagnosis and treatment of a rare, often-fatal heart and lung disease called pulmonary arterial hypertension, or PAH. PAH is a type of high blood pressure in the lungs that causes the arteries in the lungs to tighten and stiffen. This forces the right side of the heart to work harder to push blood out of the heart, through the lungs and into the rest of the body. Over time, this extra stress causes the right side of the heart to enlarge and eventually to fail.

Medical Director, Michael Eggert, MD, medical director of the PAH program at the Advanced Heart Failure Center, refers to PAH-induced right-sided heart failure as “the other heart failure.” The disease often goes undiagnosed or is misdiagnosed until it has progressed to a more advanced stage.

“In the 1990s, before specific therapies were developed, half of PAH patients died within three years of diagnosis,” says Dr. Eggert. “Today, our survival time from diagnosis has more than doubled, with some patients living more than 15 years, when the disease is caught and treated early. In time, we may be able to add even more time to patients’ lives with better disease detection and management and the possibility of transplantation.”

In 2016, Sentara Heart’s Pulmonary Hypertension Clinic was accredited as a Pulmonary Hypertension Association Regional Clinical Program (RCP). This designation of clinical excellence recognizes Sentara Heart’s status as a leader in PAH diagnosis and treatment and will further increase the program’s visibility while enhancing regional clinical research and collaboration.

Sentara Heart PAH program highlights include:

• Disease management of more than 300 patients, which is comparable to patient populations seen at large state academic medical centers
• Annual diagnostic evaluation of several hundred patients
• Multidisciplinary PAH care team comprised of a transplant-trained pulmonary hypertension cardiologist, pulmonologists, cardiologists, cardiopulmonary rehab specialists, nurses, cardiac respiratory therapists, clinical coordinators and research coordinators
• Specifically designated inpatient units within Sentara Heart for disease management of PAH patients
• Specialized training of staff at Sentara hospitals, as well as within the cardiac ICU and advanced heart failure units at Sentara Heart, in the identification and treatment of PAH
• Participation in national and international clinical trials focused on identifying new PAH therapies
• Quarterly educational support group meetings in the Hampton Roads region for patients with PAH and their loved ones
• Annual PAH symposium to raise disease awareness among clinicians in the medical specialties of pulmonary medicine, critical care, infectious disease, internal medicine, family medicine and respiratory care and to discuss the future direction of the diagnosis, treatment and management of the disease

To contact the Sentara Advanced Heart Failure Center, call (757) 388-2831 or go online to sentara.com/HeartFailure.
Medical Director, Paul Mahoney, MD, Cardiologist

The Sentara Heart Valve and Structural Disease Center is the only program in Southeastern Virginia and Northeastern North Carolina focused on diagnosing and treating heart valve and structural heart disease.

The center offers the most innovative heart valve repair options available including the newest generation of valves that doctors implant through minimally invasive catheterization. The center was the first in the region to offer these advanced transcatheter cardiac treatments:

• MitraClip device for mitral valve repair
• Transcatheter aortic valve replacement (TAVR) for severe aortic stenosis
• WATCHMAN left atrial appendage closure device for atrial fibrillation
• Parachute investigational device for ischemic cardiomyopathy

In addition, the center continues to perform a high volume of other types of heart valve repair and replacement surgeries including percutaneous aortic and mitral balloon valvuloplasty, atrial septal and ventricular septal defect repairs, closures of paravalvular leaks, and as a result of the multidisciplinary approach, traditional aortic valve surgeries.

Program Team
Novella Mistry, MD, Cardiologist
Lauren Morris, PA-C, Advanced Practice Clinician
Marianna García, PA-C, Advanced Practice Clinician
Kelley Meredith, PA-C, Advanced Practice Clinician
Elizabeth Willette, NP

At the center, a program navigator guides first-time patients through the referral and screening process. Upon completion, a team of interventional cardiologists, cardiothoracic surgeons and advanced practice clinicians work collaboratively to assess the patient’s condition and determine the most appropriate course of therapy or treatment.

The result is an individualized disease management plan tailored specifically to a patient’s cardiac needs.

The program navigator and coordinators provide a single point of contact for referring physicians, providing updates on a patient’s progress and communicating follow-up care management upon the patient’s discharge from the center.

Rapidly growing advancements in minimally invasive heart surgery are yielding faster recoveries and improving patient satisfaction and comfort – all with less visible scarring. Because of these benefits, doctors at the center perform catheter-based heart procedures for most single-valve repairs and replacements whenever possible.
For the past decade, Sentara Heart has been an active participant in clinical trials for the WATCHMAN left atrial appendage (LAA) closure device. Doctors at Sentara Heart have implanted over 100 of the devices since FDA approved the WATCHMAN in March of 2015.

The WATCHMAN is a self-expanding device that seals off the LAA, a small pouch off the left side of the heart where blood clots can form in patients who have atrial fibrillation (Afib). At first, a mesh membrane on the device acts as a filter, allowing blood to flow through while stopping clots from entering the bloodstream where they can cause strokes. Eventually, heart tissue grows over the device, permanently sealing off the LAA.

LAA occlusion eliminates the risk of stroke without the need for blood thinners, which is great news for the many patients who are unable to take them due to side effects or bleeding risks. Most patients who receive the WATCHMAN go home within 24 hours and can stop taking blood thinners within two months.

Sentara Heart is participating in the PARTNER-II and SURTAVI clinical trials studying TAVR. Dr. Mahoney and cardiothoracic surgeon Joseph Newton, MD, are leading both studies.

Because TAVR is a catheter-based procedure, it can be a good alternative for high-risk and elderly patients once considered inoperable.

With this minimally invasive procedure, doctors at Sentara Heart can repair the aortic valve without removing the old, damaged one. Instead, they use a catheter to place a balloon-expandable replacement valve into the heart. Most patients are often out of the ICU in a day and home within 72 hours.

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To contact the Sentara Heart Valve and Structural Disease Center, call (757) 388-6144 or go online to sentara.com/HeartValveCenter.
The team provides fast, accurate diagnoses and treatments in our Advanced Imaging Center and Hybrid Cardiac Operating Suites. Treatment options for aortic conditions at Sentara include medication management, minimally invasive endovascular surgery, ascending aorta and aortic arch open surgery, and valve-sparing surgery.

The Sentara Aortic Center serves as a medical home for patients needing long-term disease management, providing medical management of hypertension, genetic counseling, patient and family education, and ongoing monitoring via diagnostic and imaging tests.

Aortic Alert Program

The Sentara aortic emergency call system is helping to save lives. If an aortic emergency occurs at a Sentara hospital, staff need only dial 1-2 within the hospital to put the Aortic Alert Program into immediate effect.

This system connects the caller with a highly trained operator who assesses the situation and deploys the aortic disease team. Together, they use their expertise to create a personalized plan for a patient’s aortic care.

Since the Aortic Alert Program went into effect in 2014, Sentara hospitals have seen dramatic improvements in the following areas:

Outside Sentara, someone experiencing an aortic emergency can call (844) 601-2255 or (757) 252-9001.

Sentara Aortic Center

Our multidisciplinary team of specialists includes:

- Cardiothoracic Surgeons
- Vascular Surgeons
- Cardiologists
- Emergency Department Physicians
- Radiologist/Imaging Specialists
- Geneticist
- Advanced Practice Clinicians (Nurse Practitioners and Physician Assistants)

The Sentara Aortic Center opened in 2015 and is one of only a handful of programs in the U.S. with physicians who specialize in aortic diseases. The center merges its expertise with sophisticated technology to ensure fast and effective diagnoses and treatment of aortic conditions. The center’s high quality emergency care and long-term management of aortic disease is unmatched in the mid-Atlantic region.

Our multidisciplinary team of specialists includes experts in aortic disease, emergency medicine, surgery and imaging—all working together to deliver exceptional and compassionate care. The team manages a full range of aortic conditions including:

- Thoracic aortic aneurysms
- Abdominal aortic aneurysms
- Thoraco-abdominal aneurysms
- Aortic dissection
- Traumatic aortic injury
- Penetrating aortic ulcers
- Intramural hematoma
- Aortic occlusive disease

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Cardiac Nursing

Heart patients at all Sentara hospitals receive exceptional care from our team of highly specialized cardiac nurses. Many of our nurses hold advanced certifications or degrees, including doctoral degrees, in various subspecialties. At Sentara, we encourage our nurses to perform at the highest level of their clinical expertise while providing support to patients who are undergoing or recovering from advanced cardiac procedures.

Patients and their loved ones agree that the care provided by Sentara nurses is extraordinary. Our customer service scores show that patients consistently rate their overall care at Sentara at the highest level possible, a 9 or 10 on a scale of 10 (best hospital) to 0 (worst hospital).

Advanced Care for Patients with Chronic Illness

The role of cardiac nurses continues to expand and become more vital as the care delivery model for each patient increases in complexity. Many patients have multiple comorbidities or chronic illnesses, such as heart disease and diabetes. This combination of health problems can complicate cardiac treatment and recovery. Nurses must manage the primary reason for hospitalization, such as heart surgery, while also monitoring other conditions that can interfere with recovery. For instance, heart patients who also have diabetes often need special wound treatment to ensure proper healing. Our nurses tap into their high-level education and training to ensure a patient’s recovery goes as smoothly as possible with few risks or complications.

Advanced Practice Clinicians Perform Top-of-License Work:

- Coordination of care through ambulatory clinic and physician practice sites
- Assistance with advanced structural heart procedures
- Cardiothoracic surgery program support
- Assistance with complex catheter ablations in electrophysiology and catheterization labs
- Management of advanced heart failure patients
- Support for a range of bedside procedures

Nurse-Directed Stress Testing

Over the past decade, the responsibility for performing heart stress tests has shifted from physicians to cardiac nurses. Under the guidance of a cardiologist, Sentara cardiac nurses who have completed special training conduct exercise stress tests for patients to check for heart disease, irregular heartbeats and other cardiac-related problems.

Surgical Partners

An increasing number of cardiac nurses are assisting with complex cardiac procedures in the hybrid operating room, electrophysiology (EP) lab and catheterization lab. Sentara nurses provide support for catheter ablations, cardiac surgical procedures and advanced structural heart procedures, such as mitral valve repair and replacement. This surgical collaboration allows for a seamless transition to post-surgical care during a patient’s recovery. Our nurses also work closely with patients who have received ventricular assist devices (VADs), implantable cardioverter defibrillators (ICDs) and pacemakers, as well as those recovering from heart transplants.

Post-Surgical Intensive Care

In the cardiac surgery intensive care unit (CSICU), cardiac nurses are part of a multidisciplinary team comprised of cardiologists, cardiovascular surgeons, nurse practitioners and cardiovascular perfusionists. The nurses collaborate with heart experts to ensure a continuum of care for patients who require extracorporeal life support (ELS), also known as extracorporeal membrane oxygenation (ECMO). ELS is an emergency stabilizer for patients suffering from acute heart failure or respiratory failure. This ventricular support system pumps and oxygenates a patient’s blood in order to give the heart and lungs a temporary rest. Caring for patients on ELS requires advanced nursing skills.
Medical education is integral to fulfilling the Sentara mission of improving health every day. For cardiology specialists at Sentara Heart, this means extending expertise and knowledge to internal medicine residents and students at Eastern Virginia Medical School (EVMS) in Norfolk, VA. EVMS shares a campus with Sentara Norfolk General Hospital (SNGH), which serves as the medical school’s primary teaching institution.

Every year, cardiology experts from Sentara Heart hospitals volunteer hundreds of hours of time to educate EVMS internal medicine residents and students about heart disease and treatments. Many serve as preceptors to residents and students, providing one-on-one guidance and instruction.

Sentara cardiologist John E. Brush Jr., M.D., serves as division chief of cardiology for internal medicine at EVMS and coordinates all Sentara volunteer cardiology education efforts. All internal medicine residents at EVMS complete a mandatory cardiology rotation at Sentara Leigh Hospital in Norfolk, VA.

Dr. Brush leads this rotation using his well-respected book, The Science of the Art of Medicine, as an instruction guide. The rotation focuses on both cardiology and medical reasoning, equipping residents with the logic and probability tools needed to make a diagnosis, order appropriate tests, develop a treatment plan and make a long-term prognosis.

Each month, a different cardiology expert from a Sentara hospital prepares and presents a lecture for EVMS internal medicine residents and students. Core topics for these monthly lectures range from congestive heart failure to atrial fibrillation and hypertension.

SNGH also hosts weekly grand rounds featuring cardiology experts from world-renowned medical institutions, such as Johns Hopkins University School of Medicine in Baltimore, MD, and McMaster University Michael G. DeGroote School of Medicine in Ontario, Canada. These livestreamed presentations can be viewed by other clinicians worldwide.

Sentara Heart also provides postgraduate training for EVMS advanced practice clinicians, such as physician assistants and nurse practitioners. When appropriate, Sentara Heart physicians collaborate with EVMS on research projects to improve the delivery of healthcare to cardiac patients.
Echocardiogram Sonographer Training

Before a Sentara cardiologist can make a diagnosis, our exceptionally skilled echocardiogram sonographers use their expertise in non-invasive technology to produce clear, readable images of a patient’s heart.

Checking for early signs of cardiac disease is especially important for patients with cancer undergoing chemotherapy and radiation because these treatments can weaken heart muscle. As part of a newly formed cardiac oncology program, Sentara cardiologists work closely with oncologists to ensure cancer treatments aren’t damaging a patient’s heart. Information from echocardiograms with strain imaging enables cardiologists to more clearly see and identify subtle changes in heart function. If needed, a patient’s oncologist can alter treatment before too much damage occurs.

An education specialist conducts annual workshops. In 2017, Sentara sonographers dissect cow and pig hearts to get an in-depth understanding of how the chambers, valves and arteries interact.

Sonographers also participate in a monthly guest lecture series presented by various Sentara heart experts. The annual workshops and monthly lectures allow sonographers to learn new techniques. In 2016, cardiology teams participated in a hands-on workshop to learn more about the strain imaging function available on some ultrasound machines at various Sentara hospitals. This ultrasound test captures information that helps doctors identify early signs that a heart is under stress or starting to incur damage. Heart strain is a predictor to heart failure and congestive heart disease.

Echocardiogram Sonographer Core Competencies

- Clinical skill: High-quality cardiac sonography under direct supervision of a registered cardiac sonographer.
- Understanding imaging function available on some ultrasound machines.
- Interpretation of echocardiograms with strain imaging.
- Technical competence: Basic echocardiography training and the demonstration of basic sonographic skills.
- Patient care: A personal connection and a commitment to patient satisfaction.
- Communication: Effective and clear communication to the interventional cardiologist.
- Documentation: Knowledge to document critical findings.
- Quality: A commitment to quality improvement.
- Professional conduct: The proper use of professional conduct during the examination.
- Problem-solving: The ability to identify and solve problems.
- Behavior-based safety habits: Medical response teams, daily safety huddles, and patient-centric care.

The clinical staff worked diligently to promote the four pillars of an HRO culture: accountability, leadership, safety and patient-centric care. Staff then applied the HRO principles to three targeted safety components that greatly impact clinical care: out-of-unit codes, catheter-associated urinary tract infections, and patient falls with injuries.

By 2015, the staff noted remarkable results at Sentara Heart, and it is looking to expand the HRO program to other hospital locations. HRO program results at Sentara Heart as of October 2015 reflect decreases in:

- Out-of-unit codes: 6 in 2015 vs. 20 in 2014
- Catheter-associated urinary tract infections: 6 in 2015 vs. 12 in 2014
- Inpatient falls with injury: 11 in 2015 vs. 16 in 2014

Recent Areas of Focus and Change Include:

- High Reliability Organization: In 2013, Sentara Heart made a commitment to change the organization’s culture to be more reflective of a High Reliability Organization (HRO). Sentara Heart’s cardiac nurses piloted this initiative. They recognized that Sentara already had all of the tools needed to initiate and sustain this change, most notably behavior-based safety habits, medical response teams, daily safety huddles, and patient-centric care.

- Partners in Research: Since 2011, Sentara Heart has encouraged front-line nurses to participate in research and quality improvement initiatives by creating a culture of inquiry and providing logistical support. Every Friday, researchers from the Sentara Cardiovascular Research Institute host a Cardiac Journal Club where nurses bring a significant amount of intellectual capital to the evidence-based delivery model. Highly specialized cardiac nurses bring a significant amount of intellectual capital to the evidence-based delivery model. Highly specialized cardiac nurses promote continuing education among all nurses, including doctoral degrees, in various subspecialties. Sentara Heart continues to promote continuing education among all nurses in an effort to transform the care delivery model. Highly specialized cardiac nurses bring a significant amount of intellectual capital to the evidence-based care they provide every day.

- Exceptional Patient Care: In 2015, there were 32 Sentara Heart quality improvement projects with experienced nurse leaders, including doctoral degrees, in various subspecialties. Sentara Heart has increased steadily each year. Since 2011, many cardiac nurses are taking the initiative by creating a culture of inquiry and promoting best practices to reduce variations in lab reporting and ensure consistent standards systemwide.

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As the pre-eminent cardiac research institute in the mid-Atlantic region, Sentara Heart works collaboratively with local institutions, government agencies and biomedical companies on nationally and internationally recognized clinical research trials. We focus our efforts on discovering more effective cardiovascular treatments and protocols while eliminating those that are potentially harmful or not as beneficial. Our ultimate goal is to provide enhanced clinical care that advances patient outcomes and improves the overall health of our community.

Our research touches on every aspect of heart care, including medical devices, heart failure, electrophysiology, cardiac surgery, pulmonary hypertension, cardiac interventional procedures, structural heart disease, and the medical management of coronary artery disease risk factors such as diabetes and high cholesterol.

Collectively, our research nurses coordinate more than 80 clinical trials at any given time, shepherding participants through the entire trial process, providing care during periods of need, and tirelessly advocating for their patients’ well-being.

For more information about current research trials or questions about SCRI, please call (757) 388-5480.
Glossary of Terms

atrial septal defect (ASD) A form of congenital heart defect that enables blood flow between two compartments of the heart and can lead to lower-than-normal oxygen levels in the arterial blood that supplies the brain, organs and tissues. However, an ASD may not produce noticeable signs or symptoms, especially if the defect is small.

balloon valvuloplasty A procedure performed to open a narrowed heart valve using a thin tube called a catheter with a small balloon at its tip. The catheter is inserted through a small incision in the groin and then thread up to the opening of the narrowed heart valve. The balloon is then inflated to stretch the valve open and relieve valve obstruction.

bi-leaflet A valve that has two leaflets that regulate the flow of blood. A normal aortic valve has three leaflets.

calcification A disease state in which calcium from the blood collects in the body tissues. When this occurs on the leaflets of the heart’s valves, it may cause them to harden and reduce their ability to open and close properly.

cardiac ablation A procedure that can correct heart rhythm problems, typically using long, flexible tubes inserted through a vein in the groin (or wrist) and threaded to the heart. During ablation, the heart’s electrical system is interrupted to correct structural problems. Cardiac ablation works by scarring or destroying tissue in the heart that triggers an abnormal heart rhythm.

cardiac catheterization Cardiac catheterization is a minimally invasive procedure commonly used to diagnose and treat heart conditions. During catheterization, small tubes (catheters) are inserted into the circulatory system to determine if there are obstructions within the blood vessels that feed the heart.

cardiovascular bypass (CAB) Bypass of the heart and lungs. During this technique, which is often used during heart surgery, a heart-lung machine temporarily takes over the function of the heart and lungs.

cataract A procedure in which a thin tube called a catheter is inserted into the body.

cardioversion The presence of one or more additional disorders or diseases that occur at the same time as a primary disease or disorder.

congestive heart failure A condition in which the heart cannot pump enough blood to the body’s other organs.

coronary artery disease A narrowing of the small blood vessels that supply blood and oxygen to the heart.

cardiac echocardiogram (ECHO) A test that uses sound waves to produce live images of your heart, allowing your doctor to monitor how your heart and its valves are functioning. An echo can help spot blood clots in the heart, fluid in the sac around the heart, and problems with the aorta.

cardiac embolus A small piece of heart muscle for examination.

cardiac electrophysiology (EP) A branch of cardiology that deals with the diagnosis and treatment of heart rhythm disorders. EP doctors (electrophysiologists) ablate tissue, implant and manage cardiac devices, and otherwise care for patients with heart rhythm disorders.

coronary angiography (coronary angiogram) An imaging test to evaluate the function of the heart and lungs. During this test, a thin tube called a catheter is inserted into the circulatory system to determine if there are obstructions within the blood vessels that feed the heart.

cardioversion A diagnostic test in which ultrasonic waves are used to produce images of the position and motion of the heart and its internal structures.

coronary angiography The percentage of blood pumped out of the right and left ventricles with each heartbeat.

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percutaneous coronary intervention (PCI): A procedure more commonly known as coronary angioplasty that is used to treat the narrowed (stenotic) coronary arteries of the heart found in coronary heart disease. These narrowed segments are due to plaque buildup.

perioperative: The time period describing the duration of a patient’s surgical procedures from check-in through recovery—preoperative, intraoperative, and postoperative.

peripheral vascular disease (PVD): A slow and progressive circulation disorder. It may involve disease in any of the blood vessels outside of the heart or in the arteries, veins, or lymphatic vessels. Organs supplied by these vessels, such as the brain, heart, and legs, may not receive adequate blood flow. The legs and feet are most commonly affected.

pericardial effusion: A collection of fluid in the pericardial sac that may compress the heart and cause symptoms.

pericardiocentesis: A diagnostic procedure in which fluid is drawn from the pericardial sac with a needle.

pericarditis: Inflammation of the pericardium, which is the tough, fibrous sac that surrounds the heart.

pericardiectomy: The surgical removal of the pericardium.

pertussis: An acute infection of the respiratory tract caused by the bacterium Bordetella pertussis.

peritoneal dialysis: A method of dialysis in which the blood vessels are not used. Instead, a thin tube is inserted into the abdomen, and a dialysis solution is introduced through the tube and removed.

peritoneal cavity: The space in the abdomen that contains the abdominal organs and is also called the abdominal cavity.

peritonitis: An inflammation of the peritoneum, which is a membrane that lines the inside of the abdomen and covers the organs in the abdominal cavity.

perimenopause: The time period between a woman’s last menstrual cycle and menopause.

perimenopausal: Pertaining to or occurring during the perimenopausal period.

perimacular: Pertaining to the periphery of a macula.

perimetric: Pertaining to or measuring the periphery.

perimetry: A method of assessing peripheral vision.

perimetry test: A test used to measure peripheral vision.

perimorphosis: The process of becoming a perimorph.

perinatal: Pertaining to or occurring at or near the time of birth.

perineal: Pertaining to or occurring in the perineum.

perineum: The region of the body between the rectum and the external genitalia in females and the external genitalia in males.

perineal pain: Pain that occurs in the perineum.

perivascular: Pertaining to or occurring around a blood vessel.

perivascular disease: A term used to describe conditions that affect blood vessels and their surrounding tissues.

peristalsis: The coordinated, wave-like muscle contractions that move material through the digestive tract.

periocular: Pertaining to or occurring around the eye.

periosteum: The membrane-like covering of bone that supports bone cells and blood vessels.

periostitis: An inflammation of the periosteum.

periosteum biopsy: A biopsy of the periosteum.

peripheral neuropathy: A condition characterized by damage to the nerves that supply the arms and legs.

peripheral nervous system: A system of nerves that transmit signals from the central nervous system to the muscles, glands, and organs of the body.

peripheral resistance: The resistance to blood flow in the peripheral vascular system.

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