



FALL 2022

Carilion Medicine

In partnership with the Virginia Tech Carilion School of Medicine and Fralin Biomedical Research Institute at VTC

CANCER FIGHTERS

We're finally winning the age-old battle, thanks to state-of-the-art medicine—and some extraordinary people

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CARILION MEDICINE

FALL 2022

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IT STARTED RAINING ON HALLOWEEN. Trick-or-treaters got soaked, their nylon costumes sticking to their skin and makeup running in rivulets down their faces. My dad had always loved seeing the children dressed up. He would buy big Hershey candy bars to hand out. (I wasn't sure if they were really for the kids or for my mother, who adored them.) That year, 1985, few trick-or-treaters came to our house. It didn't matter. Daddy was in Room 1105 of Roanoke Memorial Hospital, unaware that it was Halloween. His raspy breathing and only

occasional lucid moments signaled the beginning of the end of his battle against cancer.

And it kept raining.

On the sixth day, the rain fell in sheets. In a surreal moment, we watched from the 11th floor as the swollen Roanoke River burst out of its banks and brown, muddy water engulfed the hospital. All the power went out. No lights, no phones, no flashlights. It would be five days before electricity was fully restored. Many staff stayed at the hospital, doing their best despite worries about their own homes and loved ones. Some of us (for I was a nurse supervisor in those days) still have a small pin that says *I survived the flood of '85*.

The Cancer Center of Southwest Virginia, nearby, had opened only a few years earlier. Beautiful and spacious, with modern equipment and a professional, caring staff. My dad had his treatments there. He loved his nurse, technologist, and physician. He thought the Cancer Center was amazing and told everyone about the garden in his treatment room. Dad had the gift of gab and spent hours talking with the other patients, playing puzzles, whistling dance tunes. You could hear laughter and sweet chitchat. Oddly, some of his happier times were when he was at the Cancer Center.

On that sixth day, November 5, as water surrounded the hospital and the lights went out, I sat holding my dad's hand. The stillness was comforting. I talked and prayed and said my goodbyes. Just before midnight, Daddy quietly breathed his last.

Thirty-seven years later, Roanoke Memorial Hospital has grown into the flagship of a sophisticated health system, Carilion Clinic, with state-of-the-art, often world-class services, specialties, education, and research. The Cancer Center—also part of the Carilion system—has remained at the forefront of care, with plans to expand in the near future.

If my dad were here today, he would be surprised at how much we've grown. Yet I know he would recognize the compassion of our staff and the courage of our patients.

This issue of our magazine brings to life the many things we do, especially in the field of cancer. I think Dad is smiling proudly.

Nancy Howell Agee
President and Chief Executive Officer
Carilion Clinic

Carilion Medicine

President and Chief Executive Officer
Nancy Howell Agee

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Carilion Clinic is a nationally ranked integrated health system headquartered in Roanoke, Virginia. Its flagship, Carilion Roanoke Memorial Hospital, is the clinical affiliate of the Virginia Tech Carilion School of Medicine and Radford University Carilion.

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On the pulse of the Carilion Clinic community

USDA Facilities Grant

Carilion Clinic is among the beneficiaries of a \$74 million investment by the U.S. Department of Agriculture to improve health care facilities in rural communities. The funding comes from the Emergency Rural Health Care Grants program, part of the American Rescue Plan Act. Carilion's share—\$335,000—is designated for the 15-bed Carilion Tazewell Community Hospital (CTCH), in Tazewell, Virginia.

"We are honored to receive this grant, which will help us continue to provide quality care close to home for patients in far southwest Virginia," said Michael Rorrer, M.D., medical director of the Emergency Department and hospitalist at CTCH. "Having sustainable and accessible health care infrastructure locally is critical to our residents, as well as the economic prosperity of our region."

The funding will be used to upgrade heating, ventilation, and air conditioning to meet the Center for Disease Control's COVID-19 protocols for health care.



in brief



AN UPLIFTING MOMENT: The opening of the LIFT wellness center in Roanoke brought children together with local leaders, including Nancy Howell Agee, Carilion president and CEO (far right), and Shirley Holland, vice president of Planning and Community Development (in pink jacket).

COMMUNITY WELLNESS GETS A LIFT

When is a community health center more than a community health center? When it's a multi-service wellness center, like the one Carilion Clinic helped build at Fallon Park Elementary School in southeast Roanoke. The LIFT Center (short for Local Impact for Tomorrow) will give a boost to families in a neighborhood with low access to health care and high levels of chronic disease and other challenges. The center, which opened in March 2022, offers pediatric care, dental services, and mental health counseling, as well as financial coaching and other programming to families. "To truly improve health, we must think beyond traditional boundaries and adopt new, innovative approaches to meeting patients where they are," said Donald W. Kees, M.D., interim chair of Pediatric Medicine. "This project

is the result of a collaborative partnership that does just that."

Carilion surveyed residents to learn which services they needed. Then it partnered with Freedom First Credit Union, Delta Dental of Virginia Foundation, Roanoke City Schools, and other donors to cover the almost \$1 million cost of building the addition to the school. A nurse practitioner works onsite, with doctors available through telehealth.

The center grew out of Carilion's commitment to serving local communities, according to Shirley Holland, vice president of Planning and Community Development. "This community adjoins our largest hospital facility. As a neighbor, we wanted to do more to make health care and wellness more accessible."

Autism and the Gut

Teens with autism spectrum disorder (ASD) often display irritability and aggression, even to the point of throwing severe tantrums or deliberately injuring themselves. A new treatment under study could provide some relief. Carilion Clinic is one of 25 locations worldwide offering a clinical trial of a carbon-based therapy that targets the gut microbiome.

AB-2004, made from tiny carbon spheres, is designed to isolate certain bacterial metabolites in the gut, preventing them from entering the bloodstream and reaching the brain. The trial—which looks at the medication’s potential benefits, safety, and tolerability in teens—is based on growing evidence of a link between gut bacteria and the brain.

“Many children with ASD experience more gastrointestinal inflammation than neurotypical kids,” says Anita S. Kablinger, M.D., primary investigator and director of clinical research for Carilion’s Department of Psychiatry and Behavioral Medicine.



RUMBLINGS OF A LINK: Growing evidence suggests that intestinal problems are common in teens diagnosed with autism.



SHOULDER PATIENTS GET THE OK TO DRIVE SOONER

Of the many indignities that follow rotator-cuff repair surgery (sleepless nights, bathroom ordeals, wardrobe failures), none is more limiting than the conventional six-week ban on driving. Fortunately, that could soon change.

“The previous driving restriction guidelines were outdated and didn’t consider newer, less invasive surgical procedures now available,” said Linsen Samuel, M.D., a Carilion clinical research coordinator specializing in orthopaedic surgery.

Researchers from Carilion Clinic, Virginia Tech Transportation Institute, and the Virginia Tech Carilion School of Medicine set out to test how soon patients

can safely drive. Using a car outfitted with monitoring equipment and a second set of controls, the team observed patients driving two, four, six, and twelve weeks after surgery.

The study showed that patients compensate well for their postsurgical impairments—so well that there are no noticeable differences between their earlier and later driving. The verdict, according to Peter Apel, M.D., the Carilion orthopaedic surgeon who led the study: patients can safely drive after two weeks. “Patients are smart, they are adaptive, and they make modifications to their techniques,” Dr. Apel said.

emergency medicine

Testing for Geriatric Concussions



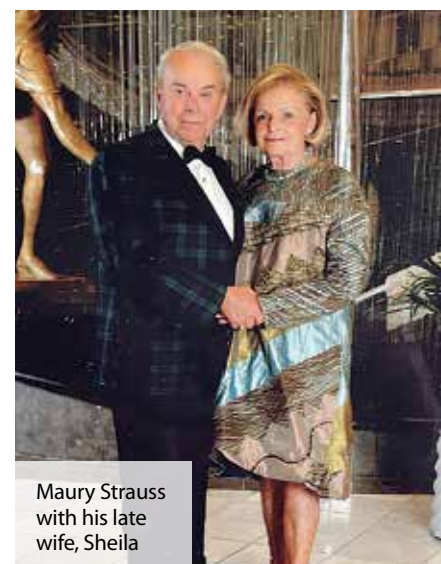
A concussion is easy for an emergency physician to miss. Even easier if the patient is elderly and perhaps cognitively impaired. In a hectic ED, a geriatric patient with a head injury is likely to be given a brain CT scan, which won’t pick up a concussion. Now, a collaborative research effort aims to develop the first rapid test for the condition.

Researchers from Carilion Clinic, BRAINBox Solutions (Richmond, Virginia), and the University of Pennsylvania will focus on using biomarkers in the blood, combined with cognitive testing, to identify brain injury in elderly patients. Funded by a \$3.5 million NIH grant, the project will study hundreds of head trauma patients over three and a half years, according to Damon Kuehl, M.D., Carilion’s vice chair of Emergency Medicine and a co-principal investigator in the study.

“I think everybody who hears about it is very excited for the future,” said Dr. Kuehl.

FOR CANCER CARE, TWICE THE LOVE

A \$1 million gift for a nonprofit health care organization is always good news. But two such gifts in close succession, both earmarked for the expansion of Carilion’s cancer program, are guaranteed to have double the impact. The donations come at a time when the Cancer Center, built in 1980, is being pushed to its limits. The past decade has brought a 40 percent increase in patient volume, including more than 2,000 new cancer patients last year alone. The two gifts—both from Roanoke philanthropists—will aid in the creation of a new Cancer Center that will bring together personalized care, advanced treatment options, and cutting-edge research in a single location.



Maury Strauss with his late wife, Sheila

Honoring His Wife’s Memory

For Maury Strauss, a real estate developer—founder of Strauss Development Corporation—and a longtime community benefactor, boosting cancer care is a cause that carries immense personal significance. Sheila, his wife of 65 years, succumbed to cancer in 2016. He contributed his \$1 million gift in her honor.

“We are so grateful to Maury for the opportunity to honor Sheila’s memory as we continue to advance cancer care for our region,” said Nancy Howell Agee, Carilion’s president and chief executive officer. “The thousands of patients in our region diagnosed each year with cancer

deserve access to the latest, most advanced care right here.”

After Sheila was diagnosed with bladder cancer, the Strausses traveled out of state so she could participate in a clinical trial. Expanding the number and scope of clinical trials available locally was a strong motivation for Maury Strauss’s gift. The gift also builds on the couple’s belief in the importance of giving back.

“Health care,” said Strauss, “is one of the most important things in any community, and what Carilion has done to advance care in the Roanoke Valley is remarkable. I want to see that continue for generations to come.”

A Boon to Regional Health Care

Bill and Shireen Kirk’s \$1 million gift celebrates their deep connection to Roanoke and to medicine. Bill, chairman of Associated Asphalt, was born at Carilion Roanoke Memorial Hospital. Shireen, who moved to Virginia from Northern Ireland as a child, comes from a medical family—her father was a physician, her mother a nurse.

“The Roanoke area is a great place to grow a business and raise a family,” said Bill. The new Cancer Center will not only “attract high-caliber employees and their families,” he said, but will “help grow the region as a hub for health sciences innovation and discovery.”

Shireen, an attorney—she was Associated Asphalt’s longtime general counsel—feels drawn to honor her parents’ profession. “I’ve always appreciated the importance of medicine, and maintain a great respect for all medical staff and caretakers who work so selflessly,” she said.

Cancer has taken a personal toll on the Kirks, claiming the lives of both their mothers.

Nancy Howell Agee, Carilion president and CEO, hailed the gift’s impact on the goal of providing the best cancer care in the region. It “puts us one step closer to making our vision a reality,” she said.



Bill and Shireen Kirk

briefings

Top Regional Hospital Listing



Carilion Roanoke Memorial Hospital has been named among the 12 percent of hos-

pitals nationwide to earn “Best” honors by *U.S. News & World Report*. It was ranked high-performing in 14 procedures and conditions and in the Orthopaedics specialty. The accolades also extend to the community level, with Carilion Giles Community Hospital earning the high-performing status for hip fractures.

Energy Rock Star



Carilion Rockbridge Community Hospital has earned the U.S. Environmental

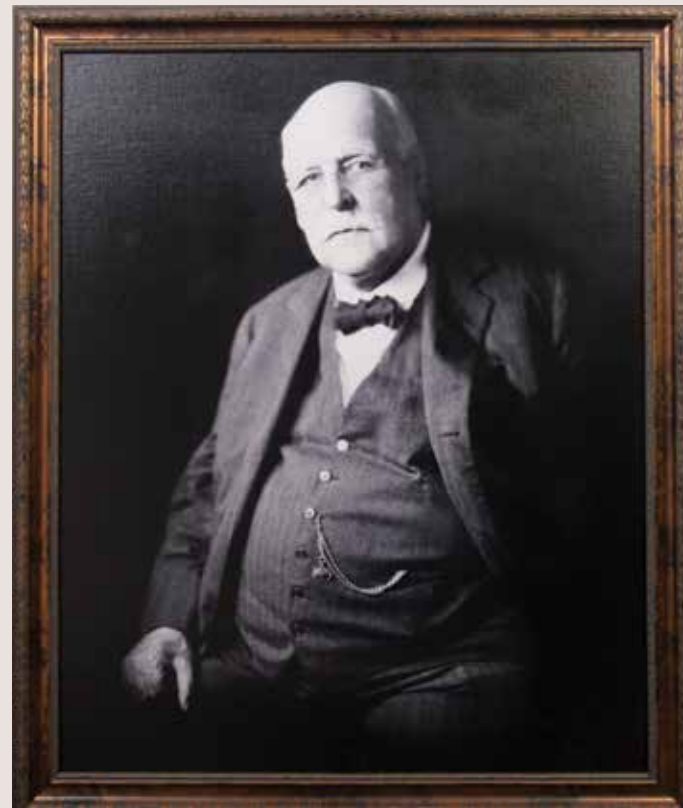
Protection Agency’s Energy Star certification for superior energy performance. A raft of energy-saving measures contributed—including new boilers and chillers, weatherproofing, LED lighting, and good old preventive maintenance.

Philanthropy Vice President



Carilion has appointed its first vice president for philanthropy. Ralph Alee, a veteran

health care fundraiser, provides strategic leadership for development efforts systemwide and oversees the Carilion Clinic Foundation, which raises private funds for equipment, programs, and services. He was previously executive director for philanthropy—medicine at the Medical College of Georgia at Augusta University.



Builder of Bridges (and a Hospital)

The industrialist David W. Flickwir left a lasting mark on Carilion’s early development

Even though Carilion Clinic didn’t officially begin treating cancer until 1960 (see “Cancer Fighters,” on page 10), the disease was a catalyst for transforming Carilion’s flagship hospital a century ago. It was cancer that claimed the life of a Roanoke socialite named Charlotte Nalle Flickwir in 1923. Her death set off a remarkable string of expansion and improvement projects at Roanoke Hospital, including the building of the four-story Flickwir Memorial Unit, which forms the heart of today’s Roanoke Memorial Hospital and also lends the “Memorial” to its name.

The dynamo behind those works was Charlotte Flickwir’s bereaved husband, David W. Flickwir (1852–1935). The *Roanoke Times* described Flickwir as “big of body, big of mind, big of heart.” In his line of work—railroad magnate, civil engineer—he never balked at taking on gargantuan projects. His engineering firm built major sections of the Lackawanna Cutoff, an early-1900s “super-railroad” between New Jersey and Pennsylvania; it offered straighter, faster rail transport, thanks to enormous concrete bridges and other structures.

Flickwir’s most famous project was the

Flickwir’s most famous project was the Tunkhannock Viaduct, a many-arched railroad bridge built in Nicholson, Pennsylvania, in 1915.



Tunkhannock Viaduct, a many-arched railroad bridge built in Nicholson, Pennsylvania, in 1915. As elegant as it is monumental, the viaduct extends 2,375 feet and looms 240 feet above the streambed. It was the world’s longest and largest concrete bridge when it was built. Freight trains still roll across it.

The motto “Go big or go home” could almost apply to David Flickwir—except his home was big, too. The stately Colonial Revival dwelling he built for himself and Charlotte in 1906 was, and remains, a Roanoke architectural landmark. Today known as Fralin House, it is the home of the Carilion Clinic Foundation.

Flickwir’s flurry of hospital improvements began within months of his wife’s death. In the summer of 1923, when the hospital ran out of money to furnish and equip its newest wing, Flickwir stepped into the breach, checkbook in hand. Then he financed and supervised the construction of the Flickwir Memorial Unit, in honor of his late wife’s “very practical sympathy for the ill” (as a local magazine put it). Opened in 1925, the unit was a model of Roaring Twenties opulence, complete with top floor sunroom, silver tray tea service, and elegant dining on white damask tablecloths. Other improvements followed: a new laundry, new fencing, an addition to the nurses’ home, and more.

All told, Flickwir’s contributions are estimated at a tidy \$250,000—more than \$4 million in today’s currency. Small wonder that he is remembered as Roanoke Memorial Hospital’s “Greatest Benefactor.”



BIG DREAMS: Flickwir, who built the world’s largest concrete bridge (top), also constructed two Roanoke landmarks: Fralin House, his former residence, today the home of the Carilion Clinic Foundation; and the Flickwir Memorial Unit, a tribute to his late wife that is now part of Carilion Roanoke Memorial Hospital.

grand rounds

Education at Carilion Clinic and its affiliates

Going Critical

In response to the expanding need for critical care specialists, Carilion Clinic has added a third critical care fellowship. The new two-year fellowship in critical care medicine joins those in pulmonary and surgical critical care, and accepts physicians from a range of specialties. Carilion now offers 16 accredited fellowships and 13 accredited residencies.

An Incoming Class for the Books

The Virginia Tech Carilion School of Medicine (VTCSOM) drew its 49-member Class of 2026 from a record number of applicants—6,916, up 500 from the year before. VTCSOM remains one of the most selective medical schools in the country. The diverse new class has an average MCAT score of 512 and includes 17 master's degree holders. A record 31 students are female. All will complete a rigorous longitudinal curriculum in health systems science and inter-professional practice, as well as an original research project. The training will prepare them as scientist physicians and systems citizens who can lead improvements in health care.



CELL BUILDERS: Roanoke kids assemble Styrofoam neurons.

PLAY'S ANATOMY

Children at Roanoke's West End Center for Youth are a lot smarter about their bodies after participating in Bodies & Bites, a joint outreach project of the Virginia Tech Carilion School of Medicine, Radford University Carilion, and the Virginia Cooperative Extension.

For four weeks in the spring and fall, kids in the second to fifth grades learn about how their bodies work and how to keep them healthy through nutrition and exercise. The program is led by med-

ical students from VTCSOM and graduate students from the Fralin Biomedical Research Institute at VTC. Each week, the children learn about specific body systems, including the nervous system, digestive system, and musculoskeletal system. Each session ends with making a healthy snack (like guacamole for the nervous system, which requires fats).

The West End Center serves about 150 children each year who live in some of Roanoke's most disadvantaged neighborhoods.

OPEN TEXTBOOKS, NOT WALLETS

When Renée LeClair, Ph.D., looked for a textbook to complement the integrated course she had designed for her first-year students at the Virginia Tech Carilion School of Medicine (VTCSOM), she couldn't find a single one. So she and her colleague Andrew Binks, Ph.D., teamed up to author their own set of books.

The result is a five-volume textbook series for pre-clinical medical students, released through VTCSOM, Virginia Tech Publishing, and the university's Open Education Initiative. The series can be freely adapted using a Creative Commons license and is downloadable through Pressbooks and LibreTexts.

Such open-source textbooks fill a growing need in medical education as curricula turn away from separate basic science courses, each with its own expensive textbook. "There is now a transition to integrate the disciplines in the classroom to reflect how they are integrated and interdependent in the human body and in medicine," said Dr. Binks. Fittingly, the books consist of short chapters that can be rearranged to suit the instructor.

The five titles meld together a wide range of first-year topics: *Cell Biology, Genetics, and Biochemistry for Pre-Clinical Students*; *Neuroscience for Pre-Clinical Students*; *Cardiovascular Pathophysiology for Pre-Clinical Students*; *Pulmonary Pathophysiology for Pre-Clinical Students*; and *Pulmonary Physiology for Pre-Clinical Students*.

Dr. LeClair reports that other medical schools are already adopting the books.



MAKING BOOK: Authors Andrew Binks and Renée LeClair collaborate with Anita Walz (right), of Virginia Tech's Open Education Initiative.

new directions



Say Awww

Who's a good facility dog? Keeper is. He's the resident canine who's lifting spirits and relieving burn-out on Virginia Tech's Health Sciences & Technology campus. Highly trained by Saint Francis Service Dogs, Keeper makes his rounds to various parts of campus, including the Health Sciences Library, where he's shown guarding the Physiology shelf.



Quitters Never Lose

Kenan Michaels, a fourth-year student at the Virginia Tech Carilion School of Medicine, surveyed 384 smokers nationwide who had been diagnosed with COPD. He found that those who didn't mind waiting for a reward were more likely to have given up smoking—as were those of greater age, less severe COPD, and milder nicotine dependence. Michaels has submitted his findings (part of a required four-year research project) for publication.



» **The field of oncology has come a long way** since 1960, when Carilion Clinic entered the fight against cancer. At the time, the health system's new Cobalt-60 radiotherapy unit—primitive by today's standards—offered the strongest line of defense against a disease that few expected to survive: only one person in three lived five years beyond a diagnosis.

Carilion took a leap forward in 1980, with the opening of the Cancer Center of Southwest Virginia. There, linear accelerators joined the fray, along with lasers, simulation rooms, and computer-assisted treatment planning. Those technologies now serve alongside da Vinci robotic assisted surgery, high-dose radiation therapy, CyberKnife stereotactic radiosurgery, hyperthermic intraperitoneal chemotherapy (HIPEC), theranostics, and other powerful tools.

Along the way, Carilion Cancer Care has attracted legions of dedicated specialists. These cancer fighters—oncologists, surgeons, nurses, biologists, physicists, pharmacists, technicians, therapists, and others—keep

pushing the boundaries of what the technology makes possible. Together with peers nationwide, they've got cancer on the run: the average five-year survival rate across all cancers is now close to 70 percent.

That figure is guaranteed to rise as better treatments—and treatment venues—emerge. At Carilion, for example, a vision is taking shape for a new cancer center: a world-class facility that brings together the full range of oncology services, providing personalized care, advanced technology, and an ideal setting for multidisciplinary teams.

But the cancer fighters will always be the heart of the operation. In this special report we celebrate the efforts of those who treat difficult brain tumors (**page 12**), provide specialized rehabilitation (**18**), use AI to gain insight into care (**22**), guide the growing population of survivors (**26**), test experimental drugs (**32**), and observe oncology's long-term progress (**35**). Above all, we salute the most important cancer fighters: the patients.

CANCER FIGHTERS

WE'RE FINALLY WINNING THE AGE-OLD BATTLE, THANKS TO STATE-OF-THE-ART MEDICINE—AND EXTRAORDINARY PEOPLE

IRON MAN MEETS ASTROCYTOMA

DID A RESILIENT KID STAND A CHANCE AGAINST
A LIFE-THREATENING BRAIN TUMOR?
HIS PARENTS WERE ABOUT TO FIND OUT.

by Michael Blanding

» **Eric O'Brien first knew there was something** seriously wrong with his son Chase on Halloween. He took the boy, then five years old, out trick-or-treating in their Roanoke, Virginia, neighborhood. Chase, dressed up as his favorite superhero, Iron Man, seemed listless and had difficulty balancing. "He literally had trouble walking down the street and didn't even have a sense of urgency to trick-or-treat," Eric says. "It just hit me in the gut that something's not right with my kid."

It wasn't the first time Chase had had problems. A few months earlier, in August, he had begun walking on his toes everywhere he went. His parents brought

him to the pediatrician, but the doctor pointed out that toe-walking wasn't uncommon among young children, and most kids outgrew it. "They said there was no real medical reason behind it, he's just got a tight Achilles tendon, let's send him to physical therapy," says his mother, Jessica.

Jessica, a health care consultant and former Carilion nurse, and Eric, assistant director of a municipal parks and recreation department, hoped physical therapy would bring back the old Chase. "He has always been a very, very active child," says Jessica. He loved playing with LEGOs and video games on his Nintendo Switch, as well as zooming around on his scooter, swim-

COSTUME DRAMA:
Chase O'Brien, who
was laid low on
Halloween, takes
another shot at
playing his favorite
superhero.



ming, and playing soccer and T-ball.

But the toe-walking didn't go away. Instead his problems got worse. The balance trouble began, and he stopped riding his scooter. Then, during a physical therapy appointment, he fell off the table and hit his head. For the next two weeks, he vomited every morning upon waking. With her background as a nurse, Jessica couldn't believe there wasn't something wrong with her son. "I was like, is there really no cause for this?" she says. Then, two days after Halloween, Chase woke up with the left side of his face slack and drooping, and his parents brought him in again to the pediatrician, pressing for answers.

They could see the doctor's concern above her mask as she examined Chase. Fearing he had had a stroke, she told them to hurry to the ED. Just 45 minutes later, the family was at the Emergency Department of Carilion Roanoke Memorial Hospital, listening to the results of a CT scan. Chase, the physician said, had a brain tumor the size of a ping-pong ball that had been growing inside his head for months. It was now blocking the drainage of cerebrospinal fluid from the brain, creating a dangerous buildup of pressure. If they didn't operate immediately, Chase could face permanent neurological damage or even death.

A Risky Procedure

Eric's first feeling upon hearing the diagnosis was one of relief, knowing there was finally an explanation for the strange symptoms. Then came terror. "You hear the words 'brain tumor' and you think the worst," he says. "As a parent, there is nothing you can do. You are relying on someone else to hopefully fix your child."

Jessica went into "nurse mode," trying to understand everything she could about what was going on medically with her son. She watched as Chase underwent anesthesia and had a tube put down his throat almost before his parents could explain to him what was happening. In the back of her mind, she wondered whether she would ever see him alive and well again. "The thought immediately goes through your mind: is he going to wake up?" she says. "And if he does, is he going to be able to eat or breathe or walk again?"

When Lisa Apfel, M.D., heard the details of the case, she knew it looked bad. A pediatric neurosurgeon, Dr. Apfel could see the tumor wasn't located in the fluid space inside the brain, where it could be more easily removed. Chase's tumor was growing inside the brain stem, engorging it to twice its normal size. To get at it, she would have to burrow through healthy brain tissue, in hopes of at least removing a piece for biopsy to determine if it was

cancerous. Given the tumor's location, it was unlikely the surgeon would be able to remove a significant amount.

It was a risky procedure. "The brain stem tissue is the highest-price neurological real estate in the brain," Dr. Apfel says. "It controls being awake, it controls breathing, it controls sending signals for your heart to beat. One wrong move, and he doesn't wake up or he doesn't come off a ventilator."

Dr. Apfel was up for the challenge. She had graduated from Boston University and worked several years in corporate finance before going into medicine. "I wanted to do something that I felt had more of an impact on society," she says. She went back to school for pre-med, and then medical school at the University of Buffalo, followed by a general surgery internship and a five-year residency in neurosurgery, to which she was drawn by its intensity.

"I thrive on the adrenaline," says Dr. Apfel, who in her off-hours skydives and races cars. "I like that it's fast-paced and high-stakes and technically demanding. It's something I'm good at where I can make a difference."

She came to Roanoke both for the beauty of the Blue Ridge Mountains and for the complexity of the cases Carilion handles. As the only Level 1 Trauma Cen-



“

THE BRAIN STEM TISSUE controls being awake, it controls breathing, it controls sending signals for your heart to beat. One wrong move, and he doesn't wake up or he doesn't come off a ventilator.

—Lisa Apfel, M.D., Pediatric Neurosurgeon, Carilion Clinic

”

ter in western Virginia, Carilion Roanoke Memorial sees the most critical cases in a hundred-mile radius.

In Chase's case the first thing she did was perform a procedure called an external ventricular drain, drilling a small hole through the skull and using a tube to drain some of the cerebrospinal fluid to release the pressure. Then she ordered an MRI scan of the brain to get more detail on the shape and position of the tumor, as well as to identify the most important healthy tissue to avoid. The process took several hours, lasting until 2 a.m.

The next morning, nurses prepped

Chase for surgery to attempt to remove the tumor. To access it, Dr. Apfel cut a small opening through the brain stem less than half a centimeter in diameter, the width of a chopstick, trying her best to avoid damaging critical healthy tissue. "You try to choose a window close to the surface, where you think it is least likely to cause a deficit," she says. Starting around 1 p.m., she attacked the tumor using a microscope and electrocautery forceps, a tool that sends electric current to burn away tissue.

The surgery took hours of intense concentration. At every moment, Dr. Apfel had

IRON CONSTITUTION:
Chase with his parents, Eric and Jessica O'Brien.

to be careful to differentiate normal from abnormal tissue. To her relief, Chase's tumor released itself more easily than she had expected. As she suctioned more and more of it out, the brain stem kept shrinking closer to its normal size.

Chase's parents spent the night and the entire next day in Chase's intensive care room, sick with worry. Nurses and chaplains took turns staying with them, bringing the latest word from the doctors. Most of the time, however, they had precious little to say. "I would sit on the floor and cry, and nurses would just sit with me while I cried," Jessica says. The couple took comfort in small acts of kindness. After Eric told a night-shift nurse he drank Diet Coke instead of coffee, he was touched to find a 12-pack of it in the morning. A friend brought Jessica coffee every morning.

As they waited, Eric reached out to

friends and family to explain the dire situation, sharing a post on social media asking for prayers and telling people, "we are hoping for a miracle." Looking through photos of Chase, he came across one of him in his Iron Man costume and added the hashtag #IronChase. Late in the afternoon, the family got the welcome news that the tumor was coming off more easily than expected, and Jessica finally allowed herself a tinge of hope. By the time Dr. Apfel closed up the incision, around 6 p.m., she had removed a stunning 70 percent of the tumor.

After the Nightmare

Even given that success, there was still the question of whether Chase would wake up with any impairment. "That

BACK WITH HIS BUDDY: Though not out of the woods, Chase now enjoys the usual activities of a six-year-old.



“WE ANTICIPATE A CURE—that we’ll slow the tumor cell growth enough so that it doesn’t come back. I can never say one hundred percent to anything, but it’s more likely than not that Chase will make a complete recovery.”

—Violet Borowicz, M.D., Oncologist, Carilion Clinic

is the most nerve-wracking part,” Dr. Apfel says. “After you are done, you just wait.” His parents watched as the nurses wheeled Chase into his room, still with a tube in his throat and IVs in his arms, along with an ugly bandage on his head. Dr. Apfel accompanied him, sitting for more than an hour by his bedside before his eyes fluttered open. Jessica and Eric watched anxiously as the surgeon asked him to blink and move his arms and legs. Chase gave her fingers a weak squeeze. “He woke up beautifully,” Dr. Apfel says.

After contemplating their worst nightmare, Jessica and Eric O’Brien felt flooded with relief. Chase had emerged from the brain surgery with no sign of lasting damage. Within a few days he was standing and taking a few halting steps, and he was no longer walking on his toes. Soon, he was begging to watch movies and play video games.

“It is amazing to see how resilient children are,” Jessica says. “Until you see it, you don’t really understand.”

The Diagnosis

While Chase was in recovery, Carilion’s lead child life specialist, Sarah Kress, answered the family’s questions. She helped explain to Chase what was happening, saying there was something “very yucky” growing inside his head where his brain

lived. “The brain is like a computer for the body, and when something is there that’s not supposed to be, it can make the whole body sick,” she told him. “So we had to figure out a way to make it go away.” Chase latched onto the idea in superhero terms, thinking there was a “bad guy” inside his head that he and his doctors had to fight.

After removing the tumor, Dr. Apfel sent a sample to pathology for a biopsy. They identified it as a grade I astrocytoma, the most benign and slow-growing type of brain tumor. Chase’s oncologist, Violet Borowicz, M.D., recommended Chase’s family wait to see if it grew any larger before starting any kind of chemotherapy.

January brought a setback: the tumor had grown back several centimeters. Dr. Borowicz started him on a two-drug regimen of chemo in May. So far, Chase has been tolerating it well, usually with only a day or two of nausea and fatigue after each dose—mitigated by the fact he is allowed to play Nintendo as much as he wants in the clinic.

“We anticipate a cure—that we’ll slow the tumor cell growth enough so that it doesn’t come back,” Dr. Borowicz says. “I can never say one hundred percent to anything, but it’s more likely than not” that Chase will make a complete recovery.

“The Bad Guy Made Me Dizzy”

Despite his harrowing experience, Chase is back to the normal activities of a now-six-year-old boy. On a recent Zoom call, he showed off a blue tongue from a popsicle, and talked excitedly about playing a LEGO Star Wars videogame. “The bad guy made me dizzy,” he said about his recent surgery, adding he felt nervous in the hospital, but he would tell other kids in a similar situation that “it’s going to be okay.”

Jessica now wishes she had trusted her gut more when he first started showing symptoms. “I would tell parents if you feel something is off, continue to advocate until you get answers,” she says.

Eric has continued to share social media posts with the hashtag #IronChase, detailing his son’s progress. He says the experience taught him to savor the small moments spent with family, knowing how quickly life can change. The night after that fateful Halloween, Chase had asked to stay up late for a family movie night, but his parents said no, since it was a school night. By the next morning, he was in the ED, fighting for his life. “If he ever wants to have a movie night again,” Eric says, “we’re doing it.”



by Jessica Cerretani | photos by Jared Ladia

FOR CANCER PATIENTS, A MOVING EXPERIENCE

CARILION'S ONCOLOGY REHABILITATION SPECIALISTS PROVIDE EXERCISE REGIMENS, PAIN RELIEF, AND PLENTY OF TLC. OH, AND THEY MAKE HOUSE CALLS.

» The first time Beverly Shull received a lymphatic massage, she was in tears. Shull, now 75, had developed lymphedema—chronic fluid retention in the body's soft tissues—following surgery to treat breast cancer. Her arm was swollen and painful, and scar tissue limited her range of motion. "I don't think I realized how much I'd been hurting until that massage," she admits. "I felt so much better afterward that I cried with relief."

Lymphatic massage uses gentle manipulation to move lymph fluid from the tissues, reducing swelling. It's just one of the services offered through Carilion Clinic's burgeoning Oncology Rehabilitation Program. A collaboration between occupational therapy, physical therapy, speech

therapy, oncology, nursing, and other disciplines, the program aims to improve side effects and complications of cancer treatment, including lymphedema, scar tissue, weakness, and fatigue.

For Shull, that has meant regular sessions of lymphatic massage, exercise, and other therapies, as well as educational support to help her keep lymphedema at bay. Her goal when she began the program two years ago was simple but challenging. "I wanted to feel well enough to travel," she explains. Following a month of intensive therapy, and equipped with a selection of compression garments to ward off swelling, Shull was ready. "Because of this program, I was able to enjoy a trip to Italy with my daughter," she says.

ONWARD: After cancer treatment, Beverly Shull's rehab has kept her going.

Caring, Hands-on Therapy

Improving patients' quality of life is the heart and soul of the program, according to Tara Newberry, Carilion's oncology rehab coordinator and the program's chief instigator. She drew much of her inspiration from her experience with her own father, who was diagnosed with mesothelioma in 2014. "I had seen lung cancer patients die and couldn't stand to watch my own father go through it, too," she says.

Although she couldn't treat his cancer, Newberry knew she had something else to offer: caring, hands-on therapy. Using techniques she had learned as a certified occupational therapy assistant, she worked to ease his discomfort. Despite his bleak prognosis, her father was able to better enjoy his last 18 months. "He got two more Christmases with us," she says. "He got to see his grandkids and go to the beach. It was time—and it was good time. That was a gift to all of us."

The experience lit a spark for Newberry. She went on to get certified in oncology care and lymphedema therapy and began working at a cancer center. She taught patients safe exercises to address fatigue, massaging their swollen, scarred tissue—and provided hope they might return to activities they had enjoyed before their cancer diagnoses. When

Newberry arrived at Carilion in 2020, she brought not only a wealth of experience, but also an idea: to offer oncology rehabilitation to all cancer patients, and make it easily accessible—whether in a Carilion hospital, at an outpatient clinic, or even (as in the case of Shull's first appointments) in the patient's own home.

It's a service whose time has come, according to Kathy Chalfinch, D.N.P., Carilion's senior director of rehabilitation and early mobility. "As more people with cancer are living longer," she says, "the need for rehabilitation has become vastly important."

Research on the benefits of movement for cancer patients has added to the demand. "We used to tell people with cancer to stay home and not do anything, but the truth is, most of them start to feel better the moment they get up and move," says Chalfinch. That shift in expert guidance also has the potential to help patients change their mindset about cancer. "Helping patients stay active and reduce their pain helps them feel more positive, no matter how much time they have left," she says.

That knowledge has helped Newberry, Chalfinch, and their colleagues convince both fellow clinicians and patients of the benefits of rehabilitation therapy—which Carilion is now extending beyond the traditional inpatient

and ambulatory settings. In collaboration with occupational therapist Virgil Thompson, rehabilitation manager of Carilion Clinic Home Care, the team developed a pilot program that brings oncology rehab to two of its more remote service areas in Virginia: New River Valley and Tazewell. That effort includes "the whole package," says Newberry: physical and home safety assessments, education and maintenance tips, therapeutic exercise, massage and other hands-on techniques, and ongoing support. "We really form relationships with these patients and follow them into survivorship," she says.

The pilot program has focused first on cancers of the head and neck. As with breast cancer, treatments for those illnesses often result in lymphedema—causing chronic pain, swelling, changes to appearance, and difficulties with swallowing and speech. Therapies like lymphatic massage, says Newberry, "can have a huge impact on these patients. We can significantly improve their quality of life just by improving their ability to eat and communicate."

Buoyed by its success with this group of patients, Carilion has expanded the service to people with breast cancer, like Shull. Diagnosed with the triple-negative form of the disease in 2013, Shull had already developed lymphedema by the time the Oncology Rehabilitation Program was launched. Newberry and her colleagues hope that, by intervening early enough, they can prevent lymphedema from worsening and even from occurring in the first place.

Others at Carilion have been quick to embrace the program. "We assumed we might need to sell our colleagues on it," says Thompson. "Instead, the response has been, 'How fast can we make this happen?'"

They won the endorsement of Charles Bissell, M.D., chief of Surgery at Carilion New River Valley Medical Center. "Rehab is a natural fit for our whole-person approach to care," he says. "It's another part of our armamentarium." Dr. Bissell routinely sends patients to Newberry and the rehabilitation team.

On the strength of the pilot's success in New River Valley and Tazewell, the

group plans to expand the service to the rest of Carilion's Home Care locations, with the goal of creating a single, seamless program that meets patients where they are.

"You Don't Have to Live with This Pain"

Getting patients onboard has been slightly more challenging. For somebody faced with an overwhelming diagnosis and a flood of appointments, rehab can seem like just one more task on an endless to-do list. Newberry's approach: convince patients that the benefits of therapy are worth it, so they view these appointments as enjoyable self-care breaks. "In the beginning, Tara told me, 'Bev, you don't have to live with this pain,'" recalls Shull. For her, the improvements in energy and reductions in pain have been reason enough to stick with the program. "It's changed my life, so I never miss an appointment."

What sells many patients is the option to receive therapy at home. The target patient for home care, says Thompson, is one who's too exhausted to even get in a car, let alone travel to a clinic. At a home "prehab" visit, therapists check for any hazards that might cause falls, and assess what activities patients might need assistance with—bathing or eating, for example. "We're in their world," Thompson says.

Then the therapy (and reassurance) begins. Newberry recounts a recent visit with an older woman facing a mastectomy. "She had never really been sick before and was anxious about being able to keep up with daily activities," she says. "When I told her we could come to her home, she was so happy she hugged me."

Once patients build the strength and confidence to receive therapy outside the home, they usually don't have far to travel. Oncology rehab is available at 16 outpatient clinics across the region. This is a boon to patients who live in rural areas, lack reliable transportation, or simply don't have the time or energy to travel to the medical center in Roanoke. "Not everyone has the resources for a



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NOT EVERYONE HAS THE RESOURCES for a long drive. This program helps keep oncology rehab in people's own backyards.

—Virgil Thompson, Rehabilitation Manager, Carilion Clinic Home Care


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long drive or an overnight stay," says Thompson. "No matter where you are in the Carilion system, you should get the same care. This program helps keep that care in people's own backyards."

Carilion is also working to make oncology rehab available at all stages of care. In palliative care or home hospice, for example, oncology rehab may mean getting patients strong enough to sit on a commode or feed themselves. Or it may mean providing comfort through massage, which family members can also learn. "We're helping patients gain dignity at end of life, which is something unique about this program," says Newberry.

For other patients, rehab is part of a long-term survivorship plan. Working closely with Carilion's Cancer Survivorship Program (see "The Rise of Survivorship," on page 26), therapists focus on easing side effects of what for an increas-

ing number of patients is no longer a death sentence, but a chronic disease. "If we can collaborate to provide comprehensive treatment now," says Newberry, "then our patients will have a higher chance of not just beating cancer, but also of really living well after it."

Living well is something that Shull has experienced firsthand, thanks in part to her oncology rehab sessions. After experiencing a recurrence of cancer, which a Carilion therapist first detected during a massage, Shull is doing well. In addition to weekly clinic appointments, she's mastered lymphatic massage techniques at home, does yoga, and takes daily walks with a friend. She finds her therapy appointments calming, relaxing, and, most of all, caring. "I know I have metastatic cancer, but it just doesn't feel that way right now," she explains. "I'm grateful to be able to enjoy every day I've got." 



CLOSE AT HAND: Tara Newberry wants to put rehab within reach of all cancer patients.

THE **BIG** SORT

A NEW AI EFFORT IS COMBING THROUGH A JUMBLE OF MEDICAL DATA IN SEARCH OF CANCER INSIGHTS

by Charles Slack

» **Modern health care generates an enormous amount** of data. File upon file of medical records—documents, text, facts, insights—reflect every procedure, operation, injection, prescription, examination, assessment, and outcome. And the mountain just keeps growing, piling up at such a rate that you might have to learn a new digital prefix. From 2013 to 2020, data produced by the health care industry rose from 153 to 2,314 *exabytes*. For anyone counting, each exabyte equals a billion gigabytes.

That repository might hold the keys to breakthroughs in the treatment of cancer and other diseases—if only the data could be tapped in an orderly and scalable way. The ability to identify clear patterns in treatments and results could yield lifesaving improvements in early disease detection, personalized therapies, incidence of hospital infections, and more. Yet because of the challenges involved in transforming and retrieving the data, most of that information goes unused.

Carilion Clinic, an early adopter of electronic health records (EHR), began digitizing outpatient records in the late 1990s, and by 2008 had essentially adopted EHR across its entire system. But while Carilion's data is growing by 17 percent a year, less than 2 percent of what's collected is ever analyzed in a systematic way, estimates Stephen A. Morgan, M.D., Carilion's senior vice president and chief medical information officer. Until recently, the challenge for Dr. Morgan and his colleagues was how to gather and digitize data. Now, he says, they are kicking it up a notch. "We need to leverage these systems to glean information so that we can actually make better decisions."

“**WE’RE TAKING THESE clinical documents and texts and making them into usable clinical facts and data assets.**”



Chiny Driscoll, CEO and Founder, MetiStream

That’s the idea behind an innovative partnership between Carilion and MetiStream Inc., a health care analytics company based in northern Virginia that uses artificial intelligence (AI) and natural language processing (NLP) to transform and analyze medical data. The technology is already being used to overhaul the way doctors measure their success at screening for colorectal cancer. Eventually it may help doctors assess individuals’ risk for developing lung or other cancers. It could even lead to customized therapies based on a patient’s genetic profile.

Taming Unstructured Data

MetiStream’s technology works within Carilion’s secure cloud environment, explains the company’s chief executive officer and founder, Chiny Driscoll. “We pull in the data from the designated EHR database, and then we process and transform the data,” she says. “We’re taking these clinical documents and texts and making them into usable clinical facts and data assets.”

That’s easier said than done, of course. Some 80 percent of EHR information arrives in the form of unstructured data—a doctor’s notes, a transcript of a phone conversation, a radiological scan, a medical history, and the like—all of which must be digitized before use. The structured data of tables and charts is easy to scan, but unstructured data is incredibly varied. “Doctors write ‘platelets’ in differ-

“**WE’RE ALL LOOKING for ways to personalize medicine down to the patient level based on genetic factors.**”



Stephen A. Morgan, M.D., Senior Vice President and Chief Medical Information Officer, Carilion Clinic

ent ways,” Driscoll says. It could be the full word, or PLT, or PLTK, for example. Computers must recognize the variants.

They also need to understand the context. Identifying the word “cough” is only so helpful. “When did the cough start? What were the other symptoms? Did the patient actually have a cough, or not?” Driscoll asks. Or there may be references to associated pain and potential causes.

To understand the context of the data, the computer must employ NLP and AI, along with deep clinical domain knowledge. “Identifying and extracting clinical evidence within unstructured data is complex and requires a significant level of processing,” Driscoll says.

Carilion had explored creating its own AI platform through its joint research program with Virginia Tech, Dr. Morgan recalls. But the magnitude of the undertaking soon became apparent. Then he met Driscoll (a Virginia Tech graduate herself) at an innovation summit. He was impressed by her company’s work analyzing data for other medical institutions.

The Carilion project is based on MetiStream’s Ember platform. Ember provides data integration (organizing and managing structured and unstructured data), NLP (algorithms and processes to identify and transform documents and text into sets of “clinical facts”), and AI (analyzing and discovering insights). On top of that comes the power to customize searches based on specific query terms and filters.

“**DOCTORS MIGHT SAY of a patient, ‘We think they’re at risk of getting colon cancer. Let’s reach out and engage them.’**”



Paul Yeaton, M.D., Chief of Gastroenterology, Carilion Clinic

Probing Colonoscopies

One of the first initiatives under the Carilion/MetiStream partnership aims to better gauge physicians’ success detecting certain early signs of colorectal cancer during colonoscopies. The procedures can reveal precancerous polyps known as adenomas, which can be removed before they cause harm. Patients found to have adenomas are advised to increase the frequency of screenings, and regular colonoscopy screening is credited with reducing the incidence of colon cancer by 52 percent and mortality from the disease by 62 percent.

Yet despite these impressive numbers, colorectal cancer kills more than 50,000 Americans each year. There is still room for improvement in physicians’ proficiency detecting adenomas—a skill that is measured by the adenoma detection rate (ADR), or the proportion of colonoscopies, on average, in which the physician spots these elusive growths. Doctors shoot for an ADR of 30 percent for men (who have a higher incidence of colon cancer) and 20 percent for women.

But the ADR is an imperfect yardstick, according to Paul Yeaton, M.D., Carilion’s gastroenterology chief. Not only is the benchmark too low, he argues, but ADRs are typically self-reported (by the doctor or institution), and are based on inconsistent information. This makes it hard to accurately compare rates between doctors, hospitals, or regions.

With MetiStream’s Ember solution,

Dr. Yeaton is using the power of advanced analytics to seek more accurate figures—something that would be virtually impossible with the old manual methods of reviewing one patient file at a time. Consider, says Driscoll, that a patient’s chart in the EHR may contain hundreds of pages. “It can take [a nurse] hours to look through a patient’s case chart or documentation,” she says. But MetiStream’s technology was able to process records of tens of thousands of patients to swiftly isolate results from more than 24,000 screening colonoscopies performed at Carilion during the past five years.

The results revealed Carilion’s ADR to be a healthy 46.51 percent (52 percent for male patients, 40 percent for females)—well above the government-defined quality standard. The systemwide information, says Dr. Yeaton, can also be broken out to calculate ADR rates for individual physicians. Expanded beyond Carilion’s walls, this initial study could ultimately lead to more standardized ADR calculations nationwide, he believes.

Moving forward, Dr. Yeaton hopes to use the technology to measure detection rates for other potentially cancerous growths in the colon, such as sessile lesions, which are harder to detect but potentially more dangerous. Hospitals could use such information to revise procedures or to help physicians with lower averages refine their skills. Patients—increasingly given to shopping around—could more confidently compare

detection rates. And researchers could better pinpoint the correlation between detection rates and incidence of cancers—all with potentially lifesaving benefits.

AI at the Patient Level

While the ADR study aims to elevate health care at a macro level, the partnership also holds promise in the other direction. “The next step is, how do we apply that [technology] to a patient level?” Dr. Morgan says. For the next phase of their partnership, Carilion and MetiStream plan to explore ways AI and NLP could be used to help prevent cancer in individual patients. Drawing on clues ranging from family history to lifestyle habits to genetic markers, Dr. Morgan says, the technology could identify those at risk and even assist in creating personalized treatment and medication plans.

Consider lung cancer. The system might be tasked with scanning a broad population of patients, including those with no current health issues. Clues from past doctor visits, buried in the electronic health records, might yield at-risk patients based on smoking habits, exposure to asbestos, or family history of the disease, Dr. Morgan says. “Or if you had a nodule that was just an incidental finding on a chest X-ray or a CT, it would capture that information discreetly and then help us continue to follow you.”

Similarly, Dr. Yeaton believes such data could help identify individuals at special risk of colon cancer. “What’s your

family history? Do you smoke? Do you drink? Do you have any genetic problems?” he says. Such information, combined with results from past colonoscopies, could help create personalized “dashboards” assigning risk scores. If someone hasn’t seen a doctor in a while, dashboard results might prompt doctors to say, “We think they’re at risk of getting colon cancer,” Dr. Yeaton notes. “Let’s reach out and engage them.”

Dr. Morgan adds: “We’re all looking for ways to personalize medicine down to the patient level based on genetic factors.” Oncology researchers, of course, have made tremendous strides identifying genetic markers for breast cancer and other cancers. Currently, that data sits in patient files or lab reports, where it must be manually extracted by clinicians. One goal of the MetiStream partnership, Dr. Morgan says, “is to extract that out, so it’s automatically available when you’re making up a treatment plan.”

The benefits are only likely to grow as advances in digital technology are matched by further breakthroughs in genetic understanding of even the most intractable forms of cancer, Dr. Morgan adds. “If we knew that someone had a genetic predisposition to, say, pancreatic cancer, you could start screening or using other forms of intervention.”

Or consider the potential to better personalize drug treatments. “We know that, depending on your genetic makeup, *your* body’s going to break down some drugs differently than mine does,” says Dr. Morgan. “That could make a big difference in whether a medicine’s effective for you, or you’re going to have side effects.” The MetiStream/Carilion partnership might lead to algorithms that study a patient’s history, then help a doctor prescribe the best medication for that patient.

Indeed, while AI sometimes conjures visions of computers replacing humans, the underlying goal is to help human clinicians better serve human patients, Driscoll believes. They’ll spend less time searching records and getting up to speed, and more time administering care. As Driscoll says, “Someday I’d like to go to a hospital or a doctor’s office where *they* know more about me than I know about me.” **CM**



THE RISE OF SURVIVORSHIP

by Anita Slomski | photo illustration by Ann Cutting

➤ **In 1971, just 3 million Americans**, a scant 1.5 percent of the population, were still alive following a cancer diagnosis. Today, with better detection and treatment, survivors number 18 million, or 5.4 percent of the population, according to the American Cancer Society. That means more people than ever need help dealing with the long-term medical, physical, and emotional effects of cancer treatment. Survivorship clinics are multiplying. At Carilion, a host of related services—fitness classes, mental health referrals, support groups, speaker series, rehab programs—are gradually coming together to form a comprehensive survivorship program. It's a process driven by passionate cancer fighters. People like Modupe O. (Seyi) White, D.N.P., and Shannon Armbruster, M.D., M.P.H., each of whom champions cancer survivors in her own way. Their stories follow.





“YOU HAVE ME AT YOUR SIDE,” SEYI WHITE TELLS WORRIED BREAST CANCER SURVIVORS

A woman newly diagnosed with breast cancer typically has many questions, medical as well as existential. “The first question always is, ‘Am I going to die?’” says Seyi White, D.N.P., “followed by ‘I don’t know what to think or what to do.’” It’s normal to feel overwhelmed and lost if you’ve never experienced cancer before, White tells her patients. “But you have me at your side, and I’ve worked with many women with cancer that is just like yours.”

White is one of two doctorally prepared nurse practitioners who run Carilion’s Breast Cancer Survivorship Clinic. Every day, patients treated for breast cancer at Carilion come to White for the moral support, strength, and knowledge they need to prepare themselves for what lies ahead. “Wherever my patients are on their journey with breast cancer, from that devastating moment when they get their diagnosis throughout the course of their life, I will meet them there,” White says.

For cancer survivors, information is power, and White gives her patients plenty of it. Women who are diagnosed at

younger ages want to know how treatment will affect their fertility and when it’s safe for them to get pregnant after treatment, so White refers them to a specialist in reproductive endocrinology. She talks to her patients about how treatment might affect their sexual health, and the importance of staying fit. “The more active people are, the more comfortable they are in their own bodies and the better they feel,” she says. “Exercise also decreases the risk of breast cancer recurrence.”

White can connect newly diagnosed patients with survivors who have already completed treatment to get first-hand

information about breast reconstruction, the challenges of treatment, and what their lives will look like in years to come. Anxiety and depression is a frequent topic—along with medication, mindfulness, and deep-breathing exercises that can help.

When patients ask whether their cancer will come back, White never tells them they have nothing to worry about—even if the cancer was caught early. “Because recurrence is always a possibility with breast cancer,” she says. Instead she shows patients how their risk decreases when they adhere to their treatment plan. They have a choice, she tells them: either be crippled by the fear of a recurrence, or lower the risk and continue with their lives. “There are always things you can do—exercise, choosing a healthier diet, and reducing the anxiety that increases the risk of a cancer coming back,” says White.

Close monitoring is key to survivor-



Seyi White

ship. Post-treatment, White will see survivors every six months for five years, and then once a year after that. Often, she treats a host of maladies in one visit.

Recently, a patient complained of heaviness in one arm, as well as depression and menopausal symptoms related to endocrine therapy. “I referred the patient to occupational therapy for treatment of lymphedema, started her on an antidepressant to help manage menopausal symptoms, encouraged her to increase physical activity, and directed her to the Survivorship web page for access to exercise videos and psychosocial resources,” White says.

Sometimes she has to dispel misinformation—like when a survivor wanted to stop endocrine therapy because she read on the internet that it increases the risk of developing endometrial cancer (it wasn’t true for the medication she was taking). When patients miss follow-up appointments—some of them live more than four hours away from Carilion—White keeps in touch with them until they can make it in. She takes meticulous notes and listens to her patients’ concerns, always encouraging them to achieve their short- and long-term goals and aspirations.

One newly widowed survivor recently confessed to White she was afraid to drive alone for six hours to see her son and grandchildren, a visit she had looked forward to for weeks. White helped the patient come up with a plan: her daughter-in-law would fly in and the two would drive together. She even called her patient to help solve last-minute logistical challenges. “That was the most important goal that day for my patient,” White says. “So we tackled it together and made it happen.”

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THE FIRST QUESTION ALWAYS IS, ‘Am I going to die? Followed by ‘I don’t know what to think or what to do.’ —Seyi White, D.N.P., Co-director, Carilion Breast Cancer Survivor Clinic

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A GYNECOLOGICAL ONCOLOGIST TRIES TO HOOK PATIENTS ON EXERCISE AND VEGGIES

When Shannon Armbruster, M.D., M.P.H., began her residency in obstetrics and gynecology, she was alarmed at the state of her patients' health. "We were curing women of cancer, yet as survivors, they often struggled emotionally and physically with poor quality of life and poor health," says Dr. Armbruster, now a board-certified gynecologic oncologist at Carilion Clinic and assistant professor at the Virginia Tech Carilion School of Medicine.

For the last 13 years, Dr. Armbruster has made it her mission to improve the quality of life for survivors of endometrial cancer, the most common gynecologic cancer. In 2019, she joined Carilion Clinic for the opportunity to build a survivorship research program for gynecologic cancers. And in May of 2022, she received a competitive career development award from the integrated Translational Research Institute of Virginia (iTHRIV) Scholar Program; it will provide training and mentoring to help translate her research into clinical care. "Ultimately," she says, "I hope to apply what I'm learning about enhanc-

ing the lives of survivors of endometrial cancer to patients with other types of cancer at Carilion and across the country."

One of her prime targets is obesity. People who are obese have a higher risk of developing 13 different cancers. For women, endometrial cancer tops the list. Upwards of 70 percent of women with that diagnosis are obese, and about half of U.S. endometrial cancer cases are attributed to obesity. "Fat cells make estrogen, which stimulates the lining of the uterus," explains Dr. Armbruster. "An excess amount of estrogen causes the cells to keep replicating, which can lead to a hyperplasia,

or pre-cancer, and ultimately cancer." Although rates of other cancers have fallen over the years, the incidence of endometrial cancer has risen in lock step with the rise in obesity in the United States.

Just as it increases the risk of developing endometrial cancer, obesity can also send survivors to an early grave. "Five years after diagnosis and treatment for endometrial cancer," says Dr. Armbruster, "women are more likely to die from cardiovascular disease related to their obesity than they are from their cancer."

The Group Effect

Inspiring people to move is challenging—only 20 percent of the general population gets the recommended amount of exercise, and even fewer endometrial cancer survivors do. Dr. Armbruster—together with her co-investigator, Samantha Harden, Ph.D., a registered yoga teacher who is associate professor and exercise extension



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FIVE YEARS AFTER DIAGNOSIS and treatment for endometrial cancer, women are more likely to die from cardiovascular disease related to their obesity than they are from their cancer.

—Shannon Armbruster, M.D., M.P.H., Gynecologic Oncologist, Carilion Clinic

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specialist in the Department of Human Nutrition, Foods, and Exercise at Virginia Tech—is trying out a possible solution.

The pair have devised an eight-week lifestyle intervention they hope will show endometrial cancer survivors the benefits of incorporating physical activity, along with a few fruits and veggies, into their lives. In previous research, Dr. Armbruster demonstrated that survivors of endometrial cancer who exercised had better quality of sleep and sexual health, and lowered their body mass index.

The new intervention is a specially tailored version of FitEx, a group-based online physical activity and nutritional program that is offered by health educators of USDA's Cooperative Extension System in at least 14 states. After conducting surveys and focus groups with Carilion patients, Dr. Armbruster felt confident that FitEx, customized with content relevant to endometrial cancer survivors, would be an excellent intervention to pilot-test. "We found that our survivors did not want a weight-loss intervention," she says, "but they did want to focus on their health. And they wanted to connect with other survivors, but not in a face-to-face group."

Dr. Armbruster and Dr. Harden recently wrapped up a proof-of-concept study on their FitEx version, which they call FitEx-ECS (for "endometrial cancer survivor"). They enrolled six survivors and fourteen family members and friends, who were the survivors' supporters and participated in FitEx activities with them.

Teams racked up a credit of one mile for each 15 minutes of their chosen activity. Participants also tried to eat five servings of fruits and vegetables per day. The intervention included a weekly 30-minute virtual group session for participants to talk about a topic related to cancer and do yoga or exercise together.

"We know from behavioral science studies that people who do things in a group are more successful at that activity," says Dr. Armbruster. "This is a personalized intervention that allows survivors to choose their support group and what exercises they will do, and it avoids the negative connotation of exercising solely to lose weight." 



A SNEAK PEEK AT TOMORROW'S WONDER DRUGS?

MAYBE. THE ONLY CERTAIN THING ABOUT THESE CANCER-THERAPY TRIALS IS THE HOPE THEY OFFER PATIENTS. **by David Bumke**

» Phase I cancer trials are the starting point for what is usually a long and winding road to Food

and Drug Administration approval of a new therapy. These early-stage studies, typically involving only a few dozen test subjects, mark one of the first times people will have received an experimental drug, and the primary focus is on safety. Yet the patients who join phase I trials aren't thinking about the drug development process. They're happy to have access to a therapy that just might help.

"If a new drug ends up being effective, it could give the participants a real opportunity for control of their disease they might not otherwise have," says David Buck, M.D., president of Blue Ridge Cancer Care (BRCC),

in Roanoke, and medical director of radiation oncology at Carilion Clinic's Cancer Center.

BRCC, Carilion's collaborator in oncology research and treatment, has long been involved in clinical research—larger phase II and phase III trials administered by US Oncology Network, of which BRCC is a member. Two years ago, BRCC added phase I trials to the mix.

This expansion fills an important research need, says Dr. Buck. "Phase I lets you dip your toe in the water for a new drug," he says. "It gives you the chance to answer basic questions. Does this drug work like we think it does? What are the side effects

Homing In on the Prostate

Besides collaborating on clinical trials, Carilion Clinic and Blue Ridge Cancer Care are also blazing trails in the treatment method known as theranostics. This approach combines two radioactive isotopes into a single injectable drug. One isotope zeroes in on receptors unique to a specific type of cancer cell; the other zaps the cell with high-energy radiation.

Carilion and BRCC were among the first to introduce Lutathera, a Novartis theranostic drug that targets neuro-

endocrine tumors (see *"The Next Wave,"* Carilion Medicine, Fall 2021, bit.ly/the-next-wave). Now the partnership is rolling out a similar drug, Pluvicto, to fight prostate cancer. It targets the PSMA enzyme on the surface of prostate cancer cells, according to David Buck, M.D., president of BRCC and medical director of radiation oncology at Carilion Clinic's Cancer Center. A breast cancer theranostic may not be far behind: Dr. Buck is supervising clinical trials of just such a drug.

and toxicities? What's the right dose for it to be effective?"

To find patients who might be candidates for current phase I trials, BRCC's clinical research team combs through the charts of those who come to the Cancer Center each day. "Sometimes, as physicians" says Dr. Buck, "we're so focused on taking care of a patient's immediate needs that we may not think about the possibility of a clinical trial." But, he says, a team member might notice that a patient with ovarian cancer hasn't responded to two types of treatments and might be a great candidate for the phase I study.

BRCC is currently involved in half a

dozen phase I trials. "We're looking at new drugs or combinations of drugs for several malignancies," says Dr. Buck.

Natasha Holt, BRCC's director of research operations, runs down a list of different types of drugs under study. "Some are antibody-drug conjugates, or ADCs," she says. An ADC is a highly targeted drug that combines a monoclonal antibody that can bind to antigens on tumor cells with a drug that can destroy those cells. In one trial, the focus is on NaPi2b, a tumor-associated antigen found in ovarian cancer.

Other phase I trials, Holt says, involve immunotherapy drugs, including immune

checkpoint inhibitors, which weaken the ability of tumor cells to shield themselves from detection by the immune system. Such drugs will be pitted against a variety of cancers. "These are what we call 'basket trials,' which include numerous malignancies, such as gastric cancers and lymphoma, that may respond to the antibodies," she says.

BRCC teams are also evaluating the effectiveness of an exciting new class of drugs known as selective estrogen receptor degraders, or SERDs, in treating breast and endometrial cancer. These drugs bind with a cancer cell's estrogen receptors and destabilize them.

Yet another class of drugs under study is small-molecule inhibitors, which, Holt says, "can obstruct major enzymes that act as signals for cancer development." This is a basket trial in which the molecule is being evaluated for treating prostate, colorectal, and lung cancer.

Phase I trials are often an exercise in patience for physicians, researchers, and test participants. In this early stage of research, progress tends to be incremental, and it's a victory when drugs do well enough to be moved into later-stage trials that may involve thousands of patients. "But along the way, some people do better than we anticipated," says Dr. Buck. "Someone who has pretty quickly failed other therapies may stabilize or respond to these newer drugs. That's always gratifying." **CM**

“ IF A NEW DRUG ENDS UP being effective, it could give the participants a real opportunity for control of their disease they might not otherwise have. **”**



David Buck, M.D., President, Blue Ridge Cancer Care, and Medical Director, Radiation Oncology, Carilion Clinic

“ 'BASKET TRIALS' INCLUDE numerous malignancies, such as gastric cancers and lymphoma, that may respond to immunotherapy drugs. **”**



Natasha Holt, Director of Research Operations, Blue Ridge Cancer Care

BLACK COAT, WHITE COAT

REFLECTIONS ON THE TRANSFORMATION OF ONCOLOGY

by William A. Fintel, M.D., Medical Director of Hematology-Oncology, Carilion Clinic

» In 1984, when I was a resident at the University of Virginia, I had a young patient with testicular cancer who failed to show for his second round of cisplatin chemotherapy. In his mind, dying of the cancer seemed preferable to another round of chemo (this was before effective nausea medications existed). I got the brilliant idea of calling the Charlottesville police to go pick him up.

Such was the precarious state of cancer care in those days. As I emerged from my fellowship in medical oncology and set up practice in southwest Virginia, patients often greeted me with a look of horror as if to say, "Oh no, you're an oncologist!" And they had a point. Aside from some early breakthroughs in



rare cancers, I was able to cure very few people. I sometimes thought I should be wearing a black lab coat instead of a white one.

Reflecting now on a nearly 40-year journey in the world of cancer, I see what an honor it has been to participate in the lives of so many people fighting this scourge. The same span of time has also given me a ring-side seat onto the field's growing success. Almost by the decade, I look back and see patterns of growth, where cancer treatments have become vastly more effective and more humane.

I completed my training in the first phase of cancer "success." Researchers were coming up with cellular toxins that killed rapidly growing cells advantageously over less rapidly growing cells. But, oh, the side effects! Any of us who practiced in that era can still tell you the stomach-emptying tales our patients loved to share with us. We were less concerned about making people feel sick than we were about killing what was killing them. So when cisplatin-based chemotherapy was found to have a cure rate above 90 percent for a previously incurable cancer of the testicle, we did not hesitate to drip it into veins. Coercing a no-show into the back of a police cruiser seemed like the right thing to do.

The 1990s ushered in a second era of oncology, kinder and gentler. Therapies were still mostly nontargeted, and toxic, but our ability to support patients through their treatment improved vastly. The anti-nausea drug ondansetron (Zofran) was approved by the FDA in 1991. That same year, filgrastim (Neupogen) was approved to prevent infections caused by these cytotoxic therapies. During my fellowship we got to see the drug in action, pre-approval—and wow! It helped patients sail through chemotherapy by telling the bone marrow to recover faster. I still recall my faculty mentor telling me to buy stock in Amgen, then a startup, as this drug was going to change oncology. I also remember telling him that, with my kids in diapers, I didn't have a spare 100 dollars.

The third phase, starting in the early 2000s, grew from the discoveries made by the Human Genome Project. New



BOTH SIDES NOW:
Dr. William Fintel
welcomes the shift
from gloom to hope.

“

REFLECTING NOW ON A NEARLY 40-YEAR JOURNEY in the world of cancer, I see what an honor it has been to participate in the lives of so many people fighting this scourge. The same span of time has also given me a ring-side seat onto the field's growing success. —Dr. William Fintel

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therapies were all about the genes and mutations and “targets.” Crazy-smart researchers were discovering what made cancer cells different from normal cells. They learned that turning an errant gene off, or turning a crippled normal gene back on, could lead to cancer cell death.

I'll never forget Brad, a law student in Lexington, Virginia, who went to the student health service feeling a bit piqued, only to find a white blood cell count over 100,000—ten times the norm. Even with a basic office microscope, I could see he had chronic myelogenous leukemia (CML). As healthy as he appeared, I told him to pack a bag and get back home to Houston, where he would have access to a clinical trial. Soon I learned he'd be getting an oral nontoxic drug called STI571—to which I replied, “Well, that will never work.” In a matter of weeks he was in remission, and back to school in Virginia.

CML's cause, the so-called Philadelphia chromosome (where pieces of two chromosomes have traded places), had been known for years. What was new was the ability to inhibit this mutant DNA from making its deadly protein. STI571, the oral cancer fighter I had doubted, proved to be a game-changer. Released as Gleevec in 2001, it led the way to dozens of targeted therapies in the years to come, with far fewer side effects than the nontargeted drugs.

I have seen the power of targeted delivery again and again. Let me tell you about Christy and her daughter Chloe.

Christy and her husband came to my office distraught. The couple had been trying to conceive, and Christy's pregnancy test had just turned positive. That same weekend, she'd noticed a painful area in her breast. The biopsy showed a fast-growing cancer, but it was one known to be susceptible to a targeted agent. Although a mastectomy was permissible in her first trimester of pregnancy, the use of either chemotherapy or targeted drugs would likely kill her first little one.


The decisions were heart wrenching. But knowing that a cure was possible using chemotherapy and a targeted agent, coupled with surgery—and that waiting until the thirteenth week of pregnancy gave her and the baby a fighting chance—we took that leap. Long story short, we were able to safely treat mom, who is now fine. The baby, Chloe, emerged unscathed, and today is planning to be an oncologist herself.

The dizzying world of cancer discovery caught yet another tailwind in the 2010s, when immunologists found a way to unleash the killing effect of our immune cells onto the surface of a cancer cell. We have known of spontaneous remission for a hundred years. On rare occasions people who were dying of malignancy went home, and then would return for an office visit showing no signs of cancer. While some (including me) would call that a miracle, others sought to explain the unexplainable, pointing

especially to the immune system.

It turns out the immune system's “killer” cells (mostly in the T-cell subset) can be taught to kill not just germs and other toxic threats but cancer cells as well. In this fourth era of oncology, we stood on the shoulders of those who invented cytotoxic therapies and supportive medications and targeted gene busters, to move into an era of immune checkpoint inhibitors.

In explaining this concept to my patients, I liken it to Harry Potter's invisibility cloak. A cancerous cell cloaks itself in the guise of a friendly cell. So disguised, it convinces the immune protective cells to simply swim by and leave it alone. But the new immune checkpoint inhibitor molecules remove the invisibility cloak, exposing the cancer to the killer T cells. In 2011 and 2014, the FDA approved the first and then second generation of these cancer fighters.

In the course of my career, I've counseled, cared for, and prayed with too many people to count. The days of police escorts to infusion centers where oncologists seemingly wore black coats, and told most people they had six months to live, are long past. Now we see a future where cancer is mostly cured, or at least kept in remission. Survivorship clinics are bursting with healthy participants. Targeted therapy is the rule. People with cancer lead flourishing lives. And the garb of oncology is a shimmering white, endless in possibility. 



From a centralized location across town, remote technicians keep an eye on fall-prone hospital patients and track hundreds of vital signs. *by Jacqueline Mitchell*

The Monitor Never Blinks

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HE NURSES ON 10 West at Carilion Roanoke Memorial Hospital were skeptical when they first heard about the virtual observation cart. Their unit cares primarily for older adults, many of whom have dementia. Often, these patients need one-on-one sitters—trained staff who sit in patients’ rooms to ensure they don’t tug at feeding tubes, pull out catheters, or, worse yet, attempt to get out of bed and fall. But in 2021, the virtual observation cart, a mobile communication unit that is monitored from off campus, began taking the place of the human sitter.

“It kind of looks like an alien, with these awkward legs at the bottom and a big eyeball at the top where the camera is,” says 10 West’s unit director, Annie Philips, R.N. “Most of our patients are already confused, and many of us wondered how the patients would react to this robot thing in their room talking to them.”

The virtual observation cart, which houses a camera and a two-way communication system, is wheeled into the room of a patient who needs constant monitoring. A remote technician keeps tabs on the patient from three miles away, in the Virtual Care Operations Center (VCOps) at another Carilion campus. A single technician, watching screens intently during a 12-hour shift, can observe up to 16 patients at a time. Liberated from cell phones and other distractions, the virtual observers have surprised skeptics with their effectiveness.

Virtual observation is one of two types of remote monitoring that happen at VCOps. The other, begun in November

2020 when the center opened, is remote telemetry, in which technicians watch patients’ heart rhythms and pulse oximetry. Between the two programs, 80-plus technicians observe up to 48 patients across the Carilion system and monitor up to 295 cardiac telemetry patients at Carilion Roanoke Memorial. “Together,” says Jon Sweet, M.D., chair of Carilion’s Department of Medicine, “remote monitoring and telemetry help us get the right staff in the right place, so clinicians can provide prompt, high-value, patient-centered care.”

Reducing Falls

Virtual observation answers a need that bedevils hospitals everywhere. Each year, hospital patients in the United States suffer as many as a million falls, resulting in about a quarter million injuries and more than 10,000 deaths. Few of the traditional interventions—including bed alarms, traction socks, and even deploying one-on-one sitters—have had much effect.

On 10 West, reducing falls was high on Philips’s priority list. The unit, with its concentration of older patients, had the greatest number of falls. “There were opportunities for improvement,” Philips says. The team had taken steps to decrease falls in the past, but continued to feel defeated, she says. “That’s because we work with geriatrics, a population at high risk for falls.”

Enter the virtual observation cart. Whenever a patient does something risky, the remote technician can attempt to intervene, or redirect, through the two-way communication system, according to Wrenn Brendel, D.N.P., senior director of the Carilion Transfer and Communications Center (CTaC), which includes VCOps. “So, if it were my family member attempting to get out of the bed,” Brendel says, “the tech could say, ‘Ms. Brendel, I need you to get back into bed—we don’t want you to fall.’ Or they could ask, ‘Do you need assistance? I can call your nurse for you.’”

If the patient doesn’t respond, the technician can sound an alarm on the observation cart to summon floor staff. Rooms monitored by virtual observers are marked by magnetic flags posted to the doorway. “That way,” Brendel says, “when a technician hits the alarm, the nurse or clinical staff can quickly look down the hallway and know where to go.”

A patient who wants assistance can wave at the camera to ask the tech to turn on the cart’s two-way radio, which is usually kept off to allow privacy and to keep the control room from becoming completely cacophonous.

Despite initial misgivings that patients might find the robotic presence confusing or off-putting, technicians and their charges often establish a close rapport—passing time by chatting about their families and hearing each other’s stories. “We have a handful of patients who have been here long term—months, a year, two years—and these patients really benefit from having the virtual observers,” says Philips, the 10 West director.

Raven Tuck, who has been a virtual observation technician for nearly a year, remembers one patient with particular fondness. “I would say to her, ‘Hey, tell me a story. Once, she told me about the time her brothers and their friends blew up a car when they were teenagers. There were days she wouldn’t want to talk, and I get that. But the days she wanted to talk, we would talk like we were best friends. When I told her I had to go home, she would tell me she loved me, and I would tell her I loved her, too.’”

Tuck says monitoring multiple patients can be a challenge. But she manages to stay focused because her charges tend to be active, and because she knows they need her. “They are stuck in a room—sometimes they can’t leave—and they need that comfort of someone being there. Because not everyone has somebody.”



“IF IT WERE MY FAMILY MEMBER ATTEMPTING TO GET OUT OF THE BED,” THE TECH COULD SAY, ‘MS. BRENDEL, I NEED YOU TO GET BACK INTO BED—WE DON’T WANT YOU TO FALL.’”

—Wrenn Brendel, D.N.P., Senior Director, Carilion Transfer and Communications Center



Wrenn Brendel



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—Jon Sweet, M.D., Chair, Department of Medicine,
Carilion Clinic

control tower. And like an air traffic controller, she’s keenly aware that people’s lives are in her hands, even though she’ll never interact with them personally. “We treat every patient as if they were our family,” she says. “Because that’s what they are to us when we are at work for twelve hours.”

Meanwhile, back at the nurses’ station, staff are free to focus on other things. “The nursing assistants do not have to watch the monitors now,” says Shannon Robertson, R.N., a unit director at VCOps. “That frees them to do direct patient care.”



Brendel, the CTaC senior director, says the virtual observation program has already proven its worth. For one thing, it has maximized efficiency, allowing clinical staff to spend more time caring for fragile patients. And by reducing physical visits to patients’ rooms, it also lowered the risk of COVID-19 transmission and eased shortages of personal protective equipment during the pandemic.

But what about falls? “That’s the number-one impact I have seen on our patient population,” says Philips. “Since the introduction of the virtual operations center, we’ve had a thirty-three percent reduction in falls.”

For her part, Brendel says the virtual observers “prevent hundreds of adverse events each month, primarily falls.”

Any remaining reservations clinical staffers had about replacing one-on-one sitters melted away after the data came in, says Philips. “With the implementation of this tech, people thought, ‘Okay, we can do this.’ Seeing the impact made them even more engaged.”

Maintaining Focus

Unlike virtual observers, cardiac telemetry technicians don’t watch video streams of the patients.

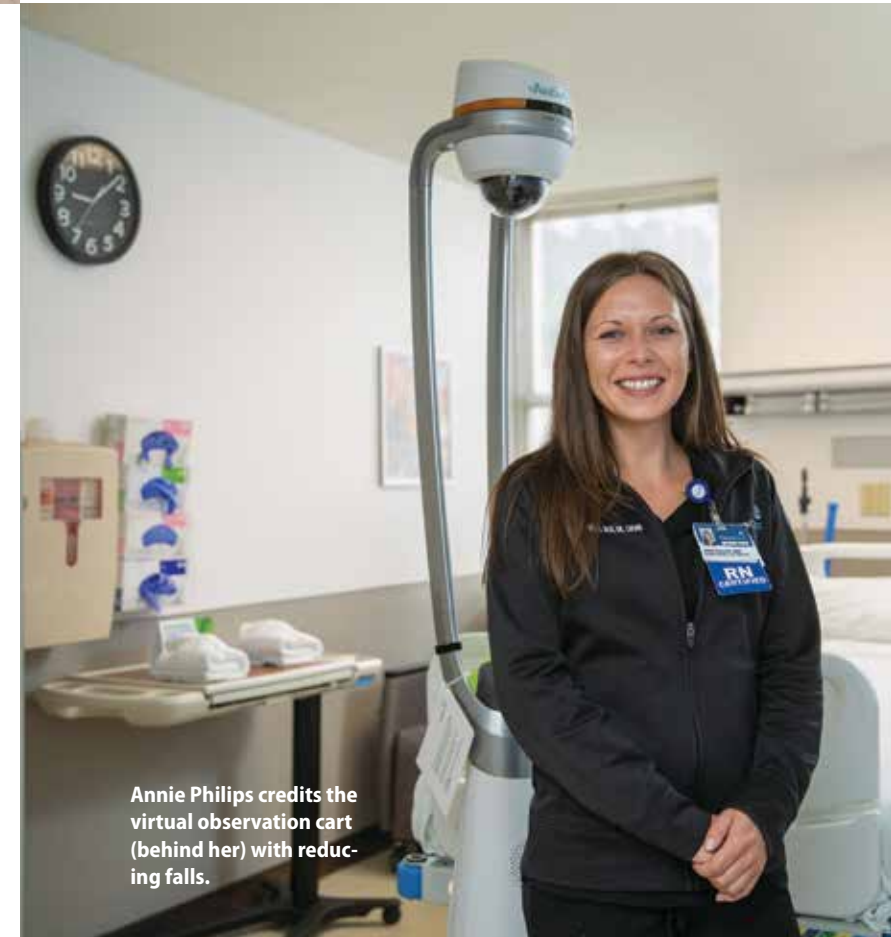
KEEPING TABS: Technicians at Carilion’s Virtual Care Operations Center track key vital signs (above) and observe patients’ safety in their rooms (far right). Here the rooms are blacked out for privacy.

Instead they keep tabs on patients’ blood oxygen levels and cardiac rate and rhythm, looking for any changes that require medical attention. Each technician monitors an average of 30 to 40 patients—more than were previously handled by a nursing assistant sitting at a hectic nurses’ station on the patient floor.

Tammie Holland, a monitor tech with four years’ experience, worked as a nursing assistant on the 9 South progressive care unit before moving to VCOps. On 9 South, she watched up to 24 patient monitors at a time. If a patient’s heart rate spiked or dipped or became irregular, Holland would immediately tell the nurses. But she also had to answer the unit’s telephone and handle the call bell. She helped with patient discharges and retrieved and delivered medications and supplies as necessary. Clearly the nurses’ station was a less than ideal setting for patient monitoring.

Hence the move across town to VCOps. “What’s near and dear to our hearts is improving patient safety and quality of care,” says Brendel. Bringing monitor techs like Holland into an environment that is much more controlled and quiet, she says, lets them maintain their focus.

Holland agrees the virtual setting allows greater focus, likening the job to working at an air traffic



Annie Philips credits the virtual observation cart (behind her) with reducing falls.

Remote Future

Like any major new system, cardiac telemetry will evolve as the technology matures, according to Jim Cady, director of VCOps. One upgrade: instead of alerting floor nurses by phone—requiring them to stop whatever they’re doing—the monitor techs may soon be able to send a text message first. This would allow clinical staff to simply glance at an incoming warning without interrupting their workflow.

The current setup is only the beginning. Carilion is adding 24 more mobile communications units to expand virtual observation to the Emergency Medicine and Psychiatry and Behavioral Medicine departments. Beyond that, plans are afoot to expand cardiac telemetry throughout the Carilion system.

The VCOps team also has its eye on wearable technology that can provide real-time feedback on a patient’s status. “For example,” says Cady, “a wearable monitoring device can often detect subtle changes in temperature earlier than an oral thermometer, allowing the clinicians to proactively manage complex medical conditions.”

In the near future, Cady predicts, VCOps could be monitoring patients in their homes or elsewhere outside the hospital. “We’ve just scratched the surface of what’s possible,” he says. **CM**



ASSESSMENT

A digital screening tool based on addiction research can spot early signs of hazardous drinking. *by John Pastor*

SOME TOPICS ARE TOO SENSITIVE TO TALK ABOUT, even in a doctor's office. Alcohol use is one of them.

"Very few people are prepared to say, 'Yes, I drink alcohol and I have x number of drinks a day,'" says Anita S. Kablinger, M.D., a psychiatry and behavioral medicine provider and clinical trials research director with Carilion Clinic. "Whether it's because the clinician doesn't ask or the patient doesn't want to tell, the reality is fewer than twenty percent of people with alcohol use disorder are ever treated."

Therein lies the inspiration for Beacon-Alc, a digital screening tool being tested at Carilion. Beacon-Alc determines a patient's risk of having an alcohol use disorder (AUD) by asking non-stigmatizing questions. The application doesn't ask people how much alcohol they consume but instead poses hypothetical questions that get to the heart of how much value they place on alcohol. The app then generates a score that tells clinicians how at-risk a patient is.

The screening can be done at home before the patient comes into the office or on a digital tablet in a waiting room. "I've been in the same room with people while they were answering the questions," says Dr. Kablinger, who oversees use of the screening tool at Carilion's Psychiatry and Behavioral Medicine clinic in Roanoke. "It's self-explanatory, and there are no right or wrong answers."

Better yet, it appears to work. In a clinical study conducted at Carilion Clinic, Beacon-Alc identified three times as many patients





“People who have problems with alcohol have a decision-making process focused on immediate outcomes, and they make choices that aren’t very healthy for them.”

—Warren Bickel, Ph.D., Director, Addiction Recovery Research Center, Fralin Biomedical Research Institute at VTC

zon is only a matter of a week or two, he says, “reinforcers such as alcohol are brief, intense, reliable, and have greater value. Instead, we want to explore ways for people to mentally construct how they will feel at future events—say, a family member’s birthday party or graduation—and this lowers the value they place on alcohol.”

In the course of their work together, a light bulb went off for the two scientists: they could put their research into practice by forming a company dedicated to heading off substance use problems before they start. BEAM Diagnostics was born.

Beacon-Alc is the first fruit of that effort. “We are very much using our understanding of concepts from behavioral economics and decision-making, and translating it into a practical tool for the physician,” says Dr. Snider. “The assessment only takes a few minutes. You click through a series of questions that look like, ‘Would you rather have \$100 today or \$1,000 in three weeks?’”

The concept recently gained a vote of confidence from the National Institutes of Health, in the form of a \$1.7 million grant to commercialize the technology. “The current funding launches BEAM’s mission into reality—to identify people

at risk for developing hazardous drinking habits or AUD compared with current assessment practices.

A tool that reliably gauges alcohol risk could help ease one of the country’s major public health problems. In 2020, among persons 12 or older, 28.3 million people had an AUD within the year, making alcohol the most frequently misused substance in the United States, according to the Substance Abuse and Mental Health Services Administration. The estimated economic burden to the nation is \$249 billion every year.

Risky Behavior

Beacon-Alc was developed by BEAM Diagnostics Inc., a faculty startup that emerged in 2017 from the Fralin Biomedical Research Institute at VTC in Roanoke. The screening tool is the brainchild of two company cofounders: Sarah Snider, Ph.D., the CEO, and Warren Bickel, Ph.D., a Virginia Tech professor at the institute and director of its Addiction Recovery

Research Center, who serves as BEAM’s senior scientific advisor.

The business enterprise, like the screening tool, grew out of the pair’s common interest in understanding risky behavior. As a postdoctoral associate in Dr. Bickel’s lab at the Addiction Recovery Research Center, Dr. Snider studied what drives people to do things they know they shouldn’t. Dr. Bickel himself was leading research in behavioral economics, particularly the behaviors underlying addiction. His work helped explain how people could make risky decisions even at great cost to themselves. The decision-making process, he found, hinges on someone’s temporal window—on how far ahead they can imagine themselves in the future.

For instant gratification, nothing works quicker than liquor. “People who have problems with alcohol,” says Dr. Bickel, “have a decision-making process focused on immediate outcomes, and they make choices that aren’t very healthy for them.” When their time hori-

“Whether it’s because the clinician doesn’t ask or the patient doesn’t tell, fewer than twenty percent of people with alcohol use disorder are ever treated.”

—Anita S. Kablinger, M.D., Psychiatry and Behavioral Medicine, Carilion Clinic



who could use help before alcohol use becomes a worse problem for their health and in their life,” Dr. Snider says. “We want to promote proactive, not reactive, intervention.”

Accordingly, Beacon-Alc does not attempt to make treatment decisions. The aim is simply “to provide information on whether there is a potential alcohol problem and how urgent it might be,” Dr. Snider says. “The caregiver can decide whether this is something to ad-

dress right away or something to keep an eye on.”


Linking to Patient Records

Before becoming available to Carilion providers and patients, the tool would be integrated with the organization’s electronic health record system. (Carilion, like thousands of other hospitals and clinics, uses the Epic system.) “We were excited by the concept, and we began

to figure out how to seamlessly connect the digital screening to an individual’s private electronic health record,” says Stephen A. Morgan, M.D., Carilion senior vice president and chief medical information officer. “This is a first for Carilion—working with a startup company to add the functionality of an outside application in a way that is secure, safe, and accessible to patients.”

In the process, Carilion has been pushing the boundaries of electronic medical communication. “By introducing Beacon-Alc to the mix,” Dr. Morgan says, “Carilion is taking a step toward surmounting the technical and privacy concerns and introducing interoperability in the digital exchange of medical information—an ongoing challenge in the health care industry.”

BEAM Diagnostics, meanwhile, is just getting warmed up. The company expects the lessons learned through the development of Beacon-Alc will lead to other tools on the Beacon platform—for tobacco or opioid screening, for example, as well as for helping people in recovery.

“BEAM,” says Dr. Snider, “is making it easier for providers and patients to have open, honest communication that can lead to better care and counsel.” Health care providers appreciate the quick read on alcohol risk, while patients are amused by the questions, she says. “It’s like a game, and all very non-confrontational.” 



“The assessment only takes a few minutes. You click through a series of questions that look like, ‘Would you rather have \$100 today or \$1,000 in three weeks?’”

—Sarah Snider, Ph.D., CEO, BEAM Diagnostics Inc.

LET THERE BE BUNNIES

The whimsical rabbits of Hunt Slonem brighten young patients' care. **BY TIFFANY HOLLAND**

WITH ITS VIVID COLORS AND BRIGHT LIGHTS, the Carilion Children's Tanglewood Center, the new home of outpatient pediatric care, is tailor made for the health system's youngest patients. Even the artwork, including an interactive wall display, was created to form a comforting environment for children. And in one of the waiting rooms, an adult with an artistic eye will take special notice.

The "bunny wall" in the aptly named Meadow Room waiting area is covered with paintings by Hunt Slonem, the distinguished American artist. Slonem's works hang in museums and other venues all over the world, and often sell for tens of thousands of dollars.

The artist is best known for his paintings of living things—butterflies, birds, and his signature bunnies. He uses a variety of techniques, including an unusual cross-hatching effect in which he scrapes through layers of wet paint using the sharpened end of a paint brush, giving his paintings rich dimensions. The whimsical, repetitive rabbits—25 pieces in all, each in its own ornate frame—are just the right décor for a building filled with colors that pop and soothe at the same time.

The art found its home at Tanglewood Center by way of an exhibition at Roanoke's Taubman Museum of Art in 2019–2020. When he heard about the new children's center, Slonem donated the exhibited works to the Taubman, with the stipulation that they would hang at the new Carilion facility.

Slonem—a big believer in the healing power of art—has had many works find their way into health care settings. Fittingly, the Tanglewood Center bunnies are displayed as part of the Dr. Robert L.A. Keeley Healing Arts Program. The program, an initiative of the Carilion Clinic Foundation, aims to address the emotional needs of patients and families by integrating literary, performing, and visual art into the healing process.

"The benefit of the Healing Arts Program for its calming and soothing effect is profound," says Christopher Pierce, M.D., chief of General Pediatrics. "For children, entering a health care facility is often anxiety provoking." But now they will have bunnies. Lots of bunnies. **CM**

WALL OF WABBITS

Bunnies reproduce quickly, especially on the canvases of Hunt Slonem. That's the whole point, according to the artist. "Repetition is divinity," he has said. "Just like the act of repeating a phrase creates a mantra, the act of repeating forms becomes an act of worship."



cheers for peers



Construction on Carilion Roanoke Memorial's new Crystal Spring tower is on schedule for completion in 2025.

Emergency Medicine

MATTHEW BORLOZ, M.D., Emergency Medicine, **ERWOOD G. EDWARDS JR., M.D.**, chief of Pediatric Hematology and Oncology, **SUSAN GUELICH, M.D.**, Valley Nephrology Associates, **ANNE ICKES, D.O.**, Emergency Medicine resident, **JESSICA PELLETIER, D.O.**, Emergency Medicine resident, and **CHAD WARD, D.O.**, pediatric intensivist, published "A Case of Childhood Severe Paroxysmal Cold Hemoglobinuria with Acute Renal Failure Successfully Treated with Plasma Exchange and Eculizumab" in *Case Reports in Pediatrics*.

Family Medicine

JOHN EPLING, M.D., vice chair of research and population health for Family and Community Medicine, and **MICHELLE ROCKWELL, PH.D.**, were recognized with the 2021 Pearl award at the North American Primary Care Research Group for their research project "Does De-Implementation of Low Value Care Impact the Patient-Clinician Relationship?"

Medicine

MANDY ATKINSON, M.D., Pediatric Hematology and Oncology,

co-published "ALK-Positive Histiocytosis: A New Clinicopathologic Spectrum Highlighting Neurologic Involvement and Responses to ALK Inhibition" in *Blood*, from the American Society of Hematology.



ANTHONY BAFFOE-BONNIE, M.D., interim chief of Infectious Diseases, and **JORDAN**

TORRES, D.O., co-published "Time to Reconsider Hepatitis A Vaccination in Food Handlers: Are We Seeing More Outbreaks and Severe Disease?" in *Open Forum Infectious Diseases*.



ADEGBENGA BANKOLE, M.D., chief of Rheumatology, was a speaker at the American College

of Rheumatology's Reproductive Health in Rheumatic Disease Symposium.

ANDREW BEHNKE, M.D., chief of Endocrinology, **KATHERINE MUSTAFA, D.O.**, and **JARROD UHRIG, D.O.**, Diabetology, published "Nutritional Deficiencies in Persons with Diabetes in Southwest Virginia" in *Diabetes*.

PAUL DALLAS, M.D., Internal Medicine, published "Diagnosis at 10 Paces for Bitemporal Wasting" in *ACP Internist* in January.

GREGORY DEHMER, M.D., Cardiology, published "Hospital Characteristics and Early Enrollment Trends in the American College of Cardiology Voluntary Public Reporting Program" in *JAMA Network Open*.

JOSHUA EIKENBERG, M.D., Dermatology, presented "Rash-onale: An updated case-based approach to diagnosing

rashes and their systemic associations" at the Virginia Academy of Family Physicians winter meeting.

BIWAR MAROF, M.D., Hospital Medicine, presented "Successful Management of a Rare Case of Recurrent Multi-Vessel Spontaneous Coronary Artery Dissection" at the American College of Cardiology meeting.

ERIN WORTHINGTON, M.D., Pediatric Pulmonology, co-published "Meta-Analysis Brings Rigor to Preclinical Studies of Extracellular Vesicles for Respiratory Disease" in *ExRNA*.

Orthopaedics



PETER APEL, M.D., PH.D., Hand and Upper Extremity, and **RANDY CLEMENTS, D.P.M.**, chief of

Foot and Ankle, co-published the book chapter "Free Flaps for Lower Extremity Trauma" in the textbook *McGlamry's Foot and Ankle Surgery*. Dr. Clements published two more chapters, "Lisfranc Fracture/Dislocation" and "The Management of Pilon Fractures: Operative Principles & Approaches."

CESAR J. BRAVO, M.D., Hand and Upper Extremity, has been elected to the American Shoulder and Elbow Surgeons, an honor awarded to experienced orthopaedic surgeons who concentrate on shoulder surgery, elbow surgery, and/or sports medicine.

BENJAMIN COOBS, M.D., Joint Replacement, presented "Dislocation Rates Following Total

Hip Arthroplasty via the Direct Anterior Approach Regardless of Spinopelvic Deformity" for the International Congress in Joint Replacement at the 10th Annual Direct Anterior Approach Hip Course at Methodist Institute for Technology, Innovation, and Education.

JOE MOSKAL, M.D., chair of Orthopaedic Surgery, presented as faculty and moderator for the 89th Annual Meeting of the American Academy of Orthopaedic Surgeons in Chicago.

Radiology

MOHAMMED BERMO, M.D., Diagnostic Radiology, published "Testicular FDG Uptake on PET/CT in Patients with Lymphoma: Correlation with Age" in *Current Problems in Diagnostic Radiology* and "Utility of SPECT Functional Neuroimaging of Pain" in *Frontiers in Psychiatry*.

Surgery



In April, **MICHAEL NUSSBAUM, M.D.**, chair of Surgery, completed 32 years as an associate

examiner, director, and senior director of the American Board of Surgery. Over that time, Dr. Nussbaum administered more than 1,200 oral board examinations. In 2005–2006 he led the initial development of the ABS maintenance of certification process for all diplomates.

KATHERINE HOWE, M.D., General Surgery resident, and **MICHAEL NUSSBAUM, M.D.**,

New Chair of Medicine



JON SWEET, M.D., has been appointed chair of the Department of Medicine at Carilion Clinic and the Virginia Tech Carilion School of Medicine (VTCOSM). Dr. Sweet is a longtime professor of medicine at VTCOSM. He is also on the core faculty of the Carilion Clinic–

Virginia Tech Carilion Internal Medicine residency, of which he served as program director for several years. Under his leadership, the program achieved a 100 percent three-year pass rate on the American Board of Internal Medicine Certifying Examination for the first time.

His many honors include Preceptor of the Year, Roanoke Valley Region (2020); the Virginia American College of Physicians Teaching Award (2019); and induction into the Gold Humanism Honor Society, VTCOSM chapter.

Dr. Sweet earned his M.D. at the University of Virginia. He served his residency and chief residency in internal medicine while on active duty at Wright-Patterson USAF Medical Center in Ohio.

chair of Surgery, co-published "Burrell Memorial Hospital: Establishing Surgical Care for Black Appalachians in the Early 20th Century" in the edited volume *Black Surgeons and Surgery in America*.

SHYAM ODETI, M.D., chief of Hospital Medicine, was appointed to the faculty of the Society of Hospital Medicine's Peer-to-Peer Learning Program on COVID-19 Vaccine Hesitancy, an 18-month nationwide educational effort.

JESSICA PARTIN, M.D., Breast Surgery, was co-editor of the March issue of *Obstetrics and Gynecology Clinics of North America*, titled "Management of Benign and Malignant Breast Disease." She also published

"Special Considerations in Patients with Early-Stage Breast Cancer and Survivors" in *Obstetrics and Gynecology Clinics of North America*.

Affiliated Institutions

LEE LEARMAN, M.D., PH.D., dean of the Virginia Tech Carilion School of Medicine, has been appointed by the Association of American Medical Colleges to its Council of Deans Insight Circle on Leadership Accountability for Diversity. The 11-member group will help develop an accountability framework to guide the nation's medical school leaders in their diversity efforts across the education continuum.

Institutional Official Appointed



ROBERT TRESTMAN, PH.D., M.D., has been named Institutional Official for Human Research Protection. He will assume responsibility for oversight of Carilion's clinical research, the Institutional Review Board, and the Human Research Protection Office, while continuing as chair of the Department of Psychiatry and Behavioral Medicine for Carilion and the Virginia Tech Carilion School of Medicine.

Dr. Trestman earned his Ph.D. and M.D. from the University of Tennessee and trained at the Mount Sinai School of Medicine in New York City. He serves as senior editor of the *Oxford Textbook of Correction Psychiatry*. He is also chair of the American Psychiatric Association Council on Healthcare Systems & Financing, is past chair of the American Hospital Association's Behavioral Health Council, and leads the American Association of Chairs of Departments of Psychiatry's Clinical Enterprise Committee.

He has been with Carilion since 2017.

FROM BENCH TO EXAM ROOM

Health care systems like Carilion can speed the flow of research knowledge into real-world practice. **BY ROBERT TRESTMAN, PH.D., M.D.**

AS CLINICIANS, WE KNOW THAT EVERY DECISION we make, every treatment we provide, has the potential to change lives for the better. But in the complex and rapidly shifting landscape of medicine, how do we know which decision or treatment is best? This question, broadly speaking, is what drives the field of translational research. The field aims to take innovations that have been shown to benefit patients in research settings and translate them into the “real world” of day-to-day care delivery. Health care systems have an important role to play in advancing that effort. Here at Carilion, in fact, many elements are already in place

Let’s think of the work as falling into two categories. The first category—often called implementation science—is the process of incorporating research knowledge into practice. Carilion’s quality improvement projects, along with its Clinical Advancement and Patient Safety initiative, are intended to do just that: identify a problem, select an intervention, and create a new workflow to implement it. We have seen concrete benefits of this work in our operating rooms and our successes in reducing morbidity and mortality from life-threatening sepsis.

One of Carilion’s partners, the Virginia Tech Carilion School of Medicine, has a new department devoted to such work. Called Health Systems Science and Interprofessional Practice, it examines how complex care-delivery systems operate, and how to improve them—investigating things like how best to engage patients’ families to support recovery and how to expand access and keep costs down without impairing quality. One outgrowth of this has been the development of our leading-edge Center for Simulation, Research, and Patient Safety.

The second category of translational research to

address is more specific: real-world comparative studies to identify which treatments or procedures work best. This approach, which has direct benefit for our patients, is rarely funded by device manufacturers or pharmaceutical companies—their products are already approved for use. But health systems like Carilion, working with colleagues and partners, have the resources to build routine-treatment studies. We can examine through our regular clinical practice whether the current standard of care is indeed better than another available treatment.

A recent large-scale Veterans Administration study of different statins underscored the value of comparing treatments. Studying the risks and benefits in patients who were receiving regular care led to recommendations for the statin drugs that work best, with fewest side effects, in real-world practice.

By building a culture that makes such “comparative effectiveness trials” a standard of care, Carilion can dramatically improve outcomes for our patients while leveraging existing resources such as our Health

Analytics Research Team. We can compare patients receiving different appropriate treatments for the same condition. This will help us determine which approaches produce the best results in what sorts of patients, which ones work fastest, and which have the best patient adherence.

I am excited to envision the fruits that will arise from these labors: less wasted effort, better guidance for our decisions, and vast amounts of actionable information to improve the care we deliver. **CM**

Robert Trestman, Ph.D., M.D., chair of the Department of Psychiatry and Behavioral Medicine at Carilion Clinic and the Virginia Tech Carilion School of Medicine, is Carilion’s new Institutional Official for Human Research Protection.



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U.S. News & World Report evaluated more than 4,300 hospitals and Carilion Clinic’s flagship facility was ranked No. 5 in Virginia, earning top ratings in 14 procedures and conditions. As leaders in innovative and collaborative care, at Carilion Roanoke Memorial Hospital we work every day to advance our mission: Improve the health of the communities we serve.

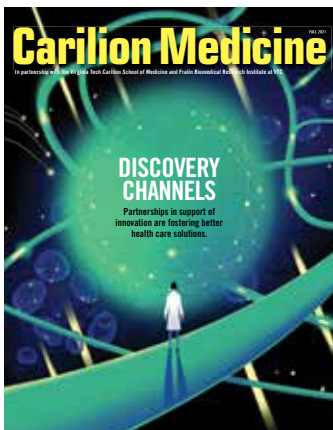
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ONWARD AND UPWARD WITH CANCER SURVIVORS

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