Cancer care is extremely complicated. And it’s getting more complex every day — from intricate radiotherapies to advanced immunotherapies to revolutionary cancer surgeries. On top of this, we are caring for a patient population that is emotionally, physically and sometimes financially stressed.

That’s why integration is at the core of everything at the Rush University Cancer Center.

TREATING THE WHOLE PATIENT
At Rush, we have integrated basic sciences, clinical trials, advanced treatments and innovative surgical techniques to provide the impressive level of care patients expect from our nationally ranked academic medical center.

Rush’s strong research and scientific base gives our patients access to the latest research, immunotherapies, diagnostic technologies and surgical techniques. Notably, our clinical trials program has continued to grow this year, offering our patients access to novel therapies and specialized care from experienced providers. You can read more about our clinical trials program and immunotherapy research on page 7 of this report.

With our patients at the center of everything we do, we also recognize that they need more than just access to the most advanced treatment options. They also need personalized support.

At Rush, we are focused on helping patients navigate the complexities of cancer care. As a member of the Coleman Supportive Oncology Initiative — an innovative effort among eight Chicago medical centers to implement improvements in supportive oncology — Rush has become a leader in providing meaningful supportive care.

The supportive care program at Rush includes psychosocial support, financial assistance, patient navigation, palliative care, pain management, nutrition counseling and more for our cancer patients. You can read more about our supportive care efforts on page 9 of this report.

BRINGING IT ALL TOGETHER
By successfully integrating basic science research, clinical trials, advanced treatments and innovative surgical techniques with our dedicated supportive care program, Rush is providing truly comprehensive and personalized care to our patients.

This report highlights how we are integrating different elements of cancer care in the following areas:

- Advanced treatments, including immunotherapy and phototherapy
- Using big data to provide more accurate and personalized diagnostics and care
- State-of-the-art surgical techniques that provide more accurate diagnostics, improved quality of life, options for treating formerly inoperable cancers and lower transfusion rates
- Improved screening methods
- Clinical trials and translational research
- Supportive care that addresses the needs of the whole patient

We also present our 2015 cancer registry report on page 25.

A TEAM EFFORT
We would like to take this opportunity to thank the many organizations with which Rush collaborates to provide high-quality patient care, including the Commission on Cancer of the American College of Surgeons and the American Cancer Society.

In addition, we would like to extend our gratitude to everyone involved in the cancer program for their dedication and commitment to our patients. At each and every level at Rush, staff make unique contributions that raise our standards of care.

On the cover: Medical oncologist Marta Batus, MD, is working on a predictive study that uses a blood test to help determine patients who will respond best to immunotherapies for advanced stage malignancies.

Chairs’ Letter
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Aidnag Diaz, MD, MPH, (left) and Robert DeCresce, MD

Aidnag Diaz, MD, MPH
Chair, Cancer Committee

Robert DeCresce, MD
Interim Director, Cancer Center

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Rush University Cancer Center Happenings

INNOVATIVE ROBOTIC SURGERY FOR PROSTATE CANCER
Srini vas Vourgant i, MD, urologist, is working with a novel investigational device that will allow transperineal prostate procedures, including prostate biopsy, with robotic assistance. The platform could potentially be useful in the development of novel clinical trials aimed at focal (partial gland) therapy for prostate cancer.

For prostate biopsy, the device uses a real-time, 3D image-guided system that enables the cancer foci position to be pinpointed within 1 mm accuracy.

This technique enables complete prostate coverage, while also lowering the rate of complications (e.g., sepsis, hematuria).

THE NCI-MATCH TRIAL
As part of its commitment to personalized cancer care, Rush is participating in the National Cancer Institute Molecular Analysis for Therapy Choice (NCI-MATCH) trial. This national trial matches patients who have advanced solid tumors, lymphomas and myelomas that are no longer responding to standard therapies to clinical trials with investigational drugs.

The NCI-MATCH trial analyzes patients’ biopsy specimens to determine whether they contain certain mutations for which targeted drugs exist.

Patients who have one of the mutations may be eligible to participate in a trial for a drug that has either been approved for another cancer indication or is still being tested in clinical trials.

MELANOMA SURVEILLANCE CLINIC
The Melanoma Surveillance Clinic at Rush utilizes photographic surveillance to carefully monitor high-risk patients for new or changing moles. Evidence has found that photographic surveillance can help detect melanoma earlier when it may be more curable, while also reducing the number of biopsies patients have.

This program, led by Arthur R. Rhodes, MD, allows physicians to compare all of patients’ visible moles and anatomic sites of the total skin surface to a database of patients’ visible moles and anatomic sites of the total skin surface to a database.

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ADVANCED CARE FOR NEUROENDOCRINE TUMORS
In 2016, Rush began the neuroendocrine tumor program. Led by Xavier M. Keutgen, MD, endocrine surgeon, the program provides comprehensive care for the following types of neuroendocrine tumors:

- Neuroendocrine tumors of the gastrointestinal tract and lungs (including carcinoid tumors)
- Neuroendocrine tumors of the pancreas (including insulinoma, gastrinoma, VIPoma, glucagonoma, somatostatinoma and nonfunctioning)
- Neuroendocrine tumors of the pharyngeal gland
- Neuroendocrine tumors resulting from genetic conditions such as Von Hippel-Lindau syndrome, multiple endocrine neoplasia Type 1, neurofibromatosis and tuberous sclerosis
- Mediastinal thyroid cancer
- Phaeochromocytoma and paragangliomas

Rush is the first hospital in Chicago to use 68-Gallium DOTATATE PET CT, the most sensitive diagnostic test for neuroendocrine tumors. It provides tumor location with greater than 90 percent accuracy, compared with the 80 to 70 percent accuracy of an octreotide scan, the next-most-sensitive test.

IMPROVING GENETIC TESTING FOR CANCER
In 2016, the Rush Inherited Susceptibility to Cancer (RISC) Program participated in a soft launch for a genetic test that looks at a patient’s somatic mutation tumor profile in conjunction with analyzing the patient’s germline genetics. This is one of the first tests of its kind, and Rush was chosen as one of the select institutions to participate in the test’s soft launch.

The test can distinguish between somatic genetic mutations (present in malignant tissue) and germline mutations (present in every cell in the body). This type of testing can aid in more personalized treatment options for patients and find potential clinical trials for which a patient may be eligible.

ONCOLOGY CARE MODEL
In partnership with the Centers for Medicare & Medicaid Services (CMS), clinicians from Rush are streamlining the care process for chemotherapy patients, while also improving the patient experience and outcomes through an innovative oncology care model.

The oncology care model is a new payment and delivery model created to improve the effectiveness and efficiency of cancer care for patients undergoing chemotherapy. The goals of this initiative are to improve health outcomes for cancer patients and improve the quality of cancer care from diagnosis to survivorship.

The model enables and encourages clinicians to coordinate care, allowing patients access to treatments that address their individual needs. The practice requirements of the program include the effective use of electronic health records, 24-hour access to clinicians who can consult patients’ records in real time, comprehensive treatment plans, patient navigation, using data to conduct ongoing quality improvements and using therapies consistent with nationally recognized clinical guidelines.

QUALITY IMPROVEMENTS FOR PALLIATIVE CARE
Nurses on the inpatient hematology, oncology, stem cell transplant units launched a quality improvement project to increase screening and access to palliative care and improve holistic patient care.

Through the nurse-led initiative, staff on the unit did the following:

- Developed an evidence-based, electronic and comprehensive screening tool to help determine if patients could benefit from palliative care consult
- Screened patients upon admission, weekly and when their status changed
- Initiated a palliative care inquiry when indicated during the screening process

This project helped increase staff awareness of palliative care through the screening process. It also increased the number of patients screened for distress to help improve access to palliative care support. Staff felt empowered to advocate for their patients’ palliative care needs and collaborate with the multidisciplinary team to enhance patient care.

BREAST CANCER
In 2016, breast surgeons Katherine Kopkash, MD, and Andrea Madrigrano, MD, started using a 3D intraoperative specimen imaging system at Rush. Rather than sending the specimen to radiology and waiting for results, breast surgeons and radiologists can review the specimens immediately in the operating room with this system. Surgeons are then able to take more tissue if necessary.

The benefits of this system include the following:

- Shortened surgical time — an estimated 20 percent decrease in length of the procedure
- Decreased re-excision rates
- Improved cosmetic outcome due to lower volume of breast tissue removed

Rush is the only institution in the Chicago area — and one of few institutions within the Midwest — with 3D intraoperative breast specimen imaging.
COMPREHENSIVE CLINICS

Rush, which serves both adults and children with cancer, is home to The Coleman Foundation comprehensive clinics. These multidisciplinary clinics apply a team approach to patient care. The clinical team gathers to discuss the patient’s condition, review diagnostic tests and develop a treatment plan, often in collaboration with the patient’s diagnosing physician.

The comprehensive clinics are dedicated to the following:

- Blood cancers and bone marrow transplants
- Brain cancer
- Breast cancer
- Chest and lung tumors
- Gastrointestinal cancers
- Head and neck cancers
- Inherited susceptibility to cancer
- Leukemias
- Lymphomas
- Multiple myeloma
- Myelodysplastic/myeloproliferative neoplasms
- Prostate cancer
- Spine tumors

The cancer center also has tumor conferences for a number of different disease sites. See pages 22-24 for a complete list of disease site conferences.

SUPPORT SERVICES

Rush University Cancer Center is committed to helping patients and their families cope with the psychological, emotional and spiritual challenges often associated with a cancer diagnosis. Available support services at Rush include the following:

- Social work services, including a licensed clinical social worker dedicated to cancer patients at Rush, as well as a social worker from the American Cancer Society.
- Psychotherapy and other psychosocial oncology services to help patients, caregivers and families manage stress and physical symptoms.
- Nutrition counseling with a registered dietician to help improve overall health and manage treatment side effects.
- Palliative care services, with recently expanded services that focus on reducing pain, stress and other symptoms.
- Pastoral services from chaplains at Rush to support the spiritual and emotional health of patients and families.
- Survivorship care planning that includes a comprehensive plan for patients and their primary care physicians regarding the care received and follow-up recommendations.
- Integrative therapies — such as acupuncture and massage therapy — through the Cancer Integrative Medicine Program.
- Genetic counselors dedicated to the cancer center to counsel patients with suspected predispositions to breast, gynecologic and gastrointestinal cancers, along with rare endocrine tumors and sarcomas.

RECOGNITION AND ACCREDITATIONS

- Rush has received four consecutive outstanding achievement awards from the Commission on Cancer of the American College of Surgeons.
- The Coleman Foundation Blood and Bone Marrow Transplantation Clinic is accredited by the Foundation for the Accreditation of Cellular Therapy.
- Rush’s pathology and clinical laboratories are accredited by the Joint Commission.
- Four times in a row, Rush has received Magnet status — the highest recognition for nursing excellence — from the American Nurses Credentialing Center.
- The Regenstein Breast Imaging Center at Rush is an American College of Radiology-accredited Center of Excellence. This designation is awarded centers that have received full accreditation in mammography, breast ultrasound, and stereotactic and ultrasound-guided needle biopsies.
- The Association for the Accreditation of Human Research Protection Programs has awarded Rush full accreditation with distinction in community programs, giving special recognition to Rush’s community-based participatory research.
- In 2016, Rush received Vizient’s Quality Leadership Award, ranking No. 5 among 102 academic medical centers. It is the fourth consecutive time Rush has been ranked among the top five in the study and the eighth time since the University HealthSystem Consortium, now part of Vizient, began the study in 2005. Rush is the only medical center in Illinois to have received this award.
- The Rush Radiosurgery program is one of the few Novalis-certified radiosurgery centers in the country.
- Cancer services at Rush are consistently ranked among the best in the country by U.S. News & World Report.

RESIDENCY AND FELLOWSHIP PROGRAMS

- Residency in radiation oncology
- Residency in nuclear medicine
- Fellowship in hematology/medical oncology
- Fellowship in orthopedic oncology
- Fellowship in hospice and palliative medicine
- Residency in general surgery

ADVANCING MEDICINE THROUGH RESEARCH

The Rush University Cancer Center fosters research across four broad programs that aim to deepen understanding of cancer to better prevent, detect and treat it:

- Cancer biology
- Clinical, behavioral and translational research
- Molecular signatures and cancer outcomes
- Tumor immunology

SPOTLIGHT: URGENT CARE FOR CANCER PATIENTS

In 2016, the cancer center opened an urgent care, walk-in clinic specifically for cancer patients at Rush University Medical Center. The goal for the center is to help patients avoid unneeded trips to the emergency room and hospitalizations.

Location: Rush University Cancer Center, 1725 W. Harrison St., 10th floor, Chicago, IL 60612

Hours: 8 a.m. to 3 p.m., Monday through Friday

Patients who are experiencing the following symptoms during the above business hours can visit the walk-in clinic:

- Edema, including leg swelling
- Nausea and/or vomiting
- Pain
- Symptoms of low blood pressure, including dizziness, fatigue and shortness of breath
- Lightheadedness, dizziness or falls
- Diarrhea or bloody stool
- Increased fatigue
- Increased difficulty breathing (dyspnea) or increased or new cough
- Chest pain
- Fever or chills

Rush University Cancer Center at a Glance

The Rush University Cancer Center comprises all cancer-related clinical, research and educational efforts at Rush, crossing 20 departments, divisions and sections, inpatient and outpatient areas, professional clinical activities; and the colleges of Rush University.
Unprecedented Growth for Cancer Research Program

Rush’s cancer clinical trials program experienced a renaissance in 2016, including the arrival of Timothy M. Kuzel, MD, as chief of the Division of Hematology, Oncology and Cell Therapy. Not only has the number of open trials multiplied—from around 30 in early 2015 to nearly 150 by the end of 2016—but the focus of the research has broadened.

“Historically, our trials were mostly for breast cancer and lung cancer,” says Crista Brawley, PhD, CCRP, director of cancer clinical research. “But since 2015, Kuzel’s leadership and vision, we are also building up our gastrointestinal cancer, melanoma, lymphoma, pancreatic cancer, and head and neck cancer research programs.”

The expansion includes several early-phase, multisite trials, including studies of immunotherapy and other targeted therapies.

A PERFECT MATCH

It’s not a coincidence that the newer trials align with Rush’s patient population and areas of clinical expertise. “We want to make sure every study we take is a good fit for the types of cancers our oncologists treat,” Brawley says.

In addition to ensuring peak enrollment, this approach gives patients more treatment options at every stage of care. “Clinical trials are baked into routine cancer care here,” Brawley explains. “Our oncologists view trials as viable options—not just last-ditch treatments—and do a terrific job of finding qualified patients to enroll. They are involved in these studies and believe in them.”

EXPLORING IMMUNOTHERAPY

Kuzel, for instance, brought his decades-long passion for immunotherapy to Rush, an institution already known for its pioneering use of immunotherapeutic agents. Rush was a leader in trials for Herceptin and TDM-1—a known as “Super Herceptin”—for HER-2 positive breast cancer. Investigators at Rush have also participated in trials for lung cancer, melanoma and prostate cancer vaccines.

A nationally recognized authority in this rapidly evolving field, Kuzel is currently leading a trial comparing ipilimumab and nivolumab vs. anti-LAG-3 antibody and nivolumab for renal cancer; Rush was the first site in the U.S. to enroll a patient.

“We are seeing that when we combine therapies we often get higher rates of response and better efficacy,” Kuzel says. “So there is definitely reason to be encouraged by this approach.”

DELIYERING A ONE-TWO PUNCH

Perhaps the most promising results are coming from combination immunotherapeutic approaches, which are being studied for patients who don’t respond to single-drug regimens.

One combined therapy already FDA-approved for melanoma marnies ipilimumab and nivolumab, two checkpoint inhibitors that block receptor molecules on the surface of immune T cells. Kuzel is currently leading a trial comparing ipilimumab and nivolumab with an anti-CD8 T-cell blocker for pancreatic cancer; Rush was the first site in the U.S.-based on a trial comparing ipilimumab and nivolumab vs. anti-LAG-3 antibody and nivolumab for renal cancer; Rush was the first site in the U.S.

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STREAMLINES THE PROCESS

With so many immunotherapies being developed, and at such a fast pace, studying all of the various combinations is challenging. “It requires a lot of both patience and persistence to get results,” Kuzel says.

To expedite the process, Rush has partnered with a pharmaceutical company to administer small, rapid rotations of various combination immunotherapies to renal cancer patients. The goal is to get these drugs to patients faster and more efficiently so doctors can identify sooner whether a specific treatment warrants a more exhaustive trial.

“The process can take years. That’s why we are looking at novel trial designs that enable us to know sooner whether a treatment has any merit,” Kuzel says. “If it does, we can then move more quickly into a large randomized trial that the FDA would sanction for approval.”

A PERSONALIZED APPROACH

Brawley and her colleagues in the Cancer Clinical Trials Office share Kuzel’s — and Rush’s — commitment to bringing the latest therapies to patients.

That’s why cancer research nurses participate in all comprehensive cancer clinics and conferences. “We have a seat at the table along with the physicians, so we’re able to present any trials that may be good options for specific patients,” Brawley says. “Our goal is to make sure both the care teams and patients are able to make fully informed treatment decisions.”

The cancer clinical trials staff grew by more than 20 percent in 2016 to help investigators develop, activate and manage the influx of new trials.

With Kuzel at the helm and all of the operational pieces in place, the program anticipates continued expansion. “But more important than simply increasing volumes,” Kuzel says, “patients are coming to Rush for trials because we offer the novel trials they are seeking.”

The science behind immunotherapy

Basic scientists at Rush are helping to shape the future of cancer care, including these current investigations related to immunotherapy and the immune response to cancer.

THE LAB OF VINIET GUPTA, PHD

Gupta and his team are developing novel, immune-targeted small molecule therapeutics to treat both cancer and autoimmune diseases. The group has developed several compounds that target tumor-associated macrophages (TAMs) in the tumor microenvironment to enhance antitumor T-cell immunity.

“These agents show high efficacy in reducing tumor burden and growth in many experimental models of solid tumors, including pancreatic cancer, breast cancer, melanoma and lung cancer,” Gupta says.

He and colleagues are also working to develop this approach into an oral agent that could potentially be a treatment for solid tumors and sarcomas; they hope to initiate phase I clinical trials in patients in the second half of 2017.

THE LAB OF AMANDA MARZO, PHD

Management of head and neck squamous cell carcinoma (HNSCC) currently consists of multiple-modality therapies, including surgery, radiation and chemotherapy. Although significant advances have been made in targeted therapies, HNSCC recurrence, resistance to chemotherapeutic and cervical lymph node metastasis remain significant factors contributing to the poor prognosis of patients with HNSCC,” says Marzo.

Marzo’s lab is attempting to identify and characterize the molecular mechanisms underlying HNSCC initiation and progression, with the goal of enabling earlier diagnosis and developing more effective treatments. The group is studying the synergistic potential in targeting a combination of IL-15 therapy with co-inhibitory molecule blockade to elicit durable antitumor immunity and enhanced immunoreactivity of tumor antigen-specific CD8 T cells.

“Patients are coming to Rush for trials because we offer the novel trials they are seeking.”

- TIMOTHY M. KUZEL, MD, CHIEF OF THE DIVISION OF HEMATOLOGY, ONCOLOGY, CELL THERAPY
Supporting Patients Through Cancer

The Institute of Medicine (IOM) report Care for the Whole Patient reported that patients are less able to adhere to their treatment and manage their illnesses and health when psychological and emotional problems are present.

In recent years, the report has helped shine the spotlight on supportive care — and the critical need for it — especially among cancer patients.

“Cancer patients’ needs are complex, and we need to have a support system to successfully manage those needs,” says Aidnag Diaz, MD, radiation oncologist and chair of the cancer committee at Rush.

THE IMPORTANCE OF SUPPORTIVE CARE

While new treatments and techniques, like immunotherapy and plasma technology, are revolutionizing cancer care — and ultimately providing cancer patients with more options and improved outcomes — strengthening supportive care can be just as important for patients’ survival.

“It doesn’t matter how advanced patients’ treatments are if they do not have the means to travel to get to an appointment, if they do not have an emotional support network, if they are struggling financially or if they are not eating right,” says Diaz. “If they don’t have these important elements in place, they’ll have a lower chance of surviving the cancer.”

Rush is providing the best of both worlds: innovative, cutting-edge elements in place, they’ll have a lower chance of surviving the cancer.

DISTRESS SCREENING

An important first step in supportive care is meaningful distress screening that helps reveal the severity of patients’ psychological, social, financial, nutritional and behavioral hardships. Rush has focused much of its supportive care efforts on implementing a comprehensive distress screening program to help guide patients to the supportive services they need.

Clinicians use a number of validated tools, including questionnaires, to determine patients’ levels of distress and specific needs. “We’re finding out a lot of information beyond distress; we’re also finding out if they have questions about their treatment, if they have spiritual concerns, how pain is interfering with their lives and what is happening in their day-to-day lives,” says James Gerhart, PhD, director of psychosocial oncology.

Providers then input patients’ answers into their electronic medical records, which automatically generates referrals to social work, palliative care, nutritional counseling and so on.

BUILDING A SUPPORTIVE CARE PROGRAM

The goal of the supportive care program at Rush is to prevent, treat or manage the symptoms of cancer, the side effects of treatment, and the psychosocial, social and spiritual problems related to cancer.

Supportive care encompasses much more than end-of-life and palliative care. At Rush, supportive care includes the following range of services:

- Distress screening
- Psychosocial services
- Pain management
- Nutritional counseling
- Complementary, alternative therapies (e.g., acupuncture, massage therapy)
- Palliative care services
- Occupational therapy
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- Transportation services

NURSES’ VITAL ROLE

Nurses in the infusion center have been instrumental in improving distress screening and connecting patients with the supportive services they need. Patients spend anywhere from 30 minutes to eight hours receiving an infusion, allowing them to get to know their infusion nurses well and feel comfortable confiding in them.

“We have always been concerned with the day-to-day quality of life issues of our patients,” says Kati Cousins, BSN, RN, OCN, infusion nurse coordinator.

“The screening helps us identify specific hardships more thoroughly. These are not easy conversations to have, especially when it comes to psychosocial challenges, depression and financial struggles. But screening has helped open the door to have a frank conversation.”

Cousins and her colleagues regularly communicate with patients’ primary oncologists to help provide a comprehensive view of what is happening with the patient.

How stress affects outcomes of stem cell transplant

Stress can have indirect and direct effects on a cancer patient’s outcomes. Stress can interfere with patients’ ability to communicate well with their care team and follow their treatment plans properly.

“There is also evidence that shows when you are stressed, your immune system isn’t optimized,” says James Gerhart, PhD, director of psychosocial oncology.

“We know that across almost every disease — including all kinds of cancer — depression is linked to mortality. That is why screening for distress and addressing it is such an important part of care.”

Gerhart and his colleagues looked at the role of trauma-related stress symptoms to help determine the role of stress in stem cell transplant outcomes.

The study, published in Psycho-Oncology, assessed emerging evidence that suggests trauma-related stress symptoms can predict significant health complications following stem cell transplant. The study looked at traumatic stress after stem cell transplant as a predictor of neutrophil recovery, a crucial component of immune defense against infection.

The study followed 51 autologous stem cell transplant recipients who were assessed for trauma-related stress symptoms seven days after transplant. The patients’ neutrophil counts were then collected for the first 30 days following transplant.

The study found that the presence of trauma-related stress symptoms seven days after stem cell transplant was significantly associated with slower neutrophil recovery.

The researchers concluded that while trauma-related stress symptoms may be a normal response to stem cell transplant, trauma-related stress following a transplant may interfere with neutrophil recovery and overall health.

“This study fits in with the rationale for why distress screening and supportive care are so important,” says Gerhart. “It provides good evidence that traumatic stress is related to poor medical outcomes for patients who receive a stem cell transplant.”

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Solving the Puzzle of Lung Cancer

Forty years into his career as a medical oncologist specializing in lung cancer, Philip Bonomi, MD, looks to the past to inform his vision of the future. “Consider breast cancer,” he says. “First mammography found more operable, early-stage cancers, which adjuvant chemotherapy was shown to help improve long-term survival, and then targeted therapies like Herceptin (trastuzumab) led to even greater improvements.” Five-year survival for breast cancer patients in the U.S. increased from 63 percent in the early 1960s to about 90 percent today.

Bonomi thinks lung cancer — whose five-year U.S. survival rate hovers around 16 percent — is headed in the same direction. “It won’t become evident for another 10 or 15 years,” he predicts. “Screening still needs to gain traction, and we need to figure out which targeted therapies are effective in those early-stage patients who need additional treatment.”

The lung cancer team at Rush is focused on solving precisely these parts of the lung cancer puzzle. In the past year, they have expanded Rush’s lung cancer screening program and conducted research that points the way toward more effective diagnosis and treatment. This work has built on their decades-long practice of applying their cumulative knowledge to the most pressing problems in the field — and, of course, to each individual patient’s case.

Fitting the Pieces Together

SCREENING: A LARGER PROGRAM, FEWER FALSE POSITIVES

The Rush lung cancer screening program has certification from the American College of Radiology (ACR) and is a designated center of excellence from the Lung Cancer Alliance.

The program also increased its year-over-year patient volume and added services provided by a new full-time lung cancer screening coordinator, Linda Dowling, RN. Dowling counsels patients before and after screenings, offers classes and one-on-one assistance to help them quit tobacco, and enrolls those who consent in Rush’s biorepository (see Translational Research below).

She works closely with Palmi Shah, MD, a thoracic radiologist who evaluates all screening patients using the ACR’s recently released Lung-RADS (lung CT screening reporting and data system) criteria. The ACR found that these criteria reduced false positives from 26.6 percent to 12.8 percent when retrospectively applied to National Lung Screening Trial (NLST) data.

The NLST results suggested in 2011 that screening with low-dose CT reduced mortality by 20 percent in older patients with the equivalent of a 30-year/pack-a-day smoking history. In 2013, the U.S. Preventive Services Task Force enshrined the finding as a recommendation. Private insurance and CMS now cover low-dose CT screening for patients with the equivalent of a 20-year/pack-a-day smoking history.

In 2015 and 2016, the lung cancer screening program identified 12 lung cancers, and five other clinically silent malignancies.

SURGERY: BUSIEST IN ILLINOIS, AMONG THE BEST IN THE U.S.

In 2016, the Society of Thoracic Surgeons designated the Rush Department of Cardiovascular-Thoracic Surgery as a three-star program for lobectomy. It is the society’s highest rating, bestowed on the top 5 percent of thoracic surgery programs in the U.S.

Michael Liptay, MD, chairperson of the Department of Cardiovascular-Thoracic Surgery, attributes this unusually high quality to his team’s unusually robust experience. Thoracic surgeons at Rush have performed around 900 lung surgeries over the past three years, including more video-assisted thoracoscopic surgeries (VATS) than any other team in Illinois.

Rush’s growing lung cancer screening program (see Screening above) is likely to nudge this figure even higher. Between 2014 and 2016, thoracic surgeons at Rush performed VATS on nine of the 13 Rush patients whose cancers were detected via screening.

TRANSLATIONAL RESEARCH: THE SEARCH FOR BIOMARKERS CONTINUES

In 2016, the Rush University Cancer Center biorepository began collecting blood samples from lung cancer screening patients (see Screening above), expanding what was already one of the world’s largest institutional repositories of blood and tissue samples from patients with thoracic lesions. (Over the past decade, most patients whose lung tumors have been biopsied or resected at Rush have agreed to enroll the biorepository.)

Using this unique resource, a team led by biochemist Jeffrey A. Borgia, PhD, has been working to identify several distinct panels of protein biomarkers that will help personalize treatment selection in order to ensure that all patients, regardless of their stage of disease, receive the most effective care possible.

Thanks to the new samples from screening patients — about 10 percent of whom fall outside current screening criteria — the team is also searching for biomarkers that could lead to a “prescreening” test designed to detect additional populations that might benefit from screening.

THERAPEUTICS: FOCUS ON IMMUNOTHERAPIES, CANCER CACHEXIA

In 2016, medical oncologists at Rush continued to participate in multicenter trials of several immunotherapies for advanced and early-stage lung cancers, including the following:

• Phase I/II studies of investigational monoclonal antibodies and a small molecule, given as single agents and in combination to patients with advanced disease
• A phase II trial of crizotinib (AZD9291) — which targets a mutation in the epidermal growth factor receptor gene (EGFR mutation) — with and without adjuvant chemotherapy following surgery in early-stage patients

They will continue these studies this year, in addition to opening a phase III trial of chemotherapy combined with an immune-stimulating monoclonal antibody following surgery in early-stage lung cancer patients.

Researchers at Rush also continued their pioneering research on cancer cachexia. They had been among the first to report that weight gain during treatment for advanced lung cancer was associated with longer survival, suggesting that effective treatment can reverse the wasting (cachexia) that occurs in most patients at this stage. In the August 2016 issue of Annals of Oncology, they coauthored a large retrospective study confirming these earlier findings.

By continuing to study serial body weights and serum protein patterns in lung cancer patients, they hope to eventually identify targets for novel treatment strategies.

“What’s unique about our program is not only our breadth and depth but also our collaborative spirit.”

- MICHAEL LIPTAY, MD, CHAIRPERSON OF THE DEPARTMENT OF CARDIOVASCULAR-THORACIC SURGERY
The low-temperature plasma scalpel is an innovative new surgical tool that kills cancerous tissue remnants while sparing healthy normal tissue. Rush is using the technology in certain sarcoma and pancreatic cancer surgeries.

“Low-temperature plasma technology is one of the most innovative and exciting tools in cancer surgery today,” says Steve Gitelis, MD, director of the Section of Orthopedic Oncology. “This tool has great potential as a surgical oncology tool, and Rush is becoming a leader in using this technology.”

IMPROVING SARCOMA SURGERY

Gitelis has used the argon hybrid low-temperature plasma device in more than 50 surgeries in the past year. Rush is one of a few U.S. hospitals that uses the plasma scalpel, and Gitelis is the only surgeon in the U.S. to use the device to remove sarcomas. Traditional electrosurgical devices operate at high temperatures (typically 200°F or higher), which damage nerves, arteries and surrounding healthy tissue. The low-temperature plasma scalpel, however, operates at close to body temperature, which is less damaging.

“This is particularly important in limb-sparing sarcoma surgery to help preserve the vascular supply and the nerve supply to the organs near the tumor,” says Gitelis. “This tool allows me to operate next to those nerves and arteries with limited to no damage.”

Additionally, the device significantly reduces blood loss, which is critical in major, open sarcoma surgeries. In fact, transfusion rates are a fraction of what they are in orthopedic procedures using traditional methods.

HOPE FOR INOPERABLE PANCREATIC CANCER

The low-temperature helium plasma device is currently under investigational use for patients with inoperable cancers. An FDA compassionate use exemption allowed pancreatic cancer surgeon Keith Millikan, MD, to use this technology on a patient with inoperable stage IV pancreatic cancer. Rush was the first institution in the world to use the plasma scalpel on a human with pancreatic cancer.

The patient had borderline-resectable pancreatic cancer located very close to the portal vein and the superior mesenteric artery, along with cancerous nodules in the liver. “The patient had been receiving chemotherapy to keep the cancer at bay and had received the maximum amount of radiation possible; there were no other options for the patient,” said Millikan.

The patient underwent a Whipple procedure to remove parts of the pancreas, stomach, small intestine, liver tumor nodules and kidney. Millikan then used the plasma device to spray cold atmospheric plasma on the tissue immediately surrounding the tumor, the liver bed where he removed the nodules and the blood vessels to the intestine.

“The plasma sprays ions that change the intracellular mechanism of cancer cells without damaging normal tissue cells,” says Millikan. “The big advantage of this device is that we can get a larger margin. And since it doesn't hurt normal tissue cells, we can spray it on the artery that goes to the intestines, the vein that goes to the liver, and on the whole margin of resection.”

The patient is receiving regular chemotherapy treatments to prevent recurrence, but is otherwise back to a normal lifestyle. “Even if we have not cured him, we have given him a high quality of life for a while,” says Millikan. “He is walking well, eating what he wants, maintaining his weight and having normal bowel function. He is stronger now than he’s been since he was diagnosed over a year ago.”

Steven Gitelis, MD, is the only surgeon in the U.S. using plasma to remove sarcomas.

WHAT IS PLASMA?

Plasma is considered the fourth state of matter. It is an ionized gas (either argon or helium) that — when generated at a low temperature (about 60 to 98°F) — becomes cold atmospheric plasma.

The plasma scalpel has two applications: the argon hybrid low-temperature plasma device and the helium plasma device. The argon device is approved by the U.S. Food and Drug Administration (FDA) as a surgical cutting and coagulating tool. The thermoablative scalpel uses a high-frequency current to charge argon, which generates a beam of ions that cut and cauterize. Gitelis is also currently investigating using this device as an adjunct to prevent local recurrence.

The helium plasma device, currently under investigational use through a FDA compassionate use exemption, is an adjunct to cancer surgery. The device uses cold atmospheric plasma during surgery to eradicate microscopic cancerous tissues and cells and provides a better surgical margin of resection than conventional surgery.
Antibody that specifically targets and binds cancer cells. The photosensitive drug is the immune system’s ability to target only cancer cells when exposed to a specific light wavelength. But in this form of cell-killing oxygen when exposed with a photosensitive drug that produces a payload drug that is inert unless activated by laser light, and the laser does not harm healthy tissue.

**WHAT IS PHOTOIMMUNOTHERAPY?**

Photodynamic therapy is the technique that involves injecting patients with a photosensitive drug that produces a form of cell-killing oxygen when exposed to a specific light wavelength. In photodynamic therapy, physicians incorporate drugs that target various forms of cancer. The drugs used are called photosensitizers, and they are activated by light, which triggers a photochemical reaction that kills cancer cells.

**IMPROVED PRECISION AND SAFETY**

While photodynamic therapy kills cancer quickly, photodynamic therapy is unique and promising is how it allows us to precisely and selectively deliver cancer-killing power. The payload drug is inert unless activated by laser light, and the laser does not harm healthy tissue.

“Getting inside the cancer cell means we can get systemic treatment locally more than with any other treatment,” says Stenson.

The lethal blow delivered to cancer cells is delivered by water, not radiation or a toxic chemotherapy drug. Therefore, patients treated with photodynamic therapy do not run the post-procedure risk of toxic sunburns as do patients who receive photodynamic therapy, those patients must stay out of the sun for several weeks due to trace amounts of the photosensitizer drug, which can be activated by sunlight.

**COLLABORATIVE CARE**

While the technique is currently being tested only for recurrent head and neck cancer, there is potential for photodynamic therapy to be used as a first-line therapy for other cancers, and possibly as a part of a novel combination therapy with surgery.

Fidler, who has led a series of research efforts designed to prove the effectiveness of immunotherapy and chemotherapy combinations for lung cancer, notes that the EGFR proteins in lung cancer are also the signature of other tumor types. Thus, using other monoclonal antibodies in this technique may benefit patients beyond the head and neck population. If the clinical trial establishes the effectiveness of the technique, the photosensitizer could be combined with immune checkpoint inhibitors and immune-stimulating drugs that target other forms of cancer.

“This technique is the epitome of collaboration between surgery and medical oncology,” says Stenson. “It is the most exciting and promising therapy I’ve ever been involved with.”


definitions

**PHOTOBOMBING CANCER: A NEW THERAPY ENTERS THE PICTURE**

Two Rush physicians are leading the development of an innovative therapy that combines the immune system’s ability to precisely target cancer cells with laser energy’s ability to destroy them. This combination provides an option for patients in the final stages of head and neck cancer.

Kerstin Stenson, MD, director of the head and neck cancer program, and Mary Jo Fidler, MD, oncologist, are the principal investigators for a phase I clinical trial testing the experimental photodynamic immunotherapy technique for patients whose advanced head and neck cancer has not responded to chemotherapy or radiation and cannot be addressed surgically. Rush is the only center in Illinois offering this treatment.

**WHAT IS IMMUNOIMMUNOTHERAPY?**

Immunotherapy is an extension of the existing photodynamic therapy technique that involves injecting patients with a photosensitive drug that produces a form of cell-killing oxygen when exposed to a specific light wavelength. In immunotherapy, physicians incorporate the immune system’s ability to target only cancer cells. The photosensitive drug is combined with rituximab, a monoclonal antibody that specifically targets and binds with epidermal growth factor receptor (EGFR) proteins present at abnormally high levels on the surface of the vast majority of head and neck cancers.

Administered intravenously, this photosensitizer/antibody conjugate — referred to as a payload drug — circulates throughout the patient’s body but only latches onto the EGFR cells. The next day, Rush physicians allow tiny laser optic fibers near the surface of the tumor or directly into the tumor through small catheters. The laser light energy that then beams through the fibers sets off millions of molecular-level explosions where the photosensitizer/antibody conjugate has accumulated: the surface of cancer cells.

The weakened cancer cell walls collapse, nearby water molecules rush in and “the cancer cells basically burst,” says Stenson. “Almost immediately, you can see the tumor become necrotic. It becomes white, dies and melts away.”

**IMPROVED PRECISION AND SAFETY**

While photodynamic therapy kills cancer quickly, Stenson stresses that what makes this first-in-class approach so unique and promising is how it allows her to precisely and selectively deliver cancer-killing power. The payload drug is inert unless activated by laser light, and the laser does not harm healthy tissue.

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**TORS causes less long-term damage than open procedures,” says Al-Khudari. “Patients who undergo this type of surgery have fewer cosmetic and functional side effects. They also typically receive lower doses of radiation. All of this offers these patients a better quality of life in the long-term.”

Research, however, has found that HPV-related cancers can — and should — be treated less massively. Head and neck surgeons at Rush use minimally invasive transoral robotic surgery (TORS) to treat these HPV-related cancers of the throat, tonsil, tongue and larynx. With TORS, a surgeon uses a guided endoscope to access the back of the mouth and transorally remove the cancer and surrounding tissue, without damaging healthy surrounding tissue.

“TORS causes less long-term damage than open procedures,” says Al-Khudari. “Patients who undergo this type of surgery have fewer cosmetic and functional side effects. They also typically receive lower doses of radiation. All of this offers these patients a better quality of life in the long-term.”

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- SAMER AL-KHUDARI, MD, HEAD AND NECK SURGEON
Improving Diagnostic Accuracy in Lymphoma

Image-guided surgery has been widely used in neurosurgery, thoracic surgery and otorhinolaryngology, and it is now playing a role in cancer diagnostics. Cancer surgeons at Rush have started using this technology to improve diagnostic accuracy for biopsies of intra-abdominal masses in patients with suspected lymphoma.

One of the biggest challenges of performing laparoscopic biopsies of these masses is accurately locating the mass amidst intra-abdominal tissue and fat. Surgeons often have to convert to open procedures to get the most accurate biopsy.

To address this issue, investigator-clinicians at Rush sought to adapt existing image-guided technology to improve minimally invasive, or laparoscopic, biopsies for these patients. “The goal is to reduce the frequency of, and need for, converting to an open procedure,” says Jonathan Myers, MD, general surgeon.

This approach reduces patients’ time in the hospital and recovery time, while also allowing them to begin treatment more promptly. “If patients have a big, open incision, they frequently can’t start treatment within several days, which is a huge advantage,” says Myers. “If patients have a big, open incision, they frequently can’t start treatment within several days, which is a huge advantage.”

AN INTEGRATIVE PROCESS

Image-guided laparoscopy begins with surgeons uploading perioperative imaging into the platform prior to the procedure. The surgeons then sync the images to landmarks on the patient, allowing them to accurately navigate the laparoscopic instrument toward the target lesion and biopsy it — all while viewing it on a monitor.

“This technique improves accuracy in getting to the actual tissue that will give the oncologist the most comprehensive, accurate diagnosis,” says Myers.

Frequently, patients will have multiple lymph nodes in their abdomen for a disease like lymphoma. This makes determining which lymph nodes to biopsy a challenge. To determine which lymph nodes to biopsy, Myers notes that a CT-PET scan, which shows tumor activity, is the preferred imaging test.

“The most useful lymph nodes to biopsy are ones that are PET-avid, which are the most active ones,” says Myers. “There’s no way to just look at a lymph node to know if it’s PET-avid or not. However, when I upload the CT-PET scan to our platform and sync that to our patient, I can look for a PET-avid mass on the monitor, and I can biopsy that exact one.”

The PET-avid mass or tumor provides the most accurate, useful information available — allowing the oncologists to determine a diagnosis and, ultimately, treatment protocol.

“Over the past several years, a CT-PET scan has become more important than other types of imaging, such as CT alone, in terms of determining the extent of disease, as well as the response to treatment and remission, which in turn determines the outcome of the patient,” says Parameswaran Venugopal, MD, hematologist.

PERSONALIZING TREATMENT

Appropriate tumor tissue sampling is the first step in the management of lymphoma. “We depend heavily on the results of the biopsy for determining treatment and managing the patient,” says Venugopal. “This unique biopsy technique has made a significant difference in our patient management.”

Lymphoma treatment, for instance, is personalized in terms of identifying targets — including proteins, pathways or molecular abnormalities — in the tumor cell. “We use those targets to personalize treatment options for each patient,” says Venugopal. “Without adequate tissue from the biopsy, we can’t personalize the treatment.”

This type of personalized care is the hallmark of Rush’s lymphoma program. The Coleman Foundation Comprehensive Lymphoma Clinic brings together a number of different specialists to review cases and determine the best treatment plan for patients.

In addition to combining clinical expertise, the lymphoma team also makes patients’ personal needs a priority. “We personalize everything to the patient when we are designing a treatment program,” says Kelly Szynanski, NP, lymphoma program coordinator.

“In addition to their test results, we consider their backgrounds, preferences, support network, financial challenges, travel times and much more. We have a good support system here for them. It’s very much about each individual patient, not just their disease.”

Integrating Big Data with Cancer Care

As the role of big data in health care continues to make headlines, Rush has taken steps to integrate big data with a personal approach to cancer treatment through a partnership with Tempus, a tech startup focused on bringing genomic data to a clinical setting.

Through this partnership, cancer patients at Rush now have the option of undergoing genetic analysis that may allow their oncologists to customize treatments for their particular cancer.

Advances in genetic science and cancer care increasingly are enabling researchers and clinicians to design treatments for cancer that specifically target genetic mutations that lead to disease.

“As we get a better understanding of how these tumors grow and develop, we can design drugs that affect the mutated genes but not the normal ones,” says Robert DeCresce, MD, pathologist and interim director of the Rush University Cancer Center. “This is the area of big promise.”

STANDARDIZING MOLECULAR DIAGNOSTICS

Tempus takes a unique approach to testing, focusing on highly personalized data. “Currently, commercially available genetic testing is only able to inform on mutations that are identified within a tumor itself,” says Nick Pfanzelter, MD, medical oncologist.

“However, our approach with Tempus will also look at the germline genes. That means we’ll be looking at both sporadic changes in the tumor and those that the patient was born with. This provides a better understanding of the mutations in the cancer.”

USING DATA TO DRIVE TREATMENT

After sequencing a patient’s genes, Tempus performs a computerized analysis to compare the patient’s genetic information with the company’s large, proprietary biological database. The analysis uses machine learning and advanced bioinformatics to search for patterns that are potentially relevant for patients unlikely to respond to conventional therapies.

“Tempus tells us which drugs similar patients have been treated with and how similar patients have done based on national clinical trial information and Tempus’ database,” DeCresce says.

The company can also recommend current clinical trials that are accepting new patients and might benefit the patient. The ultimate goal is to determine more targeted, personalized treatments. “We’re trying to identify either new mutations that might respond to new therapies or new tumor types for which an existing therapy might provide patient benefit,” says Pfanzelter. “We’re also hoping to find new combinations for patients.”

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Quality of Life After Skull Base and Sinus Tumor Surgery

One of the challenges in treating skull base and sinus tumors is that there is no easy way to access them. These tumors are often located precariously close to the optic nerve, olfactory nerve and brain. This creates a high risk for morbidity after surgery. Further, these cancers often present with nonspecific nasal symptoms, which means they are typically in a more advanced stage by the time they are diagnosed.

OLD VS. NEW
Transnasal endoscopic resection, however, has substantially changed the once grim quality of life outlook for patients with these complex tumors.

Since 1960s, the primary method to treat these tumors was a craniotomy, a radical craniofacial resection. These large, open procedures can lead to high patient morbidity and significantly diminished quality of life after surgery. “People often can’t function and work in the same way after these surgeries,” says Pete Batra, MD, a rhinology and skull base surgeon and co-director of the Rush Center for Skull Base and Pituitary Surgery.

Improved endoscopic technologies over the last 10 years have helped pave the way for minimally invasive transnasal endoscopic resection, which provides comparable outcomes to open surgery to treat skull base and sinus tumors.

“Working through the nose, we can now resect these tumors using oncologic principles with negative margins,” says Bobby Tajudeen, MD, a rhinology and skull base surgeon. “This minimally invasive approach also helps us avoid major side effects that affect quality of life, such as complete smell loss and cosmetic effects.”

Batra and Tajudeen are leaders in the field of transnasal endoscopic resection for skull base and sinus tumors. While patients with the most advanced and complex tumors may still require open procedures, the majority of patients can be treated with endoscopic resection, according to Batra.

PSYCHOLOGICAL IMPROVEMENTS
Batra and Tajudeen are also conducting extensive research on quality of life after minimally invasive procedures for these complex cancers.

Batra has done a number of studies assessing long-term changes in quality of life after endoscopic resection for sinus and skull base tumors. In one study, published in the International Forum of Allergy & Rhinology, Batra and his colleagues followed 72 sinus cancer patients for two years after surgery, analyzing data at one year and then again at two years. The team measured patients’ quality of life with the sino-nasal outcome test (SNOT-20) — which looks at nasal symptoms, along with quality of life factors (e.g., sleep quality, mental state).

The study revealed that the endoscopic approach resulted in overall improvements in quality of life. “We found that patients’ nasal symptoms did get better, but they didn’t normalize,” says Batra. “But we did find that patients’ sleep function and overall psychological well-being improved significantly after undergoing surgery.”

Further, the study found that quality of life improvements across the board are lower for patients who have one-sided tumors, who underwent unilateral endoscopic resection of esthesioneuroblastoma.

“Historically, for this type of cancer, we’ve done aggressive surgery and resected many of the smell mechanisms,” Tajudeen says. “But this study shows that for carefully selected patients who have one-sided tumors, we can do a minimally invasive endoscopic resection approach from one side, sparing the smell fibers.”

The study found that 43 percent of the patients who had residual smell function, with 14 percent having normal or mildly reduced smell function.

Beyond smell preservation, this minimally invasive approach also offers all the other benefits of less aggressive surgery (see Endoscopic Resection vs. Open Surgery sidebar).

“While you can intuitively assume that would be a win-win for patients who are or have been smokers. “While you can intuitively assume that would be the case, there had not been data to back up that assumption; this is the first time we’ve

SMELL PRESERVATION
A common side effect of skull base and sinus tumor surgery is complete smell loss. “Smell loss can be debilitating in terms of detecting hazards, and when you completely lose your sense of smell you also cannot taste anything, which certainly impairs quality of life,” says Tajudeen.

Endoscopic resection, however, may help preserve sense of smell in certain patients. For example, the gold standard treatment for esthesioneuroblastoma (also known as olfactory neuroblastoma), a rare cancer in the nasal cavity, is en bloc craniofacial resection.

“It used to be that if you had this type of olfactory neuroblastoma, we would have to do very aggressive surgery, removing the dura and the olfactory nerve,” says Batra. “But with more thoughtful treatment like transnasal endoscopic resection, we can remove the cancer with comparable survival without open radical surgery. It’s a win-win.”

ENDOSCOPIC RESECTION VS. OPEN SURGERY

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<tr>
<th>ENDOSCOPIC RESECTION</th>
<th>OPEN SURGERY</th>
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<tr>
<td>LENGTH OF HOSPITAL STAY</td>
<td>2 to 5 days</td>
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<tr>
<td>PAIN MANAGEMENT- IN HOSPITAL</td>
<td>Pain is generally managed with low-dose oral pain medications, including narcotics</td>
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<tr>
<td>PAIN MANAGEMENT- AT HOME</td>
<td>Within a week after surgery, patients can be weaned off narcotics and onto extra strength acetaminophen</td>
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<tr>
<td>RETURN TO NORMAL ACTIVITY</td>
<td>2 to 6 weeks</td>
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<td>COSMETIC SIDE EFFECTS</td>
<td>No cosmetic side effects</td>
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The role of my research is to find the preclinical evidence needed prior to moving into clinical research, which will help determine how cancers with the NF1 mutation will react to certain drugs, with medical oncologist, Abukhdeir hopes that his work will move patients "one step closer" toward manipulating the gene. "This allows us to see how and when a benign cell begins to change when we can manipulate one gene at a time to push it toward cancer — mimicking the natural process," he says. "It is the opportunity for more in-depth, realistic data. "We take a normal, noncancerous cell and genetically engineer it looking at an exaggerated effect from putting in hundreds of copies of a gene. This provides more in-depth, realistic data. "We take a normal, noncancerous cell and genetically engineer it to manipulate one gene at a time to push it toward cancer — mimicking the natural process," says Abukhdeir. "This allows us to see how and when a benign cell begins to change when we manipulate the gene." Collaborating with Melody Cobleigh, MD, medical oncologist, Abukhdeir hopes that his research will help determine how cancers with the NF1 mutation will react to certain drugs, with the ultimate goal of providing more targeted treatments to breast cancer patients. "The role of my research is to find the preclinical evidence needed prior to moving into clinical trials to test the effect of specific drugs on breast cancers with NF1 mutations," says Abukhdeir.

**The Impetus for Abukhdeir's NF1 Research**

Abukhdeir's research revolves around the heterogeneous nature of cancer. For instance, in metastatic disease, one lesion is never identical to another. The genetic variability in the cells is responsible for different levels of drug resistance and aggressiveness of the cancer. "Cancer is caused by damaged DNA," he says. "There are changes in certain genes in breast cancers, and we treat these cancers differently based on these changes. There are a few genes that are very frequently changed, and we know what to do with those cancers when they change." However, there are many genetic mutations that are less common and, thus, studied less often and in less depth. "For those genes, we can only extrapolate about what drugs to give to patients based on what we know about biology rather than specific scientific testing," he says. "My team and I are looking at those genes more scientifically.

**The NF1 Gene**

Abukhdeir's Lynn Sage-funded research centers on the neurofibromin 1 (or NF1) gene. Every person has two copies of NF1 in each cell. Most breast cancer patients with a NF1 mutation have breast cells that developed one or two bad copies of NF1. "Most labs in the cancer world look at what happens to the gene when a patient has cancer: Was it mutated or deleted — or are there extra copies of it?" says Abukhdeir. "Most labs use artificial tools that will deplete the gene product or put in tens or hundreds of copies of the gene, and then they study the effects. While that is fine for certain studies, that is not what happens in a real patient." In his lab, Abukhdeir is working on recapitulating what happens in real patients, rather than looking at an exaggerated effect from putting in hundreds of copies of a gene. This provides more in-depth, realistic data. "We take a normal, noncancerous cell and genetically engineer it to manipulate one gene at a time to push it toward cancer — mimicking the natural process," says Abukhdeir. "This allows us to see how and when a benign cell begins to change when we manipulate the gene."
GASTROINTESTINAL CANCERS

CLINICAL SPECIALISTS

Colorectal surgeons: Joanne Fawazza, DO, Bruce Orkin, MD, Marc Singer, MD

Gastroenterologists: Faraz Bishahni, MD, Salina Lee, MD, Johe Losardo, MD, Joshua Melson, MD, MPH, Sohrab Mobahari, MD, Peter Sargon, MD

General surgeons: Daniel Dezel, MD, Minh Luu, MD, Keith Millikan, MD, Jonathan Myers, MD, Benjamin Veenstra, MD

Interventional radiologists: Bulent Arintan, MD, Allan Chen, MD, Jordan Tasse, MD, Ukko Cerk Turba, MD

Liver radiotherapists: Ross Abrams, MD, Neklyan Sen, MD

Medical oncologists: William Leslie, MD, Lawrence Schilder, DO

Pathologists: Brian Fishman, MD

Radiation oncologists: Matthew Colman, MD, Kern Singh, MD

PEDIATRIC CANCERS

CLINICAL SPECIALISTS

Orthopedic oncologist: Shawn Giraldo, MD

Pediatric endocrinologists: Stelois Marits, MD, Carla Minniti, MD

Pediatric hematologist/oncologists: Lisa Boggs, MD, Paul Kent, MD, Nupur Mittal, MD, Mindy Simpson, MD

Pediatric neurooncologists: Sharon Byrd, MD, Mehmet Kocak, MD

Pediatric neurosurgeon: Lorenzo Murzio, MD

Plastic and reconstructive surgeon: Gordon Derman, MD

Radiation oncologists: Ross Abrams, MD, Aidnag Diaz, MD, MPH

SPINE TUMORS

CLINICAL SPECIALISTS

Neurosurgeons: Richard Ressler, MD, Ricardo Fontes, MD, PhD, John O’Toole, MD, MS

Neuro-oncologist: Clement Flemming, MD

Orthopedic surgeons: Matthew Colman, MD, Karn Singh, MD

Radiation oncologist: Aidnag Diaz, MD, MPH

SPINE TUMOR CONFERENCE

Thursday, 9 a.m. to noon, Woman’s Board Cancer Treatment Center, 500 S. Paulina St.
### New Cancer Incidence by Diagnosis Year, 2011-2015

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>942</td>
<td>789</td>
<td>1731</td>
</tr>
<tr>
<td>2012</td>
<td>2957</td>
<td>2938</td>
<td>5895</td>
</tr>
<tr>
<td>2013</td>
<td>2894</td>
<td>2868</td>
<td>5762</td>
</tr>
<tr>
<td>2014</td>
<td>2841</td>
<td>2841</td>
<td>5682</td>
</tr>
<tr>
<td>2015</td>
<td>2841</td>
<td>2944</td>
<td>5785</td>
</tr>
</tbody>
</table>

### Analytic Case Distribution by Gender and Age at Diagnosis, 2015

#### Age Groups

<table>
<thead>
<tr>
<th>AGE GROUP</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-25</td>
<td>72</td>
<td>46</td>
<td>118</td>
</tr>
<tr>
<td>25-39</td>
<td>103</td>
<td>56</td>
<td>159</td>
</tr>
<tr>
<td>40-49</td>
<td>256</td>
<td>239</td>
<td>495</td>
</tr>
<tr>
<td>50-59</td>
<td>285</td>
<td>282</td>
<td>567</td>
</tr>
<tr>
<td>60-69</td>
<td>199</td>
<td>202</td>
<td>401</td>
</tr>
<tr>
<td>70-79</td>
<td>78</td>
<td>72</td>
<td>150</td>
</tr>
<tr>
<td>80-89</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>90+</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

### Top 10 Analytical Sites in Comparison to National, 2015

<table>
<thead>
<tr>
<th>SITE</th>
<th>Rush</th>
<th>USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thyroid</td>
<td>18.8%</td>
<td>17.7%</td>
</tr>
<tr>
<td>Kidney/Bowel Pelvis</td>
<td>15.2%</td>
<td>14.7%</td>
</tr>
<tr>
<td>Colorectal</td>
<td>23.7%</td>
<td>24.2%</td>
</tr>
<tr>
<td>Prostate</td>
<td>10.2%</td>
<td>10.7%</td>
</tr>
<tr>
<td>Breast</td>
<td>4.9%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Uterus</td>
<td>2.9%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Thyroid (other)</td>
<td>1.9%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Leukemia</td>
<td>1.9%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Lymphoma</td>
<td>1.9%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Pleural</td>
<td>1.9%</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

### Analytic Cases
- Sites diagnosed and/or treated at or part of first course of care at Rush University Medical Center.
- Nonanalytic: Sites diagnosed and all first course treatment completed elsewhere.

This chart represents the Cancer Registry Report by first contact.
saxagliptin and metformin is effective as initial treatment for Type 2 diabetes.


The Rush University Cancer Center comprises all of the cancer-related clinical, research and educational efforts at Rush, crossing 20 departments, divisions and sections; inpatient and outpatient areas; professional clinical activities; and the colleges of Rush University.

For more information about cancer programs at Rush or to refer a patient for an initial visit or a second opinion, please call (312) CANCER-1 (226-2371).

Visit rush.edu/cancer to learn more.

Rush has received four consecutive outstanding achievement awards from the Commission on Cancer of the American College of Surgeons.

Rush is an academic health system comprising Rush University Medical Center, Rush Copley Medical Center and Rush Oak Park Hospital.

PLEASE NOTE: All physicians featured in this publication are on the medical faculty of Rush University Medical Center. Some of the physicians featured are in private practice and, as independent practitioners, are not agents or employees of Rush University Medical Center.

Photography by the Rush Photo Group and Eric Herzog.