



Rusk Rehabilitation

2019 HIGHLIGHTS

Using Artificial Intelligence to Assist the Visually Impaired

High-tech tools offer promise for patients with visual or sensorimotor impairments

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Oncological Rehabilitation

Exploring the use of exercise as medicine, with a focus on cancer patients

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Improving the Odds of a Successful Transplant

Rehabilitation helps patients prepare for transplantation—and make a full recovery

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305,000+

Outpatient visits

Top 10

In *U.S. News & World Report*

179+

Conference posters and presentations

MESSAGE FROM THE CHAIR



STEVEN R. FLANAGAN, MD

Howard A. Rusk Professor of Rehabilitation Medicine
Chair, Department of Rehabilitation Medicine

This was an exhilarating year for Rusk Rehabilitation, with new initiatives aimed at helping patients regain their strength, independence, and quality of life.

This annual report presents some of our recent achievements, as well as complex cases in which patients benefited from our faculty and staff members' extraordinary expertise.

In 2019, our researchers created high-tech navigational tools for visually impaired patients. We explored the impact of exercise for oncology patients, working to advance its adoption throughout the field. Our clinicians enabled the amazing recovery of a young woman left with profound brain injuries after cardiac arrest. We partnered with NYU Langone's Transplant Institute to improve outcomes for patients receiving new organs.

Moving forward, we will continue to pursue our passion for restoring patients' abilities—and for exercising leadership that helps patients everywhere.



Cover image: Optical nerve.

PHOTO: GETTY IMAGES

High-Tech Tools Offer Promise for Patients with Visual or Sensorimotor Impairments

Recent advances in miniaturized sensors and actuators—as well as artificial intelligence—have broadened horizons for assistive and rehabilitative technologies. The laboratory of John-Ross Rizzo, MD, assistant professor of rehabilitation medicine and neurology, is leveraging these innovations to help patients with conditions such as blindness and stroke, enhancing their ability to interact physically with their environment.

STEP-BY-STEP GUIDANCE FOR VISUALLY CHALLENGED PEDESTRIANS

Dr. Rizzo’s focus is driven, in part, by his own experience as a patient with choroideremia—an inherited, progressive eye disorder that has left him legally blind. His team at Rusk Rehabilitation, in partnership with the NYU Tandon School of Engineering, is developing advanced wearable devices to provide visually impaired pedestrians with step-by-step navigational instructions and obstacle warnings. “Most wearables are designed to provide interoceptive information, like heart rate or sleep quality,” Dr. Rizzo explains. “Our devices focus on the wearer’s exteroceptive needs. We’re working to connect the quantified self with the quantified environment.”

These devices, currently in prototype form, are based on technology similar to that used in self-driving cars. The user wears a backpack, a waist belt and headphones. The belt and shoulder straps are fitted with specialized

cameras as well as infrared and ultrasound sensors, which transmit data to a microcomputer carried in the backpack. Visual imagery is processed by deep-learning software that is trained to recognize objects and faces as well as the user’s gestures, and to calculate the best route to a designated terminus. At the entrance to a supermarket, for example, a synthesized voice identifies each landmark (“door, table, shopping carts”) as the user sweeps a pointing finger from left to right. The user then uses gestures to indicate which object they wish to engage with, and the voice offers detailed guidance toward it. Haptic motors in the belt and straps provide error correction.

In April 2019, a team led by Dr. Rizzo presented at the Computer Vision Conference in Las Vegas on one of the lab’s projects: Cross-Safe, a computer vision-based approach to making intersection-related pedestrian signals accessible for the visually impaired. Conceived as part of a larger wearable device, Cross-Safe uses a compact processing unit programmed with a

specialized algorithm to enable identification and interpretation of crosswalk signals, and to provide situational as well as spatial guidance. A custom image library was built and developed to train, validate, and test the team’s methodology on actual traffic intersections. Preliminary experimental results, to be published in 2020 in *Advances in Computer Vision*, showed a 96 percent accuracy rate in detecting and recognizing red/green pedestrian signals across New York City.

HELPING STROKE PATIENTS REGAIN EYE-HAND COORDINATION

For many stroke patients, seeing an object isn’t the problem; reaching for it is. Beyond any underlying sensorimotor deficits, as Dr. Rizzo’s past research has helped demonstrate, stroke may impair eye-hand coordination by disrupting the cycle of feedforward predictions and feedback-based corrective mechanisms that normally link visual planning



John-Ross Rizzo, MD
PHOTO: NYU LANGONE STAFF

and limb movement. Existing rehabilitation techniques have limited success in restoring this delicate relationship. “Patients often hit plateaus in terms of recovery,” he observes. “We’re developing therapies designed to break through those plateaus and further boost function.”

In a study published in July 2019 in *Progress in Brain Research*, Dr. Rizzo and his colleagues pursued that goal using a computer game-like system that provided extrinsic feedback to correct reaching errors. Although such approaches have previously been explored in eye-hand re-coordination studies, they have targeted only the hand. This study was the first to test a biofeedback-based technique aimed at retraining the eyes as well.

Participants included 13 patients with a history of middle cerebral artery ischemic stroke, and 17 neurologically sound controls. Dr. Rizzo’s team used a headset fitted with miniature cameras that tracked each subject’s eye movements. A sensor attached to the index finger tracked hand movements across a table. To assess potential learning effects (secondary to the feedback focused on ocular motor errors) subjects participated in two trial blocks involving a pro-saccade look-and-reach task.

Subjects were instructed to move their eyes and finger as quickly as possible to follow a small white circle on a computer screen. In the first experiment, they received on-screen

feedback showing any discrepancy between the final location of the circle and that of the finger. In the second experiment, the feedback also included any discrepancy between the location of the circle and that of the subject’s gaze. In each experiment, controls participated in one session; stroke patients completed up to two sessions, one for each arm (if they were capable). Each session consisted of 152 reaches.

In the first experiment, the primary saccade produced by stroke participants consistently occurred earlier than in healthy participants, with finger movement lagging behind. Over the course of the second experiment, however, stroke patients significantly improved their performance—reducing errors in the timing of saccades and the accuracy of reach in both the more- and less-affected arms. (Non-stroke patients, paradoxically, grew slightly less coordinated when given feedback including ocular errors.) “We believe visual feedback through extrinsic spatial prompting served here has the potential to improve eye movement accuracy,” Dr. Rizzo and his co-authors wrote. Although further studies will be needed to optimize therapeutic outcomes, these results indicate that extrinsic feedback, in appropriate doses, may be a valuable tool for enhancing ocular motor capabilities in the setting of eye-hand coordination for stroke rehabilitation.



Advanced wearable device
PHOTO: NYU LANGONE STAFF

Rusk Insights on Rehabilitation Medicine Podcast

Podcast for PM&R Professionals



Learn more by visiting
nyulangone.org/rusk2019

Hear experts from NYU Langone’s Rusk Rehabilitation discuss the latest in research and treatment options during the Rusk Insights on Rehabilitation Medicine podcast.

Various topics covered, including but not limited to:

- Improving navigation in brain injury patients
- Integrative medicine approach in pediatric care
- Intersection of cardiac rehabilitation, mHealth, and telemedicine

Search “Rusk” on the Podcast app (Apple devices) or Stitcher (Android devices) to find the podcast and subscribe.



Research shows exercise can affect outcomes for cancer patients
PHOTO: GETTY IMAGES

Exploring the Use of Exercise as Medicine, with a Focus on Cancer Patients

Emerging research indicates that exercise not only can help prevent a wide range of chronic and acute diseases, but also can enhance outcomes and help prevent recurrence. Rusk Rehabilitation at NYU Langone Health is pioneering the use of this powerful tool, and working to develop protocols and policies for its widespread adoption.

A NEW PRESCRIPTION FOR CANCER SURVIVORS

In October 2019, an international roundtable of experts convened by the American College of Sports Medicine published new guidelines on the integration of exercise into cancer treatment. The report—entitled “Exercise is medicine in oncology: Engaging clinicians to help patients move through cancer”—recommended a minimum of thrice-weekly aerobic activity and twice-weekly resistance exercise for most patients and survivors, citing a growing body of scientific evidence supporting “the prescription of exercise to improve cancer-related health outcomes.” The co-authors issued a call to action to healthcare providers and policymakers to help make exercise assessment, advice, and referral a standard practice in clinical oncology.

Among the report’s co-authors is Jonas M. Sokolof, DO, clinical associate professor of rehabilitation medicine and director of the division of oncological rehabilitation at Rusk Rehabilitation. Since launching the division in 2018, Dr. Sokolof has worked to make exercise oncology central to its therapeutic approach. “We’re trying to shift the paradigm,” he explains. “Exercise is typically prescribed to cancer patients only to mitigate specific impairments—for instance, arm pain after mastectomy. Yet research indicates that it can affect outcomes including depression, anxiety, sleep, overall physical functioning, even mortality and survival. Our approach is to use exercise to support the optimal health of all patients living with or beyond cancer.”

Rusk Rehabilitation is one of the first rehabilitation departments in the country to establish an oncology rehabilitation services program. “We’re fortunate to have a direct line to NYU Langone’s Perlmutter Cancer Center, a National Cancer Institute–designated Comprehensive Cancer Center,” Dr. Sokolof notes. Rehabilitation physiatrists meet regularly with the cancer center’s survivorship coordinator and medical oncologists to collaborate on building the program and developing appropriate exercise prescriptions for individual patients.

ATTACKING THE CANCER–
CARDIOVASCULAR
DISEASE CONTINUUM

“You can think of cancer and cardiovascular disease as part of the same spectrum,” observes Jonathan H. Whiteson, MD, associate professor of rehabilitation medicine and vice chair for clinical operations and medical director of cardiac rehabilitation at Rusk Rehabilitation. These diseases share many common biological pathways, such as inflammation and oxidative stress, along with common risk factors, such as smoking, sedentary lifestyle, and obesity. In addition, cancer patients often experience weight gain and deconditioning—and some cancer therapies can damage patients’ arteries and hearts. According to a 2019 scientific statement by the American Heart Association (AHA), such factors may contribute to a 1.3- to 3.6-fold increased risk of cardiovascular-specific mortality in long-term cancer survivors.

As survival rates for cancer continue to improve, the problem of cardiovascular comorbidity is becoming increasingly urgent. To address it, the AHA statement (endorsed by the American Cancer Society) calls for cardio-oncology rehabilitation to become a standard part of cancer care. This emerging approach adapts techniques from cardiac rehabilitation—including exercise, nutritional management, and lifestyle counseling—to reduce cancer patients’ cardiovascular

risk. “More than two dozen clinical trials have shown that exercise can compensate for the declines in cardiac health associated with cancer treatment,” Dr. Whiteson says. “The challenge is translating the science into clinical practice, and getting it covered by insurance.”

Rusk Rehabilitation is at the forefront of these efforts, helping to develop cardio-oncology protocols that can be implemented on a wide scale. In September 2019, Dr. Whiteson and Dr. Sokolof led an Innovative Leadership session on this topic at the annual meeting of the American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) in Portland, Oregon. “There’s a lot of trench work to be done,” Dr. Whiteson says, “but we’re beginning to move this model into the mainstream.”

BUILDING A COMMUNITY
OF PIONEERS

Dr. Whiteson is also leading other efforts to collate, review, and disseminate evidence for exercise-based rehabilitation therapies. He recently established an Exercise as Medicine member community within the American Academy of Physical Medicine and Rehabilitation (AAPM&R). The group, which has more than 700 members, is collecting published scientific data on the topic in a digital reference library for consultation by clinicians.

In November 2019, Dr. Whiteson led an educational session on prescribed exercise at the AAPM&R annual assembly in San Antonio, Texas, covering areas including brain injury and immune function. “Aerobic exercise, in particular, can be used to treat a broad variety of disease,” he explains. “For instance, there’s data to show its value in neuro-recovery following stroke. It boosts the immune system to fight off infection and rid the body of damaged or malignant cells. And, of course, it enhances strength, stamina, and pulmonary function. Aerobic exercise should be incorporated into the whole continuum of rehabilitative care, from the acute setting through outpatient and into the community.”

“Exercise is typically prescribed to cancer patients only to mitigate specific impairments—for instance, arm pain after mastectomy. Yet research indicates that it can affect outcomes including depression, anxiety, sleep, overall physical functioning, even mortality and survival.”

Dr. Jonas M. Sokolof



→ A multidisciplinary team at Rusk Rehabilitation worked closely with the patient to restore function and support her transition to post-discharge life.

PHOTO: GETTY IMAGES

Complex Case: Restoring Function for a Young Patient After a Devastating Cardiac Arrest Causes Brain Damage

After weeks in the intensive care unit (ICU), a 27-year-old woman was unable to control her limbs, speak, or swallow. Restoring these functions—while managing mental health issues that emerged during rehabilitation—required coordinating treatments across a broad range of disciplines.

A CATASTROPHIC LOSS OF OXYGEN

The patient was visiting New York City from Seattle for a conference in November 2018 when she grabbed her chest, collapsed, and lost consciousness. Bystanders called 911, and an EMS crew arrived 10 minutes later. Finding the patient in cardiac arrest, paramedics performed CPR and administered resuscitative medications en route to NYU Langone’s Ronald O. Perelman Center for Emergency Services. Once the patient’s heart was restarted, she was intubated and mechanically ventilated. In the ICU, she experienced recurring ventricular fibrillations.

Doctors managed to bring the woman’s arrhythmias and hypoxia under control; she received an implantable cardioverter defibrillator to prevent future incidents. Over the next few weeks, however, she remained critically ill. She had ischemic damage to her kidneys and liver. She developed pneumonia, rhabdomyolysis, and spiking fevers.

The most devastating damage, however, was anoxic brain injury. An MRI revealed lesions in the basal ganglia, and other brain regions

were likely affected. At first, the patient was completely nonresponsive, except for intermittent agitation that at one point led her to pull out her gastric tube. She exhibited tremors in both arms, consistent with injury to the motor centers. To control those symptoms, she was started on anti-seizure medications, sedatives, and antipsychotics.

A MULTIMODAL APPROACH TO COMPLEX REHABILITATION

In mid-December, the patient was admitted for inpatient rehabilitation care at Rusk Rehabilitation. By then, she had begun looking around at her environment but remained unable to communicate or follow commands; she also could not stand or walk. Although she had been transitioned to a tracheostomy, she still needed periodic breathing support. “We knew she would require intensive and comprehensive rehabilitation care,” recalls neurophysiatrist Brian S. Im, MD, assistant professor of rehabilitation medicine and director of the Brain Injury Rehabilitation Program.

Dr. Im and the rehabilitation team designed a treatment plan for the young woman. A speech therapist helped wean her from the tracheostomy collar; soon, the patient was beginning to form words, then simple sentences. A swallowing therapist helped restore her ability to take food by mouth, enabling the gastric tube to be removed. Restoring other functions, however, required coordination across a range of specialties.



For more on this story and other topics, visit nyulangone.org/rusk2019



 Jonathan H. Whiteson, MD
PHOTO: KARSTEN MORAN

Improving the Odds of a Successful Transplant

Heart and lung transplant operations make extraordinary demands on patients, both during and after surgery. In partnership with NYU Langone’s Transplant Institute, Rusk Rehabilitation helps them prepare for the procedure—and make a full recovery.

FROM “PREHABILITATION” TO REHABILITATION

Many patients who undergo heart or lung transplants have been weakened by years of chronic illness, reducing their ability to endure the stresses of surgery and its aftermath. All transplant candidates at NYU Langone are referred to Rusk Rehabilitation’s Joan & Joel Smilow Cardiac Prevention and Rehabilitation Center for evaluation of physical, metabolic, and emotional fitness. Since its inception in 1991, the center, the largest and

most comprehensive program of its kind in the tri-state region, has been at the forefront of managing cardio-pulmonary disease.

If needed, the patient will receive a course of “prehabilitation”—exercise and lifestyle modification to boost his or her strength and stamina. “The healthier a patient is before surgery, the better they’ll do during the operation, during their hospital stay, and over the course of their recovery,” explains Jonathan H. Whiteson, MD, associate professor of rehabilitation medicine, vice chair for Rusk Rehabilitation clinical operations, and medical director of cardiac rehabilitation.

After transplant surgery, patients are mobilized as soon as possible—generally, while still in intensive care. Most are discharged to Rusk Rehabilitation for two to three weeks of inpatient rehabilitation, in which physical and occupational therapists treat patients daily to promote mobility and foster independent functioning. Three months of outpatient therapy typically follow, with a focus on increasing endurance, reducing shortness of breath and fatigue, and (for heart transplant patients) improving cholesterol and blood sugar levels, facilitating weight loss, and instilling a heart-healthy lifestyle.

A MEASURABLE IMPROVEMENT IN OUTCOMES

The efficacy of Rusk Rehabilitation’s approach is reflected in the exceptional outcomes reported by the Transplant Institute, which performed 31 heart transplants and 35 lung transplants in 2019. Thanks in part to this advanced model of pre- and post-surgical care, the median length of stay for heart transplant patients at NYU Langone was 14 days, compared to 16 across the United States and 19 in the New York metropolitan area; for lung transplant patients, median length of stay was 7 days at NYU Langone versus 18 nationwide and 19 throughout the region.

Referral to Rusk Rehabilitation also contributes to superior results in longer-term patient recovery and survivorship. The one-year survival rate for heart transplant patients at NYU Langone was 100 percent—nearly nine percentage points higher than the U.S. figure.

“The coordinated care that Rusk Rehabilitation provides has helped NYU Langone achieve national leadership in this challenging arena,” notes Dr. Whiteson. “But what’s most important is that we’re changing lives. We’re building patients up and helping get them back to their full role in society.”

“What’s most important is that we’re changing lives. We’re building patients up and helping get them back to their full role in society.”

Dr. Jonathan H. Whiteson

Complex Case: Patient Regains Strength and Independence After a Life-Altering Industrial Accident & Amputation

A fall into an industrial spice grinder led to multiple complex injuries for one 32-year-old patient treated initially at an outside hospital and transferred to NYU Langone’s Rusk Rehabilitation.

TEAMWORK: A PATIENT WITH MEDICALLY COMPLEX INJURIES REGAINS FUNCTION

Trapped in an industrial spice grinder for an hour as firefighters and police officers extricated his left arm and right leg from the machine’s augur, the patient required a tourniquet at the scene, followed by an immediate amputation of the left forearm and a massive blood transfusion. The patient suffered a degloving injury of the perineal area, a comminuted fracture of the right tibia midshaft, and a deep posterior thigh–gluteal laceration. A left orchiectomy was performed immediately, and the right testicle was placed in a pocket in the thigh to preserve it in anticipation of further scrotal surgery. The patient’s left lower extremity was stabilized with an external fixator, and the laceration was closed.

Almost two weeks later, the patient underwent penile reconstruction with split thickness skin graft, followed two weeks later by exploration of the thigh wound, seroma drainage and closer, with skin grafting to preserve the perineum. The penis and pelvic wound were regrafted 10 days later. Hyperbaric treatment was continued

until his grafts closed and healed. At six weeks post-incident, the patient was admitted for acute inpatient rehabilitation care at Rusk Rehabilitation’s Comprehensive Integrated Inpatient Rehabilitation Program.

CLINICAL EXPERTISE, ADVANCED RESEARCH, AND PATIENT-CENTERED CARE

An extensive multidisciplinary team, encompassing physical and occupational therapists, psychologists, vocational counselors, recreational therapists and integrative health counselors, was assembled to address the patient’s multiple physical and psychological needs.

The goal of physical therapy was focused on strengthening his extremities and core, as well as improving his balance and gait. The occupational therapy plan of care focused on increasing upper extremity range of motion and strength, activities of daily living retraining, as well as education on desensitization exercises for his left elbow below the amputation site, and preparation for an upper extremity prosthesis.



For more on this story and other topics, visit nyulangone.org/rusk2019



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Myoelectric hand
PHOTO: TASKA™

Trailblazing Rehabilitation Medicine Expert Launches New Department at NYU Winthrop Hospital



PHOTO: NYU LANGONE STAFF

Lyn D. Weiss, MD, joined NYU Winthrop Hospital in April 2019 as clinical professor of rehabilitation medicine, inaugural chair of the Department of Physical Medicine and Rehabilitation, and chair of physical medicine and rehabilitation at NYU Long Island School of Medicine. As the author of 9 books, as well as more than 200 articles and abstracts, Dr. Weiss is nationally known for her expertise in electrodiagnostic medicine. She joined NYU Langone from Nassau University Medical Center, where in 1996 she became one of the first women in the United States to chair a hospital's rehabilitation department.

Dr. Weiss's appointment at NYU Winthrop came as the hospital completed its merger with NYU Langone Health. In her new position, she is working to build a comprehensive care model aligned with that of Rusk Rehabilitation, which for three decades has been ranked by *U.S. News & World Report* as one of the top 10 rehabilitation programs in the country. Her team is collaborating with inpatient services at NYU Winthrop to enhance therapeutic management, transitions of care, and discharge planning. Dr. Weiss also plans to expand the hospital's outpatient rehabilitation services and to establish outpatient physiatry centers throughout Long Island.

Continuing Medical Education Save the Date

Rusk Rehabilitation is proud to offer the highest standard of continuing medical education courses covering important topics in physical medicine and rehabilitation—developed and taught by leaders in the field.

FEBRUARY 20–21, 2020

7th Annual Concussion Across the Spectrum of Injury: Latest in Diagnosis and Management

This two-day course will address clinical assessment and management, emerging neuroimaging technologies, advances in blood and imaging biomarkers, concussion in the female athlete, advances in headache management, the role of neuro-cognitive testing in returning athletes to school and play, and rehabilitation.

MARCH 23–28, 2020

45th Annual Comprehensive Review of Physical Medicine and Rehabilitation

This intensive six-day and three-evening course is designed to examine current practice with emphasis on recent advances in the field of physical medicine and rehabilitation.

JUNE 25–26, 2020

2nd Annual Sports Medicine Symposium

This two-day symposium will cover current best practices and innovations in diagnostic and therapeutic interventions used for recreational to elite athletes throughout the life span.



Learn more about these courses by visiting med.nyu.edu/cme

Fall 2020

Rusk Rehabilitation 6th Annual Research Symposium

A day of poster sessions, technical exhibits, and lectures on advances being made at Rusk.

Date and more information coming soon.

LOCATION

NYU Langone Health
550 1st Avenue, Farkas Auditorium
New York, NY 10016

CALLING FOR NOMINATIONS

The 2020 Rusk Award for Leadership and Innovation

Nominate a physiatrist that is changing the field of PM&R to be honored at our Fall 2020 Research Symposium.

NOMINATION DEADLINE

June 30, 2020

CONTACT

To submit a nomination, or for more details, please contact Linda Yuen-Moy at linda.yuen-moy@nyulangone.org

ABOUT NYU LANGONE HEALTH

Leader in Quality

NYU Langone has achieved top rankings by Vizient, and is the only full-service health system in New York City with an “A” Leapfrog safety grade and a CMS 5-star rating in 2020. These accolades are reflective of a shared culture of quality that permeates our growing network, now inclusive of NYU Winthrop Hospital and its ambulatory sites on Long Island. All of our sites are held to the highest quality standards set at an institutional level.



#9 in the Nation

Ranked ninth by *U.S. News and World Report* for both Best Hospitals and Best Medical Schools (Research)



Transforming Medical Education

To address some of today’s most pressing issues in medical education such as physician shortages, debt burden, and lack of diversity, we have introduced accelerated pathways to the MD degree and full-tuition scholarships regardless of need or merit at the recently renamed **NYU Grossman School of Medicine** and the new primary-care focused **NYU Long Island School of Medicine**.

Our team works tirelessly to help patients regain their strength, independence, and quality of life. In 2019, we developed high-tech navigational tools for visually impaired patients, explored the impact of exercise for oncology patients, and helped to improve outcomes for transplant patients.

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