NorthShore
University HealthSystem
Neurological Institute

Neurological care for what's next.

2022 ANNUAL REPORT

CONTENTS

NorthShore University HealthSystem
Neurological Institute

NorthShore University HealthSystem (NorthShore) Neurological Institute offers unparalleled access throughout the Chicago area, including at each of our five award-winning hospitals. Our expert team of neurospecialists offers comprehensive care for a wide range of neurological conditions.

Call **(877) 570-7020** for more information or to schedule an appointment.

OUR LEADERSHIP

Susan M. Rubin, MD

Co-Director, NorthShore Neurological Institute
Ruth Cain Ruggles Chair, Department of Neurology

Dr. Rubin is the Chair of the Department of Neurology at NorthShore and specializes in women's neurologic issues, including multiple sclerosis (MS) and migraines. She developed and served as the director of NorthShore's Women's Neurology Program, as well as the Vice Chair of Education and Academic Affairs for the department. She is a Clinical Associate Professor at the University of Chicago Pritzker School of Medicine and was recently featured in *Crain's* 2019 Notable Women in Health Care.

Dr. Rubin completed her medical degree at the University of Illinois at Rockford and her internship at Lutheran General Hospital in Park Ridge, Illinois. She completed both her residency and fellowship training at Northwestern Feinberg School of Medicine in Chicago. For over a decade, she has been recognized as a "Top Doctor" by *Chicago* magazine and as one of "America's Top Doctors" in a list compiled by Castle Connolly.

Additionally, Dr. Rubin is directing promising research into genetic risk factors for multiple neurologic conditions. This research will provide clinicians a link between genes and the clinical characteristics of neurologic diseases to facilitate better diagnosis and management of patients with chronic, lifelong conditions. She is the principal investigator for clinical trials addressing the causes, treatments and approaches to lifestyle modifications to improve the lives of patients living with MS. In 2019, she was awarded the Annual Volunteer Award from the National MS Society for her continued support of the society's programs and served as a member of the Board of Trustees for the Greater Illinois Chapter.

Julian E. Bailes, MD

Co-Director, NorthShore Neurological Institute
Bennett-Tarkington Chair, Department of Neurosurgery

Dr. Bailes is a nationally recognized leader in neurosurgery, with special emphasis on brain tumors and the impact of brain injury on brain function. He is also one of the first neurosurgeons in the Chicago area to use the minimally-invasive NICO BrainPath® as part of the Six Pillars approach, offering promising outcomes for patients with otherwise inoperable brain tumors and hemorrhages using the most advanced imaging and intervention technologies. Recently, he became the first neurosurgeon in the Midwest to use GammaTile® Therapy, which involves tiles embedded with radiation implanted in a patient's brain after removal of a malignant brain tumor. This new approach has been shown to significantly prolong patients' survival.

As a national authority in neurosurgery, Dr. Bailes is President of the Subcortical Surgery Group, neurological consultant to the NFL Players' Association (NFLPA), Chair of Pop Warner Football Medical Advisory Committee and an adviser to the NCAA. He is also a member of the NFL Head, Neck and Spine Committee and the NFLPA Mackey-White Health and Safety Committee. Dr. Bailes has been honored as one of the nation's best surgeons and has been recognized as a "Chicago Top Neurosurgeon" by *Chicago* magazine since 2016.

Dr. Bailes' surgical expertise in brain and spinal cord tumors, aneurysms, brain hemorrhages, and other conditions is informed by the latest research and advances in surgical technology. His current research focuses on innovative new strategies for treating and preventing the impact of traumatic brain injury. His work has been instrumental in understanding the clinical evidence of chronic traumatic encephalopathy (CTE), a progressive degenerative disease found in individuals who have been subjected to multiple concussions and other forms of head injury. The research done by Dr. Bailes as it relates to the discovery of CTE in football players was featured in the movie *Concussion*. An FDA-approved Phase III trial is commencing in 2023 at NorthShore using FD-18 DDNP to label damaged structural proteins indicative of CTE, beta-amyloid and tau.

RECOGNITION AND ACHIEVEMENTS

- Only Joint Commission Certified Comprehensive Stroke Center at Evanston Hospital in Our EMS Region
- First ALS Clinic in the Northern Chicago Suburbs Certified by the ALS Association
- Epilepsy Center Accredited by the National Association of Epilepsy Centers
- Systemwide Magnet® Recognition by American Nurses Credentialing Center
- Systemwide Certification by Joint Commission as Primary Stroke Center
- Designated Center for Comprehensive Multiple Sclerosis Care by the National Multiple Sclerosis Society
- Systemwide Blue Distinction® Center Designation for Spine Surgery Recognized by Blue Cross Blue Shield

ABOUT THE INSTITUTE

A Personalized and Team Approach to Advanced Neurological Care

NorthShore Neurological Institute's comprehensive programs offer patients and their families proven expertise, advanced technology and outstanding care coordination to treat a variety of neurological diseases and conditions.

As one of the region's preeminent providers of neurological care, we are actively engaged in clinical trials and translational research. We regularly launch new research studies to ensure that the latest technology, clinical treatments and techniques are available for our patients.

The foundation of our excellence in neurological care is the personalized and multidisciplinary approach that is essential to achieving the best possible outcomes. Each program in the center circle has a team of medical, surgical and rehabilitative members with unique expertise that maintains open lines of communication. These members often collaborate face-to-face in real time, as well as through one of the most advanced electronic health record (EHR) systems in the country, to deliver care effectively for complex neurological diseases.

KEY CLINICAL SERVICES

Brain Health

- Clinical services for patients at higher risk of Alzheimer's, Parkinson's disease or chronic traumatic encephalopathy (CTE).
- Assessment of familial, genetic, lifestyle and comorbidity risks.
- Medical, physical, cognitive, dietary and integrative therapies to reduce risk.
- Annual visits to preserve and improve brain health, and to prevent dementia and other aging-related brain disorders.

Concussion/Brain Injury

- A multidisciplinary and nationally recognized team of concussion and head injury specialists.
- Multipronged approach to the diagnosis and management of acute concussion, post-concussion syndrome and chronic consequences of brain injury.
- Sports Concussion Program with neurological and neuropsychological assessment.

Epilepsy and Central Neurophysiology

- Complete diagnostic services to identify the likelihood and cause of seizures and assess the patient's candidacy for admission to our accredited Epilepsy Monitoring Unit (EMU).
- Medication management and surgical options (for suitable candidates) that include laser interstitial thermal therapy, responsive neurostimulation and vagus nerve stimulation.

General Neurology

- Evaluation, diagnosis, treatment and management of a variety of acute and chronic neurological conditions such as pain, tingling, numbness, weakness, dizziness, fainting, and problems with speech, vision, hearing, swallowing or balance/coordination.

Memory and Cognitive Disorders

- Care team of neurologists, neuropsychologists, nurses and a medical social worker who embrace the highest standard of care, continuously seeking and offering new and innovative treatments, cutting-edge imaging techniques and neuropsychological evaluation tools.

"We strive for our patients with epilepsy to attain seizure freedom with no or minimal side effects. At NorthShore, we use a team based approach to achieve that result, using the best diagnostic and treatment modalities currently available."

— Dr. Amit Ray, Section Head, Epilepsy and Central Neurophysiology Program

"It is a privilege to be part of the Multiple Sclerosis community, and treat these patients and their families with a combination of novel pharmacologic therapies, other supportive therapies, and research involvement."

— Dr. Carolyn Helene Goldschmidt, Neurologist, Multiple Sclerosis Program

Migraine and Other Headache Disorders

- Evaluation of headache disorders by specialized neurologists in consultation with experts in physiatry, psychology or neurosurgery to aid in the treatment.
- Chronic headache specialists who may recommend Botox® therapy, integrative medicine such as acupuncture, and patient education to recognize triggers and modify habits.

Multiple Sclerosis

- Services at our designated Center for Comprehensive Multiple Sclerosis Care that begin with a diagnosis involving in-depth clinical, laboratory and neuroimaging evaluations.
- Treatments that use the latest disease-modifying therapies including injection, oral and infusion treatments, as well as acute management with intravenous corticosteroids, plasma exchange and intravenous immunoglobulin (IVIG). The latest in symptom management, including intrathecal baclofen pump management.
- Active clinical trials that explore the efficacy and safety of new treatments.

Neuro-Oncology/Brain and Spine Tumors

- Complete diagnostic evaluation leveraging advanced neuroimaging and molecular neuropathology.
- Multidisciplinary care team that reviews each patient's case at regular tumor conferences and in consultation with the patient and family to develop a personalized treatment plan.
- Clinical trials offering patients access to promising new methods of cancer detection and treatment.

Neuromuscular Disorders

- Diagnostic work-ups incorporating electromyography and an advanced Autonomics Laboratory.
- Amyotrophic lateral sclerosis (ALS) clinic offering treatment modalities to optimize quality of life.

(continued)

KEY CLINICAL SERVICES

Neuropathology

- Diagnostic services for neurosurgical specimens, including molecular testing to determine customized care.

Neurophysiology

- Comprehensive diagnostic testing available including electroencephalography (EEG), nerve conduction studies, electromyography, evoked potentials (somatosensory, visual, acoustic brain stem), home and continuous inpatient EEG monitoring, intracranial monitoring, Wada test, functional brain mapping, deep brain stimulation (DBS) testing and video EEG in the EMU.
- Intraoperative monitoring where our team of physicians and technologists work with surgeons, monitoring the central and peripheral nervous system in order to avoid preventable complications.

Neuropsychology

- Consultation and evaluation services to a broad range of inpatients and outpatients with a variety of adult and pediatric neurological disorders.
- Cognitive rehabilitation and psychological care based on a patient-specific treatment plan that is coordinated with and provided by speech therapists, occupational therapists, learning disability specialists and clinical psychologists.

Neuroradiology

- High-resolution neuroimaging with CT, MRI and PET scanning used to diagnose the full range of brain, spine and head/neck diseases.
- Advanced MRI and PET techniques that are leveraged to guide treatment and monitor treatment response.
- Nine neuroradiologists with Certificates of Added Qualification (CAQs) who collaborate to ensure the highest level of imaging performance and interpretation.
- Artificial intelligence (AI) software used to enhance detection of life-threatening conditions including acute ischemic stroke from large vessel occlusion. Upon availability, new AI modules are tested for potential implementation. Evaluation of AI modules to detect intracranial hemorrhage (ICH) and intracranial aneurysms is ongoing.

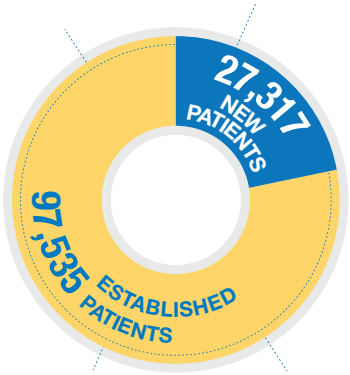
Neurosurgery

- Surgical intervention for disorders of the brain and spine by highly trained and specialized neurosurgeons using the latest technology for optimal patient outcomes.
- Minimally invasive procedures for epilepsy, neurovascular conditions, spine conditions and brain tumors of the skull base.
- One of the first centers nationwide to use the NICO Six Pillar Approach for removing tumors and blood clots located deep within the brain through a small corridor using BrainPath.

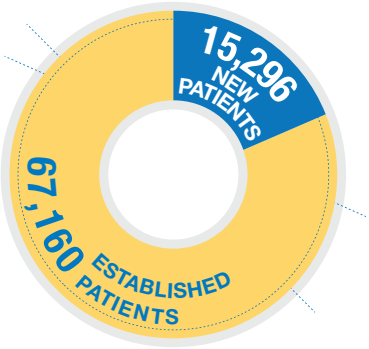
Dr. Julian Bailes, Chair of Neurosurgery and Co-Director of NorthShore Neurological Institute, prepares his team for surgery.

2022 VOLUME DATA

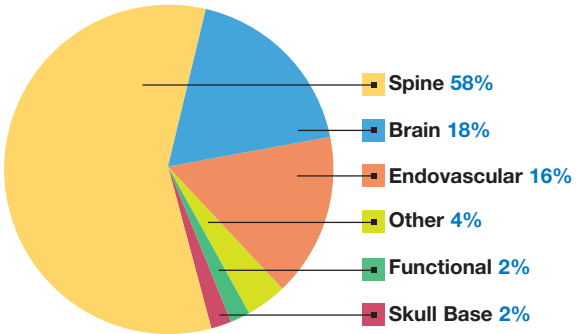
Total Patient Office Visits



Neurology Patient Office Visits



Total Surgeries



KEY CLINICAL SERVICES

Parkinson's Disease and Other Movement Disorders

- Pharmacological management, patient education and rehabilitative services to optimize functional independence and improve quality of life.
- Deep brain stimulation (DBS), a surgical therapy used for the treatment of Parkinson's disease.

Pediatric Neurology

- Family-centered diagnosis and care for children with disorders of the brain and nervous system, such as headache and seizures.
- Close collaboration with pediatricians, behavioral and developmental specialists, neuropsychologists, and clinical psychologists.

Physical Medicine and Rehabilitation

- Nonsurgical expert care delivered by our physiatrists, fellowship-trained physicians specializing in the musculoskeletal system who diagnose and treat acute and chronic pain.
- Rehabilitation plans that best help patients improve physical function and achieve rehabilitation goals.
- Spine and Sports Medicine Programs that offer epidural steroid injections, ultrasound-guided peripheral joint injections, electrodiagnostic testing (EMGs) and regenerative procedures, and specialized procedures including radiofrequency ablation, spinal cord stimulators, and Botox injections for spasticity treatment.

Sleep Disorders

- Two Sleep Laboratories accredited by the American Academy of Sleep Medicine.
- Staffed by one of the largest teams of board-certified sleep neurologists, pulmonologists and nurse specialists in Chicagoland.
- Full range of services, including consultations, nocturnal polysomnograms and home sleep apnea testing.

Spine

- Comprehensive nonsurgical pain management techniques by our fellowship-trained physiatrists, partnering with physical therapy, targeted pain-relieving medicine injections and integrative medicine.
- Advanced minimally invasive (using epidural steroid injections) and complex surgical expertise.
- Spine Center is a designated Blue Distinction® Center by Blue Cross Blue Shield based on nationally consistent criteria that recognize quality of care and treatment expertise, including the number of procedures performed every year and patient outcomes.

Stroke

- Management of acute stroke, risk factors, prevention of future strokes and post-stroke rehabilitation using a combination of medications; surgical interventions; physical, occupational and speech therapies; and lifestyle changes.
- Acute stroke team that is available 24/7 to make quick decisions regarding intravenous tissue plasminogen activator administration and minimally invasive intra-arterial interventions.
- Endovascular thrombectomy, minimally invasive surgical removal of a blood clot for patients experiencing an ischemic stroke, proven by the latest research to substantially reduce disability.
- Use of advanced telemedicine technologies to reduce door-to-needle or intervention times for best outcomes.
- Viz.ai, artificial intelligence for image assessment and provider communication

2022 RESEARCH SUMMARY

Human Subject Studies	DNA Study (DodoNA)
62 Open Studies	9,854 Total Participants
46 Studies Enrolling Subjects	9,409 Samples Genotyped
307 Subjects Consented	

Stroke Program

NorthShore is proud to be a leader in cerebrovascular health and stroke care in the greater Chicago area and recognized on the national level for excellence in care. Evanston hospital is recognized by the Joint Commission as a Comprehensive Stroke Center (CSC). The Joint Commission, in collaboration with the American Heart Association/American Stroke Association, evaluates the quality of stroke care through monthly data submissions and intensive on-site visits. Our certifications are the result of adhering to and exceeding the standard of care for stroke.

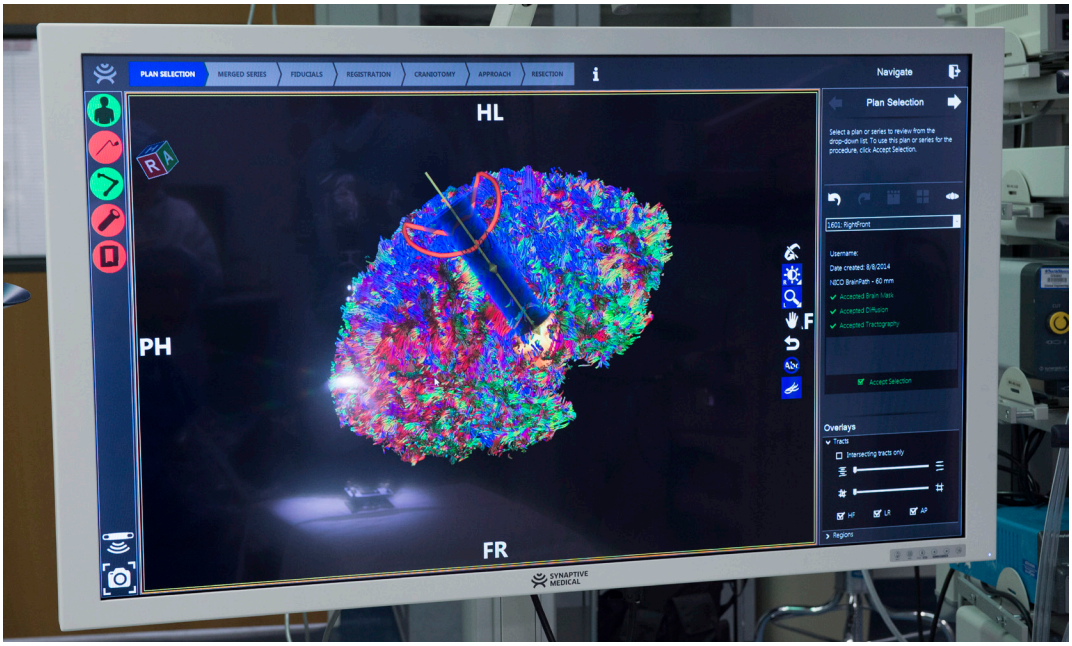
Our treatment time from door to thrombolytic therapy (using tenectaplase [TNK] or tissue plasminogen activator [tPA]) is faster than many other Illinois hospitals and well below the national target time of 60 minutes. Our on-call specialists operate a system that is ready for acute stroke intervention 24 hours a day, 7 days a week, 365 days a year. Our stroke team uses Viz.AI, an artificial intelligence system that helps to rapidly identify patients experiencing stroke who may be candidates for intervention. NorthShore is the first hospital system in Illinois to incorporate Viz.ai. Our rates of successful stroke interventions are among the best in the country.

As a comprehensive stroke center at Evanston Hospital, we are equipped to diagnose and treat stroke patients who require a high level of medical care. This includes those experiencing a large ischemic or hemorrhagic stroke, a stroke from unusual etiologies or requiring specialized testing, or a stroke requiring multispecialty management. We also treat complex vascular diseases such as cerebral aneurysms, arteriovenous malformations (AVM), arteriovenous fistula (AVF), intracranial stenoses, carotid disease, and spinal vascular disease. NorthShore is the first system in Illinois to incorporate 3D surgical planning for complex vascular disease using Surgical Theater.

In addition to standard coils for aneurysm treatment, the NorthShore team uses state-of-the-art technology to treat complex aneurysms, including cutting-edge flow diverting technology and the innovative Woven EndoBridge (WEB) device. The WEB device blocks blood flow into the aneurysm, protecting the patient from potentially lethal bleeding. NorthShore was the first hospital in Illinois to use this technology. For aneurysms that are best treated with traditional surgery, we use the latest imaging, surgical magnification, and clip technology. Our collaborative interdisciplinary team includes neurosurgeons, neurologists, interventional radiologists, speech therapists, physical therapists, occupational health therapists, and physical medicine and rehabilitation doctors to ensure that each of our patients achieves the best outcome possible.

We are excited to be at the forefront of advancing stroke treatment and to lead cutting-edge research, including studies to evaluate new ways to identify stroke in patients without the use of radiation. We also participate in national and international trials in ischemic and hemorrhagic stroke care.

With the recent growth of NorthShore, we are now the only health care system in Illinois to have three CSCs, including Edward Hospital in Naperville and Northwest Community Hospital in Arlington Heights, allowing NorthShore to provide unparalleled access and care to our patients.



NorthShore was the first hospital system in Illinois to use synaptive fiber tracking robotic optics, which allows for 3D visualization of the disease process during patient consultation.

Multiple Sclerosis

Multiple sclerosis (MS) is the most common of the demyelinating diseases of the central nervous system, a group of inflammatory diseases that affect the brain and spinal cord. These conditions affect young adults and cause focal lesions that accumulate over the years resulting in progressive and cumulative physical and cognitive disabilities, as well as emotional impact.

While the primary cause and factors that lead to the development of MS are still unknown, there has been tremendous progress in understanding the disease progression and in the development of treatments proven to slow or prevent it. There are currently greater than 20 FDA-approved treatments for MS. NorthShore's MS program was involved in the research of several of these treatments and continues to be involved through active participation in clinical trials of new therapies and the development of patient-centered tools to assess disease progression and disability.

The NorthShore MS program has been designated as a Center of Excellence by the National Multiple Sclerosis Society. Our team members are highly experienced and skilled in accurately diagnosing all forms of inflammatory and demyelinating diseases of the central nervous system and designing a personalized management plan to achieve the best outcome with the least risk to the patient. We also provide state-of-the-art management of symptoms and disabilities in collaboration with comprehensive rehabilitation services and several other specialties offered by NorthShore.

"Tremendous progress has been made in understanding and treating MS. Achieving clinical and MRI stability with the least risk possible to the patient remains the basic principle to ensure the best outcome."

— Dr. Afif Hentati, Section Head, Multiple Sclerosis

Neuro-Oncology Program

Receiving a brain tumor diagnosis may be overwhelming and scary. Our specialists are here to support patients in every way through providing all the information, available treatment options and any other needed resources. NorthShore's Neuro-Oncology Program was one of the first such programs established in the area. Through our partnership with Northwest Community Healthcare (NCH), we now offer our cutting-edge minimally invasive treatment options at NorthShore Neurological Institute at NCH.

Our neurosurgery team specializes in the diagnosis and surgical treatment of a variety of brain and spinal cord tumors, both primary and metastatic, as well as malignant and benign. To treat each patient, we collaborate with other specialties to develop a comprehensive personalized care plan. The care plan may include a combination of minimally invasive surgery, stereotactic radiosurgery, radiation oncology and chemotherapy.

Our program was the first in Illinois to offer GammaTile Therapy, a new FDA-cleared approach to treating malignant brain tumors designed to delay their regrowth for patients with high-grade gliomas, meningiomas and brain metastases, while limiting impact on brain tissue and reducing side effects such as hair loss.

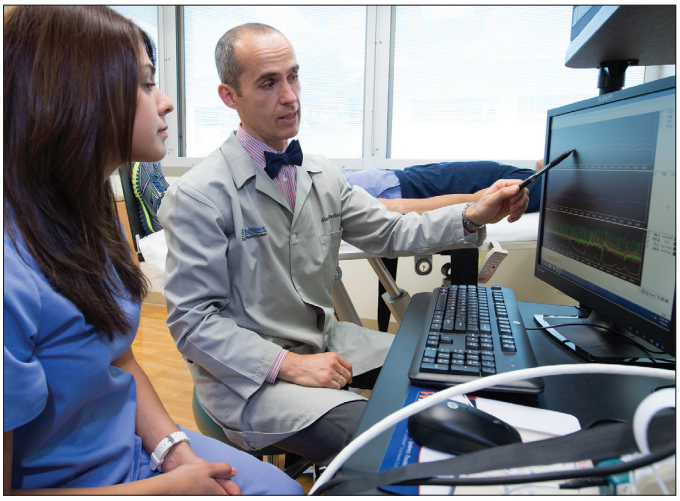
Dr. Julian Bailes holds a sample GammaTile, a 3D-collagen tile smaller than a postage stamp embedded with radiation that he can place at the site of a brain tumor after it is removed.

The GammaTile is a 3D-collagen tile smaller than a postage stamp embedded with Cesium-131 radioactive seeds that can be placed at a tumor site after the tumor is surgically removed. It immediately begins to target residual tumor cells with radiation while limiting the impact on healthy brain tissue. It adds only five to 10 minutes to surgery time and is absorbed by the body within two months, eliminating the need for surgical removal. Instead of returning for multiple visits for standard radiation treatments, patients receive their targeted doses of radiation to any remaining tumor cells while going about their daily lives.

Autonomics Program

If a patient has cardiac, respiratory, digestive, neurological or other puzzling symptoms that are difficult to diagnose or treat, they may have an autonomic nervous system disorder. The autonomic nervous system is part of the peripheral nervous system, which regulates subconscious activities such as heart rate, digestion, respiratory rate, salivation, perspiration, swallowing and more. Disorders of the autonomic nervous system are often complex and disabling conditions that are a challenge to diagnose.

NorthShore's Autonomic Testing Lab, led by fellowship-trained physician and director of the Neuromuscular Program, Alexandru Barboi, MD, offers comprehensive testing including: quantitative sweat tests, measurements of heart rate and blood pressure during deep breathing, Vasalva maneuvers and head-up tilt tests. The goal of the lab is to gather high-quality data to aid our team of multidisciplinary clinicians in making a diagnosis and in grading the degree of autonomic dysfunction the patient is experiencing. To further our understanding of autonomic disorders and offer the latest treatments, we are currently conducting research in post-COVID postural orthostatic tachycardia syndrome (POTS) and autonomic failure in multiple system atrophy (MSA).



Dr. Alexandru Barboi, Section Head of NorthShore's Neuromuscular Program (right) reviews a patient's diagnostic tests with a technician in our state-of-the-art Autonomics Laboratory.

Movement Disorders, Parkinson's Disease and Genetics

Parkinson's disease, the most common movement disorder, is a progressive disease that impairs the control of movement and can cause tremor, slowness of movement, muscle stiffness and balance problems. While there is no cure for Parkinson's disease, many of these symptoms can be treated effectively with medications for long periods of time. However, as the disease progresses, long-term use of these medications is often associated with side effects such as involuntary movements, a fluctuating response to the medications and/or diminishing beneficial effect of the medications after prolonged use.

Deep brain stimulation (DBS) is an FDA-approved surgical treatment for Parkinson's disease that can help treat the Parkinson's disease symptoms and the complications that may arise from long-term use of these medications. DBS surgery involves the insertion of electrodes deep inside the brain to stimulate specific structures that are involved in the control of movement. DBS can treat symptoms more effectively than medications alone. It allows for a reduction in medication, thus decreasing the chance for medication-related side effects. The DBS benefit is long-lasting, but it cannot halt the progression of the disease. At NorthShore, our interdisciplinary team, including neurosurgeon Ricky Wong, MD, offers eligible candidates DBS surgery and manages their post-operative care.

With the advent of the genomic and personalized medicine era, research into the genetic causes of Parkinson's has accelerated. As part of our ongoing research efforts, we have been following patients with a family history of the disease and analyzing their DNA to help identify genes that cause it. As part of these efforts, we collaborate with international genomic consortia including the Genetic Epidemiology of Parkinson's Disease (GEoPD) consortium. Our program section head, Katerina Markopoulou, MD, PhD, is its current president and a founding member. We also collaborate with the International Parkinson's Disease Genomics Consortium (IPDGC) and more recently, the Global Parkinson's Genetics Program (GP2), the largest funded international effort to date to identify genetic factors contributing to Parkinson's disease from various ethnic backgrounds.

"In general, the control of Parkinson's disease symptoms is better with DBS than with medication alone."

— Dr. Katerina Markopoulou,
Section Head,
Movement Disorders

Concussion Program

"As concussion experts, we screen for dangerous consequences following head injury and intervene early, keys to a full recovery."

— Dr. Nicole Reams, Section Head, Concussion and Sports Neurology

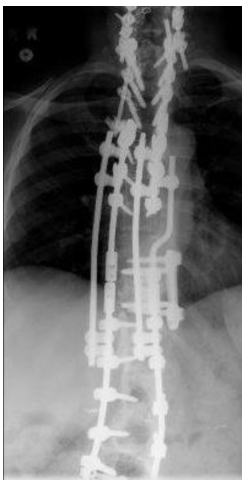
The multidisciplinary Concussion Program at NorthShore is led by sports neurology experts who are at the cutting edge of brain injury care. With expertise in sideline diagnosis, acute concussion management, post-concussion syndrome and long-term brain health, our neurological team offers a full spectrum of concussion and head injury assessment and treatment strategies to support brain health across the lifespan. The clinic incorporates up-to-date scientific recommendations and personalizes a treatment plan for every individual. Comprehensive assessments are available in our multidisciplinary clinic and may include exercise testing, neuropsychological testing and physical therapy assessment all in a single visit.

Our Concussion Clinic is now one of Pro Football Hall of Fame Health's national premier health systems offering comprehensive brain health services to former NFL players. Our neurologic experts provide consultations regarding the player's history of repetitive head impacts and use a multidisciplinary team to provide a thorough evaluation of the player's neurologic status as well as treatment modalities to improve wellness. The Clinic also provides support for players' families.

Steve Largent, member of the Hall of Fame class of 1995, visited Dr. Nicole Reams, Section Head of Concussion and Sports Neurology, with concerns about repeated exposure to head trauma throughout his playing career. Dr. Reams collaborated with Dr. Julian Bailes, Neurosurgery Chair, and neuropsychologist Dr. Leslie M. Guidotti Breting to conduct a cognitive assessment of Largent and address his concerns about his brain health and memory.

Multidisciplinary Approach: Neurosurgery and Orthopaedic Collaboration on Complex Spine Cases

For spinal deformity and instability problems that require larger surgical solutions, studies show that having two experienced surgeons lessens operative time and reduces the risk of complications. Surgeons from two different departments each bring their unique perspective and skills to a case, and their collaboration results in optimizing patient care and results. Noam Stadlan, MD, and the Department of Neurosurgery are partnering with orthopaedic spine surgeon Lukas Zebala, MD, on large and complex spinal deformity and instability cases. In addition to those cases requiring larger surgical solutions, Dr. Stadlan specializes in smaller cases such as a minimally invasive lumbar stabilization following a microdiscectomy. Having the widest possible array of options for patients is the best way to be able to offer patients the surgery that not only treats their symptoms, but also minimizes their chance of problems in the future.



This X-ray shows the correction of a complex deformity in a patient with Kümmell disease performed by a Neurosurgery/ Orthopaedic Spine partnership.

Spine Center

Back and neck conditions are some of the most common causes of pain and disability in the United States. This kind of pain can be recurring and incredibly disabling, preventing people from performing and enjoying everyday tasks and activities.

At NorthShore Spine Center at the Orthopaedic & Spine Institute in Skokie, the only hospital dedicated to orthopaedic and spine care in Illinois, our multidisciplinary team of specialists work to minimize back, neck or other complex pain issues and return patients to a full, healthy life as quickly as possible.

Taking a holistic approach toward our patients, we consider each patient's ability to manage pain, which can vary from individual to individual and is often impacted by anxiety or depression.

Moreover, stress or fear associated with pain, such as how it affects day-to-day functioning or mobility, also influences a patient's pain, overall psyche and attitude toward treatment options.

Our multispecialty team devises the best neck and back pain treatment plan for each patient. Our goal is to treat not only the pain, but the whole person.

Nonsurgical Back Pain Treatment Options

We often find nonsurgical solutions to back pain when other providers are recommending surgery. Our spine surgeons and fellowship-trained physiatrists, including several who specialize in chronic pain management, coordinate to offer an extensive variety of treatment options based on any patient's specific needs. These options include:

- **Physical therapy**—Physiatrists and therapists educate patients on proper body mechanics and establish individualized exercise programs they can follow at home.
- **Interventional procedures**—Image-guided pain-relieving injections of medicine straight to the source of the pain can make a huge difference for a patient's comfort.
- **Medication management**—Our experienced physicians and staff work closely with patients to regulate and monitor any oral medications they take to treat their back pain.
- **Integrative medicine**—NorthShore's Integrative Medicine Program can complement a patient's holistic back pain treatment plan in conjunction with any other therapies. Options include acupuncture, chiropractic care, yoga, biofeedback and more.

Dr. Thomas Hudgins, Section Head of the Physical Medicine and Rehabilitation Outpatient Specialty Programs, performs a fluoroscopy-guided spinal intervention procedure as part of his patient's back pain management.

Dr. Michael Musacchio, Division Chief of Neurological Spine Surgery, explains the cause of a patient's back pain to him.

Surgical Treatment Options

When conditions require surgery, one of the most experienced surgical teams in the region offers the most advanced minimally invasive and complex surgical techniques available.

Minimally invasive procedures offered include:

- Anterior lumbar interbody fusion
- Direct lateral interbody fusion
- Transforaminal lumbar interbody fusion
- Spinal cord/nerve root decompression
- Cervical interbody fusion
- Foraminotomy
- Total disc replacement
- Microdiscectomy
- Kyphoplasty
- Lumbar disc replacement
- Cervical disc replacement
- Lumbar interbody fusion

Use of state-of-the-art minimally invasive techniques, instrumentation and imaging helps patients recover in a shorter period of time and allows for a quicker return home.

Traumatic Brain Injury Research

Traumatic brain injury (TBI) is a leading cause of death and disability in the United States, affecting approximately 1.7 million people annually. Mild TBI, or concussion, typically results in a temporary loss of consciousness and is associated with loss of memory and impaired thinking, which may involve effects on synapses and cell calcium in the brain. John McDaid, PhD, who runs the TBI Laboratory at NorthShore Neurological Institute, is collaborating with industry sponsors to investigate the persistent synaptic and cell calcium effects of a single mild TBI/concussion in areas of the brain associated with learning and memory.

"Concussion affects millions of people in the U.S. annually with few available treatments. Increased understanding of the underlying physiology will lead to the development of treatments for concussion and its long-term effects."

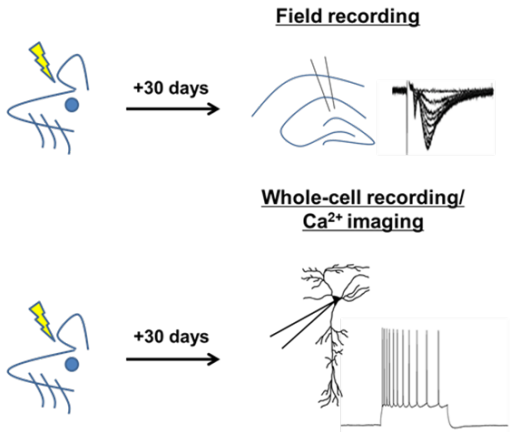
— Dr. John McDaid,
Neurosurgery Department

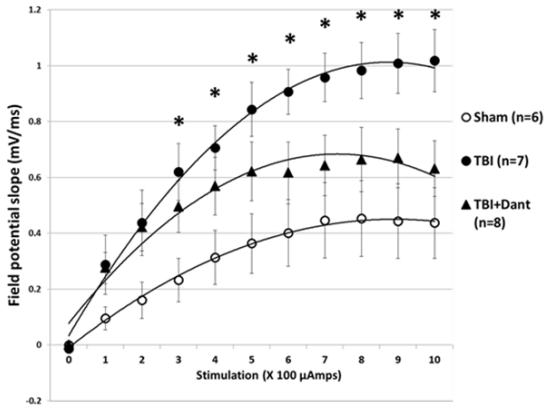
Role of calcium in mild traumatic brain injury

Cell calcium is necessary for normal cell functioning, but an excess of calcium may lead to cell damage or death. The communication points between neurons are called synapses, and communication across synapses is mediated by release of neurotransmitters, including glutamate, which then act on postsynaptic receptors. After a mild TBI, there may be an abnormal increase in the release of glutamate, resulting in abnormally increased synaptic transmission, which leads to an excess of cell calcium and eventual cell death.

The TBI Lab uses a combination of electrophysiology and calcium imaging to measure changes in synaptic transmission and cell calcium resulting from mild TBI. Dr. McDaid can investigate the effects of mild TBI in brain areas important for learning and memory, such as the hippocampus, thus helping to identify receptors that play a role in the effects of mild TBI. It is hoped that identification of these receptors will lead to the development of drugs to treat the long-term effects of mild TBI.

As part of an ongoing collaboration with Eagle Pharmaceuticals, the McDaid lab has already tested Ryanodex—a novel formulation of the drug dantrolene, which acts on the ryanodine receptor calcium channel—to assess its synaptic effects after a single mild TBI.





Ryanodex/dantrolene prevents TBI mediated increases in synaptic strength in a rat model of mild TBI. Thirty days after a single TBI, field or whole-cell recordings were performed in hippocampal CA1 (left). A single mild TBI resulted in increased hippocampal synaptic transmission (filled circles) when compared to non-TBI rats (sham) (open circles), 30 days after the impact (right). Three daily treatments with Ryanodex (dantrolene), including one immediately after the TBI, resulted in a reduction of these persistent synaptic effects of mild TBI.

Clinical Trials

For an up-to-date list of clinical trials currently enrolling patients at NorthShore Neurological Institute, go to: northshore.org/nnitrials

The DodoNA Project

The DodoNA Project: DNA Predictions to Improve Neurological Health

Aims: "DodoNA" is a metaphor. Dodona was an oracle of ancient Greece, where priestesses interpreted the rustling leaves of a sacred oak tree to predict the future and to guide actions to improve fate. Just as at Dodona, we can interpret subtle variations in DNA, the "tree of life," to improve neurological health. Specifically, we are developing medical informatics tools to capture standardized data via routine office visits that measure the progression and outcomes of patients with the following neurological disorders: brain tumors, epilepsy, memory disorders, migraine, mild traumatic brain injury, multiple sclerosis, neuropathy, Parkinson's disease, restless legs syndrome and stroke. We are also studying persons who are neurologically healthy but at increased risk for Alzheimer's disease and related brain disorders.

DodoNA is a clinical practice initiative (note-writing and workflow efficiencies) and a quality initiative (best practices). It is also a research initiative. We will invite up to 1,000 subjects for each of the 11 projects (11,000 subjects in total) to provide, via informed consent, a blood sample for DNA extraction and storage. We then will ask permission to associate information in their blood with information in their medical record (for the purposes of developing molecular prognostics and therapeutics).

Principal Investigator: Katerina Markopoulou, MD, PhD
NorthShore Project Number: EH10-139
Contact: Call **(847) 503-4344** with questions regarding the study.

Practice-Based Research

Quality Improvement and Practice-Based Research in Neurology Using the EHR System

Aims: The purpose of this study is to advance quality improvement and practice-based research in neurology using the electronic health record (EHR) system. The Department of Neurology at NorthShore has built into its commercial EHR (called "Epic") structured clinical documentation support (SCDS) and clinical decision support (CDS) tools that standardize care, write progress notes, and capture ~1,000 discrete and cascading fields of neurological data per office visit. The specific aims of this project are to first create a Neurology Practice-Based Research Network (NPBRN) by sharing SCDS and CDS tools for 10 common neurological disorders (brain tumors, epilepsy, migraine, mild cognitive impairment, mild traumatic brain injury, multiple sclerosis, neuropathy, Parkinson's disease, restless legs syndrome and stroke) and for brain health (11 projects total) with seven other Neurology Departments nationwide that also use the Epic EHR platform (eight sites total). Secondly, we will individualize medicine at the point of care by conducting pragmatic trials using subgroup-based adaptive designs, comparing the effectiveness of available treatments for common neurological disorders.

Site Principal Investigator: Steven Meyers, MD
NorthShore Project Number: EH14-355
Contact: Call **(847) 503-4344** with questions regarding the study.

Alzheimer's and Memory Disorders

New IDEAS: Imaging Dementia—Evidence for Amyloid Scanning Study (A Study to Improve Precision in Amyloid PET Coverage and Patient Care)

Aims: The goal of the study is to evaluate the utility of beta-amyloid PET for patients with Alzheimer's disease. The study will determine whether beta-amyloid PET imaging affects health outcomes for patients, including short-term outcomes related to changes in management and long-term outcomes of dementia.

Principal Investigator: Chad Yucus, MD
NorthShore Project Number: EH21-277
Contact: Call **(847) 503-4344** with questions regarding the study.

Brain Aneurysm

Humanitarian Use Device: Wingspan Stent System with Gateway PTA Balloon Catheter

Description: This device is used to increase cerebral artery blood flow in patients with intracranial atherosclerotic disease. A stent is placed in the affected area and is deployed by inflation of a very small balloon, which widens the occluded vessel.

Principal Investigator: Shakeel Chowdhry, MD
NorthShore Project Number: EH12-355
Contact: Call **(847) 570-4224** with questions regarding the device.

Humanitarian Use Device: The PulseRider® Aneurysm Neck Reconstruction Device (ANRD)

Description: This device acts as a support for the treatment of unruptured, wide-neck bifurcation aneurysms in the brain. A bifurcation aneurysm is a specific type of aneurysm that arises at the point at which there is a division of one major vessel into two branches.

Principal Investigator: Shakeel Chowdhry, MD
NorthShore Project Number: EH17-313
Contact: Call **(847) 570-4224** with questions regarding the device.

Brain and Spine Tumor

A Randomized, Double-Blind, Phase II Trial of Surgery, Radiation Therapy Plus Temozolomide and Pembrolizumab With and Without HSPPC-96 in Newly Diagnosed Glioblastoma (GBM)

Aims: The purpose of this study is to find out if adding immunotherapy (pembrolizumab) with or without a vaccine (HSPPC-96) to standard-of-care treatment for glioblastoma (GBM) improves survival of newly diagnosed GBM subjects. The standard treatment for GBM consists of surgery to remove the brain tumor, radiation and chemotherapy (temozolomide).

Principal Investigator: Janardan Khandekar, MD
NorthShore Project Number: EH18-383
Contact: Call **(847) 570-2025** with questions regarding the study.

Brain and Spine Tumor *(continued)*

Phase III Trial of Post-Surgical Single Fraction Stereotactic Radiosurgery (SSRS) Compared with Fractionated SRS (FSRS) for Resected Metastatic Brain Disease

Aims: The main goal of this study is to ascertain if time to surgical bed failure is increased with fractionated stereotactic radiosurgery (FSRS) compared to single fraction stereotactic radiosurgery (SSRS) in patients with resected brain metastasis. Secondary objectives include showing if there is better emotional wellbeing at 9 months in patients with resected brain metastasis undergoing FSRS compared to SSRS and learning whether there is improved overall survival in patients with resected brain metastases who undergo FSRS compared to patients who receive SSRS.

NorthShore Project Number: EH21-169
Principal Investigator: Janardan Khandekar, MD
Contact: Call **(847) 570-2025** with questions regarding the study.

A Phase I study of safety and tolerability of acetazolamide with temozolomide in adults with newly diagnosed MGMT promoter-methylated malignant glioma

Aims: This is a Phase I study that examines the rate of dose-limiting side effects in patients with malignant astrocytoma treated with combination acetazolamide (ACZ) and temozolomide (TMZ). Eligible patients must have histologically proven newly diagnosed, O6-methylguanine-DNA methyltransferase (MGMT) methylated WHO grade III or IV astrocytoma and be planning to undergo treatment with standard adjuvant TMZ (after completing treatment with TMZ and ionizing radiation).

Principal Investigator: Janardan Khandekar, MD
NorthShore Project Number: EH18-083
Contact: Call **(847) 570-2025** with questions regarding the study.

A Phase II Study of Checkpoint Blockade Immunotherapy in Patients with Somatically Hypermutated Recurrent Glioblastoma

Aims: Glioblastoma multiforme (GBM) is the most aggressive of the primary brain tumors. It remains uniformly lethal, and there are no treatments that extend survival once it recurs. The purpose of this study is to determine whether the combination of ipilimumab and nivolumab can lower the chance of recurrent glioblastoma with elevated mutational burden from growing or spreading after initial therapy failed. For this study, "high mutational burden" is defined as at least 20 mutations on the FoundationOne®CDx test.

Principal Investigator: Bruce Brockstein, MD
NorthShore Project Number: EH21-065
Contact: Call **(847) 570-2025** with questions regarding the study.

Phase II Trial of the Immune Checkpoint Inhibitor Nivolumab in Patients with Recurrent Select Rare CNS Cancers

Aims: The purpose of this study is to determine the efficacy of nivolumab in a variety of recurrent, refractory primary central nervous system (CNS) tumors as measured by disease control rate as confirmed Complete Response (CR) and Partial Response (PR) or durable Stable Disease (SD) for at least 6 months.

Principal Investigator: Janardan Khandekar, MD
NorthShore Project Number: EH21-004
Contact: Call **(847) 570-2025** with questions regarding the study.

Phase III Trial of Observation Versus Irradiation for a Gross Totally Resected Grade II Meningioma

Aims: The purpose of this Phase III study is to finally obtain a clear answer to the long-standing question of which treatment route leads to the best clinical outcome for patients with newly diagnosed WHO grade II meningioma. Subjects will be randomly assigned into one of two groups: Group 1 will be observed following surgery, and Group 2 will receive radiation therapy following surgery.

Principal Investigator: Bruce Brockstein, MD
NorthShore Project Number: EH18-270
Contact: Call **(847) 570-2025** with questions regarding the study.

A Randomized Phase II/III Open-Label Study of Ipilimumab and Nivolumab Versus Temozolomide in Patients with Newly Diagnosed MGMT (Tumor O6-Methylguanine-DNA Methyltransferase) Unmethylated Glioblastoma

Aims: The purpose of the study is to find out whether adding ipilimumab and nivolumab to radiotherapy will significantly prolong progression-free survival versus adding temozolomide to radiotherapy in patients with newly diagnosed glioblastoma without MGMT promoter methylation.

Principal Investigator: Bruce Brockstein, MD
NorthShore Project Number: EH20-366
Contact: Call **(847) 570-2025** with questions regarding the study.

Epilepsy

Feasibility of Continuous Pupil Dilation and Other Autonomic Monitoring as Non-Invasive Means of Seizure Prediction and Detection in the Epilepsy Monitoring Unit (EMU)

Aims: People who experience seizures have difficulty recognizing and accurately remembering when and how often they had seizures, and predicting when they will have seizures in the future. There is a need to detect and predict when seizures occur to try to reduce the harm that can come from having them. Researchers have worked on different methods of detecting and predicting seizures by looking at EEGs, body movements, sweating, heart rate variability and other things that may change around the time seizures occur. This study for the first time will look at what happens to the pupils of the eye around the time of seizures with the goal of developing another method to detect and predict seizures. This pilot study will focus on the feasibility of monitoring eye dilation in the EMU.

Principal Investigator: Kevin Novak, PhD
NorthShore Project Number: EH18-108
Contact: Call **(847) 570-2547** with questions regarding the study.

Headache

Long-Term, Prospective, Observational Study to Evaluate the Safety, Including Cardiovascular Safety, of Fremanezumab in Patients with Migraine in Routine Clinical Practice Non-Interventional Phase IV Study

Aims: The purpose of this study is to assess the incidence of adverse events in migraine patients with long-term exposure to fremanezumab relative to migraine patients treated with non-fremanezumab preventive migraine pharmacotherapy targeting the calcitonin gene-related peptide (CGRP) pathway or other preventive migraine pharmacotherapy not targeting the CGRP pathway. A primary objective of the study is to evaluate the long-term safety of fremanezumab in all patients with migraine through evaluation of incidence of all adverse events. The second primary objective of the study is to evaluate the safety of fremanezumab in a sub-population of cardiovascular compromised patients and/or with migraine with regard to cardiovascular events and major adverse cardiovascular events.

Principal Investigator: Steven Meyers, MD
NorthShore Project Number: EH20-351
Contact: Call **(847) 503-4344** with questions regarding the study.

Multiple Sclerosis

An Observational Study of Ocrelizumab-Treated Patients with Multiple Sclerosis to Determine the Incidence and Mortality Rates of Breast Cancer and All Malignancies (Verismo Study)

Aims: The purpose of this study is to assess and characterize the incidence and mortality rates of breast cancer, all malignancies, and the long-term safety regarding serious adverse events (SAEs) among patients with multiple sclerosis (MS) newly exposed to the medication ocrelizumab, (OCREVUS®) under routine clinical care.

Principal Investigator: Afif Hentati, MD
NorthShore Project Number: EH20-012
Contact: Call **(847) 503-4044** with questions regarding the study.

A Phase III Multicenter, Randomized, Double-Blind, Double-Dummy, Parallel-Group Study to Evaluate the Efficacy and Safety of Fenebrutinib Compared with Teriflunomide in Adult Patients with Relapsing Multiple Sclerosis

Aims: The purpose of this study is to compare the efficacy and safety of the study drug fenebrutinib to the FDA-approved medication teriflunomide (AUBAGIO®) in adult patients with relapsing multiple sclerosis. Primary objectives include measure of time from baseline to first occurrence of a progression event based on changes in EDSS score, increase in Timed 25-Foot Walk Test, increase in time to complete the 9-hole Peg Test and annualized relapse rate. The pharmacokinetics of fenebrutinib will also be evaluated. Eligible patients with relapsing multiple sclerosis will be randomly assigned to one of the two treatment arms at 1:1. Subjects who complete the initial 96-week-long double-blind treatment phase may be eligible to participate in a 96-week-long open-label fenebrutinib extension phase. Seven patients are expected to be enrolled at NorthShore sites.

Principal Investigator: Afif Hentati, MD
NorthShore Project Number: EH20-357
Contact: Call **(847) 503-4335** with questions regarding the study.

Neuromuscular Disorders

A Phase III, Multicenter, Randomized, Double-Blind, Placebo-Controlled Study to Confirm the Safety, Tolerability and Efficacy of Zilucoplan in Subjects with Generalized Myasthenia Gravis

Aims: The purpose of this research study is to determine the efficacy, safety and tolerability of zilucoplan in subjects with generalized myasthenia gravis. Zilucoplan is designed to work by preventing the body's attack on neuromuscular junctions by blocking a component of the body's immune system called the complement system. Participants will be randomized at a 1:1 ratio. Zilucoplan will be supplied to the patient in 1 ml prefilled syringes to be self-administered by the participant daily.

Principal Investigator: Alexandru Barboi, MD
NorthShore Project Number: EH21-109
Contact: Call **(847) 503-4333** with questions regarding the study.

A Phase III, Multicenter, Open-Label Extension Study of Zilucoplan in Subjects with Generalized Myasthenia Gravis

Aims: The purpose of this research study is to provide access to zilucoplan for subjects with generalized myasthenia gravis (gMG) who have completed a qualifying Ra Pharmaceuticals sponsored zilucoplan study and who wish to continue receiving zilucoplan. This study will also evaluate the long-term efficacy of zilucoplan in subjects with gMG who have completed the qualifying Ra Pharmaceuticals sponsored zilucoplan study.

Principal Investigator: Alexandru Barboi, MD
NorthShore Project Number: EH21-143
Contact: Call **(847) 503-4333** with questions regarding the study.

A Phase II randomized, double-blinded, placebo-controlled study to evaluate the efficacy and safety of efgartigimod IV in adult patients with post–COVID-19 postural orthostatic tachycardia syndrome (POTS)

Aims: Efgartigimod is a neonatal Fc receptor (FcRn) antagonist in clinical development for treating autoimmune diseases mediated by immunoglobulin G (IgG) autoantibodies. POTS arising in patients after infection with the SARS-CoV-2 virus (COVID-19) may be caused by pathogenic IgG autoantibodies that lead to autonomic dysfunction. This Phase II study will evaluate the efficacy and safety of efgartigimod in participants with post–COVID-19 POTS.

Principal Investigator: Alexandru Barboi, MD
NorthShore Project Number: EH22-256
Contact: Call **(847) 503-4344** with questions regarding the study.

A Phase II, Randomized, Double-Blinded, Placebo-Controlled, Parallel-Group, Multi-Center Trial to Evaluate the Efficacy, Safety and Tolerability, Pharmacokinetics, Pharmacodynamics, and Immunogenicity of 2 Dose Regimens of ARGX-117 in Adults with Multifocal Motor Neuropathy

Aims: This Phase II clinical trial serves to evaluate the safety and efficacy of 2 dose regimens of ARGX-117 versus placebo in participants with multifocal motor neuropathy (MMN) previously stabilized with intravenous immunoglobulin (IVIg). MMN is a rare neuropathy characterized by progressive asymmetric weakness and atrophy without sensory abnormalities. The objectives of the study include evaluating the safety and tolerability of ARGX-117 compared to placebo in adult participants previously stabilized with IVIg and to evaluate the efficacy of ARGX-117 compared to placebo on muscle strength and/or motor function in adult participants previously stabilized with IVIg.

Principal Investigator: Alexandru Barboi, MD
NorthShore Project Number: EH22-033
Contact: Call **(847) 503-4333** with questions regarding the study.

Neuromuscular Disorders *(continued)*

A Long-Term Extension of ARGX-117-2002 Trial to Evaluate the Long-Term Safety and Tolerability, Efficacy, Pharmacodynamics, Pharmacokinetics, and Immunogenicity of ARGX-117 in Adults with Multifocal Motor Neuropathy (MMN)

Aims: This is an open-label extension trial of ARGX-117-2002. The objectives of the study include evaluating the safety and tolerability of ARGX-117 to evaluate the long-term efficacy of ARGX-117 on muscle strength and/or motor function, arm and hand function, quality of life and fatigue in adult participants with MMN.

Principal Investigator: Alexandru Barboi, MD
NorthShore Project Number: EH22-333
Contact: Call **(847) 503-4333** with questions regarding the study.

Efficacy and Safety of Pozelimab and Cemdisiran Combination Therapy in Patients with Symptomatic Generalized Myasthenia Gravis

Aims: The primary purpose of this research study is to evaluate the effect of pozelimab and cemdisiran on daily functioning that is impacted by signs and symptoms in patients with symptomatic generalized myasthenia gravis.

Principal Investigator: Alexandru Barboi, MD
NorthShore Project Number: EH21-282
Contact: Call **(847) 503-4333** with questions regarding the study.

A Clinical Study of Patients with Symptomatic Neurogenic Orthostatic Hypotension to Assess Sustained Effects of Droxidopa Therapy

Aims: The purpose of this study is to evaluate the durability, effectiveness and safety of the study drug droxidopa in patients with neurogenic orthostatic hypotension (NOH). Droxidopa (NORTHERA®) has been approved in the United States for treatment of NOH. However, effectiveness beyond 2 weeks has not been demonstrated. This study is placebo-controlled to assess the benefits beyond 2 weeks and is therefore investigational. Total study participation can span up to 36 weeks.

Principal Investigator: Alexandru Barboi, MD
NorthShore Project Number: EH18-106
Contact: Call **(847) 503-4333** with questions regarding the study.

Parkinson's Disease and Movement Disorders

Genetic Analysis of Familial Parkinsonism

Aim: The purpose of this study is to identify inherited factors that may cause Parkinson's disease or parkinsonism.

Principal Investigator: Katerina Markopoulou, MD, PhD
NorthShore Project Number: EH16-166
Contact: Call **(847) 503-4333** with questions regarding the study.

The Longitudinal Clinical and Genetic Study of Parkinson's Disease (LONG-PD Study)

Aims: The clinical and genetic factors that influence motor and nonmotor severity, progression and outcomes in Parkinson's disease are unknown. Identification of these factors may allow us to individualize the care of patients and improve neurological health. The Genetic Epidemiology of Parkinson's Disease (GEoPD) consortium clinics care for thousands of patients each year. The purpose of this study is to develop a web-based platform for the capture and sharing of standardized data that measure motor and nonmotor severity, progression and outcomes in Parkinson's disease across 25 global sites—from 18 countries, 5 continents and 4,200 cases. These patients will be followed for 15 years for collaborative research studies. Additionally, DNA will be shared in a central repository to conduct genomic studies of severity, progression and outcomes in Parkinson's disease.

Principal Investigator: Katerina Markopoulou, MD, PhD
NorthShore Project Number: EH15-283
Contact: Call **(847) 503-4334** with questions regarding the study.

A multicenter, randomized, active-controlled, double-blind, double-dummy, parallel group clinical trial, investigating the efficacy, safety and tolerability of continuous subcutaneous ND0612 infusion in comparison to oral IR-LD/CD in subjects with Parkinson's disease experiencing motor fluctuations (BouNDless)

Aims: The primary objective of the study is to determine the effect of ND0612 on daily "ON" time without troublesome dyskinesia (defined as the sum of "ON" time without dyskinesia and "ON" time with non-troublesome dyskinesia) using subject-completed "ON/OFF" diary assessments of motor function in subjects with Parkinson's disease (PD) experiencing motor fluctuations. The key secondary objective of the study is to determine the effect of ND0612 on daily "OFF" time in subjects with PD experiencing motor fluctuations using subject-completed "ON/OFF" diary assessments of motor function.

Principal Investigator: Katerina Markopoulou, MD, PhD
NorthShore Project Number: EH21-332
Contact: Call **(847) 503-4335** with questions regarding the study.

Synuclein-One Study

Aims: The purpose of this research study is to determine whether small skin biopsies can be used as a novel method of detecting diseases collectively known as synucleinopathies, which include Parkinson's disease (PD), multiple system atrophy (MSA), dementia with Lewy bodies and pure autonomic failure (PAF). This study will evaluate the effectiveness of this skin biopsy test to confirm a diagnosis of a synucleinopathy and ensure that testing abnormalities are not detected in healthy individuals.

Principal Investigator: Alexandru Barboi, MD
NorthShore Project Number: EH21-081
Contact: Call **(847) 503-4333** with questions regarding the study.

Spine Surgery

A Multicenter, Prospective, Randomized, Clinical Trial Comparing the Safety and Effectiveness of the BAGUERA®C Cervical Disc Prosthesis to the Mobi-C® Cervical Disc for the Treatment of Patients with Symptomatic Cervical Disc Disease at a Single Level

Aims: The purpose of this study is to evaluate the safety and effectiveness of BAGUERA®C Cervical Disc Prosthesis in treating cervical disc disease at a single level. Subjects will be randomly assigned to one of the two treatment options (Baguera®C Cervical Disc Prosthesis or Mobi-C® Cervical disc) at a 2:1 ratio, and will be evaluated preoperatively, at the time of surgery, discharge, and at 6 weeks, 3, 6, 12, and 24 months after surgery. Subjects will continue to be followed annually to 7 years to fulfill postapproval study considerations.

Principal Investigator: Michael Musacchio, MD
NorthShore Project Number: EH21-058
Contact: Call **(847) 570-4224** with questions regarding the study.

A Multicenter, Prospective, Randomized, Clinical Trial Comparing the Safety and Effectiveness of the BAGUERA®C Cervical Disc Prosthesis to the MOBI-C® Cervical Disc for the Treatment of Patients with Symptomatic Cervical Disc Disease at Two Contiguous Levels.

Aims: The purpose of this study is to evaluate the safety and effectiveness of BAGUERA®C Cervical Disc Prosthesis in treating cervical disc disease when implanted at two contiguous levels. Subjects will be randomly assigned to one of the two treatment options (Baguera®C Cervical Disc Prosthesis or Mobi-C® Cervical Disc) at a 2:1 ratio and will be evaluated preoperatively, at the time of surgery at discharge, and at 6 weeks, 3, 6, 12, and 24 months after surgery. Subjects will continue to be followed annually to 7 years to fulfill post-approval study considerations.

Principal Investigator: Michael Musacchio, MD
NorthShore Project Number: EH21-059
Contact: Call **(847) 570-4224** with questions regarding the study.

A Randomized, Single-Blinded, Non-Inferiority Study Comparing AGN1 Local Osteo-Enhancement Procedure (LOEP) SV Kit Treatment of Vertebral Compression Fragility Fractures to Polymethylmethacrylate (PMMA) Bone Cement Treatment

Aims: This is a multicenter, single-blinded, randomized controlled clinical trial evaluating the safety and efficacy of the AGN1 LOEP SV Kit for the treatment of painful vertebral compression fragility fractures (VCFs). The objective of this study is to demonstrate non-inferiority of the AGN1 LOEP SV Kit for the treatment of VCFs to standard-of-care vertebroplasty treatment using bipedicular injection of PMMA bone cement.

Principal Investigator: Michael Musacchio, MD
NorthShore Project Number: EH21-293
Contact: Call **(847) 570-4224** with questions regarding the study.

Long-Term Assessment of the Safety and Performance of the NuVasive Simplify® Disc

Aims: The purpose of this study is to evaluate the long-term 10-year safety and performance of the Simplify Disc when used for cervical disc arthroplasty at one level in the cervical spine C3-C7 in subjects enrolled under the post-approval study (PAS) as measured by reported adverse events, radiographic outcomes and patient-reported outcomes.

Principal Investigator: Michael Musacchio, MD
NorthShore Project Number: EH22-228
Contact: Call **(847) 570-4224** with questions regarding the study.

Post-Marketing Clinical Follow-Up of an Annular Closure System (Barricaid®)

Aims: The primary objective of this study is to evaluate intra-operative parameters, billing/reimbursement data and post-operative outcomes of patients treated with the Barricaid annular closure device in a real-world setting.

Principal Investigator: Michael Musacchio, MD
NorthShore Project Number: EH22-370
Contact: Call **(847) 570-4224** with questions regarding the study.

Post-Approval Study Protocol for the Two Level Simplify® Cervical Artificial Disc

Aims: This is a prospective, multi-center post-approval study (PAS) evaluating subjects who participated in the non-randomized two level Simplify Disc study compared to anterior cervical discectomy and fusion (ACDF) subjects in a non-concurrent historical control Prestige LP study. The study is intended to demonstrate the 5-year long-term safety and efficacy of the Simplify® Cervical Artificial Disc ("Simplify Disc").

Principal Investigator: Michael Musacchio, MD
NorthShore Project Number: EH21-294
Contact: Call **(847) 570-4224** with questions regarding the study.

Sleep

Adherence and Outcome of Upper Airway Stimulation (UAS) for Obstructive Sleep Apnea (OSA) International Registry: ADHERE UAS Registry

Aims: The primary purpose of this registry is to evaluate the effectiveness of UAS delivered by the Inspire implanted device, by Inspire Medical Systems, Inc. This registry compares patients' pre- and post-implant responses on sleep-related questionnaires. It also measures physical pre- and post-implant data, including the frequency of patients' breathing abnormalities and oxygen saturation, and evaluates immediate and long-term safety of upper airway stimulation.

Principal Investigator: Mari Viola-Saltzman, DO
NorthShore Project Number: EH19-321
Contact: Call **(847) 503-4333** with questions regarding the study.

A Double-Blind, Placebo-Controlled, Randomized Withdrawal Study to Evaluate the Safety and Efficacy of Pitolisant in Adult Patients with Idiopathic Hypersomnia

Aims: The purpose of the study is to evaluate the safety and efficacy of pitolisant (HBS-101) compared with placebo in treating excessive daytime sleepiness (EDS) in patients with idiopathic hypersomnia (IH). The study consists of a screening period (up to 28 days), an 8-week open-label phase, and a 4-week double-blind randomized withdrawal phase. After completion of the screening phase, eligible patients will be enrolled in the open-label phase, which includes a 6-week optimization (titration) phase and a 2-week stable dose period. At the end of the stable dose period, safety, efficacy, pharmacokinetic (PK) and genotype assessments will be collected, and patients will be categorized as "responders" or "non-responders." Responders, defined as participants who achieve a decrease of ≥3 points in their Epworth Sleepiness Scale (ESS) score from baseline to the end of the stable dose period, will be randomized in a 1:1 ratio to receive blinded study drug (pitolisant or matching placebo) in the double-blind randomized withdrawal phase of the study. Non-responders will not be randomized to treatment in the double-blind randomized withdrawal phase but will complete two safety follow-up telephone contacts at 15 and 30 days after their final dose of open-label pitolisant. These follow-ups will include assessment for adverse events and concomitant medication use.

Principal Investigator: Thomas Freedom, MD
NorthShore Project Number: EH22-171
Contact: Call **(847) 570-1864** with questions regarding the study.

Sleep *(continued)*

An Open-Label Study to Evaluate the Long-Term Safety and Effectiveness of Pitolisant in Adult Patients with Idiopathic Hypersomnia Who Completed Study HBS-101-CL-010

Aims: The purpose of the study is to evaluate the long-term safety and effectiveness of pitolisant in adult patients with idiopathic hypersomnia (IH) who have completed the double-blind randomized withdrawal phase of HBS-101-CL-010. Patients who complete study HBS-101-CL-010 will have up to 7 days from the end of treatment Visit/Visit 5 to enroll in study HBS-101-CL-011 and begin open-label pitolisant.

Principal Investigator: Thomas Freedom, MD
NorthShore Project Number: EH22-371
Contact: Call **(847) 570-1864** with questions regarding the study.

Stroke Program

Carotid Revascularization and Medical Management for Asymptomatic Carotid Stenosis Trial (CREST-2)

Aims: The purpose of this randomized trial is to determine whether the incidence of stroke or death differs between subjects with high-grade asymptomatic carotid stenosis who receive intensive medical management alone, as compared to subjects who receive intensive medical management in combination with carotid artery stenting (CAS). The primary endpoint is stroke or death within 44 days after randomization or ipsilateral ischemic stroke thereafter, up to the 4-year follow-up time point.

Principal Investigator: William Ares, MD
NorthShore Project Number: EH22-019
Contact: Call **(847) 570-4224** with questions regarding the study.

Non-Blinded Data Collection Pilot Study of Acute Stroke Using the BrainPulse™

Aims: The purpose of this pilot study is to collect data from patients experiencing stroke using the BrainPulse device. In the second (current) phase of the study, data will be collected on two groups of patients: those with large vessel occlusion (LVO) acute stroke and non-LVO acute stroke. The data collected from the BrainPulse will be compared across these study groups in an attempt to distinguish stroke from other non-stroke conditions that present with similar symptoms and LVO from non-LVO types of strokes. Further assessments will also be made to evaluate whether the BrainPulse device can identify the presence of stroke.

Principal Investigator: Shakeel Chowdhry, MD
NorthShore Project Number: EH19-084
Contact: Call **(847) 570-4224** with questions regarding the study.

"We're participating in cutting-edge national prospective research trials to improve care for patients with ischemic and hemorrhagic stroke."

— Dr. Shakeel Chowdhry
Neurosurgery Department

Phase II/III Adaptive Design, Randomized Double-Blind Placebo-Controlled Study to Evaluate the Safety and Efficacy of DM199 for the Treatment of Acute Ischemic Stroke (ReMEDy2 Trial)

Aims: The objective of this study is to evaluate the safety and efficacy of DM199 in treating patients presenting with acute ischemic stroke (AIS). The study evaluates rates of both recovery and recurrent AIS in subjects for whom thrombolysis and/or a catheter-based procedure (e.g., mechanical thrombectomy [MT]) are not medically appropriate or available due to constraints of clot location, comorbidity risks, and/or time from estimated onset of stroke. Eligible subjects presenting with AIS will be randomized 1:1 to placebo or DM199 administered by a single intravenous (IV) dose followed by a subcutaneous (SC) dose within 12 hours and then SC doses 2 times per week until Day 21. The duration of subject participation in the study is 90 days.

Principal Investigator: Zachary Bulwa, MD
NorthShore Project Number: EH22-097
Contact: Call **(847) 570-2025** with questions regarding the study.

A multi-center, randomized, adaptive clinical trial comparing standard medical management to early surgical hematoma evacuation using minimally invasive parafascicular surgery in the treatment of acute spontaneous supratentorial intracerebral hemorrhage

Aims: The purpose of this study is to provide clinical evidence of functional improvement, safety and economic benefit when comparing intracerebral hemorrhage (ICH) evacuation (removal of a blood clot from the brain using the minimally invasive BrainPath access system) to medical treatment.

Principal Investigator: Shakeel Chowdhry, MD
NorthShore Project Number: EH17-038
Contact: Call **(847) 570-4224** with questions regarding the study.

Automated Detection, Characterization, Triage and Recruitment of ICH Subjects Using Artificial Intelligence in the ENRICH Trial

Aims: The purpose of this study is to evaluate the performance of the Viz ICH-VOLUME and Viz RECRUIT software in subjects identified as having an intracerebral hemorrhage (ICH) event as determined by standard-of-care imaging assessments and interpretation. If the subjects are ultimately enrolled in the ENRICH Trial (EH17-038), data from this study will be pooled with the ENRICH Trial data for evaluation and analysis of endpoints related to the time to detection of the ICH status, treatment, functional improvement, safety outcomes and economic benefit of subjects enrolled in this study as compared to those enrolled in the ENRICH trial prior to Viz ICH-VOLUME and Viz RECRUIT software use.

Principal Investigator: Shakeel Chowdhry, MD
NorthShore Project Number: EH19-253
Contact: Call **(847) 570-4224** with questions regarding the study.

The DodoNA Project

The DodoNA project is one of the major initiatives at the NorthShore Neurological Institute (NNI). The purpose of the project is to predict, prevent and halt neurological disorders through the development of DNA-based prognostic tests and therapies. Research undertaken as part of the DodoNA project will also drive quality improvement for the care of neurological disorders at the NNI.

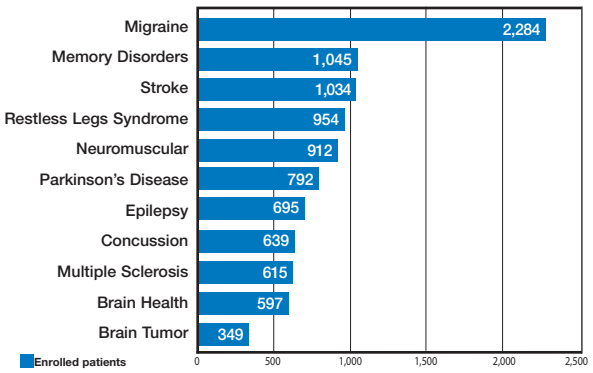
Clinical data are gathered using a set of customized toolkits within NorthShore's electronic health record (EHR) system. Clinician-researchers at NorthShore built 11 toolkits, one for each of 10 different neurological disorders and one for studying brain health in individuals without current neurological disease. These toolkits are used to collect data from routine office visits.

After genetic data are gathered from blood samples from DodoNA patients, statisticians are evaluating genetic markers associated with disease characteristics and treatment response. This information will better position us to predict and modify disease.

This is a very exciting time for this research, as we have now started to harvest the results of over 10 years of data collection. Some of the descriptive data are shown in the graphs below and on the following pages. After that, some of the insights we have gained from analyses of the data are shown.

Research Update

As of February 2023, we have enrolled over 9,800 patients in the DodoNA project.

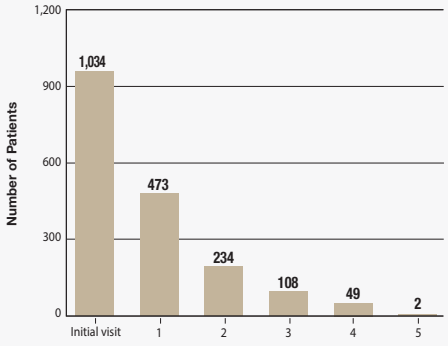


Stroke

Description of our first 1,034 patients enrolled, at their initial visit

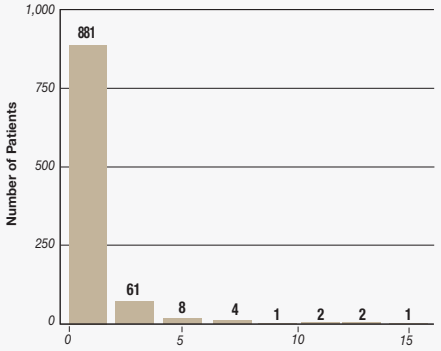
Patient Follow-Up

Patients evaluated at annual follow-up visits.



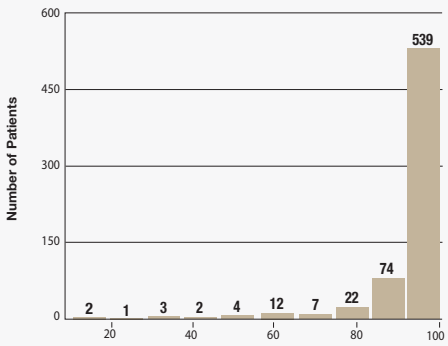
National Institutes of Health Stroke Scale (initial)

An objective measure of the severity of strokes. 0 = no symptoms, 1–4 = mild stroke; 5–15 = moderate stroke.



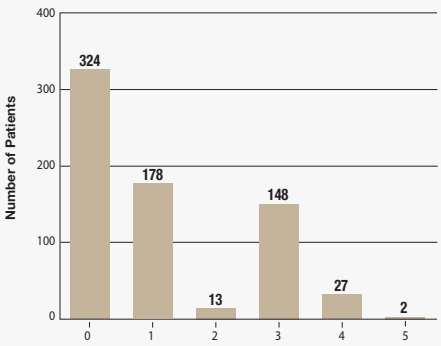
Barthel Index (initial)

A measure of performance in activities of daily living (basic activities). 100 = completely independent individual; 0 = completely nonfunctioning individual.



Modified Rankin Index (initial)

A global disability scale. 0 = no symptoms; 5 = severe disability.

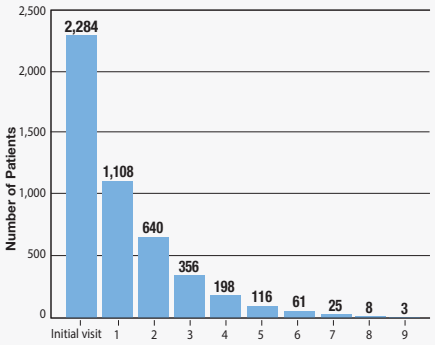


Migraine

Description of our 2,284 patients enrolled, at their initial visit

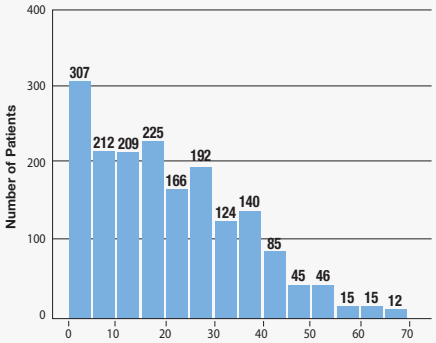
Patient Follow-Up

Patients evaluated at annual follow-up visits.



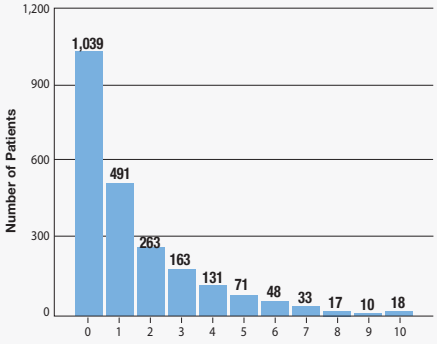
Disease Duration

Measured in years, from year of initial symptom to year of initial visit.



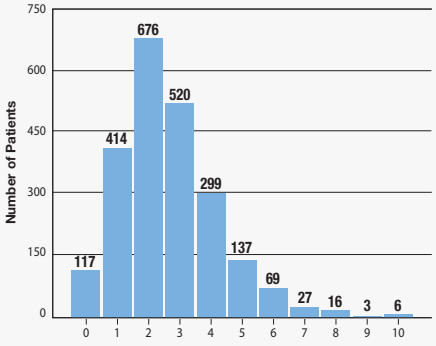
Number of Prior Preventive Medications

Preventive medications are taken daily to keep migraine attacks from occurring frequently.



Number of Prior Abortive Medications

Abortive medications are taken at the start of a migraine attack to stop the symptoms.



Clinical and Research Insights

Clinical and genetic factors that influence migraineur response to CGRP-based migraine preventive medications.

Migraine is an exceptionally common neurological condition that can cause severe disability. In 2018, three new preventive medications were introduced that target CGRP (calcium-gene related peptide), which is elevated during migraine headaches. These medications do not work in about a third of migraineurs. To understand what factors are associated with efficacy, we used two approaches. First, we reviewed the electronic health records of patients prescribed one of the three medications to identify clinical factors associated with response. Second, we analyzed data from the DodoNA migraine cohort to identify genetic factors associated with response. The DodoNA analyses revealed that genetic variation in two genes affected migraineur response. A variant in *RAMP1*, which encodes a protein important for CGRP signaling, is associated with decreased responsiveness. In contrast, a variant in *COMT*—which is involved in the degradation of catecholamines—and a higher migraine genetic risk score are associated with increased responsiveness. This work has provided real-world evidence for the importance of clinical as well as genetic factors in migraineur response to treatment.

Clinical and genetic factors influence migraineur response to CGRP-based preventatives

Negative Associations
- **Prior hospitalization for migraines**
- **≥6 failed preventatives**
- ***RAMP1 rs12615320 (G)***

Positive Associations
- **Migraine days/month**
- **Female sex**
- **Months on medication**
- **Higher migraine genetic risk score**
- ***COMT rs4680 (A)***

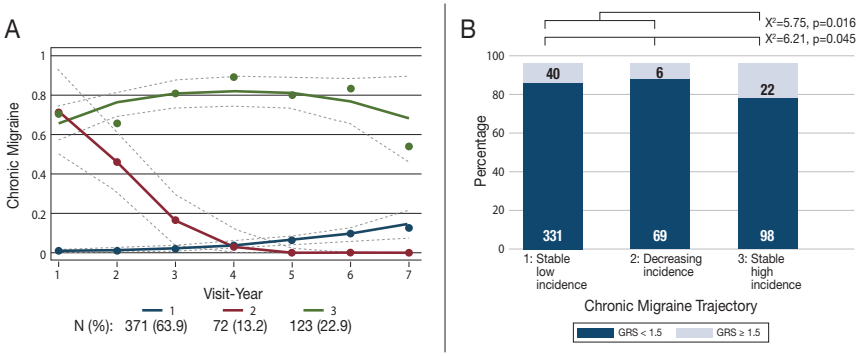
Migraine genetic risk influences migraineur outcomes.

Migraine can be considered a complex genetic disorder; both genetic variation and environmental factors affect the risk of migraine. We asked whether genetic risk of migraine also affected migraineur outcomes. We developed a genetic risk score based on genetic variants that have been previously associated with migraine in large genome-wide association studies. We then studied over 2,000 migraineurs in the DodoNA migraine cohort, characterizing their initial-visit clinical features and the longitudinal trajectories. We found that a high-risk score is associated with a decreased age of onset, increased initial-visit severity, increased refractoriness to treatment and a decreased risk of migraine-associated comorbidities.

Migraine Genetic Risk	Migraineur Outcomes
High Risk	▼ Age at onset ▲ Initial visit severity ▲ Treatment refractoriness ▼ Comorbidity risk

Trajectories of migraineurs with chronic migraine.

Chronic migraine, defined as the occurrence of migraine or other headaches on at least 15 days per month, is highly disabling. We studied the trajectories of migraineurs in the DodoNA cohort with respect to chronic migraine. We found evidence for the three trajectories shown in Panel A: (1) stable and low-incidence, (2) presence at the initial visit that responds to treatment to become low-incidence, and (3) stable and high-incidence. We then asked whether any of these trajectories are associated with a migraine genetic risk score. In Panel B, bar graphs illustrate that a high-risk score is more often found in trajectory 3, which appears to identify migraineurs who are more refractory to treatment.

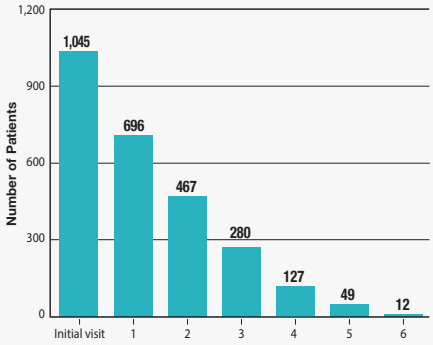


Memory Disorders

Description of our 1,045 patients enrolled, at their initial visit

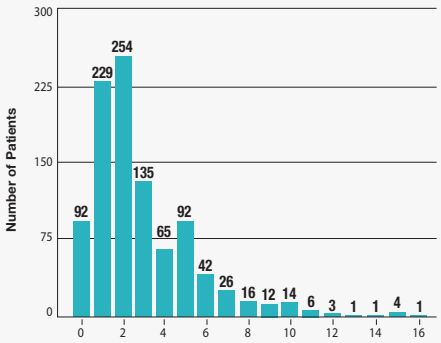
Patient Follow-Up

Patients evaluated at annual follow-up visits.



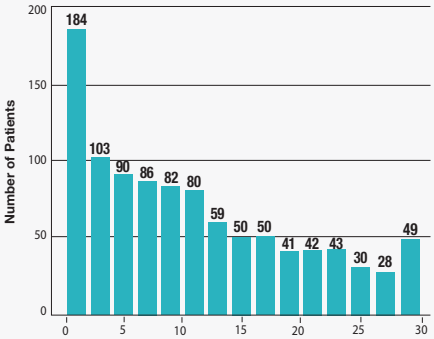
Disease Duration

Measured in years, from year of initial symptom to year of initial visit.



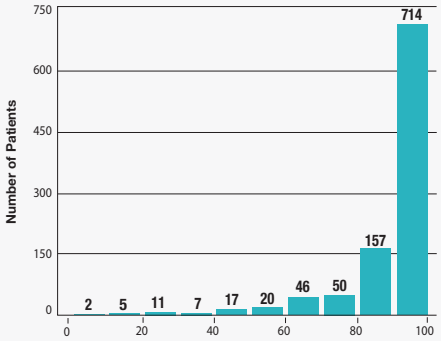
The Functional Activities Questionnaire

A measure of performance in activities of daily living (complex activities). 0 = person with no limitations; 30 = fully dependent individual.



Barthel Index

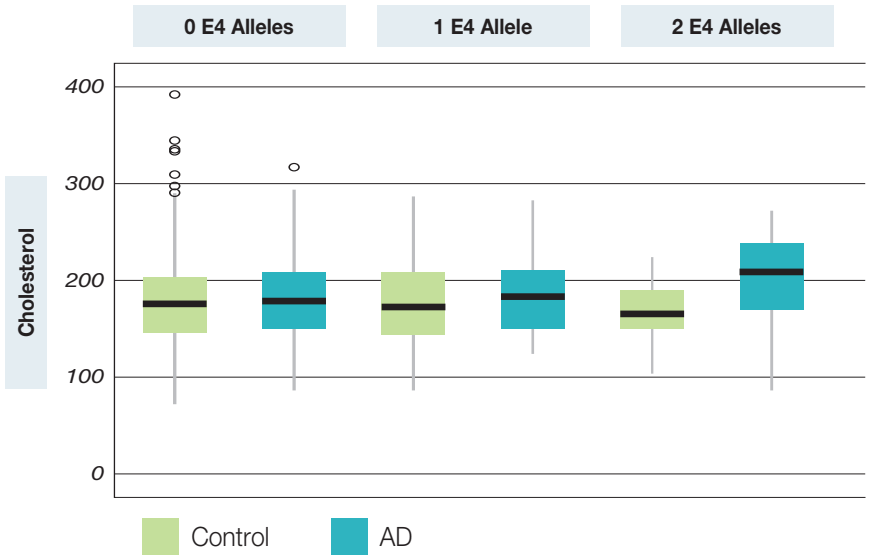
A measure of performance in activities of daily living (basic activities). 100 = completely independent individual; 0 = completely nonfunctioning individual.



Clinical and Research Insights

Lipid levels in patients who develop Alzheimer's disease (AD).

Many of the over-70 risk-loci for Alzheimer's disease, including APOE, impact lipid metabolism. Although LDL-C plasma levels are elevated in early-onset Alzheimer's disease, the association of lipids with the strongest risk allele, APOE-ε4, and their utility as a biomarker for later-onset Alzheimer's disease and disease progress remains controversial. To gain insight into this issue, we compared lipid levels in members of the DodoNA memory cohort to those in DodoNA patients lacking neurodegenerative disease. The box plots illustrate one of the results of this study and show the distribution of cholesterol levels in DodoNA control subjects and patients with Alzheimer's disease, five years prior to onset, by the number of APOE-ε4 alleles present.

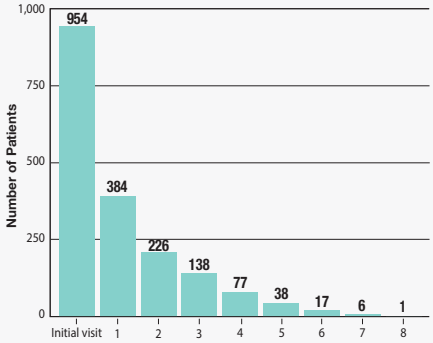


Restless Legs Syndrome

Description of our first 954 patients enrolled, at their initial visit

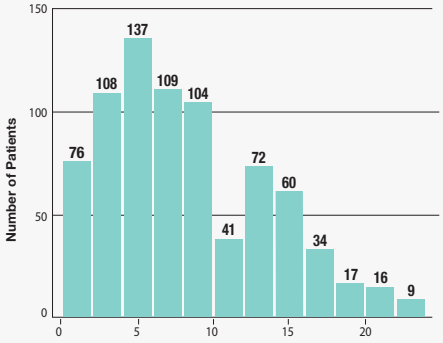
Patient Follow-Up

Patients evaluated at annual follow-up visits.



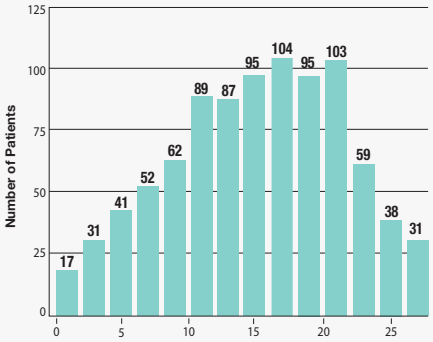
ESS Score

Epworth Sleepiness Scale (ESS), where scores greater than 10 indicate excessive daytime sleepiness.



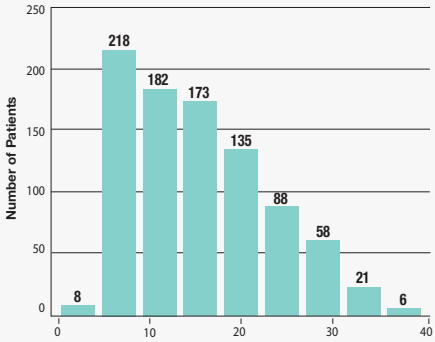
ISI Score

Insomnia Severity Index (ISI), where scores of 15 and over indicate at least moderate severity.



IRLS Score

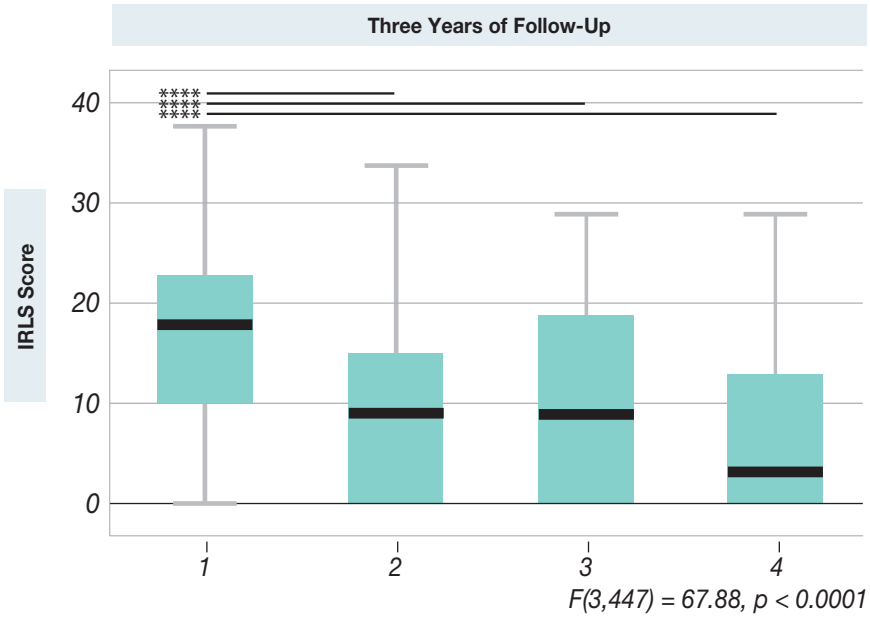
International Restless Legs Scale (IRLS) rating scale, where scores of 0–10 = mild, 11–20 = moderate, 21–30 = severe and 31–40 = very severe.



Clinical and Research Insights

Effectiveness of treatment for restless legs syndrome.

In addition to providing insights into the genetic contributions to disease and disease outcomes, analyses of the DodoNA cohort can be used to evaluate quality metrics. One example is illustrated here for the DodoNA sleep cohort, which includes patients with restless legs syndrome. The box plots and associated analyses show that, following treatment at the NNI, scores on the International Restless Legs Scale (IRLS) decline. Compared to initial visit scores, scores are lower on three subsequent annual visits.

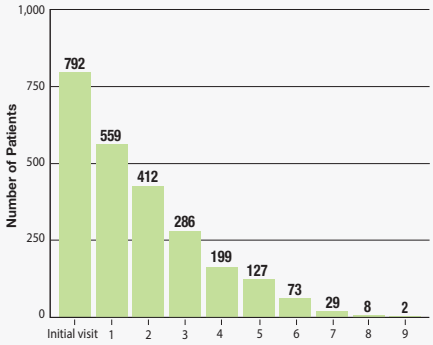


Parkinson's Disease

Description of our first 792 patients enrolled, at their initial visit

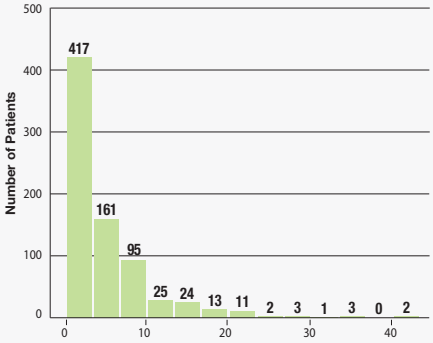
Patient Follow-Up

Patients evaluated at annual follow-up visits.



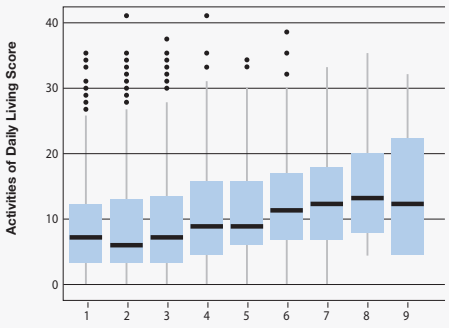
Disease Duration

Measured in years, from year of initial symptom to year of initial visit.



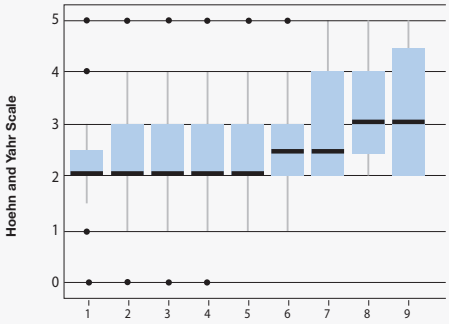
Activities of Daily Living

This scale is designed to assess difficulties in daily activities due to Parkinson's disease, with higher scores reflecting greater difficulty in daily activities.



Longitudinal Changes in Hoehn and Yahr Scale

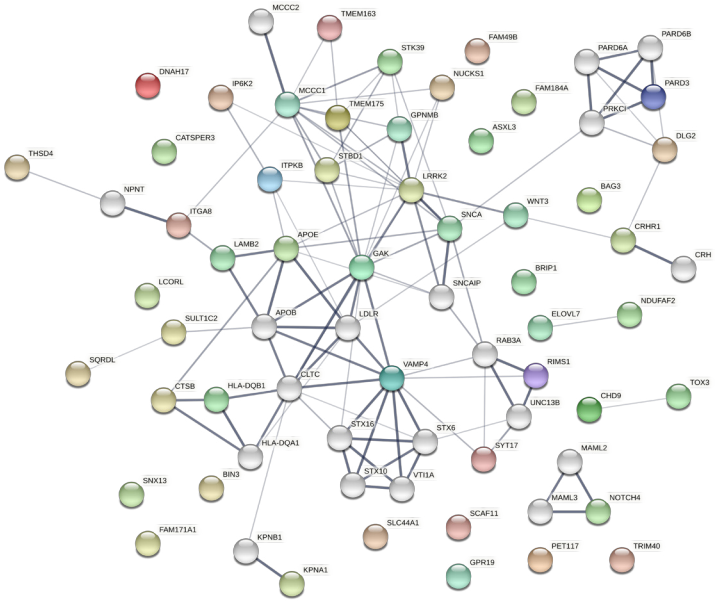
The Hoehn and Yahr scale is a measure of motor impairment; it is an objective measure of disability. As a group, our patients have remained largely stable over more than five years.



Clinical and Research Insights

Protein-protein interaction network for genes associated with differential presentation of symptoms of Parkinson's disease.

Many studies over the last 20 years have demonstrated that genetic variation impacts the risk of Parkinson's disease. Parkinson's disease presents with a variety of symptoms and can be challenging to diagnose reliably. We evaluated how genetic variation impacts the clinical features that are observed when patients are first diagnosed. By studying patients enrolled in the DodoNA Parkinson's disease cohort, we learned that genetic risk factors for Parkinson's disease do not uniformly affect the clinical presentation. We found that the genes associated with risk are differentially associated with the characteristics seen at the initial clinical diagnosis. This figure shows potential functional protein-protein interactions between the 32 genes identified in our association analysis. Each sphere represents one protein, and the thickness of the lines between the spheres corresponds to the confidence of the interactions. The colored spheres represent the proteins of the genes identified in the association analyses, while the uncolored spheres represent second-shell interactions that reveal indirect interactions among the proteins. For more information, see Markopoulou et al., 2021. *Front. Neurol.* 12:662278. doi: 10.3389/fneur.2021.662278.

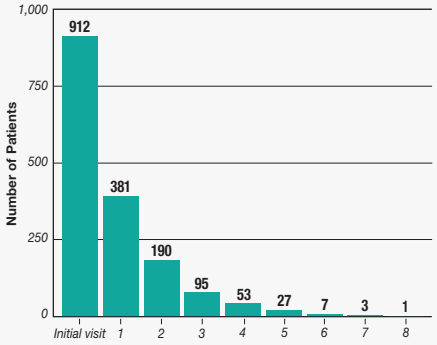


Neuromuscular

Description of our first 912 patients enrolled, at their initial visit

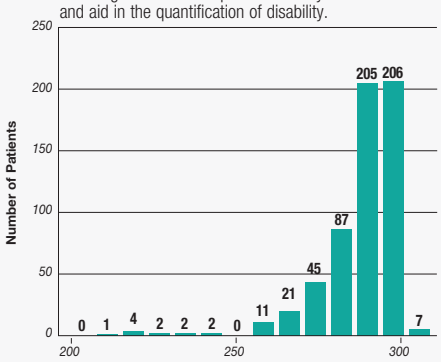
Patient Follow-Up

Patients evaluated at annual follow-up visits.



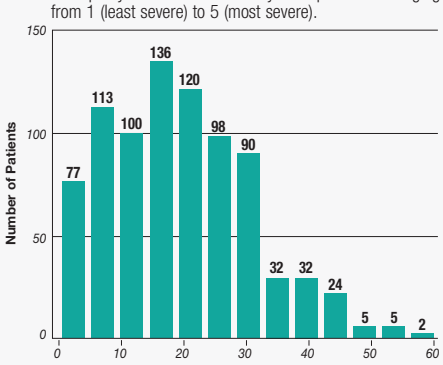
NorthShore Neuropathy Impairment Score

This test was developed by physicians at NorthShore Neurological Institute to parallel severity of involvement and aid in the quantification of disability.



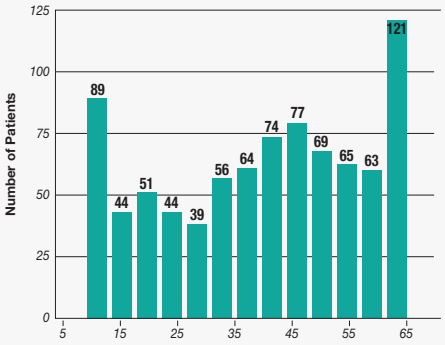
Survey of Autonomic Symptoms

The survey consists of 11 items in women and 12 in men to measure autonomic symptoms in early diabetic neuropathy. Each item is rated by an impact score ranging from 1 (least severe) to 5 (most severe).



Fatigue Severity Score

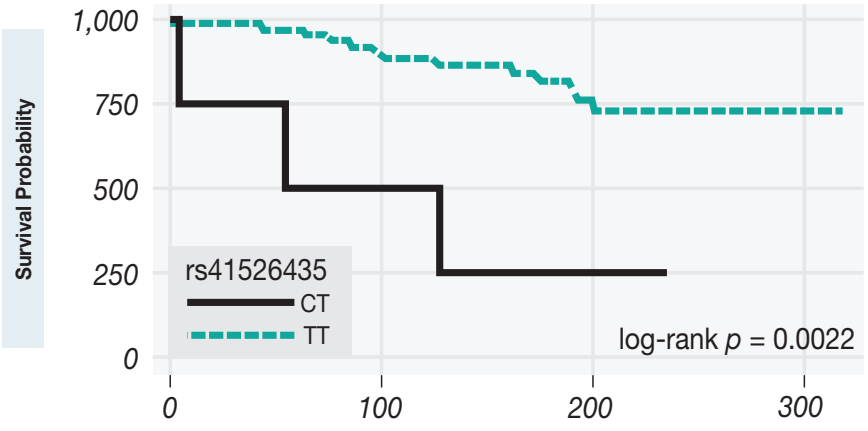
A short questionnaire for evaluating the impact of fatigue on patients. A total score of less than 36 suggests that a patient may not be suffering from fatigue.



Clinical and Research Insights

A genetic variant is associated with increased risk of mortality in patients with diabetic autonomic neuropathy.

Some patients with diabetes develop diabetic autonomic neuropathy. This condition is associated with increased mortality. To improve outcomes in patients with diabetic autonomic neuropathy, we sought to identify factors that increase mortality risk in these patients. We analyzed data from the DodoNA polyneuropathy toolkit and reviewed the electronic health record. In addition to two clinical characteristics (lower body mass index and the presence of neurogenic orthostatic hypotension), we found that carriers of a genetic variant previously associated with increased risk of polyneuropathy significantly increased mortality risk.



Number at risk

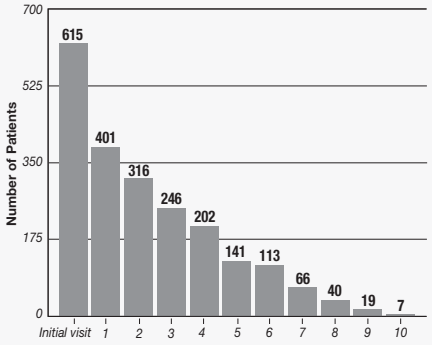
CT	4	(2)	2	(1)	1	(0)	0
TT	64	(6)	50	(7)	23	(0)	1

Multiple Sclerosis

Description of our first 615 patients enrolled, at their initial visit

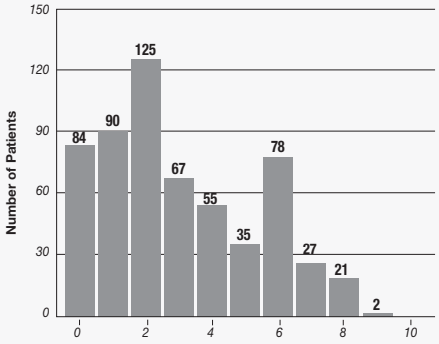
Patient Follow-Up

Patients evaluated at annual follow-up visits.



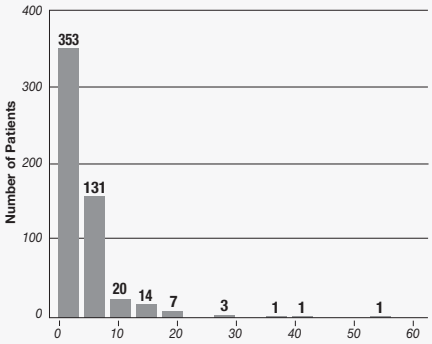
EDSS Step

Expanded Disability Status Scale (EDSS), where higher scores are more severe (e.g., scores of 5 and above indicate increasing difficulty walking).



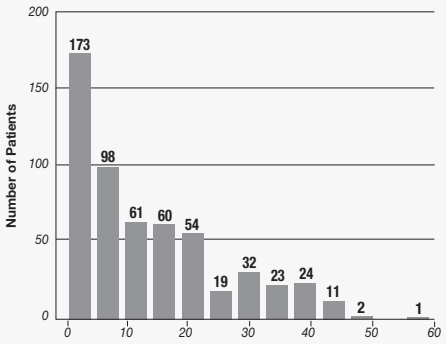
25 ft. Walk

The number of seconds required, on a second attempt, to walk 25 feet.



Disease Duration

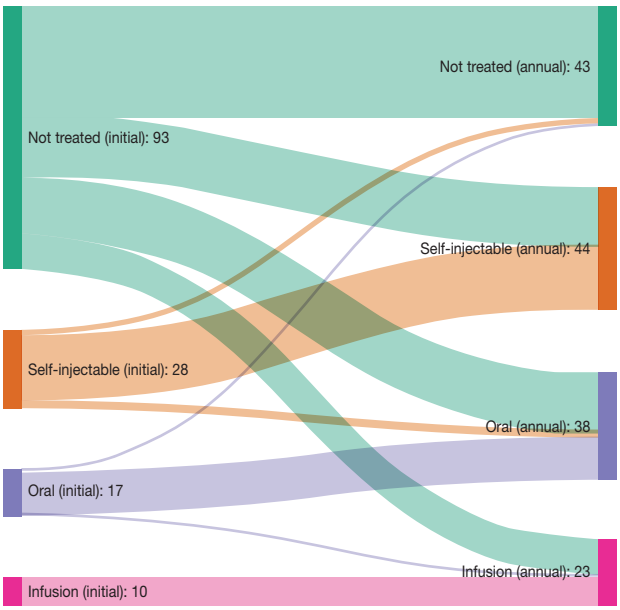
Measured in years, from year of initial symptom to year of initial visit.



Clinical and Research Insights

Changing immunomodulating medication preferences for the treatment of multiple sclerosis.

DodoNA data can be used to understand trends in patient and clinician preferences for treatment. In this example, we studied trends in the use of immunomodulating medications that are used to treat multiple sclerosis. An analysis of data from the DodoNA multiple sclerosis toolkit provided an understanding of how patient preferences for injectable, oral and infused medications have changed over the past decade. Compared to a study we performed in 2016, we found that patient choices have changed in a way that corresponds to the more varied treatment options in our patient population. The flow (Sankey) diagram presented here illustrates that though many patients still consider injectable medications a first-line agent, oral medications are equally popular in our community-based population.

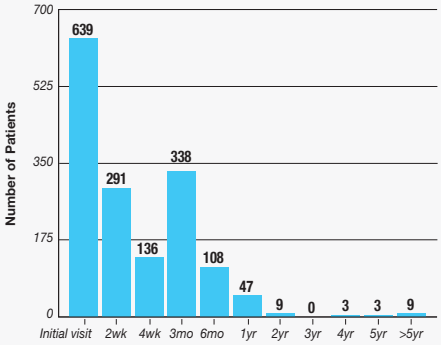


Concussion

Description of our first 639 patients enrolled, at their initial visit

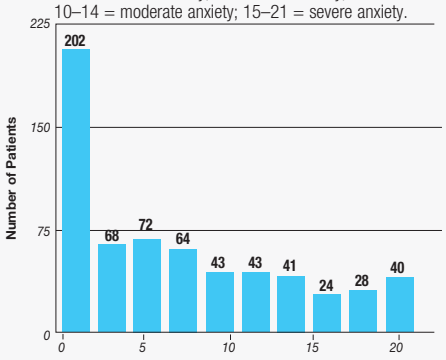
Patient Follow-Up

Patients evaluated at annual follow-up visits.



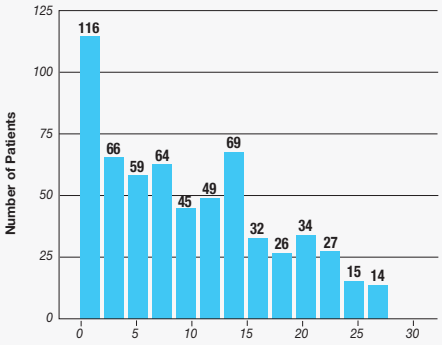
GAD-7 Score

Measuring of generalized anxiety disorder (GAD).
0–4 = minimal anxiety; 5–9 = mild anxiety;
10–14 = moderate anxiety; 15–21 = severe anxiety.



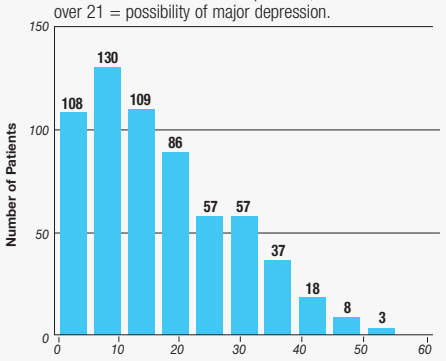
ISI Score

Insomnia Severity Index (ISI), where scores of 15 and over indicate at least moderate severity.



CES-D Score

Screening test to determine depression quotient.
15–21 = mild to moderate depression;
over 21 = possibility of major depression.

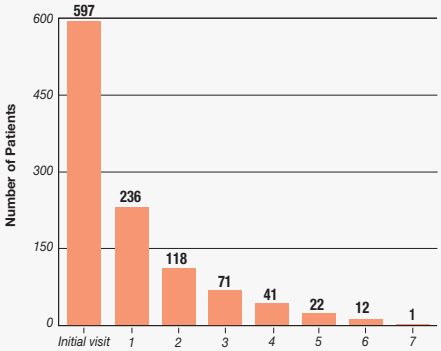


Brain Health

Description of our first 597 patients enrolled, at their initial visit

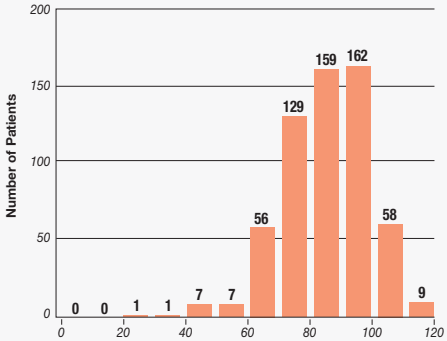
Patient Follow-Up

Patients evaluated at annual follow-up visits.



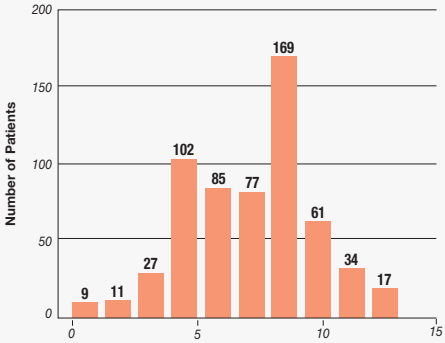
Readiness Questionnaire

The readiness questionnaire indicates readiness to engage in several brain health activities. 100 = very willing for every activity; 0 = very unwilling for all activities.



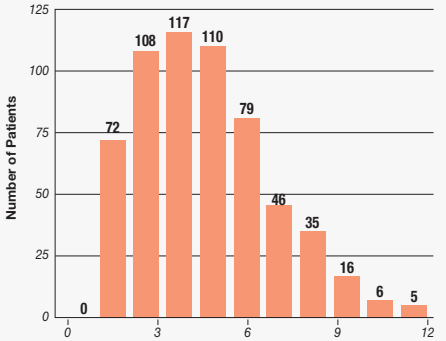
PREDIMED Questionnaire

The PREDIMED questionnaire is a 14-item quiz that defines adherence to the Mediterranean diet. 0–9 = weak adherence; 10–14 = strong adherence.



Brain Health Quiz Score

The brain health quiz includes 23 well-defined risk factors for Alzheimer's disease and related disorders.
0 = no risk factors or concerns; 23 = all risk factors and concerns.

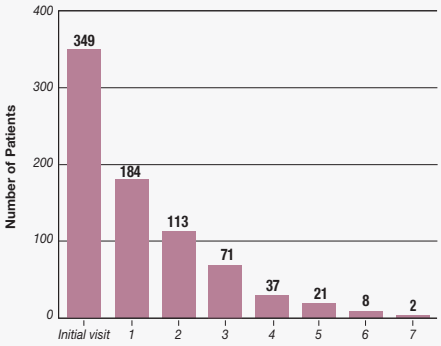


Brain Tumor (primary malignant)

Description of our first 349 patients enrolled, at their initial visit

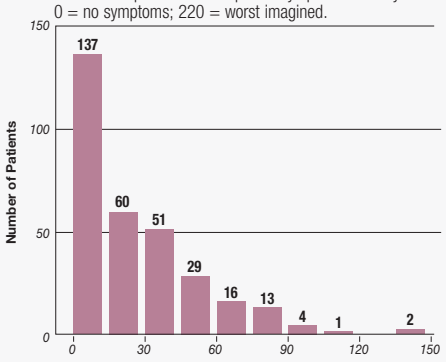
Patient Follow-Up

Patients evaluated at annual follow-up visits.



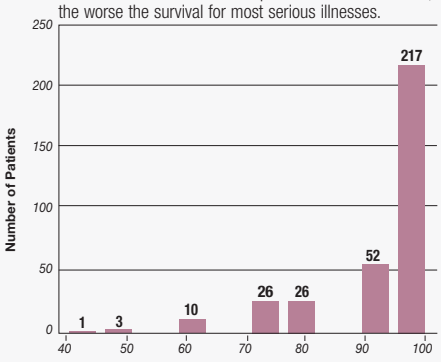
MD Anderson Symptom Inventory—Brain Tumor (Part 1)

Measures a patient's self-reported symptoms severity. 0 = no symptoms; 220 = worst imagined.



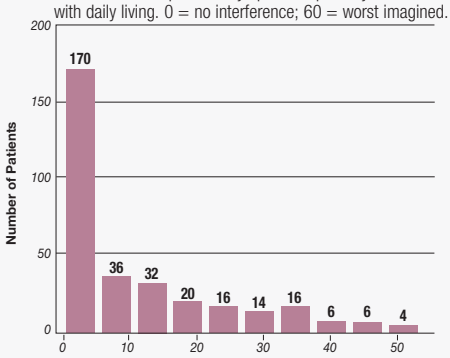
Karnofsky Performance Scale

Classification of functional impairment used to compare effectiveness of different therapies. The lower the score, the worse the survival for most serious illnesses.



MD Anderson Symptom Inventory—Brain Tumor (Part 2)

Measures how a patient's symptoms reportedly interfere with daily living. 0 = no interference; 60 = worst imagined.

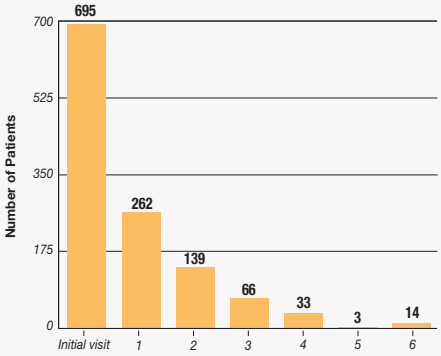


Epilepsy

Description of our first 695 patients enrolled, at their initial visit

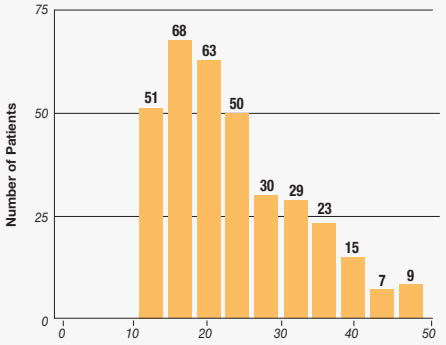
Patient Follow-Up

Patients evaluated at annual follow-up visits.



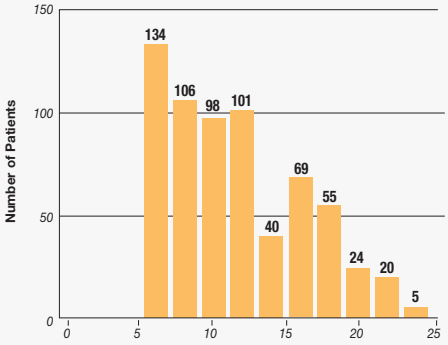
Quality of Life in Epilepsy

Quality of Life in Epilepsy (QOLIE-10-P). Lower scores indicate a greater severity and burden of epilepsy on quality of life.



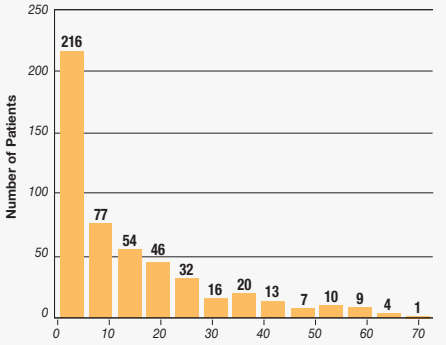
Disease Duration

Measured in years, from year of initial symptom to year of initial visit.



NDDI-E Total Score

The Neurological Disorders Depression Inventory for Epilepsy (NDDI-E) is a 6-item questionnaire validated to screen for depression in people with epilepsy. Scores greater than 15 indicate depression.



PUBLICATIONS

Ares WJ, Jankowitz BT, Kan P, Spiotta AM, Nakaji P, Wilson JD, Fargen KM, Ramos E, Leonardo J, Grandhi R. The neurosurgical marriage: Evaluating the interplay of work life and home life from the perspective of partners of neurosurgical residents. *J Neurosurg*. 2022 Sep 9:1-8. doi: 10.3171/2022.7.JNS221493. Online ahead of print. PMID: 36087329.

Suchy Y, Beebe D, **Guidotti-Breting L**, Hahn-Ketter A. Winners of the seventh annual TCN/AACN student project competition. *Clin Neuropsychol*. 2022 May;36(4):848-849. doi: 10.1080/13854046.2022.2059399. Epub 2022 Apr 19. PMID: 35438044. No abstract available.

Swartz EE, Register-Mihalik JK, Broglio SP, Mihalik JP, Myers JL, Guskiewicz KM, **Bailes J**, Hoge M. National Athletic Trainers' Association Position Statement: Reducing Intentional Head-First Contact Behavior in American Football Players. *J Athl Train*. 2022 Feb 1;57(2):113-124. doi: 10.4085/1062-6050-0062.21. PMID: 35201304. Free PMC article.

Chen CJ, Chalhoub R, Ding D, Kumar JS, Ironside N, Kellogg RT, Worrall BB, Southerland AM, Jabbour P, Wolfe SQ, Arthur AS, Goyal N, Fragata I, Maier I, Matouk C, Grossberg JA, Kan P, Schirmer CM, Crowley RW, **Ares WJ**, Ogilvy CS, Rai AT, Levitt MR, Mokin M, Guerrero WR, Mascitelli JR, Yoo AJ, Williamson R, Grande AW, Crosa RJ, Webb S, Psychogios MN, Starke RM, Spiotta AM, Park MS; STAR collaborators. Is a picture-perfect thrombectomy necessary in acute ischemic stroke? *J Neurointerv Surg*. 2022 Feb;14(2):111-116. doi: 10.1136/neurintsurg-2020-017193. Epub 2021 Feb 16. PMID: 33593800.

Novak K, **Chase BA**, Narayanan J, Indic P, **Markopoulou K**. Quantitative Electroencephalography as a Biomarker for Cognitive Dysfunction in Parkinson's Disease. *Front Aging Neurosci*. 2022 Jan 3;13:804991. doi: 10.3389/fnagi.2021.804991. eCollection 2021. PMID: 35046794. Free PMC article.

Nunley P, Strenge KB, Huntsman K, Bae H, DiPaola C, T AR, Shaw A, Sasso RC, Araghi A, Staub B, Chen S, Miller LE, **Musacchio M**. Lumbar Discectomy with Barricaid Device Implantation in Patients at High Risk of Reherniation: Initial Results from a Postmarket Study. *Cureus*. 2021 Dec 8;13(12):e20274. doi: 10.7759/cureus.20274. eCollection 2021 Dec. PMID: 35018268. Free PMC article.

Burks JD, Chen SH, Luther EM, Almallouhi E, Al Kasab S, Jabbour PM, Wolfe SQ, Fargen KM, Arthur AS, Goyal N, Fragata I, Maier I, Matouk C, Grossberg J, Kan P, Schirmer C, Crowley RW, **Ares W**, Ogilvy CS, Rai AT, Levitt MR, Mokin M, Guerrero W, Park MS, Mascitelli J, Yoo A, Williamson RW, Grande A, Crosa R, Webb S, Psychogios M, Peterson EC, Yavagal DR, Spiotta AM, Starke RM; STAR Investigators. Effect of Hispanic Status in Mechanical Thrombectomy Outcomes After Ischemic Stroke: Insights from STAR. *Stroke*. 2021 Nov;52(11):e715-e719. doi: 10.1161/STROKEAHA.120.033326. Epub 2021 Sep 14. PMID: 34517765.

Guyer RD, Coric D, Nunley PD, Sasso RC, **Musacchio M**, Bae HW, Peloza JH, Ohnmeiss DD. Single-Level Cervical Disc Replacement Using a PEEK-on-Ceramic Implant: Results of a Multicenter FDA IDE Trial with 24-Month Follow-Up. *Int J Spine Surg*. 2021 Aug;15(4):633-644. doi: 10.14444/8084. Epub 2021 Jul 19. PMID: 34281951. Free PMC article.

Moore F, Grunch BH, Miller LE, **Musacchio MJ**. Towards a More Simplified Approach for Evaluating Strength of Evidence in Health Technology Assessments. *Cureus*. 2021 Jul 21;13(7):e16528. doi: 10.7759/cureus.16528. eCollection 2021 Jul. PMID: 34430138. Free PMC article.

Swiatek PR, Nandurkar TS, Maroon JC, Cantu RC, Feuer H, **Bailes JE**, Hsu WK. Return to Play Guidelines After Cervical Spine Injuries in American Football Athletes: A Literature-Based Review. *Spine* (Phila Pa 1976). 2021 Jul 1;46(13):886-892. doi: 10.1097/BRS.0000000000003931. PMID: 34100841. Review.

Anadani M, Alawieh A, Chalhoub R, Jabbour P, Starke RM, Arthur A, Goyal N, Wolfe S, Fargen KM, Grossberg JA, Howard BM, De Leacy R, Kellner C, Kan P, Dumont T, Rai A, Osbun J, Crosa R, Maier I, Nascimento FA, Park MS, Levitt MR, Fragata I, Matouk C, Crowley RW, **Chowdhry SA**, Ogilvy C, Mokin M, Mascitelli J, Yoo AJ, Williamson RW, Webb S, Psychogios MN, Al Kasab S, Spiotta AM. Mechanical Thrombectomy for Distal Occlusions: Efficacy, Functional and Safety Outcomes: Insight from the STAR Collaboration. *World Neurosurg*. 2021 Jul;151:e871-e879. doi: 10.1016/j.wneu.2021.04.136. Epub 2021 May 8. PMID: 33974981.

Koktzoglou I, Huang R, **Ankenbrandt WJ, Walker MT**, Edelman RR. Super-resolution head and neck MRA using deep machine learning. *Magn Reson Med*. 2021 Jul;86(1):335-345. doi: 10.1002/mrm.28738. Epub 2021 Feb 22. PMID: 33619802. Free PMC article.

Raj SR, Arnold AC, **Barboi A**, Claydon VE, Limberg JK, Lucci VM, Numan M, Peltier A, Snapper H, Vernino S; American Autonomic Society. Long-COVID postural tachycardia syndrome: An American Autonomic Society statement. *Clin Auton Res*. 2021 Jun;31(3):365-368. doi: 10.1007/s10286-021-00798-2. Epub 2021 Mar 19.

Monroy-Sosa A, Navarro-Fernández JO, Chakravarthi SS, Rodríguez-Orozco J, Rovin R, de la Garza J, **Kassam A**. Minimally invasive trans-sulcal parafascicular surgical resection of cerebral tumors: Translating anatomy to early clinical experience. *Neurosurg Rev*. 2021 Jun;44(3):1611-1624. doi: 10.1007/s10143-020-01349-5. Epub 2020 Jul 18. PMID: 32683512.

(continued)

PUBLICATIONS

Zuckerman SL, Yengo-Kahn AM, Tang AR, **Bailes JE**, Beauchamp K, Berger MS, Bonfield CM, Camarata PJ, Cantu RC, Davis GA, Ellenbogen RG, Ellis MJ, Feuer H, Guazzo E, Harris OA, Heppner P, Honeybul S, Manley G, Maroon JC, Miele VJ, Nahed BV, Okonkwo DO, Oppenlander ME, Petty J, Sabin HI, Samadani U, Sherburn EW, Sheridan M, Tator CH, Theodore N, Timmons SD, Woodworth GF, Solomon GS, Sills AK. Sport-Related Structural Brain Injury and Return to Play: Systematic Review and Expert Insight. *Neurosurgery*. 2021 May 13;88(6):E495-E504. doi: 10.1093/neuros/nyab041. PMID: 33693899.

Naugle R, **Guidotti-Breting L**, Hahn-Ketter A. ANNOUNCEMENT: Winners of the sixth annual TCN/AACN student project competition. *Clin Neuropsychol*. 2021 May;35(4):838-839. doi: 10.1080/13854046.2021.1912391. Epub 2021 May 4. PMID: 33947318. No abstract available.

Wong AK, **Wong RH**. Split-Thickness Decompression in the Management of Intracranial Pressure. *Korean J Neurotrauma*. 2021 Apr 14;17(1):48-53. doi: 10.13004/kjnt.2021.17.e6. eCollection 2021 Apr. PMID: 33981643. Free PMC article.

Markopoulou K, Chase BA, Premkumar AP, Schoneburg B, Kartha N, Wei J, Yu H, **Epshteyn A, Garduno L, Pham A, Vazquez R, Frigerio R**, Maraganore D. Variable Effects of PD-Risk Associated SNPs and Variants in Parkinsonism-Associated Genes on Disease Phenotype in a Community-Based Cohort. *Front Neurol*. 2021 Apr 14;12:662278. doi: 10.3389/fneur.2021.662278. eCollection 2021. PMID: 33935957. Free PMC article.

Black EK, Phillips JK, Seminetta J, **Bailes J**, Lee JM, Finan JD. The effect of dietary supplementation with high- or low-dose omega-3 fatty acid on inflammatory pathology after traumatic brain injury in rats. *Transl Neurosci*. 2021 Feb 4;12(1):76-82. doi: 10.1515/tnsci-2021-0010. eCollection 2021 Jan 1. PMID: 33623714. Free PMC article.

Barohn RJ, Gajewski B, Pasnoor M, Brown A, Herbelin LL, Kimminau KS, Mudaranthakam DP, Jawdat O, Dimachkie MM; Patient Assisted Intervention for Neuropathy: Comparison of Treatment in Real Life Situations (PAIN-CONTRoLS). Study Team: Iyadurai S, Stino A, Kissel J, Pascuzzi R, Brannagan T, Wicklund M, Ahmed A, Walk D, Smith G, Quan D, Heitzman D, Tobon A, Ladha S, Wolfe G, Pulley M, Hayat G, Li Y, Thaisetthawatkul P, Lewis R, Biliciler S, Sharma K, Salajegheh K, Trivedi J, Mallonee W, Burns T, Jacoby M, Bril V, Vu T, Ramchandren S, Bazant M, Austin S, Karam C, Hussain Y, Kutz C, Twydell P, Scelsa S, Kushlaf H, Wymer J, Hehir M, Kolb N, Ralph J, **Barboi A**, Verma N, Ahmed M, Memon A, Saperstein D, Lou JS, Swenson A, Cash T. Patient Assisted Intervention for Neuropathy: Comparison of Treatment in Real Life Situations (PAIN-CONTRoLS): Bayesian Adaptive Comparative Effectiveness Randomized Trial. *JAMA Neurol*. 2021 Jan 1;78(1):68-76. doi: 10.1001/jamaneurol.2020.2590. PMID: 32809014. Free PMC article.

Polster SP, Satzer D, **Bailes J**. (2022). Trans-succal, Channel-Based Parafascicular Surgery: Basic Concepts and a General Overview. *Subcortical Neurosurgery: Open and Parafascicular Channel-Based Approaches for Subcortical and Intraventricular Lesions*. Zada G, Pradilla G, Day JD (Eds.), (pp 113-120).

Ahmadpour A, Vasenina V, Patel V, Bailes Jr. JE. (2022). Concussion. *Acute Care Neurosurgery by Case Management: Pearls and Pitfalls.* Radskin PB (Ed) (pp. 53-69). doi: 10.1007/978-3-030-99512-6

Ahmadpour A, Vasenina V, Patel V, Bailes JE. (2022). Concussion in Sports: What Is It and How Is It Managed? *Neurosurgical Care of Athletes*. Oppenlander ME (Ed.), (pp, 155-192) doi:10.1007/978-3-030-88227-3_10

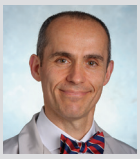
Bailes JE. (2022). Neurological Sports Medicine: Choosing a Subspecialty Which Is Both Practical and Useful. *Surviving Neurosurgery: Vignettes of Resilience*. Agarwal N, Reddy V. (Eds.) (pp. 319-321).

PHYSICIAN DIRECTORY

For more information or to schedule an appointment, please call **(877) 570-7020** or visit **northshore.org/neuro**.

Neurologists

Susan Rubin, MD
Chair, Department of Neurology
Expertise: Multiple Sclerosis, Women's Neurology, Headaches/ Migraines, Epilepsy/Seizures
Locations: GBA, LS

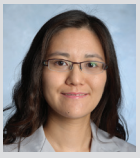


Alexandru Barboi, MD
Section Head, Neuromuscular
Expertise: Autonomic Disorders, Muscle and Nerve Disorders, EMG/NCV Testing
Location: GBA

Erik Beltran, MD
Expertise: Sports Neurology, Concussion, General Neurology
Locations: GBA, GVP, LS

Zachary Bulwa, MD
Expertise: Stroke, General Neurology
Locations: EVM, GBA, HP, SKA

Franco Campanella, DO
Vice Chair, Clinical Operations
Expertise: General Neurology
Locations: EVM, GBA, SKA, SW



Janet Choi, MD
Expertise: Epilepsy/Seizures, EEG, General Neurology
Locations: GBA, HP, LS

Sofia Dobrin, MD
Expertise: Epilepsy/Seizures, General Neurology
Locations: HP, LS

Thomas Freedom, MD
Expertise: Sleep Medicine, Headaches/Migraines
Location: GBA

Fulvio (Rob) Gil, MD
Expertise: Stroke, General Neurology
Locations: EVM, GBA, LS

Carolyn Goldschmidt, DO
Expertise: Multiple Sclerosis, Neuro-Immunology, General Neurology, Headaches/Migraine
Locations: EVM, SW

Elizabeth Harris, MD
Expertise: Memory Disorders, Headaches/Migraines, General Neurology
Locations: GBA, SKA

Afif Hentati, MD
Section Head, Multiple Sclerosis
Expertise: Multiple Sclerosis, General Neurology
Locations: EVM, GBA, SKA

Karyn Karlin, MD
Expertise: Multiple Sclerosis, Headaches/Migraines, General Neurology
Locations: GBA, LS

Ninith V. Kartha, MD
Expertise: Movement Disorders, Parkinson's Disease, Memory, General Neurology
Locations: EV, LS, SK

Nabil Thomas Makhlouf, MD
Expertise: EMG, IOM, EEG, Epilepsy, Neuromuscular Disease, Neuropathy, Bell's Palsy
Locations: EVM, SK

Angela Mark, MD
Expertise: General Neurology, Neurophysiology, Headaches/ Migraines, EMG/NCV Testing
Location: EVM

Aikaterini (Katerina) Markopoulou, MD, PhD
Section Head, Movement Disorders
Expertise: Movement Disorders, Deep Brain Stimulation
Location: EVM

Steven Meyers, MD
Vice Chair, Quality and Informatics
Expertise: General Neurology, EMG/NCV Testing, Headaches/ Migraines
Location: SK

Richard Munson, MD
Director, Stroke Program
Expertise: Stroke, Sleep Medicine
Locations: EVM, GBA, LS

Camelia Musleh, MD
Expertise: Sleep Medicine, General Neurology
Locations: SK, SW

Nabeela Nasir, MD
Expertise: Sleep Medicine
Location: LS

See page 33 for the location list with letter codes.

PHYSICIAN DIRECTORY

For more information or to schedule an appointment, please call **(877) 570-7020** or visit **northshore.org/neuro**.

Neurologists *(continued)*

Danny Park, MD
Expertise: General Neurology
Location: SW

Smita Patel, DO
Expertise: Sleep Medicine, Brain Health
Locations: GBA, GVP

Joya Paul, MD
Expertise: Sleep Medicine, General Neurology
Locations: SK, SW

Ashvini Premkumar, MD
Vice Chair, Physician and Patient Engagement
Expertise: Movement Disorders
Locations: EVM, GBA

John Pula, MD
Expertise: Neuro-Ophthalmology, Multiple Sclerosis
Locations: GBE, SKE

Amit Ray, MD
Section Head, Epilepsy
Expertise: Anterior Thalamic Deep Brain Stimulation, EEG, Epilepsy Monitoring Unit (EMU)
Location: EVM

Nicole Reams, MD
Section Head, Concussion and Sports Neurology
Expertise: Sports Neurology, Concussion, General Neurology
Locations: EVM, GVP, LS

Eunice Torres Rivera, MD
Expertise: Sleep Disorders, General Neurology
Locations: EVM, SW

Bernadette Schoneburg, MD
Expertise: Movement Disorders
Location: GBA

Irene Semenov, DO
Section Head, General Neurology
Expertise: Epilepsy/Seizures, Headaches/Migraines, EMG/NCV Testing, General Neurology, Neurophysiology
Locations: GBA, HP, LS, SK

Megan Shanks, MD
Director, Education
Expertise: Neuromuscular Medicine, EMG, Headaches/ Migraines
Locations: EVM, GBA, LS, SK

Mari Viola-Saltzman, DO
Section Head, Sleep Medicine
Expertise: Sleep Medicine, General Neurology
Location: GBA

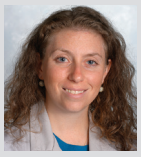
Charles Wang, MD
Section Head, Intraoperative Medicine
Expertise: Epilepsy/Seizures, Neurophysiology, General Neurology, EMG/NCV Testing, Concussion
Location: SK

Richard Wlodarski, MD
Expertise: Autonomic Disorders, Muscle and Nerve Disorders, EMG/NCV Testing
Locations: GBA, HP, LS

Chad Yucus, MD
Section Head, Memory
Expertise: Memory Disorders, Brain Health
Location: GBA

Pediatric Neurologists

Takijah Heard, MD
Division Head, Pediatric Neurology
Expertise: Epilepsy, Pediatric Neurology, Neurophysiology, Motor Developmental Delay, Headaches
Locations: CCHA, LS



Leslie Finkel, MD
Expertise: Pediatric Neurology, Epilepsy, Motor Developmental Delay, Headaches, Neurophysiology
Location: CCHA

Margaret Michelson, MD
Expertise: Pediatric Neurology, Epilepsy, Motor Developmental Delay, Headaches, Neurophysiology
Location: CCHA

continued >>

See page 33 for the location list with letter codes.

PHYSICIAN DIRECTORY

For more information or to schedule an appointment, please call **(877) 570-7020** or visit **northshore.org/neuro**.

Neurosurgeons

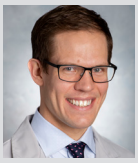
Julian Bailes, MD
Chair, Department of Neurosurgery
Expertise: Brain Tumors, Brain Disorders, Aneurysms, Spinal Disorders, Epilepsy Surgery, General Neurosurgery
Locations: EVM, HP, NCH

William Ares, MD
Expertise: Surgery for Aneurysms, Endovascular Treatment for Aneurysms, Arteriovenus Malformations (AVM), Interventional Stroke Therapy, Minimally Invasive Spine Surgery, Complex Spine Surgery and Reconstruction
Locations: EVSS, LS, LV, SKSC

Tibor Boco, MD
Expertise: Degenerative Spine Disease, Degenerative Spinal Deformity, Spinal Oncology and Tumors, Minimally Invasive Surgery, Spine Surgery
Locations: W, NCH

Shakeel Chowdhry, MD
Section Head, Cerebrovascular and Endovascular Surgery
Expertise: Surgery for Aneurysms, Endovascular Treatment for Aneurysms, Arteriovenous Malformations (AVMs), Interventional Stroke Therapy, Brain Tumors, Pituitary Tumors, Spinal Tumors
Locations: EVM, GBA, NCH

Francisco Espinosa-Becerra, MD
Expertise: General Neurosurgery, Minimally Invasive Spine Surgery, Microdiscectomy, Cervical Spine Disorders, Pain Pumps, Spinal Cord Simulators.
Locations: W, NCH

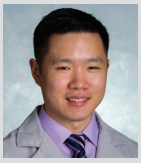


Andrew Johnson, MD
Expertise: Neurological Surgery, Neurosurgery, Cervical Spine Surgery, Minimally Invasive Spine Surgery, Complex Spine Surgery, Brain and Spine Tumors
Location: SW

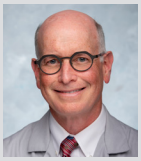
Daniel Laich, DO
Expertise: Minimally Invasive Spine Surgery; Complex Spine Surgery, Spine Tumors, Cervical Spine Surgery
Location: SW

Michael Musacchio, MD
Division Chief, Neurological Spine Surgery
Expertise: Complex Spine Surgery, Robotic Spine Surgery, Joint Replacement of the Spine, Minimally Invasive Spine Surgery, Spine Surgery
Location: SKSC

Noam Stadlan, MD
Vice Chair, Quality and Informatics
Expertise: Minimally Invasive Spine Surgery, Complex Spine Surgery and Reconstruction
Locations: HP, SKSC



Ricky Wong, MD
Section Head, Skull Base and Pituitary Surgery
Expertise: Deep Brain and Vagal Nerve Stimulators, Brain and Skull Base Tumors, Pituitary Tumors, Cerebral Aneurysms, Arteriovenous Malformations (AVMs), Trigeminal Neuralgia
Locations: BG, EVM, GBA, LV



Andrew Zelby, MD
Expertise: Brain Tumors, Degenerative Diseases of the Spine, Minimally Invasive Surgery, Neck Pain, Pituitary Tumors, Spine Problems
Locations: LV, W

Neuropsychologists

Leslie Guidotti Breting, PhD
Division Head, Psychology and Neuropsychology
Expertise: Adult Neuropsychology: Epilepsy, Traumatic Brain Injury, Concussion, Learning Disability, Attention Deficit
Location: EVD

Stephanie Aylward, PhD
Expertise: Acute Concussion (Pediatric and Adult), Pediatric Neuropsychology: Epilepsy, Traumatic Brain Injury, Concussion, Infant and Early Childhood Assessment, Congenital Heart Disease, Oncology, Metabolic Disorders, Autism Spectrum Disorders, Learning Disabilities, Attention Deficit
Locations: EVD, GVP

Laura Benson, PhD
Expertise: Adult Neuropsychology: Dementia, Concussion, Epilepsy, Learning Disabilities, Traumatic Brain Injury, Movement Disorders and Attention Deficit
Location: DF

Elizabeth Geary, PhD
Expertise: Adult Neuropsychology: Stroke, Dementia, Movement Disorders, Learning Disabilities, Attention Deficit
Locations: EVD, GBA

Navya Kamath, PsyD
Expertise: Pediatric Neuropsychology: Learning Disabilities, Attention Deficit, Epilepsy, Hematology-Oncology, Traumatic Brain Injury
Location: EVD

Alexandra Kirsch, PhD
Expertise: Pediatric Neuropsychology: Epilepsy, Autism Spectrum Disorders, Learning Disabilities, Attention Deficit, Craniofacial Conditions
Location: EVD

Alona Ramati, PhD
Expertise: Adult Neuropsychology: Dementia, Epilepsy, Learning Disabilities, Movement Disorders, Attention Deficit, Multiple Sclerosis, Pre-Surgical Evaluations
Location: GBA

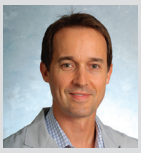
See page 33 for the location list with letter codes.

PHYSICIAN DIRECTORY

For more information or to schedule an appointment, please call **(877) 570-7020** or visit **northshore.org/neuro**.

Neuroradiologists

Matthew Walker, MD
Executive Vice Chair, Department of Radiology
Expertise: Neuroradiology
Location: EV



William Ankenbrandt, MD
Division Head, Neuroradiology
Expertise: Neuroradiology, Interventional Radiology
Location: EV

Anne Doppenberg, MD
Expertise: Neuroradiology
Location: EV

Michael Gorey, MD
Expertise: Neuroradiology
Location: EV

Aleksandrs U. Kalnins
Expertise: Neuroradiology
Location: EV

Achilles Karagianis, DO
Expertise: Neuroradiology, Head and Neck Imaging
Location: EV

Kristina Olsen, MD
Expertise: Neuroradiology
Location: EV

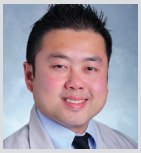
Bojan Petrovic, MD
Education Coordinator of Neuroradiology
Expertise: Neuroradiology
Location: EV

Rajeev Polasani, MD
Expertise: Neuroradiology
Location: EV

Doris Yip, MD
Director of Neuroradiology MRI
Expertise: Neuroradiology
Location: EV

Physical Medicine and Rehabilitation (PM&R)

Joseph Alleva, MD
Division Head, Physical Medicine and Rehabilitation
Expertise: Acute Spine Pain and EMG, Interventional Pain Management (Epidural Steroid Injections)
Locations: GBA, SK, SKSC



Matthew Co, DO
Expertise: Acute and Chronic Spine Pain
Locations: CH, SKSC, SW

Joseph Dadabo, MD
Expertise: Nonsurgical Management of Arthritis, Sports Injuries, Ultrasound-Guided Injections, Lumbar Spine Injections, Acute Spine Pain, EMG/NCS
Locations: GBA, LS, SKSC

Joseph Feldman, MD
Director, PM&R Lymphedema Treatment Center
Expertise: Physical Medicine and Rehabilitation, Lymphedema, EMG Testing
Locations: EVM, GVP, HP

Thomas Hudgins, MD
Section Head, PM&R Outpatient Specialty Programs
Expertise: Orthopaedic and Spine Injury Management for Athletes (All Ages and Levels)
Locations: GBA, SK, SKSC

George Kannankeril, MD
Director, PM&R Arthritis Program
Expertise: Nonsurgical Musculoskeletal Care, Osteoarthritis
Locations: SKSC, SW

Rachel Kermen, MD
Expertise: Parkinson's Disease, Stroke, Multiple Sclerosis, Chronic Pain, Recurrent Falling, General Debility, Spasticity
Location: GBA

See page 33 for the location list with letter codes.

LOCATIONS

For more information or to schedule an appointment, please call **(877) 570-7020** or visit **northshore.org/neuro**.

Buffalo Grove Primary Care Center (BG)
15 S. McHenry Road, 4th Floor
Buffalo Grove, IL 60089

Chicago Medical Office (CH)
680 N. Lake Shore Drive, Suite 924
Chicago, IL 60611

Chicagoland Children's Health Alliance (CCHA)
3232 Lake Avenue, Suite 330
Wilmette, IL 60091

Deerfield Medical Building (DF)
49 S. Waukegan Road, Suite 200
Deerfield, IL 60015

Edward Hospital (EH)
801 S. Washington Street, Naperville, IL 60540

Elmhurst Center for Health (CFH)
155 E. Brush Hill Road, Elmhurst, IL 60126

Evanston Downtown Building (EVD)
909 Davis Street, Suite 160, Evanston, IL 60201

Evanston Hospital (EV)
2650 Ridge Avenue, Evanston, IL 60201

Evanston Kellogg Cancer Center (EVK)
2650 Ridge Avenue, Evanston, IL 60201

Evanston Neurological Institute (EVM)
1000 Central Street, Suite 880, Evanston, IL 60201

Evanston Specialty Suites (EVSS)
1000 Central Street, Suite 800, Evanston, IL 60201

Glenbrook Ambulatory Care Center (GBA)
2180 Pfingsten Road, Suite 2000
Glenview, IL 60026

Glenbrook Eye and Vision Center (GBE)
2050 Pfingsten Road, Suite 280
Glenview, IL 60026

Glenbrook Kellogg Cancer Center (GBK)
2180 Pfingsten Road, Suite 1000
Glenview, IL 60026

Glenview Medical Group (GV)
2300 Lehigh Avenue, Suite 215, Glenview, IL 60026

Glenview Park Center (GVP)
2400 Chestnut Avenue, Suite A, Glenview, IL 60026

Highland Park Kellogg Cancer Center (HPK)
777 Park Avenue West
Highland Park, IL 60035

Highland Park Specialty Care Center (HP)
757 Park Avenue West, Suite 2850
Highland Park, IL 60035

Integrated Pain Center (IPC)
9600 Gross Point Road, Suite 1200
Skokie, IL 60076

Lakeview Medical Group (LV)
3122 N. Ashland Avenue
Chicago, IL 60657

Lincolnshire Medical Building (LS)
920 Milwaukee Avenue
Lincolnshire, IL 60069

Lincolnwood Medical Office (LW)
6810 N. McCormick Blvd.
Lincolnwood, IL 60712

Northwest Community Hospital (NCH)
880 W. Central Road
Arlington Heights, IL 60005

Skokie Eye and Vision Center (SKE)
9650 Gross Point Road, Suite 1900
Skokie, IL 60076

Skokie Hospital Ambulatory Care Center Spine Center (SKA)
9650 Gross Point Road, Suite 2000
Skokie, IL 60076

Skokie Spine Center (SKS)
9600 Gross Point Road
Skokie, IL 60076

Skokie Spine Center and Integrated Pain Center (SKSC)
9650 Gross Point Road, Suite 3000
Skokie, IL 60076

Swedish Hospital (SW)
NorthShore Neurological Institute
Garden Pavilion, 1st Floor
5115 N. Francisco Avenue
Chicago, IL 60625

Westchester Medical Building (W)
1 Westbrook Corporate Center
Westchester, IL 60154

PHILANTHROPY

To learn about supporting excellence in clinical care and research at NorthShore Neurological Institute, please contact Danielle Maihofer, Director of Philanthropy at NorthShore University HealthSystem Foundation, at **(224) 364-7218** or **dmaihofer@northshore.org**.

You can also support NorthShore Neurological Institute by making an online donation at **northshore.org/donate** and by selecting NorthShore Neurological Institute from the drop-down menu.

NorthShore Neurological Institute offers patients and their families superior access, proven expertise, advanced technology and outstanding care coordination to treat a variety of neurological diseases and conditions.

NorthShore's multidisciplinary team of neurospecialists—neurologists, neurosurgeons, physiatrists and others—provide personalized, patient-centered care that uniquely draws upon the strength of our extensive experience and collaborative environment.

Learn more about our capabilities at **northshore.org/neuro** or call **(877) 570-7020** for more information or to schedule an appointment.

NorthShore
University HealthSystem
Neurological Institute

2650 Ridge Avenue, Evanston, Illinois 60201
northshore.org/neuro

A publication of
NorthShore Neurological Institute

Editors/Writers:
Hannah Moulthrop, MS
Medical and Scientific Writer
NorthShore Neurological Institute

Vimal Patel, PhD
Medical and Scientific Writer
NorthShore Neurological Institute

Photography:
Jon Hillenbrand