

 **NorthShore**
University HealthSystem

Neurological Institute

Neurological care for what's next.

2019–2020 ANNUAL REPORT

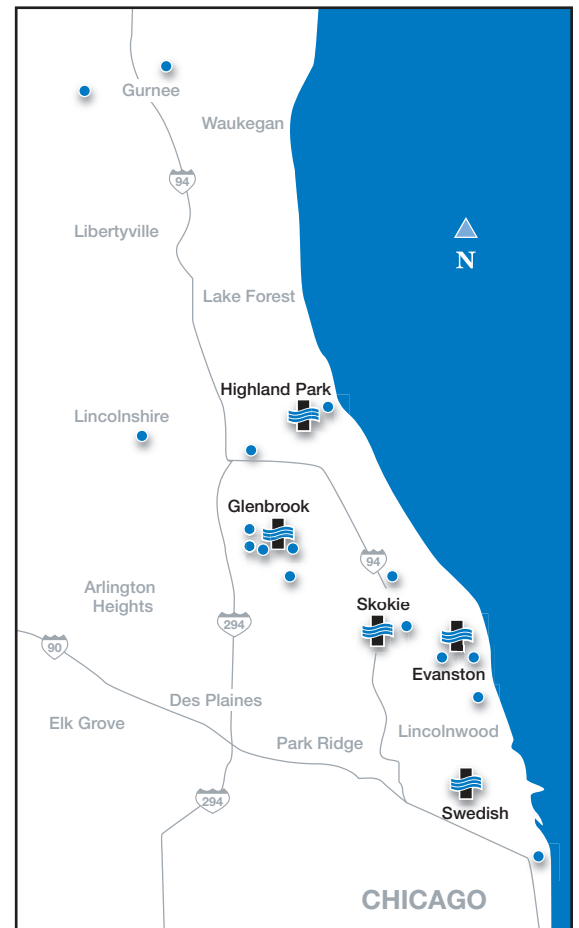


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NorthShore University HealthSystem (NorthShore) Neurological Institute offers unparalleled access throughout the Chicago area, including at each of our five award-winning hospitals. Our expert team of neurospecialists offers comprehensive care for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

Dr. Rubin completed her medical degree at 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 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*.

RECOGNITION AND ACHIEVEMENTS

10 NorthShore
Neurological Institute
Specialists Listed as
Castle Connolly
"Top Doctors"

First Certified
ALS Clinic in the
Northern Chicago
Suburbs by the
ALS Association

Accredited Epilepsy
Center by the
National Association
of Epilepsy Centers

Systemwide Magnet®
Recognition by
American Nurses
Credentialing Center

Sleep Center
Certification and
A-STEP Accreditation
by American Academy
of Sleep Medicine

Systemwide
Certification by
Joint Commission
as Primary Stroke
Center

Designated Center
for Comprehensive
Multiple Sclerosis
Care by the National
Multiple Sclerosis
Society

Blue Distinction®
Center+ 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, postconcussion 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.



“Pharma and non-pharma treatments of epilepsy can not only be life-saving, but also contribute to significant improvements in quality of life.”

— Dr. Jaishree Narayanan,
Section Head, Epilepsy and
Central Neurophysiology
Program



“General neurologists are diagnostic specialists, one-stop shopping for patients who don't know what they have, and capable of managing a wide variety of neurologic conditions.”

— Dr. Franco Michael Campanella
Vice Chair of Clinical Operations

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.

Migraine and Other Headache Disorders

- Evaluation of headache disorders by specialized neurologists in consultation with experts in psychiatry, 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 symptomatic management, including intrathecal baclofen pump management.
- Several 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.

(continued)

KEY CLINICAL SERVICES

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.

Neuropathology

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

Neurophysiology

- High-quality 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.

Neurosurgery

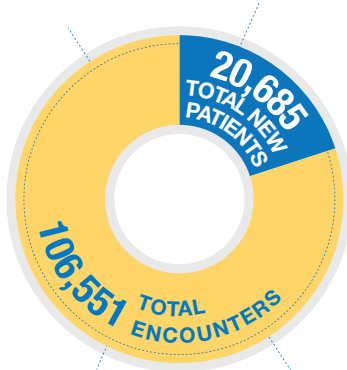
- Surgical intervention for disorders of the brain and spine by highly trained and specialized neurosurgeons using the latest technology for optimal patient outcomes.
- Minimally invasive procedures for epilepsy, neurovascular conditions, spine conditions and brain tumors of the skull base.
- One of the few centers nationwide to use the NICO 6 Pillar Approach for removing tumors and blood clots located deep within the brain.



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

2019 VOLUME DATA

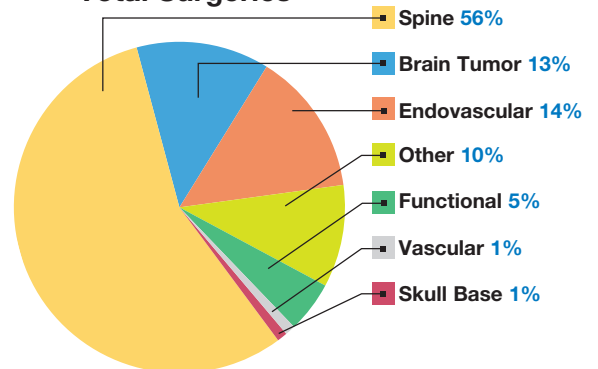
Total Patient Office Visits



Neurology Patient Office Visits



Total Surgeries



KEY CLINICAL SERVICES

Parkinson's Disease and Other Movement Disorders

- Pharmacological management, patient education, 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 the 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.
- Inpatient and outpatient rehabilitation plans that best help patients improve physical function and achieve rehabilitation goals.
- Sports Medicine Program that offers ultrasound-guided peripheral joint injections and regenerative procedures, and specialized procedures including radiofrequency ablation and spinal cord stimulators.

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.

Stroke

- Management of acute stroke, 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.
- Utilization of advanced telemedicine technologies to reduce door-to-needle or intervention times (best outcomes).

2019 RESEARCH SUMMARY

Human Subject Studies

54 Open Studies

32 Studies Enrolling Subjects

1,360 Subjects Consented

DNA Study (DodoNA)

1,287 New Participants

8,751 Total Participants

8,361 Samples Genotyped

KEY CLINICAL SERVICES

Stroke Program

Every minute counts when it comes to the best outcome for stroke. At NorthShore Neurological Institute, our Acute Stroke team works 24/7 to ensure timely screening and cutting-edge stroke treatment.

Our team is now working at Swedish Hospital and Northwest Community Healthcare to oversee stroke diagnoses, specifically “telestroke,” a telemedicine platform that specializes in stroke care.

To cover this expansion, our team of one stroke neurosurgeon and stroke neurologists led by neurologist Richard Munson, MD, has grown with the addition of two new fellowship-trained endovascular neurosurgeons, William Ares, MD, and Brian Walcott, MD.

Our stroke team is one of the few in Chicago equipped with Viz.ai, artificial intelligence software that identifies strokes from brain scans in just seconds, alerts on-call specialists and sends them the scans. We are studying the effectiveness of Viz.ai in identifying patients with a hemorrhagic stroke in a clinical trial.

With Viz.ai it takes mere seconds for our neurosurgeons to receive the scans. Then, once removal of the occlusion or blockage of a blood vessel begins, it can take as little as 15 minutes to complete. Using a small catheter placed in an artery in the arm or leg, removal occurs while the patient is awake, in some cases. Recovery begins right away, and full function is often restored within hours.

To treat complex aneurysms, the NorthShore team inserts the innovative Woven EndoBridge (WEB) device into the aneurysm. It blocks blood flow into the aneurysm, protecting the patient from potentially lethal bleeding. NorthShore was one of the first hospitals in the state to use this technology.

We were also Illinois' first hospital to use Surgical Theater, a virtual reality medical visualization platform that allows for an augmented reality 3D visualization to help our neurosurgeons improve their patient's understanding of their disease. Our surgeons also use it before and during surgery to precisely target tumors and aneurysms for rehearsing the surgery and educating our neurosurgical residents. Patients benefit from our cutting-edge research that brings new treatments and technologies to them sooner.



Dr. Shakeel Chowdhry and his team use the latest advanced technologies, such as Surgical Theater, to perform stroke interventions as quickly as possible.

KEY CLINICAL SERVICES

Neuro-Oncology Program

An Alternative to Traditional Radiation Treatment: GammaTile Therapy

NorthShore's Neuro-Oncology program is the first in Illinois offering GammaTile® Therapy, a new approach to treating malignant brain tumors. FDA-cleared, Surgically Targeted Radiation Therapy (STaRT) is designed to delay tumor 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.

The first patient in the state was treated by Julian Bailes, MD, Chair of Neurosurgery. Ryan Merrell, MD, Section Head of Neuro-Oncology, will also be participating in this new surgical therapy, offered only at NorthShore. Aggressive brain tumors tend to be resistant to current treatments and have a high likelihood of recurrence.

Smaller than a postage stamp (2cm x 2cm), the GammaTile is a 3D-collagen tile embedded with Cesium-131 radioactive seeds that can be placed at the 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.

This new treatment “protects healthy brain tissue while providing immediate, targeted therapy directly to the area that’s most at risk for recurrence,” said Dr. Bailes. “Most patients report fewer side effects and better quality of life since this eliminates the wait time and multiple visits typically associated with



Dr. Julian Bailes looks at 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.

standard radiation treatment after the removal of a tumor.”


GammaTile Therapy is the only radiation therapy specifically designed for use in the brain and offers advantages for patients undergoing surgery for brain tumors. It begins targeting residual tumor cells immediately at the time of tumor-removal surgery rather than waiting several weeks for surgical wound healing before beginning treatment.

The therapy protects healthy brain tissue while delivering a targeted dose to any remaining tumor cells. Its unique design also limits side effects typically associated with radiation therapy, including hair loss. Additionally, the burden of radiation treatment is reduced for patients treated with this therapy.

These patients receive their course of radiation while going about their daily lives, requiring no additional trips to the hospital or clinic for radiation therapy.

This new approach is just one of the latest minimally invasive techniques and technologies our multidisciplinary team uses to create a personalized treatment plan for every patient.

Our team holds regular tumor board meetings to discuss the range of treatment options for each case, from incision-free stereotactic radiosurgery performed by Ricky Wong, MD, to integrative medicine treatments to unique clinical trials led by



“Patients see us at a vulnerable, scary time in their lives. We know that and do everything to treat their tumor aggressively, while providing them with the support and knowledge they need.”

— Dr. Ryan Merrell, Section Head, Neuro-Oncology Program

KEY CLINICAL SERVICES

Deep Brain Stimulation for Parkinson's Disease

Parkinson's disease is a progressive condition that impairs the control of movement and can cause tremor, slowness of movement, muscle stiffness and balance problems. Most of these symptoms can be treated effectively with medications. However, these medications come with side effects that include involuntary movements and/or diminishing beneficial effect of the medication 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 medications. It also allows for a reduction in the medication requirements to treat the symptoms, thus decreasing the chance for medication-related side effects.

DBS surgery involves the insertion of electrodes targeted to stimulate specific structures deep inside the brain that are involved in the control of movement. For certain patients, DBS

surgery has been shown to be a more effective treatment of Parkinson's disease symptoms than medications alone. The DBS benefit is long-lasting. DBS treats the symptoms of Parkinson's but unfortunately cannot halt the disease's progression.



"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

Slipping and falling at home. Injuring yourself at work. Being involved in a motor vehicle accident. These situations as well as others from daily life can put people of all ages at risk for concussion, traumatic brain injury (TBI) or other head injuries. The experts at the Neurological Institute draw upon the collaborative strength of neurologists, neuropsychologists, neurosurgeons, physiatrists, and physical, occupational and speech therapists as well as others to diagnose and treat brain injuries—from the very mild to the most severe.

Our neurological team offers a full spectrum of concussion and head injury assessment and treatment strategies and helps promote long-term brain health with appropriate counseling, testing and reduction of risk factors.

Upon diagnosis, our skilled team develops a personalized treatment plan employing an array of options from medication to speech therapy. However, most mild brain injuries are self-limiting conditions that can be resolved through rest and medical observation and monitoring of your condition.

When left undiagnosed, the brain may not have the proper time needed to heal, which can lead to more serious, long-term effects if another head injury is sustained.

Concussion Symptoms and Diagnosis

A head injury or concussion can occur with or without a direct hit to the head, and symptoms can linger for days to weeks.

Symptoms of concussions are often very subtle and may not be immediately evident after the head injury is sustained, making a diagnosis more difficult. This diagnosis can be increasingly difficult to identify given that the majority of concussions do not result in loss of consciousness or being classically "knocked out."

Some of the most common head injury and concussion symptoms include:

- Headaches
- Dizziness
- Neck pain
- Memory loss or confusion
- Difficulty concentrating
- Sensitivity to light or sound

"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



KEY CLINICAL SERVICES

Amyotrophic Lateral Sclerosis (ALS) Clinic

NorthShore Neurological Institute has opened the first ALS Association certified ALS treatment center in the Northern Chicago suburbs.

ALS, also known as Lou Gehrig's Disease, is a progressive disease that affects nerve cells in the brain and spinal cord. Speech, swallowing and movement gradually deteriorate in ALS patients.

NorthShore's ALS Clinic—led by Octavia Kinkaid, MD,—specializes in the management, care and support of people with ALS, providing resources and clinical expertise that make it easier for patients to cope effectively with ALS and optimize their quality of daily life.

A collaborative multidisciplinary team including neurologists; pulmonologists; occupational, physical and speech therapists; social workers; and nutritionists works together to provide answers and solutions to patients and their families.

This approach ensures that team members work closely together and consult with one another regularly to help ensure the highest level of care possible.

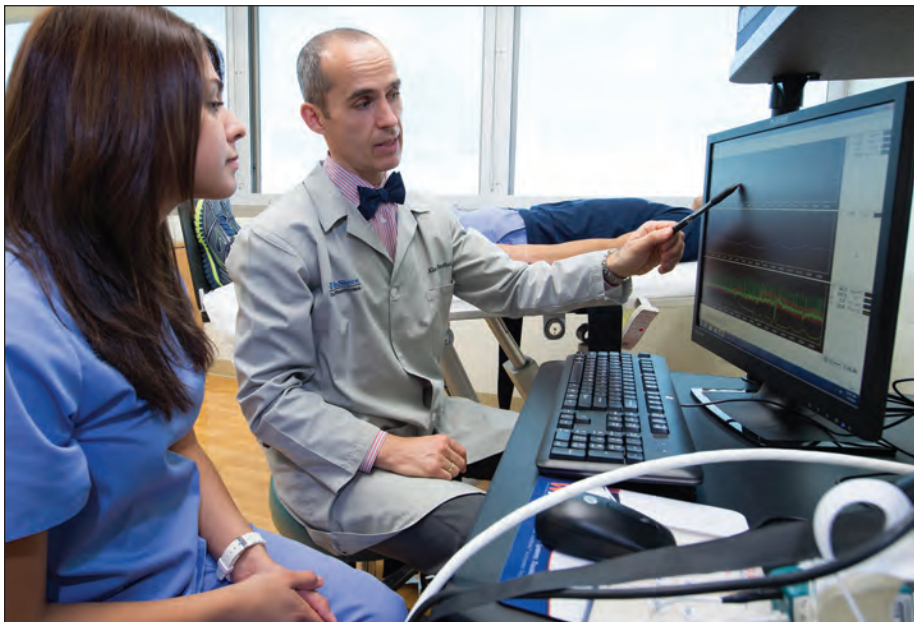
“Our ALS clinic is one of a kind in the area, helping patients manage their ALS and improve their quality of life.”

— Dr. Octavia Kincaid,
Neuromuscular Disorders
Program



Sponsored by the ALS Association Greater Chicago Chapter, our full-service clinic offers a personalized coordinated care experience all in one convenient location. A dedicated neurology nurse specialist and a home care representative from the ALS Association are also available.

Autonomics Laboratory



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

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.

As one of the most comprehensive labs of its type in the region, NorthShore's Autonomic Testing Lab includes the most advanced, state-of-the-art technology and equipment to diagnose these disorders.

Led by fellowship-trained physician and director of the Neuromuscular Program, Alexandru Barboi, MD, the lab assists him in making a comprehensive diagnosis of autonomic system disorders.

KEY CLINICAL SERVICES

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 our new NorthShore Spine Center at the Orthopaedic & Spine Institute in Skokie, Illinois' only hospital dedicated to orthopaedic and spine care, 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 not just to treat the pain, but to treat 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, bio-feedback and more.



Dr. Michael Musacchio, Division Chief, 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.



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

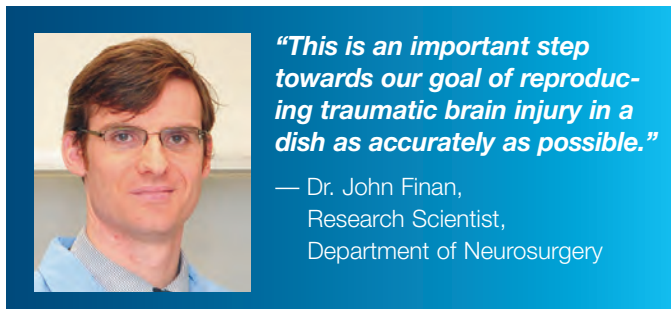
RESEARCH HIGHLIGHTS

Traumatic Brain Injury

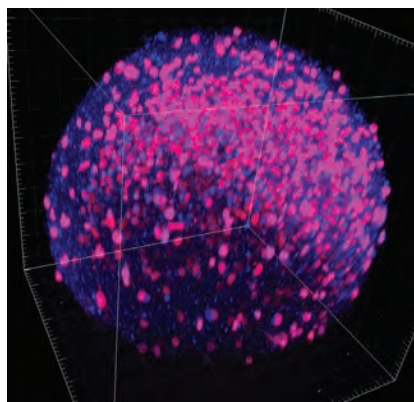
Traumatic brain injury (TBI) is a significant cause of death and disability and a risk factor for other neurodegenerative conditions. TBI is responsible for an estimated 57,000 deaths and 288,000 hospitalizations annually in the United States, yet there are currently no approved treatments targeting the injury itself and long-term outcomes are unpredictable. More than 30 TBI clinical trials have failed without a single success, making the discovery of a universal therapy seem increasingly unlikely.

Individuals vary in their response to and recovery from a TBI due to age, number of previous head injuries and genetic differences. Large-scale, observational human studies of TBI have shown a correlation between genotype and TBI outcome, revealing a need for personalized treatments. It is unethical to conduct experiments involving switching genes on and off in people. Using *in vitro* models, living models composed of specific cells, has proven useful in moving from detecting correlations to testing hypotheses for other diseases.

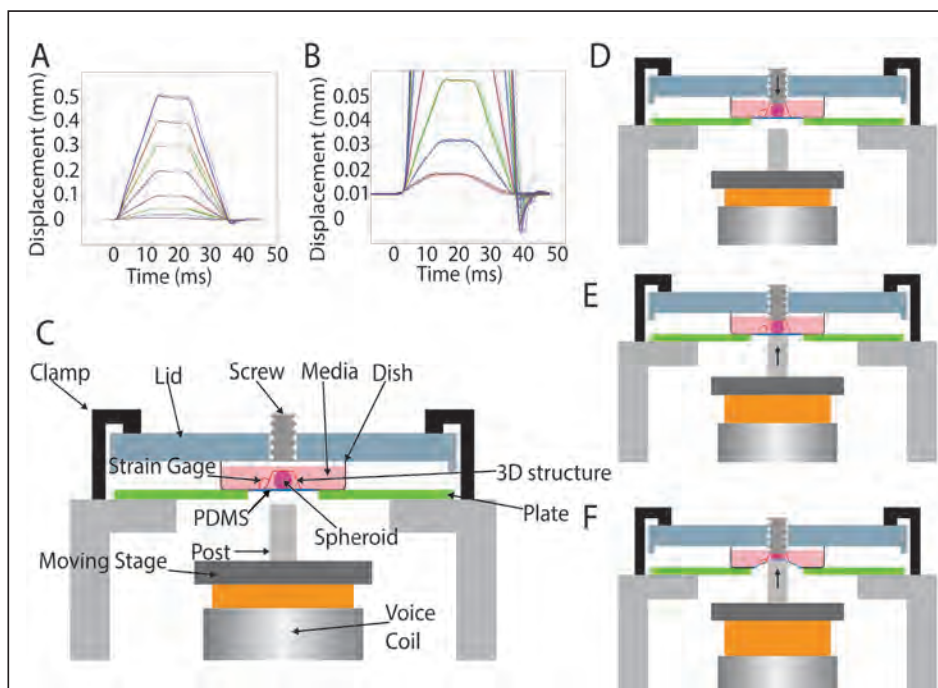
Researchers at the TBI Laboratory at NorthShore Neurological Institute are working on human *in vitro* modeling of neurotrauma funded by the National Institute of Neurological Disorders and Stroke led by John Finan, PhD, a biomedical engineer and principal investigator on the project. His team replicates naturally occurring human variation in their models by starting with blood cells or other easily obtainable cells from people. They reprogram those cells into stem



cells, which are then able to become any kind of cell, including neurons that retain the genetic identity of the patient donor. Within these cells, genetic variants can be changed one at a time. The role of genotype in TBI can then be tested after reproducing the mechanical insult of TBI on this brain organoid, a simplified smaller 3D version of a brain produced *in vitro*. Determining how to compress this ball of neurons, to injure it, is key. Currently, there are no tools for applying a mechanical insult to an organoid. Dr. Finan’s team, which includes outside collaborators, is working on developing this tool that will allow researchers to study the outcomes of TBI on genotype-specific organoids. These 3D *in vitro* models will contribute new insights to many neurological disorders in addition to neurotrauma while advancing knowledge in personalizing neurological treatment and patient-specific risk assessment.



A three-dimensional fluorescent microscope image of a spheroid or ball of neural cells. The blue blobs are cell nuclei. The red blobs are nuclei in injured cells.



The apparatus Dr. Finan’s team will use to traumatize the neural spheroids.

Figure 8: Compressing a spheroid: (A) Repeated displacement histories at submillimeter amplitudes. (B) Zoom view of repeatability performance at injury lowest amplitudes. (C) Cross-sectional schematic of spheroid injury apparatus at start of experiment. (D) **Step 1:** Lower fine thread screw until strain gage indicates contact. (E) **Step 2:** Raise post with voice coil until strain gage indicates contact. (F) **Step 3:** Compress spheroid by rapidly displacing voice coil up from the contact position and down again.

RESEARCH HIGHLIGHTS

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 EMR System

Aims: The purpose of this study is to advance quality improvement and practice-based research in neurology using the Electronic Medical Record (EMR) system. The Department of Neurology at NorthShore has built into its commercial EMR (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 EMR 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.

Brain Aneurysm Clinical Trials

Humanitarian Use Device: Neuroform Microdelivery Stent System

Aims: The Neuroform Microdelivery Stent System is used with coils for treating wide-neck aneurysms in the brain that cannot be treated with open brain surgery.

Principal Investigator: Shakeel Chowdhry, MD
NorthShore Project Number: EH12-352
Contact: Call **(847) 570-4224** with questions regarding the device.

Humanitarian Use Device: CODMAN ENTERPRISE Vascular Reconstructive Device and Delivery System

Aims: This device is used for treatment of wide-neck aneurysms. A stent is placed across the opening or neck of the aneurysm to secure the placement of coils and to maintain blood flow through the artery in which the stent is placed.

Principal Investigator: Shakeel Chowdhry, MD
NorthShore Project Number: EH12-354
Contact: Call **(847) 570-4224** with questions regarding the device.

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

Aims: 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)

Aims: 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 Clinical Trials

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: Ryan Merrell, MD

NorthShore Project Number: EH18-270

Contact: Call **(847) 570-2025** with questions regarding the study

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: Ryan Merrell, MD

NorthShore Project Number: EH18-383

Contact: Call **(847) 570-2025** with questions regarding the study.

Epilepsy Clinical Trial

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: Jaishree Narayanan, MD

NorthShore Project Number: EH18-108

Contact: Call **(847) 570-2547** with questions regarding the study.

Multiple Sclerosis Clinical Trials

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, Parallel Group, Double Blind, Double Dummy, Active Controlled Study of Evobrutinib Compared with Teriflunomide, in Participants with Relapsing Multiple Sclerosis to Evaluate Efficacy and Safety

Aims: The purpose of this study is to characterize the efficacy and safety of evobrutinib 45 mg administered orally twice daily versus teriflunomide (Aubagio®; 14 mg once a day orally) in participants with Relapsing Multiple Sclerosis by evaluation of MRI parameters and other clinical measurements. The study also aims to assess the relationship between subject disease biomarker and disease activity or treatment response.

Principal Investigator: Afif Hentati, MD

NorthShore Project Number: EH20-240

Contact: Call **(847) 570-4224** with questions regarding the study.



Dr. Afif Hentati, Section Head, Multiple Sclerosis Program

(continued)

Multiple Sclerosis Clinical Trials *(continued)*

A Multicenter, Double-Blind, Placebo-Controlled, Parallel-Group, Dose Ranging Phase 2 Study to Evaluate the Efficacy and Safety of Oral BIIB061 as Add-On Therapy to Interferon-Beta1 Therapies in Relapsing Multiple Sclerosis

Aims: The primary objectives of this study are to evaluate the safety of the study medication, BIIB061, versus placebo and to evaluate the efficacy of BIIB061 to improve disability outcome versus placebo in participants with relapsing forms of Multiple Sclerosis (MS). Secondary objectives will evaluate the effects of BIIB061 versus placebo on brain MRI markers of remyelination and axon preservation in chronic MS lesions and additional measures of improved disability outcomes.

Principal Investigator: Susan Rubin, MD
NorthShore Project Number: EH(Pending)
Contact: Call **(847) 503-4334** with questions regarding the study.

Neuromuscular Disorder Clinical Trials

RESTORE: 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 those 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 be up to 36 weeks.

Principal Investigator: Alexandru Barboi, MD
NorthShore Project Number: EH18-106
Contact: Call **(847) 503-4334** with questions regarding the study.

Theravance Protocol 0169: A Phase 3, 4-week, Multicenter, Randomized, Double-Blind, Placebo-Controlled, Parallel-Group Study of TD-9855 in Treating Symptomatic Neurogenic Orthostatic Hypotension in Subjects With Primary Autonomic Failure

Aims: The objective of the study is to evaluate the efficacy of the study medication amprelosetine (TD-9855), in subjects with multiple system atrophy (MSA), Parkinson's disease (PD), or pure autonomic failure (PAF) experiencing symptomatic neurogenic orthostatic hypotension (snOH) compared with placebo at Week 4, as measured by the change from baseline of the Orthostatic Hypotension Symptom Assessment and other. Additional objectives include evaluation of the efficacy of TD-9855 in preventing incidence of falls and evaluation of the safety and tolerability of TD-9855.

Principal Investigator: Alexandru Barboi, MD
NorthShore Project Number: EH19-229
Contact: Call **(847) 503-4334** with questions regarding the study.

Theravance Protocol 0170: A Phase 3, 4-week, Multicenter, Randomized, Double-Blind, Placebo-Controlled, Parallel-Group Study of TD-9855 in Treating Symptomatic Neurogenic Orthostatic Hypotension in Subjects With Primary Autonomic Failure

Aims: The primary objectives of the study are to evaluate the durability of effect of the study medication amprelosetine (TD-9855), in subjects with symptomatic neurogenic orthostatic hypotension (snOH) due to multiple system atrophy (MSA), Parkinson's disease (PD), or pure autonomic failure (PAF) compared with placebo over a double-blind, randomized withdrawal period of 6 weeks following an open label treatment of 16 weeks. The study also aims to evaluate the safety and tolerability of TD-9855 when taken for up to 22 weeks.

Principal Investigator: Alexandru Barboi, MD
NorthShore Project Number: EH19-232
Contact: Call **(847) 503-4334** with questions regarding the study.

Theravance Protocol 0171: A Phase 3, 182-week, Open-Label, Safety and Tolerability Study of TD-9855 in Treating Symptomatic Neurogenic Orthostatic Hypotension (snOH) in Subjects with Primary Autonomic Failure

Aims: The primary objective of the study is to evaluate the long-term safety of the study medication amprelosetine (TD-9855) over a 182-week period. This study will also assess patient reported quality of life outcomes.

Principal Investigator: Alexandru Barboi, MD
NorthShore Project Number: EH20-088
Contact: Call **(847) 503-4334** with questions regarding the study.

Parkinson's Disease and Movement Disorder Clinical Trials

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.

Rostock International Parkinson's Disease Study (ROPAD)

Aims: The purpose of this research is to genetically test patients with Parkinson's Disease (PD) for Leucine-rich repeat kinase 2 gene (LRRK2) and glucocerebrosidase (GBA) mutations. The most frequent known causes for PD are mutations in the LRRK2 and GBA genes.

Principal Investigator: Katerina Markopoulou, MD, PhD
NorthShore Project Number: EH20-075
Contact: Call **(847) 503-4344** with questions regarding the study.

Parkinson's Disease and Movement Disorder Clinical Trials *(continued)*

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.

Spine Surgery Clinical Trial

Prospective Evaluation Of Lumbar Discectomy With Additional Implantation Of An Annular Closure Device In Patients With Large Postsurgical Annular Defects For Prevention Of Lumbar Disc Reherniation

Aims: The purpose of this prospective, single-arm, multicenter study is to confirm the efficacy of the Barricaid® device when used as an adjunct to a primary lumbar limited discectomy, to limited discectomy alone, with regard to preventing reherniation and the recurrence of pain or dysfunction in a US population.

Principal Investigator: Michael Musacchio, MD
NorthShore Project Number: EH20-023
Contact: Call **(847) 570-4224** with questions regarding this study

Sleep Clinical Trial

Adherence and Outcome of Upper Airway Stimulation (UAS) for 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.



"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

Stroke Program Clinical Trials

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.

ENRICH (Early miNimally-invasive Removal of ICH)

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.

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 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.

The DodoNA Project

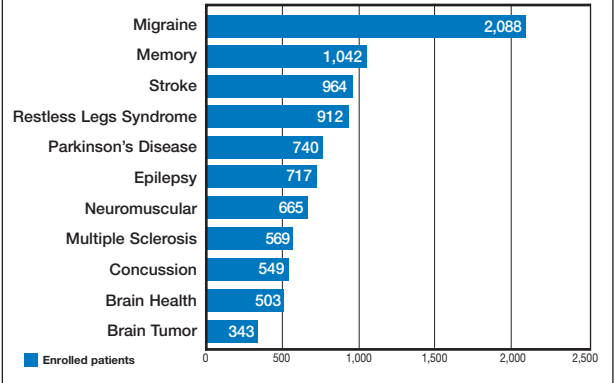
The DodoNA project is one of the major research initiatives of NorthShore Neurological Institute. The purpose of the project is to predict, prevent and halt neurological disorders through the development of DNA-based prognostic tests and therapies.

The DodoNA researchers built customized “toolkits” within NorthShore’s award-winning electronic health record (EHR) system for each of the 10 disorders plus brain health (11 total) that capture and store data from routine office visits. The researchers are also collecting blood and extracting DNA and plasma to be stored in a “biobank.” Laboratory scientists are starting our genetic analyses by performing automated DNA sequencing tests, identifying a number of genetic markers in each of the groups. Our statisticians will then determine if these markers may be significant in identifying disease characteristics or treatment response. With this information, researchers will be in a better position to deliver methods to predict and modify disease.

Some descriptive data are shown in the graphs below and the following pages.

Research Update

As of June 1, 2020, we have enrolled more than 9,000 patients in the DodoNA project, with a target enrollment of at least 1,000 for each of the disorders.

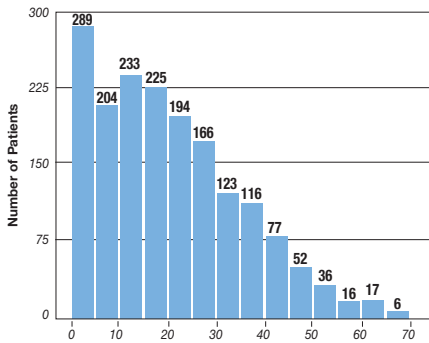


Please note that patient enrollment for migraine and memory are now closed.

Migraine Description of our 2,088 patients enrolled, at their initial visit

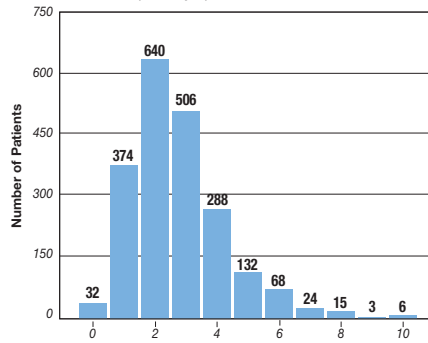
Disease Duration

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



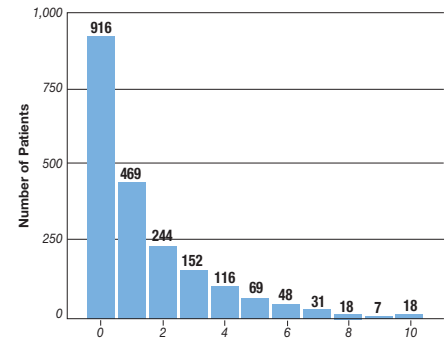
Number of Prior Abortive Medications

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



Number of Prior Preventive Medications

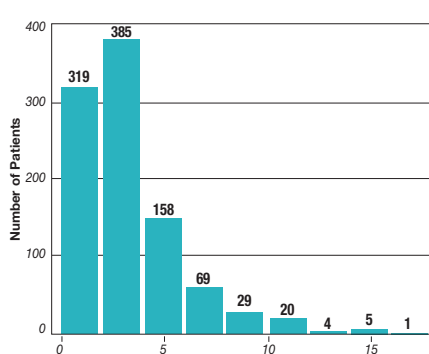
Preventive medications are taken daily to keep migraine attacks from occurring frequently.



Memory Description of our 1,042 patients enrolled, at their initial visit

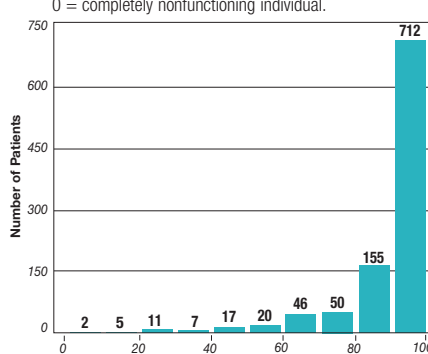
Disease Duration

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



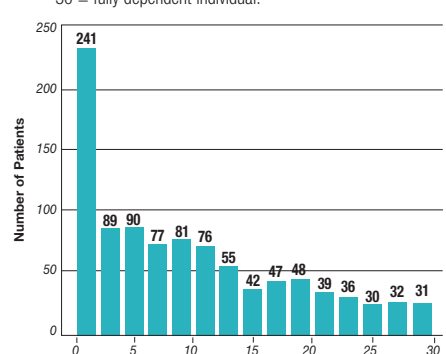
Barthel Index

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



The Functional Activities Questionnaire

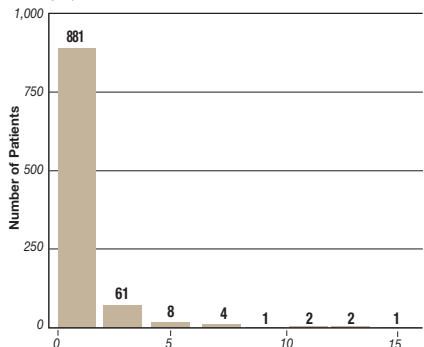
A measure of performance in activities of daily living (complex activities). 0 = person with no limitations; 30 = fully dependent individual.



Stroke Description of our first 964 patients enrolled, at their initial visit

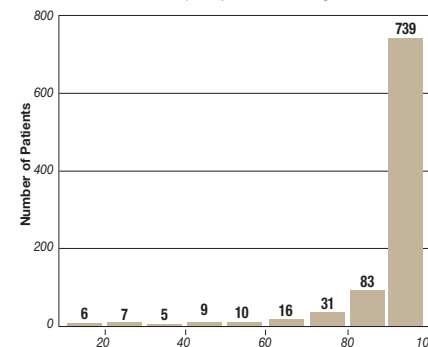
National Institutes of Health Stroke Scale (initial)

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



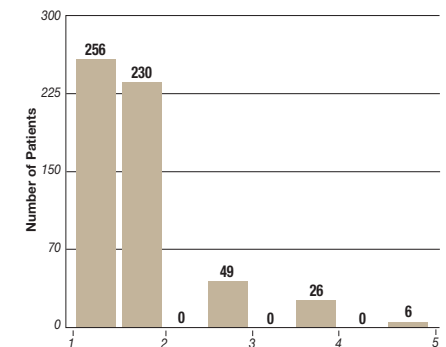
Barthel Index

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



Modified Rankin Index

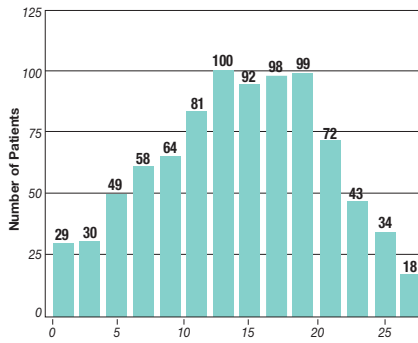
A global disability scale. 0 = no symptoms; 5 = severe disability.



Restless Legs Syndrome *Description of our first 912 patients enrolled, at their initial visit*

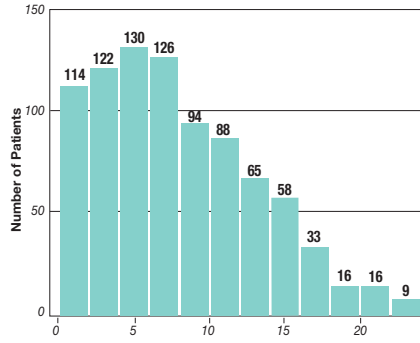
ISI Score

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



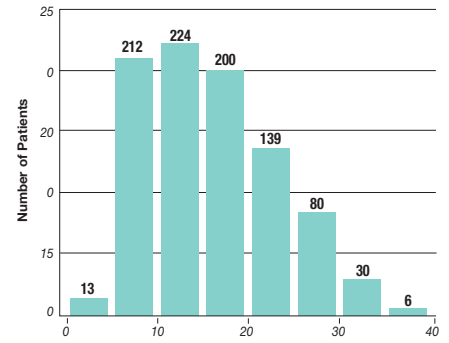
ESS Score

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



IRLS Score

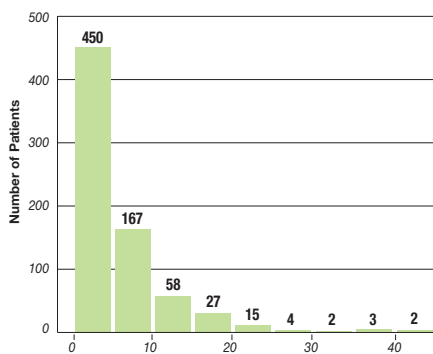
International Restless Legs Scale (IRLS) rating scale, where scores of 0-10 = mild, 11-20 = moderate, 21-30 = severe and 31-40 = very severe.



Parkinson's Disease *Description of our first 740 patients enrolled, at their initial visit*

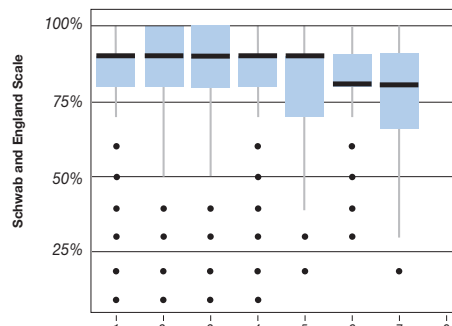
Disease Duration

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



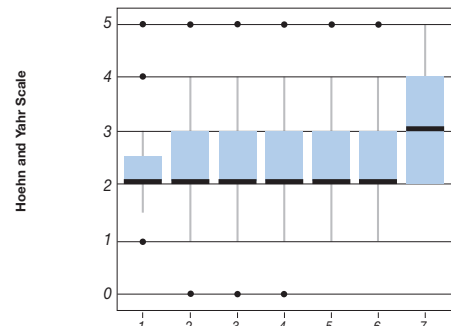
Longitudinal Changes in Schwab and England Scale

Patients self-report their abilities to perform activities of daily living. One hundred percent indicates a completely independent individual, and 0% indicates a completely nonfunctioning individual.



Longitudinal Changes in Hoehn and Yahr Scale

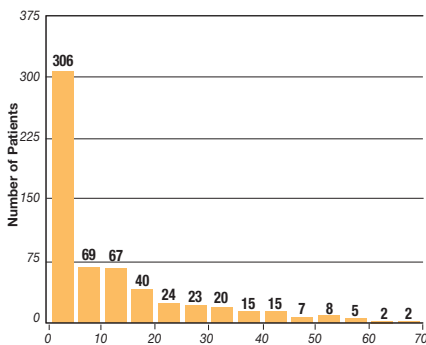
The Hoehn and Yahr scale is a measure of motor impairment; it is an objective measure of disability. As a group, our patients have remained largely stable over more than five years.



Epilepsy *Description of our first 717 patients enrolled, at their initial visit*

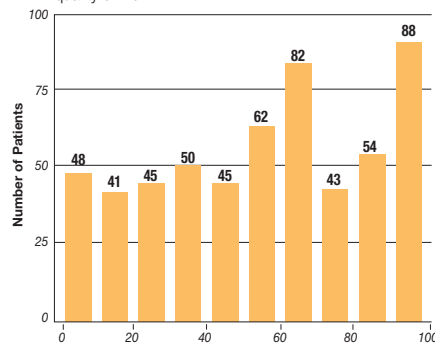
Disease Duration

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



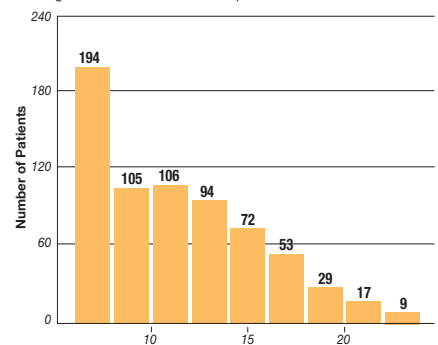
QOLIE Total Score

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



NDI-E Total Score

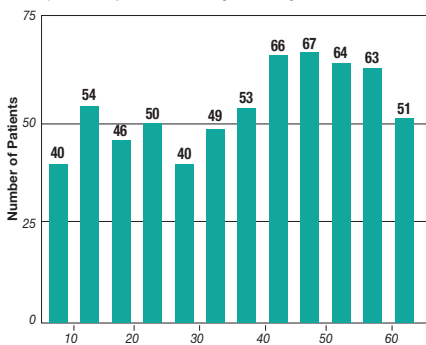
The Neurological Disorders Depression Inventory for Epilepsy (NDI-E) is a 6-item questionnaire validated to screen for depression in people with epilepsy. Scores greater than 15 indicate depression.



Neuromuscular *Description of our first 665 patients enrolled, at their initial visit*

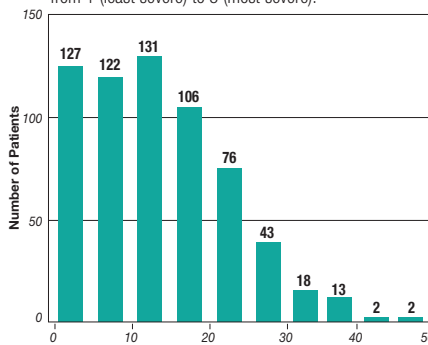
Fatigue Severity Score

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.



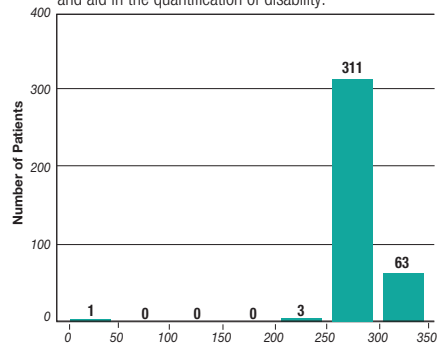
Survey of Autonomic Symptoms

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).



NorthShore Neuropathy Impairment Score

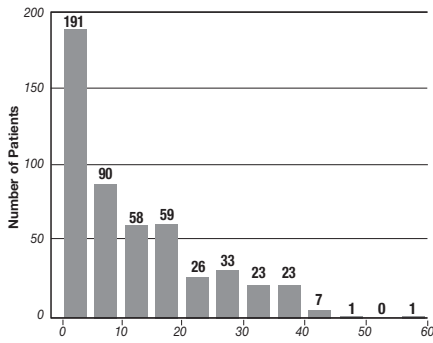
This test was developed by physicians at NorthShore Neurological Institute to parallel severity of involvement and aid in the quantification of disability.



Multiple Sclerosis Description of our first 569 patients enrolled, at their initial visit

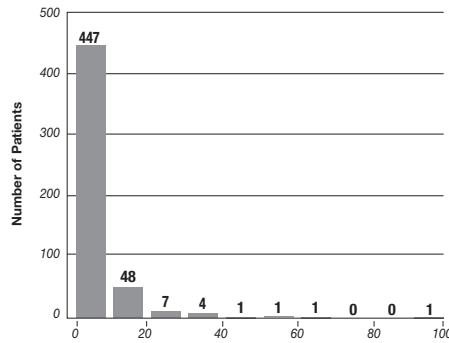
Disease Duration

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



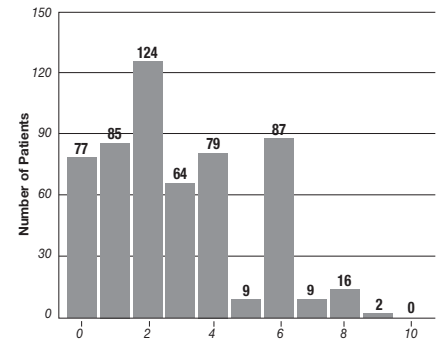
25 ft. Walk

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



EDSS Step

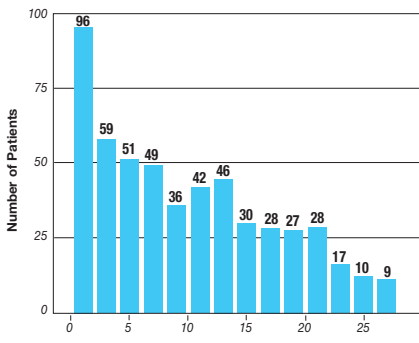
Expanded Disability Status Scale (EDSS), where higher scores are more severe (e.g., scores of 5 and above indicate increasing difficulty walking).



Concussion Description of our first 549 patients enrolled, at their initial visit

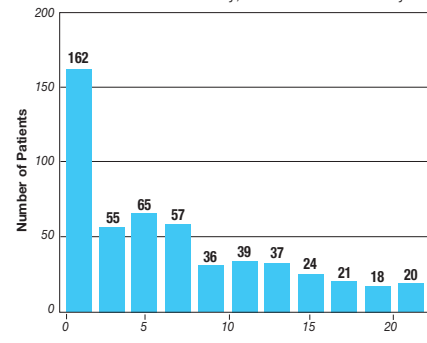
ISI Score

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



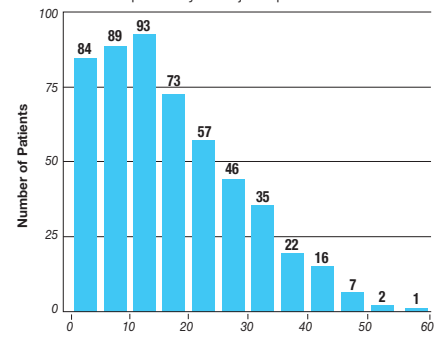
GAD-7 Score

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



CES-D Score

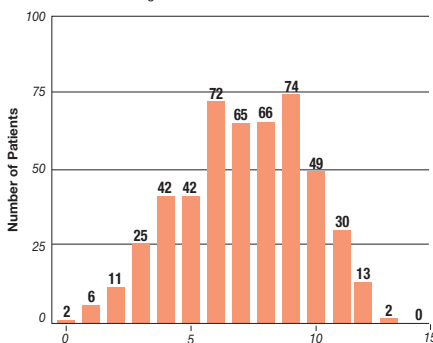
Screening test to determine depression quotient. 15-21 = mild to moderate depression; over 21 = possibility of major depression.



Brain Health Description of our first 503 patients enrolled, at their initial visit

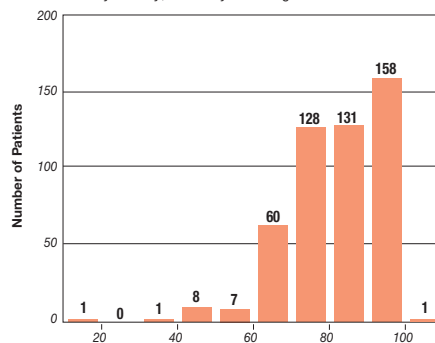
PREDIMED Questionnaire

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



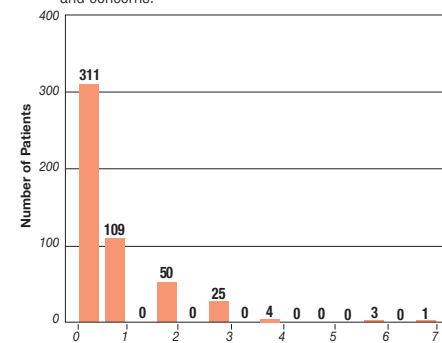
Readiness Questionnaire

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



Brain Health Quiz Score

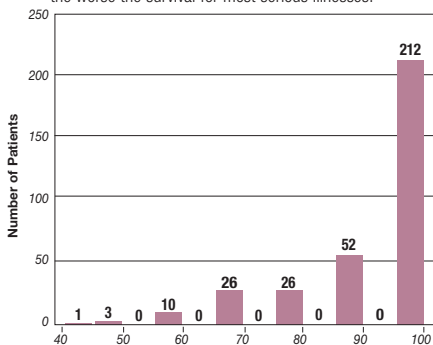
The brain health quiz includes 23 well-defined risk factors for Alzheimer's disease and related disorders. 0 = no risk factors or concerns; 23 = all risk factors and concerns.



Brain Tumor (primary malignant) Description of our first 343 patients enrolled, at their initial visit

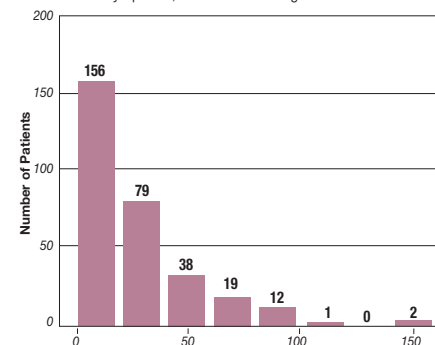
Karnofsky Performance Scale

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



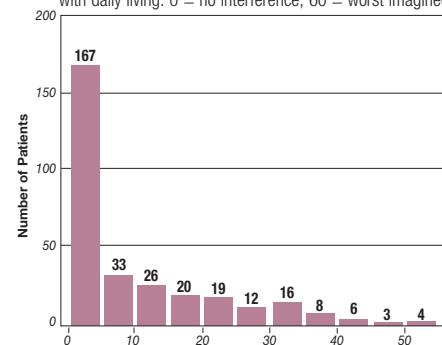
MD Anderson Symptom Inventory—Brain Tumor (Part 1)

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



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.



RESEARCH HIGHLIGHTS

Neurology Practice-Based Research Network (NPBRN)

From Best Practices to Next Practices

The mission of NorthShore Neurological Institute is to preserve and improve neurological health through clinical practice, education and research. Launched in June 2015, the Neurology Practice-Based Research Network (NPBRN) continues to advance personalized neurological care with 11 award-winning customized electronic health record (EHR) toolkits to date.

The goal of the NPBRN is to advance quality improvement and practice-based research in neurology using the electronic health record (EHR) toolkits developed by DodoNA researchers on a national scale.

Starting in 2015, we have been addressing the lack of quality initiatives and comparative effectiveness research in neurology. Using the American Academy of Neurology (AAN) evidence-based guidelines, quality improvement measures and resources for treating neurological disorders, we created tools to standardize neurology office visits to meet this need.

In 2003, NorthShore was among the first in the country to successfully launch a systemwide EMR, called “Epic,” with demonstrable benefits in quality, safety, efficiency and service to patients. NorthShore is recognized by multiple national organizations for this notable achievement. Since then,

Neurology Practice-Based Research Network Sites Progress

| NPBRN Site | Number of Toolkits Planned or Implemented (Out of 11) |
|--------------------------------------|---|
| Medical University of South Carolina | 3 |
| NorthShore University HealthSystem | 11 |
| Ochsner Health System | 8 |
| St. Luke’s Hospital (MO) | 8 |
| University of Cincinnati | 4 |
| University of Connecticut | 5 |
| University of Florida | 8 |
| University of Kansas | 4 |
| University of Nebraska | 4 |
| Wake Forest University | 4 |



the Department of Neurology at NorthShore has invested heavily and built, into Epic, tools that meet AAN guidelines, standardize care, write progress notes and capture up to 1,000 discrete data points per office visit. These EMR toolkits have so far been applied to 10 common neurological disorders plus brain health (11 toolkits total) and used to collect data for the DodoNA project.

NPBRN Sites

NorthShore has been successful in obtaining federal support for the NPBRN in the form of a \$1.2 million multiyear award from the Agency for Healthcare Research and Quality (AHRQ). The AHRQ award, titled “Quality Improvement and Practice-Based Research in Neurology Using the EMR,” has two specific aims. The first is to establish the NPBRN at multiple sites by sharing our proprietary EMR toolkits for 10 common neurological disorders plus brain health (11 toolkits total) with other neurology practices nationwide that also use the Epic EMR system. Sharing EMR toolkits in this way will not only foster collaboration, but increase the amount of data the project will be able to generate.

Since the initial call to participate in the NPBRN, 12 sites in addition to NorthShore agreed to join and have participated in collecting data in routine office visits to optimize treatments and track patient outcomes over time. The NPBRN is led by Demetrius Maraganore, MD, at the Tulane University School of Medicine and Steven Meyers, MD, is the principal investigator at the NorthShore site. The table to the left shows the current status of NPBRN sites as of January 1, 2020.

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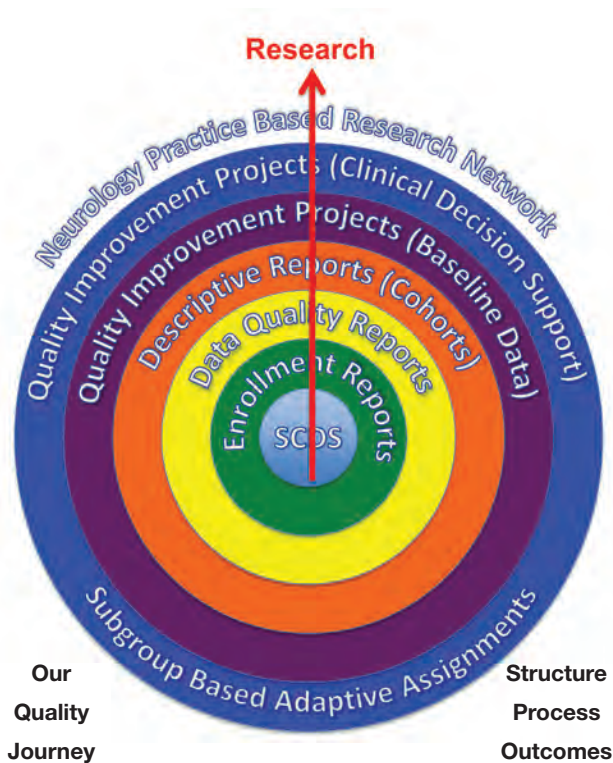


Dr. Steven Meyers, Vice Chair of Quality and Informatics in the Department of Neurology, is site principal investigator of the grant.

Our Quality Journey

The Department of Neurology at NorthShore includes 37 neurologists practicing at four hospitals, multiple outpatient sites, and in select sub-specialties at Swedish Covenant and Northwest Community Hospital starting this year.

Below is a graphic and step-by-step description of the establishment of the NPBRN for 11 projects: brain tumors, epilepsy, migraine, memory disorders, mild traumatic brain injury, multiple sclerosis, neuromuscular disorders, Parkinson’s disease, restless legs syndrome, stroke and brain health.



- Step 1:** Development and implementation of structured clinical documentation support (SCDS)–EMR–tools
- Step 2:** Enrollment reports of subjects encountered (up to 1,000 fields of data captured per office visit)
- Step 3:** Data quality reports to identify missing data
- Step 4:** Descriptive reports of group characteristics such as patient reported and physician assessment measure
- Step 5:** Quality improvement projects (baseline data)
- Step 6:** Quality improvement projects (using clinical decision support tools built into the EMR to hardwire patient safety and improved outcomes)
- Step 7:** Dissemination of tools and sharing of data via the NPBRN

Comparative Effectiveness Research

The second aim of the AHRQ award is that we will be able to perform, for the first time, pragmatic clinical trials using the EMR in neurology to compare the effectiveness of several available therapies. These trials will be conducted using a subgroup-based adaptive (SUBA) design, an innovative way to inform healthcare decisions using precision medicine and provide evidence on the effectiveness, benefits and drawbacks of different treatment options. The plan is to perform 11 SUBA trials—one for each NPBRN project—with a total of 3,300+ patients.

For each trial, we are randomly assigning the first 120 patients to one of the currently available medications. We have integrated the SUBA design within the EMR software so that data captured from these first 120 patients will identify subgroup effects and assign 200+ newly enrolled patients—in real time—to the treatments that are expected to be more effective and achieve the best outcomes.

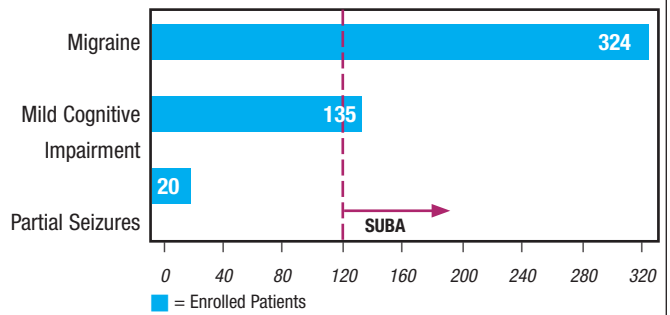
In July 2016, we launched the first of these trials—in migraine—where we are comparing the effectiveness of three preventive medications for migraine headaches. In December 2016, we launched a second pragmatic trial comparing three memory-enhancing drugs in patients with mild cognitive impairment. The third pragmatic trial was launched in July 2017 and compares three anti-epileptic drugs at the point of care in patients with partial seizures. Current enrollment status of these trials is shown below.

To increase the “learning” of the computerized system, we will continually capture outcomes data at initial and annual visits over five years whereas most clinical trials follow patients only up to a year. To date we have had a high rate of follow up visits from patients, allowing us to track outcomes over time.

Additionally, we will enroll eligible patients to provide a DNA sample and will assay the samples for up to 1 million genetic variations. We will then associate the genotypes with the longitudinal outcomes captured by the EMR tools (see The DodoNA Project on pages 16–18).

Research Update

As of June 1, 2020, we have enrolled more than 450 patients in three currently active pragmatic clinical trials, with a target enrollment of at least 300 for each of the disorders.



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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; Medical Director, NorthShore Neurological Institute
Expertise: Multiple Sclerosis (MS), Headache/Migraine, Epilepsy
Procedures: Botox
Locations: GB, LS

**Lloyd Davis, MD**

Expertise: General Neurology, Headache/Migraine, Balance and Gait Disorders, Peripheral Neuropathy, Movement Disorders
Procedures: Botox
Locations: GB, LS

**Octavia Kincaid, MD**

Director, Education
Expertise: Neuromuscular Disorders, ALS, Autonomics, Peripheral Neuropathy
Procedures: EMG
Locations: EV, GB, IPC, LS

**Alexandru Barboi, MD**

Section Head, Neuromuscular
Expertise: Neuromuscular Disorders, Autonomics
Procedures: Autonomic Testing, EMG (including single fiber), Skin Biopsy for Nerve Fiber Density
Locations: EV, GB

**Sofia Dobrin, MD**

Expertise: Epilepsy, Headache/Migraine, General Neurology, Neurophysiology, Dizziness
Procedures: EEG/IOM, VNS
Locations: HP, LS

**Lori Lovitz, DO**

Expertise: Sleep Medicine, Headache/Migraine, General Neurology, Epilepsy
Procedures: Sleep Study (PSG)
Locations: EV, SK

**Erik Beltran, MD**

Expertise: Concussion/Sports Neurology, Postconcussion Syndrome, General Neurology, Headache/Migraine
Locations: GB, LS

**Thomas Freedom, MD**

Expertise: Sleep Medicine
Procedures: Sleep Study (PSG)
Location: GB

**Nabil Thomas Makhlof, MD**

Expertise: General Neurology, EMG/NCV Testing, Neurophysiology, Intraoperative Monitoring
Procedures: EMG/NCV
Location: EV, SK

**Franco Campanella, DO**

Vice Chair, Clinical Operations
Expertise: General Neurology, Stroke, Neuromuscular Disorders, Headache/Migraine, Movement Disorders
Procedures: Botox
Locations: EV, GB, SK

**Fulvio (Rob) Gil, MD**

Expertise: Stroke, General Neurology
Locations: EV, GB, LS

**Angela Mark, MD**

Expertise: General Neurology, Headache/Migraine, Peripheral Neuropathy, Epilepsy
Procedures: EMG
Location: EV

**James Castle, MD**

Expertise: Memory, Behavioral, General Neurology
Locations: HP, LS, SK

**Elizabeth Harris, MD**

Expertise: Memory, Headache/Migraine, General Neurology
Locations: GB, SK

**Katerina Markopoulou, MD, PhD**

Section Head, Movement Disorders
Expertise: Movement Disorders
Procedures: Deep Brain Stimulation
Locations: EV, GB

**Janet Choi, MD**

Expertise: Epilepsy, General Neurology, Headache/Migraine, Dizziness
Procedures: EEG, VNS
Locations: GB, GR, LS

**Afif Hentati, MD**

Section Head, Multiple Sclerosis
Expertise: Multiple Sclerosis (MS), Neuroimmunology, General Neurology, Headache/Migraine
Locations: EV, GB, SK

**Ryan Merrell, MD**

Section Head, Neuro-Oncology
Expertise: Neuro-Oncology
Locations: EVK, GBK, HPK, SW

**Catherine Daley, MD**

Expertise: General Neurology, Neuromuscular Disorders
Locations: GB, LS

**Karyn Karlin, MD**

Expertise: Multiple Sclerosis (MS), Headache/Migraine, General Neurology
Locations: GB, LS

**Steven Meyers, MD**

Vice Chair, Quality and Informatics
Expertise: Headache/Migraine, Stroke, General Neurology
Procedures: Botox, EMG
Locations: HP, LS, SK

**Ninith V. Kartha, MD**

Expertise: Movement Disorders, Parkinson's Disease, Memory, General Neurology
Procedures: Botox
Locations: EV, GB, LS

See page 28 for 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)



Richard Munson, MD
Director, Stroke Program
Expertise: Stroke, Sleep Medicine
Procedures: Sleep Study (PSG)
Locations: EV, GB, LS



Joya Paul, MD
Expertise: Sleep Medicine, Snoring/Sleep Apnea, Insomnia, Restless Legs Syndrome
Procedures: Sleep Study (PSG)
Location: SK



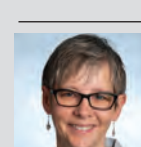
Irene Semenov, DO
Section Head, General Neurology
Expertise: Headache/Migraine, General Neurology, Neurophysiology
Procedures: Botox, EMG
Locations: GB, HP, LS



Camelia Musleh, MD
Expertise: Sleep Medicine, Sleep-Related Breathing Disorders, Insomnia, Narcolepsy
Procedures: Sleep Study (PSG)
Locations: LS, SK



Ashvini Premkumar, MD
Vice Chair, Physician and Patient Engagement
Expertise: Movement Disorders, Parkinson's Disease, Tremor, Dystonia, Balance and Gait Disorders
Procedures: Botox
Locations: EV, GB



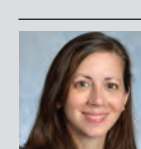
Megan Shanks, MD
Expertise: Neuromuscular Disorders, General Neurology
Procedures: EMG
Locations: EV, GB, LS, SK



Jaishree Narayanan, MD, PhD
Section Head, Epilepsy
Expertise: Epilepsy
Procedures: Anterior Thalamic Deep Brain Stimulation, EEG/IOM, Epilepsy Monitoring Unit (EMU), Neuropace, VNS
Location: EV



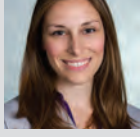
John Pula, MD
Expertise: Neuro-Ophthalmology, Multiple Sclerosis (MS)
Locations: GBE, SK



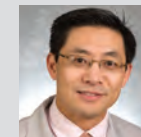
Mari Viola-Saltzman, DO
Section Head, Sleep Medicine
Expertise: Sleep Medicine, Pediatric Sleep Medicine (age 2+), General Neurology
Procedures: Sleep Study (PSG)
Location: GB



Nabeela Nasir, MD
Expertise: Sleep Medicine
Procedures: Sleep Study (PSG)
Location: LS



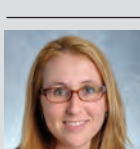
Nicole Reams, MD
Section Head, Concussion and Sports Neurology
Expertise: Concussion/Sports Neurology, Headache/Migraine, Dizziness, Movement Disorders, Neuromuscular Disorders
Locations: EV, GB, LS



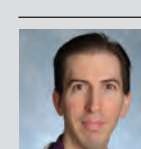
Charles Wang, MD
Section Head, Intraoperative Medicine
Expertise: Epilepsy, General Neurology
Procedures: EEG/IOM, EMG
Location: SK



Archie Ong, MD
Expertise: Stroke, General Neurology
Locations: GB, SK



Bernadette Schoneburg, MD
Expertise: Movement Disorders, Parkinson's Disease, Tremor, Dystonia, Balance and Gait Disorders
Procedures: Botox, Deep Brain Stimulation
Locations: GB, SK



Chad Yucus, MD
Section Head, Memory
Expertise: Memory, Neurodegenerative Diseases, Brain Health, Epilepsy, General Neurology
Location: GB

Pediatric Neurologists



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



Leslie Finkel, MD
Expertise: Pediatric Neurology, Epilepsy, Motor Developmental Delay, Headaches
Locations: CCHA, EVSS



Margaret Michelson, MD
Expertise: Pediatric Neurology, Epilepsy, Motor Developmental Delay, Headaches
Locations: CCHA, EVSS

continued >>

See page 28 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
Surgical Director, NorthShore
Neurological Institute*
Expertise: Brain Tumors,
Aneurysms, Spinal Disorders,
Epilepsy Surgery, General
Neurosurgery
Locations: EV, HP, SW

**William Ares, MD**

Expertise: Neurosurgery,
Vascular and Spine Surgery
Locations: EVSS, LS, SC

**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: EV, GB

**Andrew Johnson, MD**

Expertise: Neurological Surgery,
Neurosurgery, Brain and Spine
Tumors, Brain Tumors, Head and
Neck Cancers, Head and Spine
Trauma, Minimally Invasive
Spine Surgery, Myofascial Pain
Syndromes, Headache
Management
Location: SW

**Michael Musacchio, MD**

*Division Chief, Neurological Spine
Surgery*
Expertise: Neurosurgery, Complex
Spine Reconstruction, Joint
Replacement of the Spine,
Minimally Invasive Spine Surgery,
Spine Surgery
Locations: GB, LS, SC

**Noam Stadlan, MD**

Vice Chair, Quality and Informatics
Expertise: Minimally Invasive Spine
Surgery, Complex Spine Surgery
and Reconstruction
Locations: HP, LS, SC

**Brian Walcott, MD**

Expertise: Cerebrovascular
Disease, Aneurysms,
Arteriovenous Malformation,
Interventional Stroke Therapy,
Cavernous Malformations, Dural
Arteriovenous Fistula, Spinal
Vascular Malformation,
Neurocritical Care, Vasospasm
Locations: EVSS, GB

**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: EV, GB

Physical Medicine and Rehabilitation (PM&R)

**Joseph Alleva, MD**

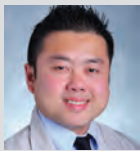
*Division Head, Physical Medicine
and Rehabilitation*
Expertise: Acute and Chronic
Spine Pain and EMG
Locations: EV, GB, IPC, LW, SC,
SKS

**Joseph Feldman, MD**

*Director, PM&R Lymphedema
Treatment Center*
Expertise: Physical Medicine and
Rehabilitation, Lymphedema,
EMG Testing
Locations: EV, GVP, HP

**George Kannankeril, MD**

Director, PM&R Arthritis Program
Expertise: Nonsurgical
Musculoskeletal Care,
Osteoarthritis
Locations: CH, SC

**Matthew Co, DO**

Expertise: Acute and Chronic
Spine Pain
Locations: CH, GB, IPC, SC, SKS

**Thomas Hudgins, MD**

*Section Head, PM&R Outpatient
Specialty Programs*
Expertise: Orthopaedic and Spine
Injury Management for Athletes
(All Ages and Levels)
Locations: GB, HP, IPC, SC, SKS

**Rachel Kermen, MD**

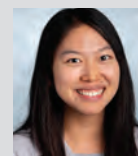
Expertise: Parkinson's Disease,
Stroke, Multiple Sclerosis (MS),
Chronic Pain, Recurrent Falling,
General Debility, Spasticity
Procedures: Botox
Location: GB

**Kristina Drabkin, DO**

*Director, PM&R Hospital Consult
Service*
Expertise: Carpal Tunnel (CTS),
Diabetic Neuropathy, Peripheral
Neuropathy, Quadriplegia,
Rehabilitation of Neurological
Conditions, Amputation, Prosthetics
Locations: EV, GB

**Daniel Hurley, MD**

Expertise: Nonsurgical
Treatment of Neurological and
Neuromuscular Disorders,
Cervicogenic Headaches
Locations: CH, IPC, SC

**Melody Lee, MD**

Expertise: Rehabilitation of
Neurological Disorders and Stroke
Rehab; Acute Spine Pain; EMG;
Botox Injections; Ultrasound
Guided Injections
Locations: EV, GB

PHYSICIAN DIRECTORY

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

Neuropsychologists



Laura Benson, PhD

Expertise: Adult Neuropsychology, Memory Disorders, Dementia, Neurologic Disorders, Concussion/Traumatic Brain Injury, Attention Deficit Hyperactivity Disorder (ADHD)/ Learning Disorders, Psychiatric Conditions

Locations: DF, GU



Leslie Guidotti Breting, PhD

Expertise: Alzheimer's Disease, Attention Deficit Hyperactivity Disorder (ADHD), Concussion, Dementia, Epilepsy/Seizure Disorder, Learning Functioning, Memory Disorders, Neurological Disorders

Location: DS



Alona Ramati, PhD

Expertise: Alzheimer's Disease, Attention Deficit Hyperactivity Disorder (ADHD), Concussion, Dementia, Epilepsy/Seizure Disorder, Learning Disorders, Learning Functioning, Memory Disorders, Movement Disorders, Multiple Sclerosis (MS), Parkinson's Disease (PD), Stroke, Traumatic Brain Injury

Location: GB



Elizabeth Geary, PhD

Expertise: Dementia, Epilepsy, Movement Disorder, Multiple Sclerosis (MS), Traumatic Brain Injury

Locations: DS, GB



Elizabeth Heideman, PhD

Expertise: Anxiety, Attention Deficit Hyperactivity Disorder (ADHD), Concussion, Depression, Learning Functioning, Neurological Disorders, Pediatric Epilepsy, Pediatric Genetic Disorders

Location: DS

Neuroradiologists



Matthew Walker, MD

*Executive Vice Chair,
Department of Radiology
Expertise:* Neuroradiology

Location: EH



Kenneth Goldberg, MD

*Director of Neuroradiology CT
Expertise:* Neuroradiology

Location: EH



Kristina Olsen, MD

Expertise: Neuroradiology

Location: EH



William Ankenbrandt, MD

*Section Chief, Neuroradiology
Expertise:* Neuroradiology, Interventional Radiology

Location: EH



Michael Gorey, MD

Expertise: Neuroradiology

Location: EH



Bojan Petrovic, MD

*Education Coordinator
of Neuroradiology
Expertise:* Neuroradiology

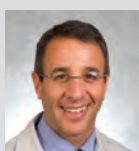
Location: EH



Anne Doppenberg, MD

Expertise: Neuroradiology

Locations: EH, HPH



Joel Meyer, MD

Expertise: Neuroradiology

Location: EH



Doris Yip, MD

*Director of Neuroradiology MRI
Expertise:* Neuroradiology

Location: EH

See page 28 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.

Chicago Lake Shore Medical Office (CH)

680 North Lake Shore Drive, Suite 924
Chicago, IL 60611

Chicagoland Children's Health Alliance (CCHA)

3232 Lake Avenue, Suite 330
Wilmette, IL 60091

NorthShore Medical Group (DF)

49 South Waukegan Road, Suite 200
Deerfield, IL 60015

NorthShore Medical Group (DS)

909 Davis Street, Suite 160, Evanston, IL 60201

Evanston Neurological Institute (EV)

1000 Central Street, Suite 880, Evanston, IL 60201

Evanston Kellogg Cancer Center (EVK)

2650 Ridge Avenue, Evanston, IL 60201

Evanston Specialty Suites (EVSS)

1000 Central Street, Suite 800, Evanston, IL 60201

Glenbrook Ambulatory Care Center (GB)

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, Glenview, IL 60026

Gurnee Ambulatory Care Center (GR)

7900 Rollins Road, Gurnee, IL 60031

Highland Park Specialty Care Center (HP)

757 Park Avenue West, Suite 2850
Highland Park, IL 60035

Highland Park Kellogg Cancer Center (HPK)

757 Park Avenue West, Suite 1810
Highland Park, IL 60035

Integrated Pain Center (IPC)

9600 Gross Point Road, Suite 1200
Skokie, IL 60076

Lincolnshire Medical Office (LS)

920 Milwaukee Avenue, 2nd Floor
Lincolnshire, IL 60069

Lincolnwood Medical Office (LW)

6810 N. McCormick Blvd.
Lincolnwood, IL 60712

NorthShore Medical Group (GU)

200 S. Greenleaf Street, Suite E
Gurnee, IL 60031

Skokie Ambulatory Care Center (SK)

9650 Gross Point Road, Suite 3000
Skokie, IL 60076

**Skokie Ambulatory Care Center
Spine Center (SKS)**

9650 Gross Point Road, Suite 2000
Skokie, IL 60076

Skokie Eye and Vision Center (SKE)

9650 Gross Point Road, Suite 1900
Skokie, IL 60076

Spine Center (SC)

9600 Gross Point Road, Suite 1200
Skokie, IL 60076

Swedish Hospital (SW)

Chicago Brain & Spine Institute

Garden Pavilion, 1st Floor
5115 N. Francisco Avenue
Chicago, IL 60625

PHILANTHROPY

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



Neurological Institute

2650 Ridge Avenue, Evanston, Illinois 60201

northshore.org/neuro

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