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ZION'S JOURNEY THROUGH SDR SURGERY AND REHABILITATION

RESIDENCY PROGRAM PRODUCES NATIONAL LEADERS IN REHABILITATION MEDICINE

COMPREHENSIVE, PROGRAMMATIC APPROACH TO TREATMENT DEVELOPMENT AT TIRR MEMORIAL HERMANN

TIRR MEMORIAL® HERMANN
Rehabilitation & Research

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COVER PHOTO

- Zion, age 8, pediatric SDR surgery and rehabilitation patient

Zion's Journey Through SDR Surgery and Rehabilitation

When Zion Walker came to the selective dorsal rhizotomy (SDR) program at TIRR Memorial Hermann at 6 years of age, he needed a walker to get around and a caregiver to shadow him at school to provide support when needed.

Eighteen months later, 8-year-old Zion, who has cerebral palsy, now walks independently and no longer requires extra supervision. He's also thriving academically and socially. The second-grader is an honor-roll student and has friends throughout the school.

"When I've walked in with him to his medical appointments, it's like right out of that television show 'Cheers,' but instead of 'Norm' everyone says, 'Zion,'" says his mother Biannka Jones-Walker, a flight attendant based in Houston. Zion lives in Houston with his mother and father, Sakata.

See Zion jumping for joy at memorialhermann.org/patients-visitors/patient-stories/zion-cerebral-palsy-story

At home, Zion often plays with a karaoke machine, singing along with Michael Jackson and moonwalking.

What brought about this significant change? In short, care and treatment from Memorial Hermann, according to Zion's mother.

Zion, born prematurely at Children's Memorial Hermann Hospital, required years of therapies and treatments to treat his spasticity caused by cerebral palsy, including Botox® injections. Spasticity is an often-painful complication associated with central nervous system disorders such as cerebral palsy that can cause muscles in any part of the body to involuntarily contract and become stiff, which can lead to jerky or exaggerated movements. According to Sheng Li, MD, PhD, director of Stroke Recovery and Rehabilitation research at TIRR Memorial Hermann, serious cases of spasticity can affect a person's quality of life and ability to perform common daily tasks, such as dressing, eating, walking, showering and getting into or out of bed.

Once he turned 5 years old, Zion qualified for a more permanent treatment–SDR surgery at Children's Memorial Hermann Hospital, one of the few pediatric neuroscience programs in the country offering single-level laminectomy

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SDR procedures for children with cerebral palsy who suffer from spastic diplegia or spastic hemiplegia. This particular procedure is one of the most effective treatments for children with cerebral palsy. SDR surgery selectively removes the abnormal stretch reflex that causes excessive muscle tone or tightness in the legs, by carefully testing and cutting the nerve rootlets in the spinal cord.

Guided by a multidisciplinary team, the unit care focuses on comprehensive recovery for pediatric patients to maximize motor function and quality of life. This recovery unit is unique to TIRR Memorial Hermann, and is one of the only recovery units of its kind in the country.

Although SDR improves spasticity and may enhance mobility and motor control, the treatment typically entails extensive rehabilitation postoperatively and requires a strong commitment from every patient and their family. Typically, SDR patients like Zion are up and moving the day after surgery; then patients are transferred to the acute inpatient rehabilitation program at TIRR Memorial Hermann via the SDR pathway. This program was developed by Stacey Hall, DO, medical director of Pediatric Physical Medicine and Rehabilitation at TIRR Memorial Hermann, and Manish Shah, MD, director of Pediatric Spasticity and Epilepsy Surgery at Children's Memorial Hermann and Zion's pediatric neurosurgeon.

"The team at TIRR Memorial Hermann told us to expect Zion to be there for six weeks, and that's tough for a parent," Biannka recalls. "You need to trust those caregivers with your child. But, from the moment we arrived, I knew Zion would be in good hands. The staff is just amazing."

In fact, the young patient "fell in love with his physical therapists" almost immediately, according to his mother.

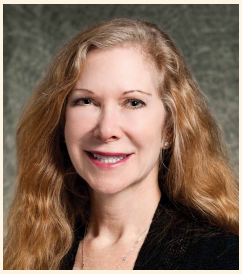
"He greeted them like they were Santa Claus whenever they came into the room," Biannka says.

This close bond meant that Zion not only adhered to a "very intensive" therapy regimen during his time as an inpatient–which involved bolstering leg and core strength, for mobility and balance–but he embraced it.

"He achieved all his goals in four weeks," his mother notes. "The compassion, the empathy, the care is unmatched."

The innovative SDR recovery unit at TIRR Memorial Hermann provides specialized rehabilitation for cerebral palsy patients who have undergone SDR surgery. Guided by a multidisciplinary team, the unit care focuses on

SPASM Program for Spasticity



The Spasticity and Associated Syndromes of Movement (SPASM) program at TIRR Memorial Hermann helps adult and pediatric patients with spasticity, across etiologies, with treatments for debilitating symptoms via multidisciplinary approaches, including physical and occupational therapy as well as medication management and surgical interventions such as cryoneurolysis.

Under the leadership of director Cindy B. Ivanhoe, MD, the SPASM program has been at the forefront of advancing treatments for patients experiencing spasticity due to neurological injuries.

"There is a whole new world where doors are opening for these patients," Dr. Ivanhoe says of the program's recent advances in treatment.

"We have one of the oldest spasticity programs in the country and perhaps the most developed," adds Gerard E. Francisco, MD, the chief medical officer of TIRR Memorial Hermann. "We offer truly comprehensive care and are able to treat patients of all types, with all injuries and disorders."

comprehensive recovery for pediatric patients to maximize motor function and quality of life. This recovery unit is unique to TIRR Memorial Hermann, and is one of the only recovery units of its kind in the country.

After completing the inpatient regimen, Zion continued his rehabilitation as an outpatient, participating in three physical therapy sessions a week for a full year.

"Before, he walked with a walker and he couldn't stand in the middle of the floor," Biannka notes. "Now, you'd never know he had difficulties walking in the past."

Dr. Hall is quick to credit Zion and his family for his positive outcomes.

"Zion was really highly motivated to do well, and his parents were also very dedicated, which really helped in his rehabilitation," she explains.

As Biannka says, "I am the subject matter expert on Zion."

Indeed, patients' families and caregivers are considered a significant part of the team in the SDR pathway program, which is designed to provide multidisciplinary care in inpatient and outpatient settings.

According to Dr. Hall, the care team includes affiliated pediatric physical medicine and rehabilitation specialists, neurologists, neurosurgeons, orthopedists, physical therapists, occupational therapists, neuropsychologists and other specialists who routinely meet on all patient cases and coordinate treatment plans.

"We take a truly collaborative approach," Dr. Hall says.

"The treatment for spasticity has really evolved over the years," Dr. Hall explains. "Many children with spasticity used to undergo muscle-lengthening surgeries annually. Now, we know it's important to medically manage tone as well."

The program has no bigger supporter than Biannka, who now volunteers with the patient and family advisory teams at Children's Memorial Hermann Hospital and TIRR Memorial Hermann to help parents considering the Memorial Hermann Health System for their children's care.

She has been in their shoes. From being hospitalized at 28 weeks pregnant for preterm labor and then a stay in the neonatal intensive care unit (NICU) at Children's Memorial Hermann Hospital, to Zion's SDR surgery and treatment, Biannka knows what it is like to worry for your child's life.

"You need to trust those caregivers with your child. But, from the moment we arrived, I knew Zion would be in good hands. The staff is just amazing," says Zion's mom, Biannka.

During calls with parents considering TIRR Memorial Herman for care, she'll answer a variety of their questions.

"They'll ask, 'What was your experience? What was it like?' Because it's scary," she notes. "It's a sacrifice for a family to go through this process, but this year or two of their lives can change the life of their child. From the moment we came to TIRR Memorial Hermann, we felt so much comfort, both in the support they provided and in their expertise. That's a game-changer for a parent." ■

Residency Program Produces National Leaders in Rehabilitation Medicine

> "At TIRR Memorial Hermann, we treat some of the most complex cases, and this experience and knowledge only helps residents and fellows as they advance in their profession."
>
> *- Gerard E. Francisco, MD*

As one of the leading rehabilitation organizations in the United States according to *U.S. News and World Report*, TIRR Memorial Hermann maintains a strong commitment to educating the clinicians of the future, across multiple subspecialties.

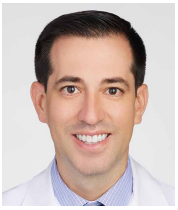
Each year, more than 20 residents and fellows in fields such as physical medicine and rehabilitation (PM&R), neuropsychology, spinal cord injury medicine, brain injury medicine, neurologic physical therapy, speech language pathology and occupational therapy graduate from TIRR Memorial Hermann–based programs and begin their careers as professionals, either within Memorial Hermann or at other health systems across the country.

This means that the approaches and philosophies ingrained at TIRR Memorial Hermann have been adopted and adapted at similar institutions across the country, says Gerard E. Francisco, MD, chief medical officer at TIRR Memorial Hermann.

"Through coursework and working alongside our top health care professionals, our residents and fellows are truly prepared for a career in rehabilitation medicine, and many of them become leaders in the field," Dr. Francisco says. "At TIRR Memorial Hermann, we treat some of the most complex cases, and this experience and knowledge only helps residents and fellows as they advance in their profession."

Here is a look at two alumni of the residency program at TIRR Memorial Hermann: Miguel Xavier Escalón, MD, MPH, FAAPMR, who graduated in 2013, and Rajeev Kanaiyalal Patel, MD, who completed the program in 1999.

New York State of Mind



After completing his residency in PM&R at TIRR Memorial Hermann, Dr. Escalón came to New York City with his wife, who was matched there for her own residency.

Starting at Mount Sinai Health System in the summer of 2013, Dr. Escalón has been the vice chair of the Department of Rehabilitation and Human Performance at Mount Sinai since 2019. He's also a professor of rehabilitation and human performance and the director of Graduate Medical Education for PM&R at the Icahn School of Medicine at Mount Sinai, also in New York City, and serves as the director of the Critical Care Rehabilitation Institute and director of Brain Injury Medicine for the health system.

Dr. Escalón, a College Station, Texas, native, credits his time at TIRR Memorial Hermann, where he was a resident from 2010 through 2013, with preparing him for these leadership roles at a large health system with an outstanding reputation.

"TIRR Memorial Hermann is an amazing hospital. The one thing I learned there and tried to carry forward is to really see the whole patient like a rehabilitation medicine doctor," he explains. "What I mean by that is that, in this specialty, we really need to assess a patient's history, their diagnosis and potential prognosis in a short period of time, so that we can optimize their care. The analogy I like to use is that this role is almost like that of an NFL quarterback, who has to see and process things on the field quickly, before he can make, what in the context of the game, is an important decision. For many of our patients who are dealing with trauma or severe injury, they rely on us to do essentially the same thing, because that's what's going to lead us to positive outcomes."

Another aspect of his time at TIRR Memorial Hermann that has stayed with Dr. Escalón is TIRR Memorial Hermann's "truly multidisciplinary" approach to care, one that engages specialists ranging from physiatrists,

such as himself, to nurses and physical and occupational therapists.

"That teamwork is so key," he notes. "At TIRR Memorial Hermann, you can truly see all those professionals working in concert. Everyone has a high-level understanding of what's needed for every patient."

The work of TIRR Memorial Hermann with organizations that help patients re-engage with their communities at the end of their treatment journey is another element that he tried to bring with him to Mount Sinai, although it is a bit more challenging in New York City, he admits.

"TIRR Memorial Hermann does a great job of that, and it's so important," he adds. "Frankly, there are few places you can send someone where you can feel confident that they're going to get the best care possible. In PM&R, TIRR Memorial Hermann is one of those places, and that's one reason it's appealing to go there from a training perspective."

Building a Program at the University of Rochester

Dr. Patel also counts the Mount Sinai Health System as part of his career trajectory. After leaving TIRR Memorial Hermann in 1999, he did an interventional spine fellowship at the University of Pennsylvania Health System in Philadelphia. From there, he worked briefly in PM&R at Mount Sinai before being recruited to the University of Rochester Medical Center (URMC), initially in the Department of Orthopedics.

After 17 years in the Department of Orthopedics, the dean and CEO of URMC asked Dr. Patel to transition into and assume the role of Chair of the Department of PM&R, which underwent significant changes under the guidance of three national consultants engaged by URMC. One of those consultants was Dr. Francisco.

"As a Chair candidate external to the Department of PM&R but internal to URMC, I was a known entity in a lot of different ways," recalls Dr. Patel, who recently signed for his second five-year term as Chair of the Department of PM&R for the health system and a professor in the discipline at the University of Rochester's School of Medicine. "URMC has really made a commitment to elevating PM&R and developing a nationally recognized program."

Under his leadership since 2018, the faculty of the updated PM&R department has grown exponentially, and its residency program has also doubled in size per year over that same period. Additionally, Dr. Patel and his team have seen great facility growth with the completion of a new musculoskeletal facility and new brain injury and neuro-rehab units.

"We're doing amazing things, and none of these facilities and programs existed prior to my taking over as chair."

Dr. Patel describes his time in the residency program at TIRR Memorial Hermann, from 1996 through 1999, as "foundational" to his current role.

"In addition to everything I learned about physiatry at TIRR Memorial Hermann, I also learned about all the subspecialties in PM&R and how they should integrate to optimize patient care," he notes. "That understanding of everyone's role, from specialists to therapists, has been fundamental to my helping to build the program here."

Dr. Patel is still planning for more growth by increasing the team of specialists in size and scope and adding specialists in brain injury, cancer and pediatric rehabilitation medicine. He and his colleagues also hope to open a new outpatient neuro-rehabilitation institute.

"One of the many things I learned at TIRR Memorial Hermann is what a nationally recognized program, with multiple affiliate hospitals and subspecialty service lines in a large academic medical center, could look like," Dr. Patel notes. "That's what I'm trying to bring [to URMC]." ■

Comprehensive, Programmatic Approach to Treatment Development at TIRR Memorial Hermann

For decades, TIRR Memorial Hermann researchers have taken a leadership role in the development of novel approaches for stroke rehabilitation, brain injury recovery and spasticity management.

In spasticity management, for example, the treatments derived from this groundbreaking research range from now-established approaches such as the use of botulinum toxin, first introduced in the United States in the late 1990s, as well as other toxins approved for spasticity by the U.S. Food and Drug Administration (FDA) in the years since. In addition, researchers at TIRR Memorial Hermann helped pioneer newer technologies, such as intrathecal baclofen.

Meanwhile, similar initiatives are exploring the use of vagus nerve stimulation for post-stroke rehabilitation and a brain-machine interface for controlling the movement of an upper-limb exoskeleton in patients following brain injury. Additionally, Sheng Li, MD, PhD, a renowned physical medicine and rehabilitation (PM&R) specialist at TIRR Memorial Hermann, was the first physician in the United States to use cryoneurolysis to provide patients with relief from spasticity. The noninvasive procedure, now available to patients at TIRR Memorial Hermann, involves inserting a needlelike probe containing highly pressurized nitrous oxide gas chilled to –90 degrees Celsius into the skin and placing it on the nerve that is causing the condition.

"I'm in my 27th year–28th if you include an additional year of training–here at TIRR Memorial Hermann," notes Gerard Francisco, MD, the health system's chief medical officer. "It's a phenomenon–the largest medical center in the world, and we're advancing the field of rehabilitation and spasticity management."

Botulinum toxin is an effective treatment for spasticity and lacks the sedating effect of oral medications. Phenol neurolysis, originally used for cancer pain, also blocks sensation in nerves and is sometimes used in lieu of or in conjunction with botulinum. Newer phenol-like medications are currently being researched by Dr. Francisco's team. A more recent addition to the anti-spasticity arsenal is intrathecal baclofen, which is administered via a hockey puck-sized pump that is placed in the abdominal wall and then connected to the spine with a catheter. The pump is programmable to deliver as much or as little medication as needed, at whatever time of day.

"We have a comprehensive, programmatic approach to spasticity management," Dr. Francisco notes. "However, I look at these medications and procedures as a way to allow the therapist to work with patients. Stretching is still the best treatment for muscle tightness, but if the spasticity is very severe, the therapist will not be able to get the work done, no matter how strong and talented the therapist is."

Dr. Francisco is leading the TIRR Memorial Hermann team and its involvement in the development of other new approaches as well. Together with an international team from 19 stroke rehabilitation centers in both the United States and the United Kingdom, the group compared vagus nerve stimulation and a placebo stimulation procedure in patients with moderate-to-severe arm weakness for at least nine months following ischemic stroke. Patient groups were provided with an intensive physiotherapy routine of 90-minute sessions three times a week for six weeks, followed by a home exercise regimen.

"We only included patients in this study who had some movement of the wrist or fingers–as long as they can activate those muscles independently," Dr. Francisco says. "Many of the participants had been told that their recovery had plateaued and essentially been written off–but it's important to understand that when people plateau, it is not because they cannot recover anymore–it's because we clinicians don't have anything else to offer."

Following rehabilitation at TIRR Memorial Hermann, Himanshu Prasad was given the opportunity to live life free of the muscle tightness and spasticity that had plagued him since birth.

The results showed that the upper limb function of study participants who received the actual vagus nerve stimulation plus physiotherapy regimen improved on Day 1 as well as Day 90. Clinical response on Day 1 was about twice that seen in those receiving the placebo stimulation plus physiotherapy, and nearly half of participants who got the active stimulation had "clinically meaningful improvements," as per Fugl-Meyer motor assessment (FMA) test scores.[1]

"There is an unwritten dictum in rehabilitation that says that the more substrate for recovery one has, the more likely it is that you will recover," Dr. Francisco says. "This study indicates that those who had the most movement to begin with are the ones who recovered the most. This therapy won't work for everybody, but I think this therapy should be offered to patients who have a particular set of characteristics."

About eight years ago, armed with funding from the National Institutes of Health, Dr. Francisco and collaborators from the University of Houston and Rice University set up a feasibility study that explored whether it is possible to use an upper-limb robot, paired with brain signals from the patient, to enhance mobility and function following chronic stroke. Four chronic stroke patients, whose motor impairments were varied, participated in the study; all four were able to use the EEG-based brain-machine interface to control the exoskeleton.

The study found that "motor intent from brain activity" in patients with chronic stroke can be detected and used to steer the motion of an upper-body powered exoskeleton.[2]

"There are no implanted devices," he explains. "Instead, the patient wears an EEG cap that has electrodes, much like an EEG cap for someone who has seizures. We are essentially training the person to use the robot–they wear the cap, and this signals the neurons in the brain to encourage the use of the robot. It looks like that this will work best for those with moderate impairments." ■

References

[1] *Lancet.* 2021;397:1545-1553.
[2] *Frontiers of Neuroscience.* 2016;10:122.

Wound Care Nursing Drives Efforts to Reduce Pressure Injuries, Support Patients With Limb Loss

At TIRR Memorial Hermann, the wound care team has undertaken an ambitious, multiyear program focused on preventing hospital-acquired pressure injuries (HAPIs), enhancing wound healing and management, conducting comprehensive risk assessments and supporting patients with limb loss. This holistic approach ensures improved care quality and better outcomes for patients facing these complex challenges.

"TIRR is leading pressure injury prevention and truly improving the ability of wound care nurses to practice to their full scope, including writing guidelines and policies."

– Juliette Lowe, BSN, RN, CWON

"We are fortunate to have a team of experienced wound care nurses who care for inpatients while they are at TIRR Memorial Hermann," notes Nicole Harrison, MBA, BSN, RN, NEA-BC, vice president and chief nursing officer at TIRR Memorial Hermann. "We want to showcase the great work the wound care team has done, highlighting the empowerment of nursing, the use of evidence-based practices and whole-team collaboration."

According to Juliette Lowe, BSN, RN, CWON, and the clinical coordinator II for Wound Care Services at TIRR Memorial Hermann, the efforts began during fiscal year (FY) 2021, when the organization hired its first wound, ostomy and continence (WOC) nurse. These specialists hold a baccalaureate degree or higher and have completed accredited specialty education programs focused on caring for patients who have a wound, an ostomy or problems with incontinence.

"WOC nursing is considered the gold standard for wound care, and really focuses on treating the whole patient, not just the hole in the patient," Lowe says. "TIRR is leading pressure injury prevention and truly improving the ability of wound care nurses to practice to their full scope, including writing guidelines and policies."

Doing so involves a deep understanding of the evidence on pressure injury prevention as well as wound healing and management, a process that motivated the team at TIRR Memorial Hermann to reevaluate how to use evidence-based practice to improve outcomes and reduce harm.

Lowe and her colleagues on the hospital's newly formed HAPI Taskforce conducted a survey evaluating HAPIs across the facility, and found that during FY 2021, more than 50% of HAPIs at TIRR Memorial Hermann involved medical devices.

"Our patient population is at high risk for medical device–related pressure injuries (MDRPIs)," Lowe explains. "We care for patients with spinal cord injuries and traumatic brain injuries, many of whom are unable to feel or respond to pressure-related pain caused by medical devices."

The team developed a strategic action plan targeting the four medical devices that were responsible for over 75% of the MDRPIs–casts, compression stockings, ankle/foot orthoses and bivalves, with the goal of decreasing the rate of MDRPIs during FY 2022.

"What we honed in on was making sure registered nurses (RNs), physical therapists, occupational therapists, speech therapists–our whole staff–understand the risk factors for getting a pressure injury related to a medical device, and then make sure we were focusing on best practices to improve them," Lowe says.

The results were significant. During 12 months, the rate of decrease per 1,000 patient-days was 44% for HAPIs, and 54% for MDRPIs. A poster summarizing the strategy was presented at the American Nurses Credentialing Center National Magnet Conference, where it was honored with a third-place ranking for Pathway to Excellence.

The success of the project motivated the wound care team to go further, examining additional approaches to achieve even more significant gains: This involved looking to outside organizations for guidance.

Inspired by North American Spinal Cord Injury Consortium (NASCIC) "Pressure Ulcer Prevention and Treatment Following Spinal Cord Injury" clinical guidelines (2014) and National Pressure Injury Advisory Panel (NPIAP) "Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline" (2019), the wound care team led Memorial Hermann in developing its own set of pressure injury prevention guidelines, focused on providing evidence-based practice dependent on patient-specific risk factors. The resulting guidelines were implemented in 2023.

In October 2023, an educational course taught to clinical RNs at TIRR Memorial Hermann focused on improving recognition of patients at risk for pressure injuries, using the Braden Scale risk assessment tool.

"By this point, we had the Memorial Hermann clinical guidelines and we wanted to really make sure that our nurses understood how to score using the Braden Scale, which is used across the organization," Lowe recalls.

The educational program proved to the team the importance of teaching the "why" of scoring and demonstrated improvement in inter-rater reliability of over 90%, a level that has been sustained for more than 10 months.

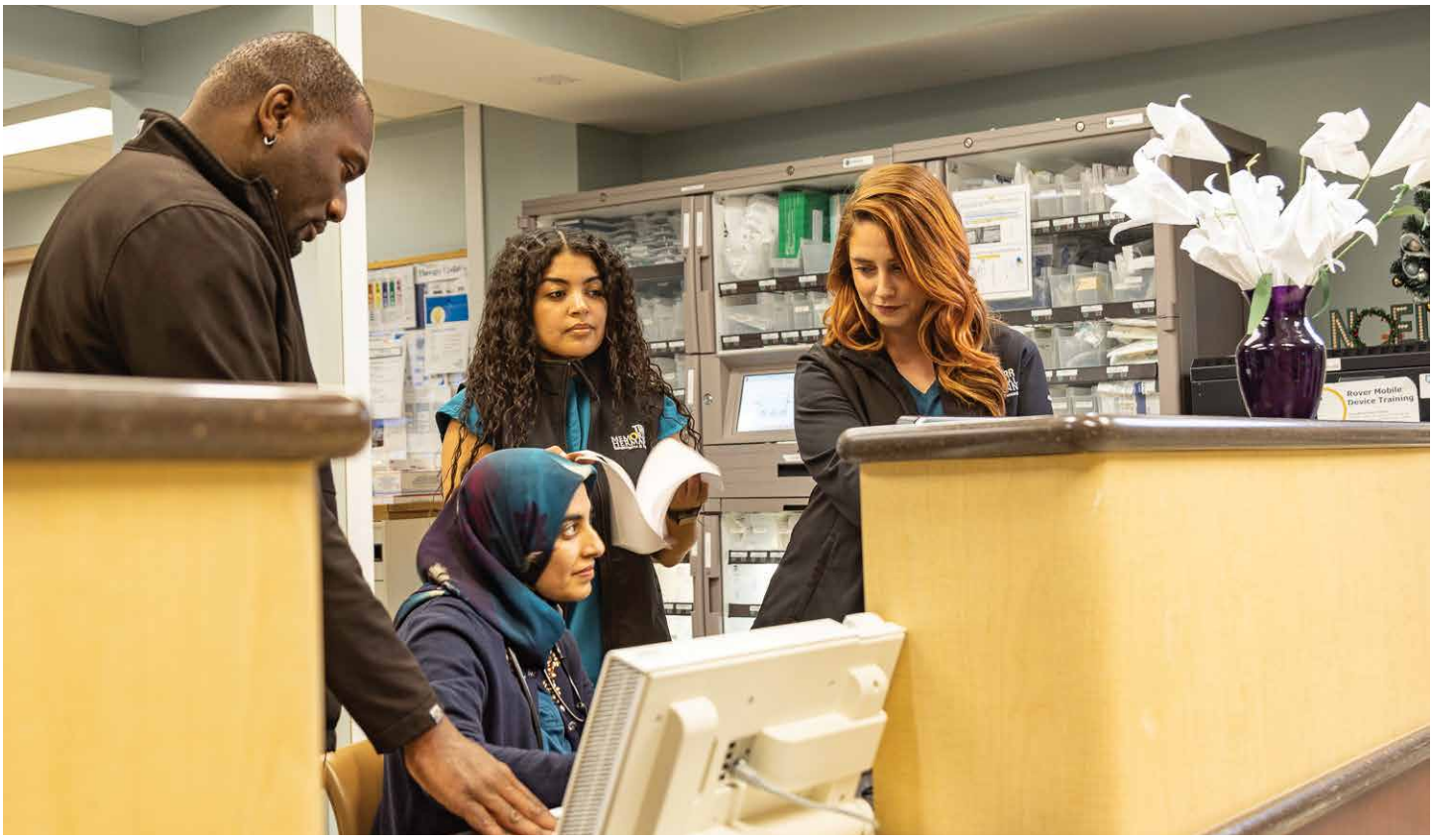
In total, the efforts put into place by the wound care team have resulted in large-scale improvements.

"From the beginning of this journey to this year, the percentage of HAPIs has decreased by 85%," Lowe notes. "Moving forward, I'm confident this will improve even further."

Future research opportunities will shed light on addressing numerous questions posed by the NASCIC, such as determining which dressings may be best for deep tissue injury resolution, or other questions, including if medical companies can help resolve deep tissue injuries, or the effect that health care disparities may have on pressure injuries for non–English-speaking patients.

"Our Amputee and Limb Loss Rehabilitation Program at TIRR Memorial Hermann takes a comprehensive, multidisciplinary approach to care, which includes certified wound care nurses, physical therapists, occupational therapists, psychologists, prosthetists and specialized, affiliated limb loss physicians," Lowe explains. "This level of collaboration is unique and not often seen elsewhere. We believe patients experience improved outcomes and a better quality of life when they receive this high level of comprehensive care prior to going home. Through our commitment to continuous learning, evidence-based practice and comprehensive, multidisciplinary care, TIRR Memorial Hermann is not only advancing the prevention and management of hospital-acquired pressure injuries but also empowering patients to achieve the highest quality of life possible. With the dedication of our expert wound care team and the collaboration of all our specialties, we are confident that these improvements will continue to have a lasting impact on patient outcomes and safety."

Harrison agrees and emphasizes that continually learning and putting those findings into practice is key to the long-term refinement of the organization's care. "We recognize that we continuously have to be in a learning environment. Just because we've made great progress, we have more improvements to make," she says. ■



Rise of Big Data and Memorial Hermann's Digital Transformation Is Driving TIRR's Vision for a Learning Health System (LHS)

> **"This unprecedented capacity to capture, analyze and interpret data opens extraordinary possibilities for utilizing LHS models across health care organizations."**
>
> ***–Farhaan S. Vahidy, PhD, MBBS***

TIRR Memorial Hermann is leading the charge in transforming health care through the development of a Learning Health System (LHS), leveraging the power of big data, machine learning and artificial intelligence (AI) to refine clinical practices and improve patient outcomes. By creating a seamless cycle of evaluation, learning and action, TIRR Memorial Hermann aims to establish itself as a benchmark for what rehabilitation systems can achieve.

"When we talk about research in health care, the concept of a Learning Health System is incredibly relevant," says Farhaan S. Vahidy, PhD, MBBS, associate vice president of research and chief scientific officer at TIRR Memorial Hermann. "While the primary mission of a health care organization is to provide exceptional care, the LHS framework allows us to continually assess that care in terms of safety, quality, efficacy, efficiency and its broader impact–not just on patients, but on their communities and our own health care workforce."

“Continuous evaluation must become the norm.”

The concept of an LHS, first introduced around 2006, has become increasingly relevant due to advances in big data, machine learning and AI. These technologies allow hospitals to systematically integrate internal data with external evidence and transform that knowledge into actionable initiatives. As a result, health care organizations can deliver higher-quality, safer and more efficient care while becoming better places to work.

“The ability to gather massive amounts of diverse data has skyrocketed over the past decade, and we are only seeing that capacity grow,” Dr. Vahidy explains. “Machine learning and AI now enable real-time insights into what an organization is doing, how processes are executed and how those procedures impact outcomes for patients and the health care system as a whole. This unprecedented capacity to capture, analyze and interpret data opens extraordinary possibilities for utilizing LHS models across health care organizations.”

At the heart of an LHS are two interconnected layers of data: internal data generated within the organization and external data from international research and health care systems. Together, they create a continuous loop of learning and improvement.

“Hospital systems are becoming data-rich environments, capturing vast amounts of heterogeneous information at an unprecedented pace,” Dr. Vahidy says. “From wearable devices to electronic medical records and smart room technology, every patient interaction generates actionable data. At TIRR Memorial Hermann, we’re embracing this data-driven era to bring the LHS model to life, ensuring we not only deliver exceptional care but also create groundbreaking advancements in rehabilitation.”

The Path to an LHS

Building a successful LHS at TIRR Memorial Hermann requires two critical and harmonious elements: cultural transformation and technological innovation. The cultural shift involves fostering an environment of continuous learning and improvement across all levels of the organization.

“It’s an organizational evolution,” says Dr. Vahidy. “Leadership must empower physicians, therapists, nurses and every team member to question their practices, evaluate outcomes and embrace the mindset that we can always do better. Continuous evaluation must become the norm.”

The technical dimension focuses on the capture, analysis and utilization of big data through predictive models, machine learning and AI. Dr. Vahidy emphasizes the need for thoughtful and ethical use of these technologies: “We must be deliberate in how we use machine learning and AI, putting appropriate guardrails in place to ensure these tools are used responsibly and effectively.”

To achieve this vision, significant investment in IT infrastructure, human capital and advanced data management systems is essential, according to Dr. Vahidy. “At TIRR Memorial Hermann, our mission is clear: Whether it’s for stroke, spinal cord injury, traumatic brain injury or the myriad other conditions we treat, we are building a system that not only delivers excellent outcomes but also exemplifies what a rehabilitation system should be,” he says.

A Continuous Cycle of Excellence

Dr. Vahidy envisions an LHS that evaluates every facet of the patient journey, starting before they come through the door and continuing well after discharge. “It’s about creating an ongoing loop of learning–analyzing our actions in light of the best available data, refining our processes and reincorporating those learnings to consistently raise the standard of care,” he explains. “This is how we ensure innovation keeps pace with the needs of our patients.”

This transformative vision incorporating research, innovation and education reinforces TIRR Memorial Hermann’s position as a leader, pushing the boundaries of what’s possible in rehabilitation and recovery. By weaving together the threads of big data, cutting-edge technology and an unwavering commitment to excellence, the health system is charting a bold path forward. As Dr. Vahidy puts it, “We are leveraging every resource to create terrific outcomes for our patients and truly become a global emblem of what a Learning Health System can achieve.” ■

Transforming Stroke Care: Advancing Recovery and Innovation–World Stroke Day Event 2024

An inaugural event, held both in-person and virtually at TIRR Memorial Hermann on World Stroke Day (October 29, 2024), focused on expert opinion and groundbreaking research in order to showcase the developments that have been made in the care of patients affected by stroke–and to highlight what still needs to be done to improve care for those with this common, devastating condition.

Titled "Reimagining Stroke Rehabilitation: Uniting Research, Innovation and Education for Recovery," the daylong seminar hosted a suite of internationally recognized expert speakers, including several from TIRR Memorial Hermann.

"We are thrilled to successfully bring this to fruition," says Farhaan S. Vahidy, PhD, MBBS, the associate vice president of research and chief scientific officer at TIRR Memorial Hermann. "The event was very timely."

According to Dr. Vahidy, focusing efforts on studying stroke and improving care for stroke patients have never been more important.

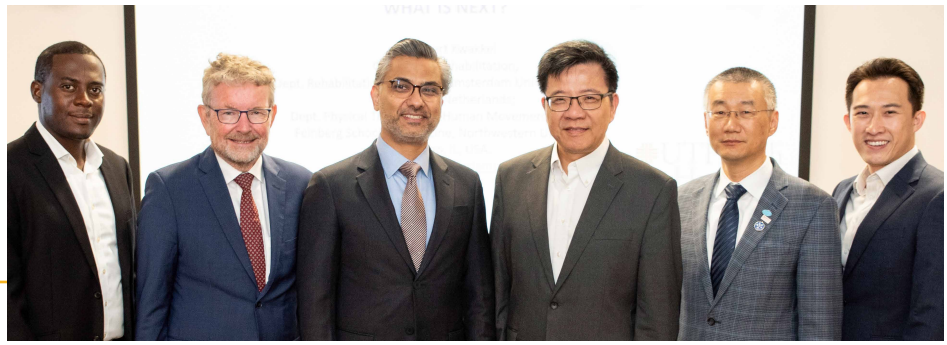
"If we look at the epidemiology of stroke, it is quite concerning," he notes. "There was a point in time when stroke mortality was declining, but some of the most recent data suggests that stroke mortality has plateaued and may in fact be increasing. Because of this, preventing strokes, stopping strokes and providing the best possible rehabilitation is very important."

The World Stroke Day Conference at TIRR Memorial Hermann aimed to elucidate the latest research for rehabilitation and recovery paradigms for those living with the long-lasting effects of stroke.

The rise in incidence of stroke is particularly concerning because studies have shown it is not simply tied to an aging population.

"Some may think that we have an aging population, and stroke is a disease of old age," Dr. Vahidy explains. "However, when we look at age-standardized incidence rates, we can clearly see a pattern where stroke incidence is increasing in the younger and middle-aged patient population."

In addition, research continues to demonstrate that stroke is a disease of disparities. Globally, the highest burden of stroke is carried by low- to middle-income countries. And at the national level, multiple disparities in stroke incidence and outcomes continue to complicate its prevention, treatment and recovery.



(L to R) Abdulaziz Bako, PhD; Gert Kwakkel, MD; Farhaan Vahidy, PhD, MBBS; Sheng Li, MD; Wayne Feng, MD, FAHA; Alan Phan, MS, PhD (candidate).

"All of this makes the fight against stroke very relevant," Dr. Vahidy says. "This is the motivation behind continuing to address stroke, bringing forward the latest research and developments in innovative care and creating an environment for education and learning."

The conference at TIRR Memorial Hermann aimed to elucidate the latest research for rehabilitation and recovery paradigms for those with long-lasting effects of stroke. Dr. Vahidy, who recently returned from the 2024 World Stroke Congress in Abu Dhabi, capital of the United Arab Emirates, presented TIRR Memorial Hermann's vision of–and the strengths associated with–a learning health care system. Sheng Li, MD, PhD, the health system's director of Stroke Recovery and Rehabilitation research, who organized the conference with Dr. Vahidy, spoke on the recent advances in diagnostics and management of stroke. Gert Kwakkel, PhD, a professor of neurorehabilitation at the VU University Medical Center in Amsterdam, Netherlands, discussed the importance of how different phenotypes drive the need for highly individualized stroke rehabilitation care. Wayne Feng, MD, the chief of the Division of Stroke and Vascular Neurology, medical director of the Duke Comprehensive Stroke Center atand tenured professor of Neurology and Biomedical Engineering at Duke University School of Medicine in Durham, N.C., discussed his role as principal investigator of a large clinical trial exploring transcranial direct stimulation for stroke recovery. Finally, Preeti Raghavan, MD, the director of the Center of Excellence in Stroke Treatment, Recovery and Rehabilitation at the Sheikh Khalifa Stroke Institute at Johns Hopkins Medicine in Baltimore, Md., demonstrated the power of big data and importance of a Learning Health System and also focused on redesigning care based on individual stroke patient phenotypes.

Other guest speakers included Alan Plan, MS, PhD (candidate); Thomas Potter, PhD; Abdulaziz Bako, PhD; and Tatiana Schnur, PhD.

One of the overarching themes of the event was the importance of rehabilitation efforts, something that too frequently isn't being provided for stroke patients in the United States.

"A lot of focus has been given–and duly so–on acute stroke treatments," Dr. Vahidy notes. "Over the past several decades, tremendous strides have been made in advancing acute treatment for ischemic and hemorrhagic stroke, with numerous trials driving improvements in emergency and acute care. However, when we turn our attention to rehabilitation, the progress has been starkly disproportionate. This is significant because rehabilitation stands as the single most effective intervention in facilitating meaningful recovery for stroke survivors. What makes rehab even more remarkable is its versatility–it can seamlessly integrate with any acute stroke treatment, enhancing outcomes across the spectrum of care."

He continues, "Our vision is clear: Every stroke patient, without exception, deserves access to a rehabilitation program that is tailored to their unique needs and potential. At TIRR Memorial Hermann, we pride ourselves on being leaders in this domain. With approximately one-third of our patient population being stroke survivors, we deliver not only exceptional rehabilitative care but also innovative treatment modalities that push the boundaries of recovery. Through cutting-edge research and a commitment to excellence, we strive to redefine what's possible in stroke rehabilitation and recovery." ■

TIRR Memorial Hermann Education Academy Celebrates 10th Anniversary

The TIRR Memorial Hermann Education Academy is celebrating its 10th anniversary, which provides an opportunity to reflect on achievements of the past decade and how the initiative is evolving in order to meet the challenges posed by technological advancements and changing health care professional needs.

The Education Academy was founded in 2015, with the goal of providing continuing education for rehabilitation medicine professionals in the United States and abroad. The breadth of educational offerings has increased significantly since the Academy was founded.

"The Education Academy is an umbrella term focused on educational programs on offer for physical and occupational therapists, nurses, social workers, case managers, psychologists and speech-language pathologists," explains Patricia Tully, OTR, ATP, an education resource specialist at TIRR Memorial Hermann. "In addition, the Academy works with partners to provide continuing medical education (CME) for physicians."

During its first year, the Academy hosted seven in-person courses, focused primarily on one- to two-day conferences. Currently, approximately 60 continuing education courses are offered each year via a variety of media, reaching more than 2,500 rehabilitation medicine professionals.

"One of the biggest changes in the Academy is how we've grown our formats," notes Victoria M. Zegarrundo, PT, DPT, the director of clinical and professional development at TIRR Memorial Hermann. "While we began exclusively with in-person events, we now host live in-person, live virtual, hybrid and on-demand content as well."

The change in content offerings began to better address emerging technology and individuals' learning preferences, and was accelerated during the COVID-19 pandemic, when Zoom meetings and virtual learning became broadly accepted.

"COVID-19 made us pivot to providing these other forms of education, which have really flourished," Dr. Zegarrundo says.

"When everyone was looking at triaging what needed to be done in order to provide safe and effective patient care, it was decided that education was paramount and that we needed to move forward with providing and bettering our educational offerings," Tully adds. "Our staff, the therapists, nurses and clinicians really banded together, and it gave us the opportunity to blossom."

Increasing the availability of shorter virtual content also has nicely balanced the longer in-person conferences and allows the Academy to reach a broader base of health care professionals.

"One of the visions we have for the Academy is to increase our on-demand content so that we can reach more clinicians, not just here at TIRR Memorial Hermann, but throughout the country and the world," Dr. Zegarrundo says. "We are ensuring that people everywhere are able to receive the most up-to-date education regarding evidence-based practice."

To achieve this, the team at the Academy is partnering with Farhaan S. Vahidy, PhD, MBBS, the associate vice president of research and chief scientific officer at TIRR Memorial Hermann, and his team of researchers.

"We are working hand in hand to observe what the research is telling us and then enact teaching programs to share that knowledge," Dr. Zegarrundo notes.

Another offering, the Professional Observer Program, will provide international clinicians the opportunity to travel to Texas to spend time at TIRR Memorial Hermann, allowing for hands-on learning.

"In the past, we've had individuals come from a number of countries–such as Australia, Singapore, the United Arab Emirates and Japan–in order to observe our health system and clinicians, so we are shaping an academic program where people can visit for a specific period of time and focus on achieving explicit learnings during their stay," Tully says.

Future programs will continue to dig into the wealth of knowledge contained at TIRR Memorial Hermann and will leverage the extensive relationships that experts at the organization have with nationally and internationally based clinicians to collaborate on educational offerings.

Message from the Chief Medical Officer

Gerard E. Francisco, MD

In this issue of the TIRR Journal, we profile two graduates from the residency and fellowship programs at TIRR Memorial Hermann, all of whom have taken leadership positions across the country and become renowned experts in their respective subspecialties.

Across multiple subspecialties, our residency and fellowship programs have graduated scores of professionals, representing the future of rehabilitative medicine. For example, since its inception in 2009, the physical therapy (PT) neuro residency program has graduated 29 professionals; it's one of only 79 accredited PT neuro residency programs in the United States. Meanwhile, after launching in 2020, our occupational therapy neuro fellowship program has graduated eight professionals and is one of only 10 such programs accredited nationally.

As another case in point, TIRR Memorial Hermann's unique, two-year postdoctoral fellowship in clinical neuropsychology has produced more than 35 clinical neuropsychologists over the course of its more than 30-year history.

In addition to these exemplary programs, we offer acute care PT residency, a rehabilitation psychology and neuropsychology internship, and spinal cord injury medicine and brain injury medicine specialty fellowship programs, as well as clinical rotations, internships and other education initiatives.

This year, we also revived our fellowship in spasticity management, continuing our tradition of taking a leadership role in education in this critical subspecialty. Decades ago, we were the second institution nationally to offer a spasticity fellowship, and, after a 20-year hiatus, our new program will be one of just three across the country. The learner-driven curriculum will see young providers working alongside our world-renowned team of affiliated experts in spasticity management, whose work is also highlighted in this issue of the TIRR Journal.

All of these programs share a common goal: educating future leaders in the field of rehabilitation medicine, in keeping with TIRR Memorial Hermann's four pillars–excellence in clinical care, advocacy, research and education. ■

Gerard E. Francisco, MD
Chief Medical Officer, TIRR Memorial Hermann

"Our goal is to create the best education possible, whether that is having our staff train and teach, or bringing in experts from around the world to teach us," Tully notes. "We spend a lot of time mentoring and training our internal staff, so they are highlighted and their knowledge and skills are shared. And TIRR Memorial Hermann provides us with a lot of freedom to develop collaborative courses in partnership with individuals and institutions that are renowned for what they do; if we don't have certain knowledge in-house, we will bring it to the health system."

Currently, offerings for 2025 include the 4th annual Cancer Rehabilitation Symposium: Advancing Patient Centered Care Across the Cancer Continuum, to be presented by TIRR Memorial Hermann and the MD Anderson Cancer Center on May 1-3, 2025, as well as a suite of virtual programs covering topics such as Advancing Clinical Practice in Brain Injury & Stroke Rehabilitation, Neuroplasticity for the Speech-Language Pathologist, and The Missing Factor of Quality Outcomes: Managing Nutrition Risk.

Moving into its second decade, the Education Academy will continue to refine its approach to professional education, changing with the times to provide cutting-edge resources for an ever-expanding professional population.

"People here believe that education is as crucial as hands-on treatment because we can't continue to serve our patients if we aren't learning every day," Dr. Zegarrundo says. "We're continuously trying to diversify our portfolio, so the learner has the choice to decide what works best for them, and our education is adjusting for those needs."

For more information about courses, visit **memorialhermann.org/TIRReducation**. ■

TIRR Memorial Hermann Joins Inaugural Innovation Center List

TIRR Memorial Hermann was among the leading health systems named to the inaugural list of Dr. Joanne Smith Memorial Rehabilitation Innovation Centers by the U.S. Department of Health and Human Services Centers for Medicare & Medicaid Services.

Signed into law by President Joe Biden in January 2023, the Dr. Joanne Smith Memorial Rehabilitation Innovation Centers Act of 2022 recognizes a leading class of pioneering rehabilitation research facilities across the country, including TIRR Memorial Hermann, for setting the standard for ongoing study and patient care in rehabilitation medicine. The Act is designed to ensure that industry best practices and cutting-edge research are disseminated broadly to enable optimum patient outcomes. There are more than 1,100 Medicare-certified inpatient rehabilitation facilities across the United States, but only a limited number of rehabilitation institutions play a role in driving the future of rehabilitation care and medicine, and in turn, patient recovery.

"We are an innovation center and recognized as such because of all the work our clinicians, researchers, teachers and advocates do in providing cutting-edge patient care, leading groundbreaking research and educating the rehabilitation medicine providers of tomorrow," notes Rhonda Abbott, senior vice president and CEO, TIRR Memorial Hermann. "As one of the innovation centers on this list, we have the opportunity to collaborate with other leading institutions nationally on research and clinical advances that will change the way rehabilitation medicine is delivered."

Named after the late Dr. Joanne Smith, who was the president and CEO of the Shirley Ryan AbilityLab in Chicago before her death in 2021, the Dr. Joanne Smith Memorial Rehabilitation Innovation Centers Act legally defines institutions that conduct specified federal research and training programs for traumatic brain injury or spinal cord injury and that serve Medicare patients.

"After the Act was signed nearly two years ago, the inaugural Innovation Center designation list recognition in 2024 provided us with a platform to leverage independent talents of our providers in a tangible way and help disseminate best practices to other rehabilitation medicine centers and beyond," Abbott says. "Like the other centers on this list, TIRR Memorial Hermann cares for the most complex patients and constantly invests in the development of state-of-the-art treatment innovations. Recognizing the accomplishments of institutions such as ours is important because it highlights the significant contributions of our affiliated providers from McGovern Medical School at UTHealth Houston and Baylor College of Medicine in improving patient care and outcomes for people with disabilities beyond the care happening within the four walls of our facilities." ■

The 2024 inaugural Innovation Center list also included:

The MetroHealth Rehabilitation Institute

The MetroHealth System of Cleveland

MedStar National Rehabilitation Hospital in Washington, D.C.

Mount Sinai Rehabilitation Center

Icahn School of Medicine at Mount Sinai in New York City

The Ohio State University Hospital in Columbus

Rehabilitation Institute of Chicago/ Shirley Ryan AbilityLab

Rusk Rehabilitation/New York University in New York City

Santa Clara Valley Medical Center in California

Mayo Clinic Hospital/Saint Mary's Campus in Rochester, Minn.

UAB Spain Rehabilitation Center in Birmingham, Ala.

Spaulding Rehabilitation Hospital in Boston, Mass.

University of Michigan in Ann Arbor

University of Pittsburgh Medical Center

UW Medicine: Harborview Medical Center/ UW Medical Center campuses in Seattle

Virginia Commonwealth University Hospital System in Richmond

Message from the Chief Executive Officer

Rhonda Abbott, PT, FTPTA

At TIRR Memorial Hermann, our teams possess many skills–first and foremost, their ability to provide state-of-the-art patient treatment and support in a caring and compassionate way.

However, recent events at our campus here in Houston highlight how our clinicians and all of our team members across specialties serve as a "multipliers," helping to disseminate best practices and serve as advocates for rehabilitation medicine to others across the country and internationally.

This unique capability was on display in October 2024, during the inaugural TIRR Memorial Hermann education event for World Stroke Day. Focusing on the theme "Reimagining Stroke Rehabilitation: Uniting Research, Innovation and Education for Recovery," the daylong seminar hosted several leading experts from around the world–as well as from here at TIRR Memorial Hermann–discussing the latest developments in the care of patients with stroke and areas for improvement.

Events such as this are just part of the reason why our team is working to establish TIRR Memorial Hermann as a true Learning Health System (LHS). The LHS model, which is described in this issue of the TIRR Journal, focuses on creating a continuous cycle of self-study and learning that allows for evaluation of the daily practices of a health care organization, and refinement of those practices to improve care.

As our robust residency and fellowship programs in several subspecialties demonstrate, TIRR Memorial Hermann is dedicated to teaching others and constantly learning. We want to help foster a culture of collaboration across the rehabilitation medicine field, working with others so that our providers are truly multipliers for the cutting-edge care we believe we offer. By allowing TIRR Memorial Hermann to serve as a "convener," experts from all health systems can come together to gather and share information and to discuss next steps and new standards of care.

Ultimately, we believe that sharing information with others–and learning from them–enhances the care we offer our patients, their families and people with disabilities in the community.

And that, of course, is our primary focus. ■

Rhonda Abbott, PT, FTPTA
Senior Vice President and Chief Executive Officer
TIRR Memorial Hermann

Memorial Hermann Health System

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Spring 2025

About TIRR Memorial Hermann

TIRR Memorial Hermann, located in Houston, Texas, a leader in rehabilitation, does more than provide therapy. We provide rehabilitation beyond the health care setting for children and adults with a disabling injury or illness, and change lives by helping people regain the skills and confidence they need to reintegrate into the community and continue living full and meaningful lives. Our highly trained rehabilitation teams see the potential in every person they work with and develop that potential to the fullest through customized goal setting and treatment planning.

We work to maximize independence, restore function and improve the quality of life for our patients.

To achieve these goals, we put the individual patient and their family at the center of the rehabilitation team and provide them with the information and skills they need to transition successfully to community settings.

TIRR Memorial Hermann is the best rehabilitation hospital in Texas and among the best in the nation, according to the *U.S. News & World Report's* Best Hospital rankings for 2024-2025. The rehabilitation hospital's ranking marks its 34th consecutive year among the magazine's Best Hospital rankings.

To make referrals or schedule an appointment, call 800.44REHAB (800.447.3422) toll-free or 713.797.5942, or fax 713.797.5988.

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