NEUROSCIENCES POISED FOR TRANSFORMATION

Medtronic
Further, Together

NEUROSCIENCES POISED FOR TRANSFORMATION

Neurological disorders are increasingly recognized as a significant contributor of death and disability. Globally, in 2016, neurological disorders were the leading cause of disability and second leading cause of deaths.[1] Worldwide, they present a significant clinical and financial burden. Neurosciences span many clinical conditions of the brain/central nervous system including stroke, spine, cancer, epilepsy, Parkinson's disease and movement disorders, sleep medicine, and behavioral health.

Historically, scientific and medical communities have struggled to clearly define the underlying causes of neurological disorders and identify effective treatments. In contrast, over the last two decades the scientific community has acquired a much deeper understanding of the brain and central nervous system. This learning has resulted in technology and interventions that have placed neurosciences at the forefront of cutting-edge innovation.

Meanwhile, health systems are facing numerous challenges as volatility caused by the public health crisis has intensified demands. There has been – and will continue to be - an increasing need for health systems to more effectively organize the clinical disciplines that traditionally comprise neurosciences and spine into a cohesive service line. Additionally, non-traditional partnerships can enhance and accelerate programmatic development and care delivery.

This paper outlines the forces that are driving the need for change across two major themes that are shaping and impacting Neurosciences: **Innovation** and **Macro Healthcare Trends**. We then offer a perspective on an approach to organize more formally around a dedicated Neuroscience service line. For health systems, this opportunity can drive program development and care redesign to improve patient outcomes and demonstrate value.

INNOVATION DRIVING CHANGE

In the past, neuroscience researchers and physicians focused on diagnosis and symptom management and had limited therapeutic options that were truly disease modifying.

Today, advances have enabled earlier and more accurate diagnoses which support more timely intervention and disease management. For example, imaging techniques for acute stroke are rapidly evolving, sometimes using artificial intelligence. This innovation is helping to identify a wider pool of candidates for advanced treatment, thus significantly improving patient outcomes and reducing disabilities.

We have also seen tremendous advances in **therapeutic** approaches which are expanding the pool of treatable

ADVANCING NEUROSCIENCE: THE MEDTRONIC JOURNEY

Since 1983, Medtronic has developed innovative neuroscience and spine solutions. Today, our impact extends beyond products and therapies to enable better outcomes for the diseases we treat and the patients we serve.

Our neurological technologies include:

- Spine
- Pain Therapies
- Neuro-oncology/brain tumor
- Neurovascular/stroke
- Neuro-trauma/critical care
- Movement disorders
- Hydrocephalus

Medtronic provides a comprehensive set of solutions aimed at:

- Enhancing the patient care experience
- Improving the health of populations
- Reducing cost of health care

KEY INSIGHT

Neurosciences today are at the forefront of cutting-edge innovation as breakthroughs in research are deepening the scientific community's understanding of the central nervous system. These insights are focused on the underlying causes of disease and the most effective interdisciplinary approach to improving patient outcomes.

patients. For acute ischemic stroke, the emergence of mechanical thrombectomy has presented a major breakthrough in reperfusion therapy. In spine and cranial surgery, imaging techniques and navigation have enhanced pre-surgical planning and execution of complex procedures. For Parkinson's disease, neurostimulation has been shown to improve quality of life compared to other medical therapies.[2] Additionally, new applications for neuromodulation are evolving with targeted therapies and relevance to a broader range of patient populations.

These advances are changing the landscape for clinical care. In response, the National Institutes of Health (NIH) provided $9.5 billion in funding for neurosciences in 2019 which represented nearly 25% of the total research budget for the year.[3] Additionally, private funding sources allocated over a billion for research in 2018.[4]

There are a variety of technologies impacting neuroscience care. Some examples of key areas include:

Telemedicine

Telemedicine in neurosciences has primarily focused on enabling remote specialists (e.g., neurohospitalists, vascular neurologists, neurointensivists) with the technology to provide consults and monitor hospitalized patients. Organizations may use their own physicians or leverage external physicians either through partnerships or relationships with third-party vendors.

Bolstered by the COVID-19 pandemic, applications of telemedicine are rapidly expanding beyond the acute care setting to include patient access to ambulatory services and enhance continuity across sites. These services can enable a greater number of patients to remain local, improve follow-up, and decrease readmissions.

As virtual health expands, it can be used to address specific problems or strategic priorities such as workforce constraints and broadening geographic reach. Effective deployment is critical to success and should include training, tech support, and integration into workflows.[5] The rapid expansion of virtual care triggered by the pandemic needs to expand to include goals, metrics, data capture, and dashboards. It is strategically important to develop a cohesive virtual offering instead of disparate and competing solutions. The pandemic has also pushed policy makers to focus on equitable payment models and establishing licensure compacts across state lines.

Workflow Automation and Decision Support

EMR systems are becoming more sophisticated and capturing ever increasing amounts of clinical, behavioral, and personal health data. Software tools are mining the data, making it actionable, and informing clinical decision making through physician prompts and alerts. EMR data also supports patient and physician portals which promotes shared decision making.

Although EMR systems have become widespread, significant challenges remain. EMR user experience is not optimal, and clinicians grow frustrated with the effort required to input data vs. spend time with patients. According to a 2016 survey from the American Academy of Neurology, the burden of clerical tasks, including EMR, was cited to be a significant source of dissatisfaction among neurologists leading to a higher risk of burnout.[6] Additionally, there is limited uniformity of platforms across health systems making cross sharing of information difficult.

Miniaturization

Recently developed classes of miniaturized devices provide powerful capabilities in neuroscience. Nanotechnology and improvements in battery chemistry allow for smaller implants that are easier to surgically implant and are more acceptable to patients. These advancements will enhance the use of neurostimulators for movement disorders, epilepsy, and chronic pain.

Technology-Enabled Procedures and Advanced Sensing

Advanced imaging, navigation, and robotics are quickly evolving technologies that transform spine surgery and neurosurgery. These technologies aim to enhance procedural efficiency and provide more predictable outcomes. Recent research has shown shorter length of stay and decrease in operative blood loss in certain spine surgical procedures .[7]

Advanced sensing is another capability that is improving neurostimulator and neuromodulation therapy. These capabilities identify physiological and biological conditions, collect valuable patient-specific data including functional outcomes, and improve treatment algorithms.

Artificial Intelligence and Data Sophistication

As exponential amounts of data are generated and gathered, providers and researchers are challenged to process and analyze information into meaningful insights. Measuring, tracking, and monitoring behavioral and physiological markers can help quantify baseline functional status which is especially important for challenging conditions involving pain, gait, and mobility. Additionally, integrating patient reported outcomes into clinical decision support tools can help identify the most appropriate patients for specific therapies.

Artificial intelligence tools are rapidly evolving and beginning to provide clinicians with powerful tools to guide diagnostic and clinical decision making. For example, radiologists from UCSF have developed an algorithm that reads PET scans and provides a highly accurate prediction of memory and cognitive impairment. This algorithm correctly identified 92% and 98% of patients from two tests who eventually developed Alzheimer's disease.[8] Additionally, there are radiology imaging platforms such as Viz.AI that provide clinicians with information for swift diagnosis of large vessel occlusion in acute ischemic stroke.

Despite innovation and important advances in technology, challenges remain. Accessibility outside of a research setting continues to be limited for many patients. Root cause and effect remains elusive for some brain and nervous system diseases such as Alzheimer's. Equally important, the current care delivery model must advance to keep pace with and reap the full benefit of scientific breakthroughs.

HEALTH CARE TRENDS IMPACTING NEUROSCIENCES

The U.S. health care system was in the midst of a period of significant and fundamental change even before the COVID pandemic added an unprecedented challenge and catalyst. Key trends include:

Growing Demand and Payor Mix Change

The aging population in the U.S. is driving increased demand for neurological care. By 2030, 20% of the U.S. population will be over age 65 (vs. 14% in 2012).[9] Health systems will continue to see a higher share of Medicare patients leading to lower reimbursement and sicker patient populations to manage. Additionally, family caregivers will become increasingly important stakeholders in the health care ecosystem, and health systems will need to provide them with resources and support.

Need to Demonstrate Value

The growing shift toward value-based care continues to pressure health systems to take on greater accountability for outcomes and cost of care. In 2017, 34% of U.S. health care payments were tied to value-based care,[10] and this trend is expected to grow. This phenomenon will have a significant impact on neurosciences services given the complexity and variability of diseases. As the shift from fee-for-service billing to a value-based care model continues, systems will need to evolve. This change will also require health systems to take care of patient populations over a longer period of time, requiring more mature strategies to manage chronic conditions such as depression and Parkinson's disease.

Health systems and specialty societies have begun to consider novel payment models for neurologic conditions including risk-based contracting. In a recent proposal by the American Academy of Neurology, a neurology practice would quarterback a full phase of care—office visits, diagnostics, medication, hospital care, post-acute care—for patients with epilepsy or chronic headache.[11] Health systems, societies, and suppliers will need to work with policy makers to design regulations that support payment models as the shift to value accelerates.

A key enabler to the shift toward value-based care will be data collection focused on outcomes from the patient's perspective. Health systems will need to effectively collect and analyze often disparate data sets to derive insights, inform clinical decisions, and demonstrate value. Data will also enhance patient selection for alternative payment models.

Evolving Sites of Care

Payer, provider, and consumer pressures are merging to shift cases to the outpatient and ambulatory surgery center (ASC) settings. Commercial payors are increasingly implementing site of care restrictions. Lower rates of reimbursement for outpatient procedures as well as complex ASC/physician/health system ownership dynamics will challenge programs to redesign care delivery. This shift will also require health systems to invest in more outpatient surgery resources and capabilities such as free-standing ASCs, equipment, patient navigation and education, and staff.

Many neuroscience procedures such as complex cranial interventions, endovascular revascularization and spinal deformity procedures will remain in high acuity settings. Others, such as less complex spine surgery, will follow the general trend in health care and shift toward outpatient care settings. Outpatient spine surgery is projected to grow 30% over the next 10 years.[12] The removal of some spinal fusion codes from the Medicare Physician Fee Schedule Inpatient Only (IPO) list is also a signal of the shift to outpatient care. Furthermore, CMS is proposing removal of the IPO list by 2024.

Beyond spine, other neuroscience procedures are forecast to shift to outpatient settings. Stereotactic radiosurgery for brain cancer and nerve blocks/pain management injections are predominantly done in outpatient settings today. In 10 years, procedures such as deep brain stimulation for Parkinson's and depression will be performed predominantly in outpatient settings.[13]

Many inpatient neuroscience admissions are discharged with post-acute care needs. The neuroscience service line provides the highest percentage of growth and case mix for inpatient rehabilitation with stroke and trauma patients as the predominant utilization drivers. In fact, neurological conditions accounted for almost a third of all inpatient rehabilitation facilities cases in 2017.[14]

KEY INSIGHT

The average wait time for new patients to see a neurologist is 35 business days. This need is anticipated to increase with expanded disease incidence and growing demand. By 2025, it is estimated there will be a 19% shortfall of neurologists.[15]

Workforce Constraints

Staffing and labor limitations have a significant impact on patient care today. These constraints go beyond physicians and include shortages of imaging, neurodiagnostic, neuropsychology, and pain management professionals. Growth of "subspecialized" providers across neurosciences also challenge the resource strategy. Meanwhile, burnout is a major concern amongst clinicians and is exacerbated by the pandemic. [15]

Opioid Crisis

In 2017, there were 47,000 deaths from opioid overdoses[16]—a number six times higher than in 1999. By 2019, drug overdose deaths in the United States rose 4.6% to 70,980, including 50,042 involving opioids.[17] Addressing the opioid epidemic will require collaboration across policy makers, law enforcement, and health care providers. In the short term, health systems will need to focus more on inpatient and outpatient pain management and opioid avoidance such as enhanced recovery after surgery (ERAS) protocols and acute pain protocol. Meanwhile, healthcare providers are developing more effective addiction therapy and behavioral health resources.

CALL TO ACTION: STRUCTURED NEUROSCIENCE SERVICE LINE

Given the innovation and health care transformation trends, a cohesive neuroscience strategy is critical. While not all health systems will have the ability to offer a full breadth of neurosciences services, many will need to evolve from the current state to meet future demands.

A structured operating model that organizes clinical delivery of care and the administration of programmatic offerings within neurosciences are required for health systems to effectively compete within the changing health care landscape. Other service lines have historically evolved through similar transitions including cardiology and oncology.

Care Redesign: Taking an Interdisciplinary Approach

Health systems have been challenged to establish cohesive neurosciences service lines with integrated multi-disciplinary care because of complexity, smaller volumes, or, more recently, due to the opportunities of important clinical advances. Among the most crucial overhauls is a re-engineering of the service line structure to foster interdisciplinary focus beyond neurology and neurosurgery. For example, for patients diagnosed with cryptogenic stroke or transient ischemic attack associated with cardiovascular comorbidities, mechanisms must be in place to enable effective coordination between the neurosciences team, cardiologists, and electrophysiologists. Without collaboration, secondary prevention and disease management are difficult.

Likewise, patients with back pain and related spine conditions benefit from collaboration among operative and nonoperative providers including physiatrists, spine surgeons, anesthesiologists, and behavioral health specialists. Improved survivability for patients with brain tumors requires that neurologists, neurosurgeons, and oncologists come together to manage both primary and metastatic tumors.

Care Redesign: Systemness

Care redesign must also aim to improve neuroscience systemness and standardization. Care should be based on clinical evidence with adherence monitored and analyzed. Value-based care will drive standardization as health systems seek to design treatment protocols that yield more predictable positive outcomes and reduce costs associated with variability in care delivery.

There are examples where care redesign has already begun to occur. This is particularly true in emergent stroke care, which has significantly advanced in therapies and procedures available. With these advances, stroke networks have evolved to address the substantial levels of coordination across multiple providers and sites that are required.

KEY INSIGHT

With the current care delivery model, health systems will be challenged to maintain strong profitability for neurosciences services compared to last 10-20 years.

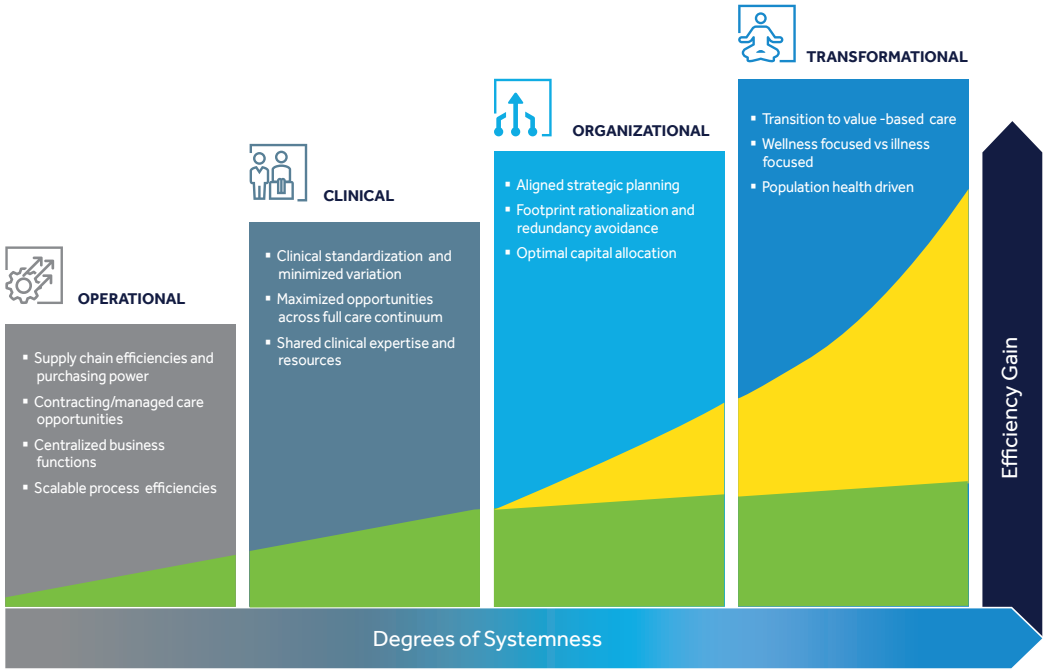
A 2017 survey in the journal *Neurosurgery* showed that neurosurgeon incentives are being increasingly defined by measures beyond productivity (e.g., quality measures, patient satisfaction and chart completion).[11]

KEY INSIGHT

Health systems seeking to become a Center of Excellence will need to offer more than a traditional suite of clinical services. A dedicated focus on quality and value as well as a truly coordinated, cross-functional team effort will be essential.

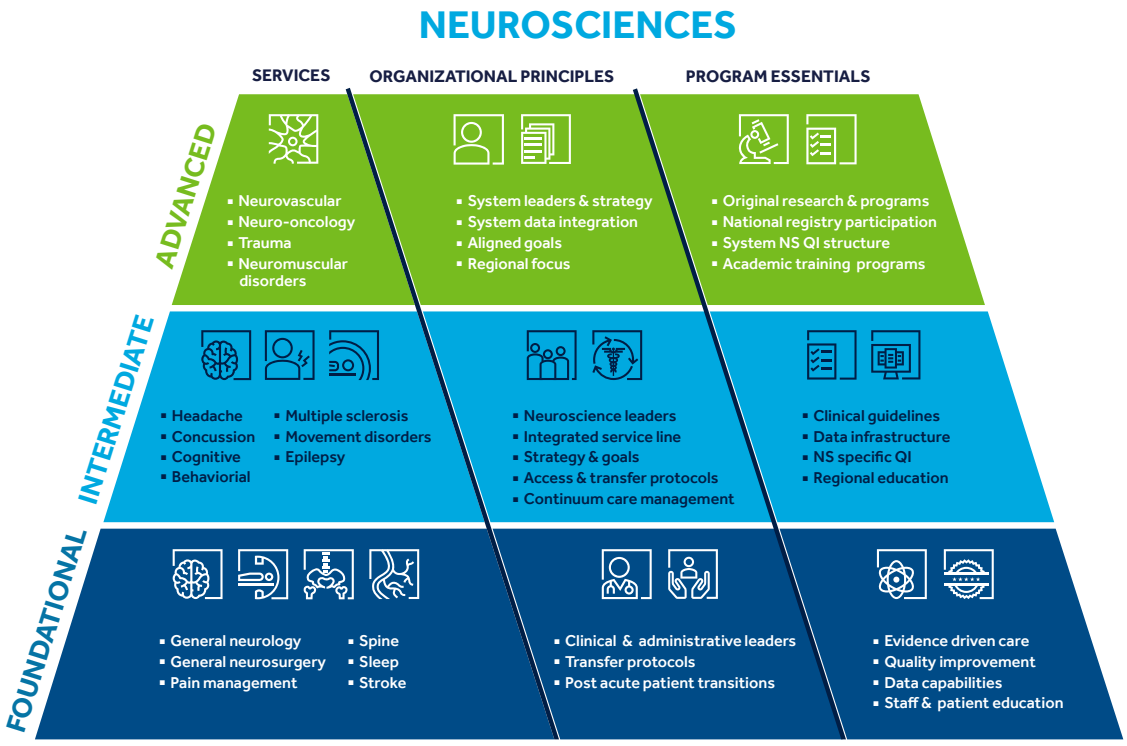
SYSTEMNESS BENEFITS
DISTINCT AND STAGED BENEFITS OF WORKING AS A SYSTEM

Systemness is a powerful way to join together the various aspects of a neuroscience service line to create a cohesive experience for patients and clinicians. The concept of systemness brings together multiple teams and components into a centralized and cohesive plan. See the graphic representation below.



Evolving State of Neurosciences

As neuroscience programs advance with collaborative and multidisciplinary teams supported by a dedicated strategic and operational leadership structure, the service line is ripe for profitable growth and market prominence. Building the neuroscience system of care is a process completed over time based on meeting the needs of the particular area.



PARTNERSHIPS FOR MEANINGFUL CHANGE

While health systems have traditionally considered partnerships in the context of providers and payers, broader opportunities exist. Health care suppliers and vendors including medical device, pharmaceutical, and technology firms are non-traditional but viable partners. Opportunities to collaborate are broad and include clinical research, product-specific R&D, strategy and operations support, data and analytics strategy, patient/provider education, and disease management. Partnerships will also be of paramount importance given the need for operational efficiency and demonstration of value.

In a best-case scenario, partnerships:

- Enable the delivery of specific solutions and products
- Open the door to external perspectives
- Help guide strategic planning
- Create an ever-evolving forum for both clinician and patient education

For neurosciences, partnering will be particularly important for procuring and implementing enabling technologies, care design expertise, and ensuring appropriate training and education. Successful partnerships allow organizations to meet the requirements of complex patients to better optimize clinical outcomes across the care continuum—ultimately improving patient outcomes and the health system's overall sustainability.

KEY INSIGHT

The hallmark of a good partner is rooted in experience and broad perspective across the neuroscience industry and includes providers, payers, and patients. Success is achieved by bringing proven and established solutions to the table. Work includes co-creating new applications and processes, rapidly beta-testing new ideas, and resourcing the partnership with the necessary expertise.

CONCLUSION

Over the last several decades, advancements in neurosciences have driven significant improvement in the lives of many patients. To take full advantage of these developments and respond to the rapidly changing environment, neuroscience leaders are encouraged to formulate a cohesive service line strategy and structure as well as identify opportunities for partnership.

Medtronic is committed to supporting this effort and partnering with patients, practitioners, and health systems to more effectively treat neurological disorders with technology and solutions. We are motivated by a desire to evolve care delivery for patients and an ongoing commitment to better health, better care, better costs, and improved patient and provider satisfaction. Working together, we can accomplish these goals.

TARGETED TAKEAWAYS

- Adopt innovations in technology to drive clinical decision making and quantify outcomes.
- Evolve the care delivery model to keep up with scientific breakthroughs, improve patient outcomes, demonstrate value, and maintain financial sustainability.
- Break down traditional silos to foster an interdisciplinary focus that extends the care team beyond neurology and neurosurgery.
- Pursue partnerships aimed at overcoming gaps in the planning and delivery of care.

This publication is a joint effort with Sg2. In a truly collaborative process, the Medtronic and Sg2 teams leveraged Medtronic's on-the-ground practical experience and Sg2's future-focused perspectives to present the evolution of the neurosciences space and the need for change.

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