

PHILIPS

Position paper

Neurovascular



Shaping the future of stroke care

Envisioning the next steps
towards a better care pathway

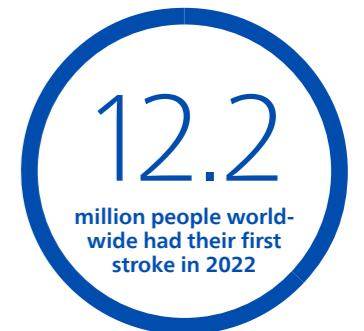
September 2023

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Envisioning the next steps towards a better care pathway

Stroke remains among the leading causes of mortality and disability worldwide¹. Prevention is the first and most crucial step in reducing the global burden of stroke; shockingly, about 80% of strokes are preventable². Secondly, the time from onset of stroke until treatment is critical; every second counts as brain cells are dying for every minute the brain is deprived of necessary blood flow. However, the current state of access to life saving treatment is lacking. The status quo needs to be lifted to provide consistent access and quality of care for stroke patients.



The key to optimizing stroke care is speed, to deliver time-sensitive, life-saving care. What are we currently doing, and could we do more together to speed up stroke care?

Moreover, how can we reduce the impact of stroke events and provide quality patient care while adjusting to an increased focus on outcomes, efficiency, and costs?

1. Stroke is a global epidemic

Today, acute ischemic stroke (AIS), or simply 'stroke', is the second leading cause of mortality and a key cause of long-term disability worldwide³. The reality of stroke epidemiology is an uncomfortable one.

Already, over 110 million people in the world have experienced stroke⁴. Globally, one in four adults over the age of 25 will have a stroke in their lifetime; about 25% will suffer a second. In 2022, around 12.2 million people worldwide had their first stroke and 6.5 million died as a result⁵. By 2050, we can expect about 200 million stroke survivors and, each year thereafter, over 30 million new strokes and 12 million deaths from stroke⁶. As a result, the pressure on stroke care is increasing rapidly around the world.

This position paper examines potential improvements throughout the care pathway beginning with symptom onset. With a focus on ischemic stroke, the principal question we want to address is how healthcare professionals can improve access to care, and provide high quality care with minimal loss of time. Healthcare professionals (HCPs) face the challenge of managing patient volumes and patient selection, while striving to improve patient outcomes. Currently, many stroke patients are moderately or severely disabled for the rest of their lives, and often require long-term care at home or within specialized centers. Although acknowledging that strong improvements are needed in stroke care across the globe, it is the responsibility of the entire system of care to strive to deliver the most effective and efficient care to ensure patients lead healthy lives after an acute event, and avoid the hefty financial, physical, and emotional costs of disability.



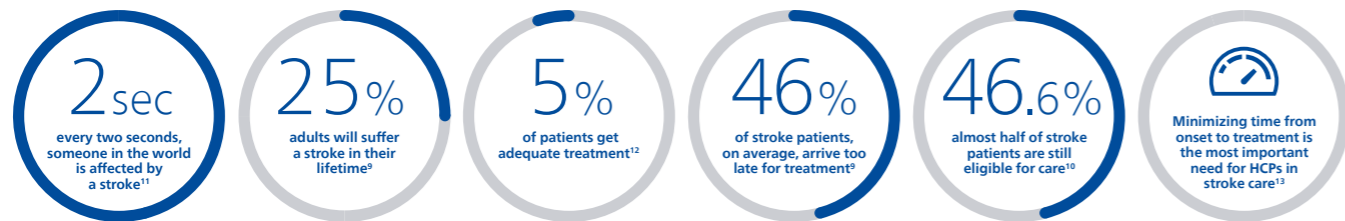
Helping care teams make the right decisions faster, treat more patients, more effectively, and improve patient outcome.

How can healthcare teams accelerate care and adopt new strategies to address this burden?

To improve stroke care, and with that save lives, acute stroke care departments have a great deal to gain from raising public awareness of stroke signs and symptoms, improving early detection methods, and increasing access to qualified, trained staff. They would also benefit from innovative approaches, better technology to support teamwork, and partnerships with industry.

What is the impact of stroke?

Stroke creates a high-cost burden on healthcare systems: 63 million years of healthy life is lost each year due to ischemic stroke-related deaths and disability⁷. A huge proportion of eligible ischemic stroke patients remain untreated or severely undertreated.



2. The current landscape in stroke care

Mechanical thrombectomy (MT) as the gold-standard treatment

The revolutionary recent developments in stroke care strike a resemblance to the field of percutaneous coronary interventions (PCI). The first PCI was performed in 1977, and over a 40-year history, there has been a substantial increase in procedural safety and success.

Most importantly, there have been considerable efforts made to ensure an established and coordinated route of access to care for patients that could benefit from this procedure, especially in acute scenarios (e.g. STEMI). By comparison, mechanical thrombectomy (MT), also called endovascular thrombectomy (EVT), is a relatively new approach in stroke and health systems and care providers are eager to improve its availability and adoption.

Multiple randomized clinical trials have proven the efficacy of MT for rapid intervention in stroke patients with large vessel occlusions (LVO). However, several challenges that precede the actual intervention, impede the ability to fully realize the potential outcomes and result in a severe undertreatment of stroke patients. For example, the ability to provide a 24/7 service line, which includes availability of trained staff, sufficient neuro ICU beds and coordination and scheduling of

acute patients across regional and country-wide stroke networks, remain a barrier.

By optimizing the stroke pathway and using integrated solutions, we could accelerate the pace of change and enable health systems to establish the infrastructure and the wide accessibility they require.

The structure of stroke care

In the US, over 50% of all thrombectomy, embolization, and angioplasty procedures are performed at comprehensive stroke centers (CSCs). Large CSCs are increasingly partnering with all levels of stroke centers: primary stroke centers (PSCs), thrombectomy-capable stroke centers (TSCs), and other CSCs to form health networks. In 2022, there were over 300 CSCs & TSCs and almost 2500 stroke centers in the US¹³. Among 5533 US Emergency Departments (ED), 2446 (44%) were confirmed as stroke centers, including 297 Comprehensive Stroke Centers, 14 Thrombectomy-capable Stroke Centers, 1459 Primary Stroke Centers, and 678 Acute Stroke Ready Hospitals. Compared with EDs without stroke centers, EDs with stroke centers had higher annual visit volumes, were more often academic, and were more often located in hospitals that had trauma or burn centers.

In Europe, a survey of 44 countries¹⁴ reported 2,139 stroke centers¹⁵, of which only 629 had MT capabilities available. The mean number of stroke units is 2.9 per million inhabitants (95% CI 2.3-3.6) and 1.5 per 1,000 annual incident strokes (95% CI 1.1-1.9). Intravenous thrombolysis (IVT) was provided in 42 of the 44 European countries investigated, and MT in 40 of the 44. However, although significant progress has been made, there is still heterogeneity in the organization of stroke care in Europe. Hence¹⁶, reliable and precise information about the structure and organization of stroke care, and the implementation of stroke management, is still lacking in many countries.

It is a promising start, but there is still a great deal more that can be done in this field; we need to augment the number of MT capabilities and implement more stroke pathways in Europe, to deliver that all-important, time-sensitive, life-saving care.

With this aim, the European Stroke Organisation (ESO) and Stroke Alliance for Europe (SAFE) teamed up to create a stroke action plan from Europe 2018-2030¹⁷.

2030

By 2030, the Stroke Action Plan aims to:

1. Reduce the absolute number of strokes in Europe by 10%.
2. Treat 90% or more of all patients with stroke in Europe in a stroke unit as the first level of care.
3. Have national plans for stroke encompassing the entire chain of care from primary prevention through to life after stroke.
4. Fully implement national strategies for multi-sectorial public health interventions promoting and facilitating a healthy lifestyle, and reducing the environmental, socio-economic and education factors that increase the risk of stroke.

Trends in stroke care

Stroke care is in transformation with an increasing role for technology and data.

Technology trends		Clinical trends	
EU classification for diagnostic support for Stroke will become Class III	EU MDR will place stricter requirements on clinical trial results to determine device approval & reimbursement	Dedicated MT training programs to expand clinical population that can treat AIS	WE-TRUST clinical trial ongoing to determine improved clinical outcome from Direct-to-Angio Suite (DTAS) approach
AI: solutions for triage & diagnostic support (right patient to right hospital)	Mergers & Acquisitions: big players leverage new capabilities by acquiring/partnering with start-ups	Thrombectomy is gold standard for major LVO strokes	Reconfiguration of services into networks of stroke care Primary stroke centers (PSC), Comprehensive stroke centers (CSC), Thrombectomy-capable stroke centers (TSC)
Pathway innovation (pre and in hospital): several concepts emerging to optimize stroke care (e.g. mobile stroke teams)	Early identification: new players focusing on technologies for pre-hospital stroke detection	Interventional neuroradiologist as lead clinician due to highly specialized nature of treatment	National stroke registries as clinical data lakes
Data: emergence of need for (cloud) solutions to holistically organize data on a single infrastructure	Mobile centers: selected healthcare organizations offer Mobile Stroke Units (MSUs) for better care	Several clinical trials ongoing to extend inclusion criteria for MT eligible patients	Treatment window for MT adjusted to 24 hours after onset of AIS, and including broader indications for treatment

3. The burden of stroke – global and local

From 1990 to 2019, the burden of stroke cases in terms of absolute numbers increased substantially. There was a 70% increase in incident strokes, 43% deaths from stroke, 102% prevalent strokes, and 143% disability-adjusted life years lost (DALYs)¹⁹.

Lack of public awareness of the signs and symptoms of stroke

In a large survey of nine European countries in 2014, nearly one in five people (19%) could not identify one stroke symptom, and fewer than half (49%) would call an ambulance if someone had a stroke²⁰. Identifying the signs and symptoms accurately is one of the leading causes of delay in seeking medical attention, leading to potential ineligibility for acute intervention. Currently, up to 40%²¹ of patients who suffer an acute event arrive at the hospital too late to receive the appropriate treatment. In the UK only 15-60% of acute stroke patients arrive at the hospital within three hours of the onset²². Thus, a proactive and concerted public health efforts are required to increase the awareness and early detection of signs and symptoms as a vital first step.

Growing clinical evidence

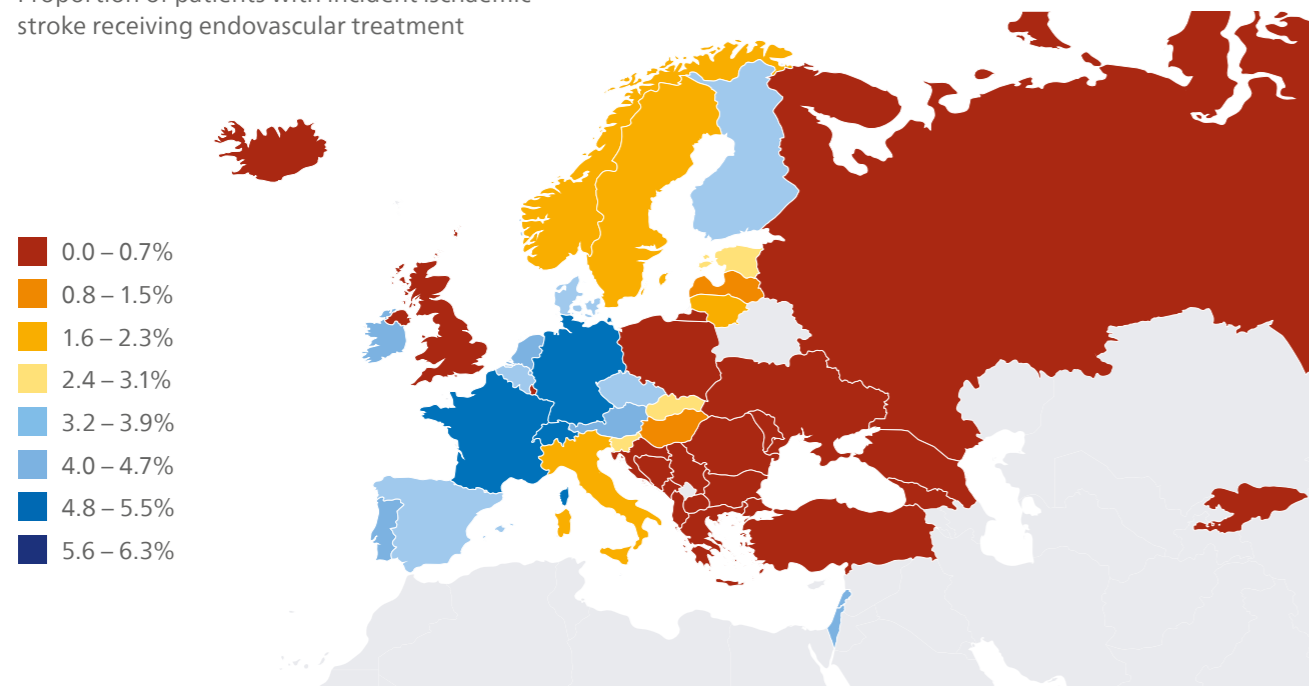
Despite advancements in stroke treatment since mechanical thrombectomy (MT) was incorporated into the guidelines in 2015, the proportion of patients with AIS receiving this treatment has remained unacceptably low.

In 2018, the American Heart Association/American Stroke Association (AHA/ASA) guidelines recommended MT for the management of large vessel occlusions (LVO). However, the guidelines also mentioned the need to revise the support systems within communities to maximize the chances of patients benefitting from this treatment. According to US data from 2012-2019, 14%²³ of patients potentially eligible, received MT²⁴. Other data from 2018 highlighted that the mean proportion of patients receiving MT in 42 European countries was 1.9%²⁵. Although only a proportion of ischemic stroke patients would be intravenous or endovascular candidates, by comparison, PCI procedure uptake to treat STEMI at this time was 78%²⁶. A clear discrepancy in access to care for stroke versus CAD patients.

Severe undertreatment for stroke patients

2018 Data

Proportion of patients with incident ischaemic stroke receiving endovascular treatment

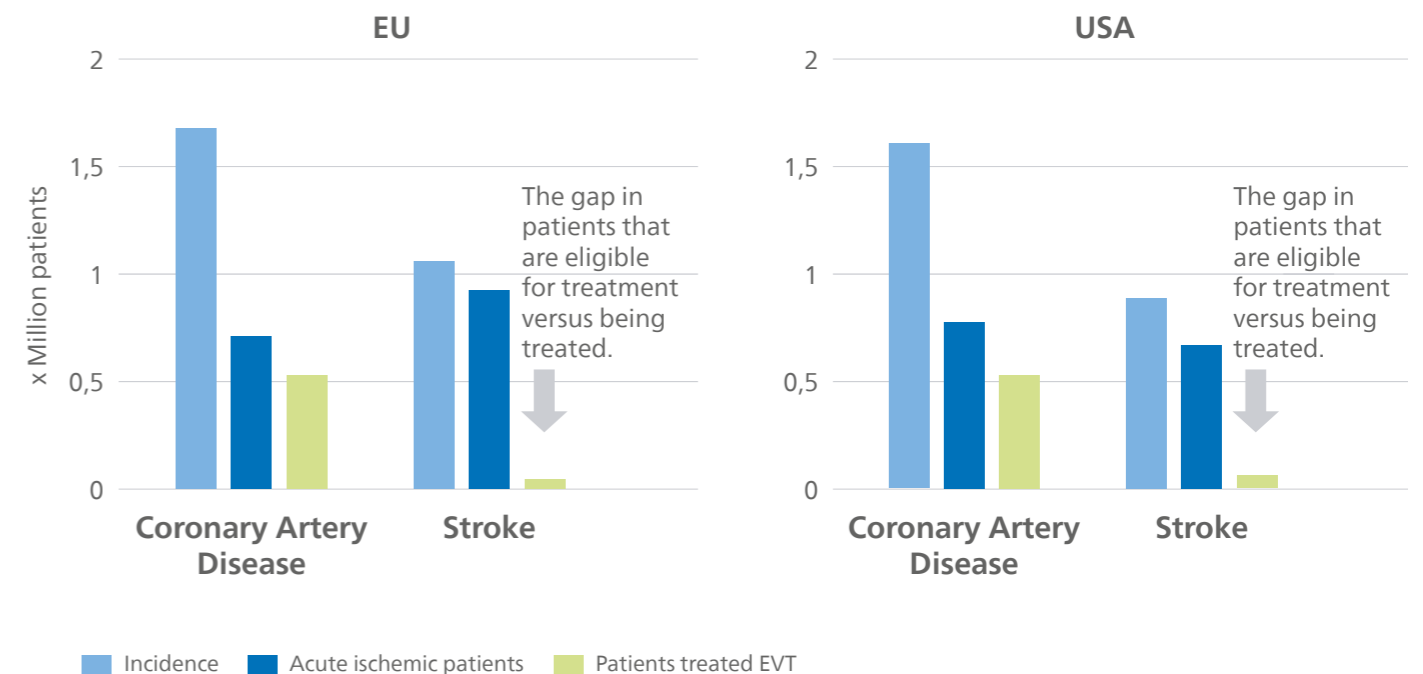


Proportion of patients with incident ischaemic stroke receiving endovascular treatment (EVT) in 42 European countries (mean 1.9%;95% CI 1.3–2.5). As per comparison: proportion PCI procedures / CAD incidence: 78%.

Stroke in infancy stage compared to Coronary Artery Disease

Undertreatment in stroke compared to CAD

Patients eligible for treatment vs patients treated with MT for CAD and stroke showing gap and undertreatment in stroke.



There are many interrelated factors that contribute to this discrepancy. Ultimately, the aim is to address each of them in turn to increase access to this effective treatment. In Europe, the plan is to increase the proportion of stroke patients receiving MT by 2030. Data published in stroke in 2022 evaluated the MR CLEAN study in the Netherlands²⁷ and concluded improved outcomes over the past years already due to better workflow times and successful reperfusion rates. Stroke treatment is expected to evolve in a comparable way to PCI. Embracing present and future innovations in the field, adopting new protocols, and revising the current systems to accommodate this growth, while also accounting for variations between geographic locations are key to achieve this.

Scarcity of 24/7 centers, stroke networks and shortage of qualified staff

Within many communities, there is large variation in access to resources, which must be addressed to encourage adoption of the MT treatment option²⁸. For example, in rural areas it is necessary for people to travel and wait for ambulances, whereas in urban areas, patients can access stroke care more quickly. This results in rural patients receiving intravenous thrombolysis (IVT) and MT significantly less frequently compared with urban patients as well as experiencing higher in-hospital mortality rates compared with their urban counterparts. This disparity did not improve over the five-year period (2012-2017) of the US study²⁹. There is also a lack of infrastructure that prevents everyone from receiving the same care worldwide. Accessibility also differs greatly per country: in South Korea, 71% of patients arrive too late for treatment in the hospital, whereas in the US, 61 million (19.8%) Americans have direct MT access within 15 minutes, and 95 million (30.9%) Americans have direct MT access within 30 minutes³⁰.

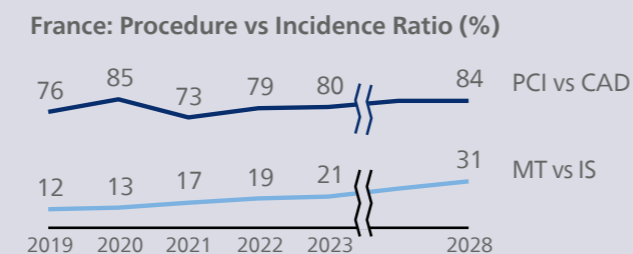
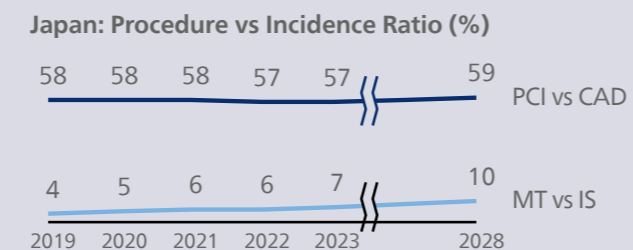
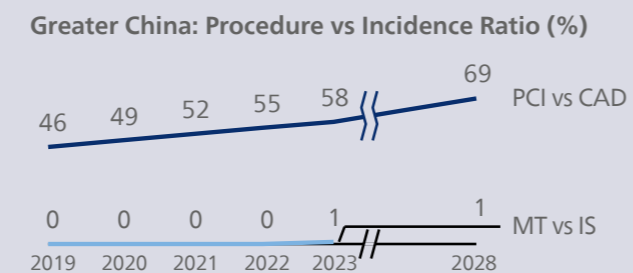
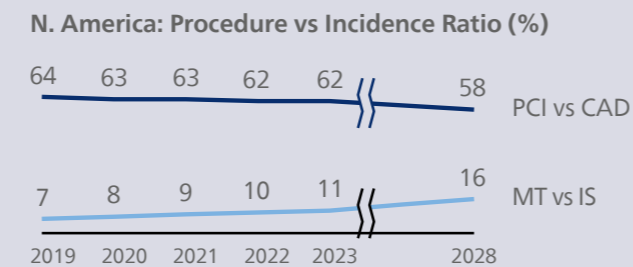
It is evident when looking at the door-to-needle quality measures that many regions and health systems require improvements in policy and infrastructure to address the current gaps in care. However, improvements have been initiated with recent investments by the European Union as a result of the Stroke Action Plan, in which there is a potential to address two significant bottlenecks:

1. Medical centers that have MT capabilities
2. Qualified **interventional neuroradiologists (INRs)** – In some countries, Many INRs are concentrated in academic centers and major hospitals with MT capabilities. In addition, the training required to become an INR is rigorous and lengthy, and training posts are often severely limited in number.

Stroke treatment expected to evolve similar to PCI

Procedure vs Incidence Ratio (%)

The rate of adoption of MT as the mainstay of treatment for ischemic stroke is projected to move towards the same rate of use as PCI for CAD across multiple health systems.



Improving networks and the integration between care teams that provide stroke care could yield potential benefits. For example, the use of a communication platform, or even simple data-sharing capabilities, would allow for care teams to connect, make faster and informed clinical decisions and ultimately impact the patient's health outcomes with an effective treatment strategy.

Similarly, there are potential collaborations³¹ between the INR and other trained interventional specialists that are worth exploring to fill the current gap in access to physicians with the necessary expertise. This could increase the availability of the procedure for patients.

Time criticality in stroke care

Time is critical for treatment as there is limited window of eligibility: IVT <4.5h; MT <6h; after 6 hours, chances for good outcome drops. Research shows that the most significant amount of time is lost in the emergent and diagnostic phases, where reportedly, fewer than half the patients who arrive in the hospital are still eligible for treatment, as too much time has elapsed since the onset of stroke. This problem was recently highlighted during the height of the COVID-19 pandemic. In Hong Kong, the median onset-to-door time during the pandemic was one hour longer, with a drop of 16% in those patients

who made it to the emergency room within the critical window³².

Unknown long-term impact for stroke survivors

Disability and impaired motor function after stroke is often a result of the event, causing patients to be wheelchair-bound or in need for full-time care. Besides this obvious impairment, there are other less obvious and less discussed issues. The hidden effects of a stroke, which can include: cognitive impairment; neuro-fatigue; chronic pain; aphasia; vision problems; sensory issues; emotional lability. The impact on a patient's daily life and their changed participation in society can greatly contribute to a low overall quality of life.

A study in China³³ suggested that among stroke patients, a higher level of stigma was influenced by a higher degree of depression, lower functional ability, a greater reliance on avoidance coping, lower subjective support, and recurrence of stroke. Depression was the most significant predictor of stigma. Better information provision, effective communications, social support, and scheduled reviews of support needs can all help to address the long-term emotional and psychological difficulties of stroke survivors and their caregivers, and reduce stigma and discrimination.

Accessibility to stroke care

Country	Population	IS cases ¹	MT-eligible ¹	Real MT numbers ²	%	EVT centers/M ²
Switzerland	8.591.365	13.179	3.388	626	18,5%	1,1
Austria	8.955.102	16.498	4.191	650	15,5%	1,3
Sweden	10.036.379	17.262	4.480	390	8,7%	0,6
Netherlands	17.097.130	23.738	6.059	1.088	18,0%	1,2
Poland	37.897.768	101.706	25.612	175	0,7%	0,5
Spain	46.736.776	67.358	17.632	2.408	13,7%	0,8
Italy	60.550.075	110.530	29.504	1.882	6,4%	0,8
France	65.129.728	88.468	23.286	4.589	19,7%	0,6
UK	67.530.172	87.921	22.908	478	2,1%	0,1
Germany	83.517.045	175.081	44.624	9.000	20,2%	1,7
USA ^{3,4}	329.064.917	530.700	137.982	13.010	9,4%	2,2 ⁵

1 Candio P. et al. Stroke. 2021;52:664-673 / 2 Aguiar de Sousa D. et al. European Stroke Journal 2019;4:13-28 / 3 MacKenzie I. et al. World Neurosurg. (2020) 138:839-846. 4 Heart Disease and Stroke Statistics 2020 / 5 Sarraj A. et al. Stroke. 2020;51:1207-1217

Meet Stacie a mother, writer, and young stroke survivor



Stacie is a writer, mother of three children and married to Johan. She was 46 years old, living a healthy lifestyle, when she woke up one Wednesday morning with a numbness in her lower right leg. "I thought I slept wrong and just got on with it. But then this debilitating fatigue suddenly hit me. Johan found me and kept screaming: 'Stacie, can you hear me? Say something!' I knew that he was there, and I knew that he sounded like he wanted me to do something, but.... I was in fairyland. When we reached ER, everything was a bit foggy. They kept asking me my children's names and then I had my first insecure moment, because I couldn't remember them. I was freaking out a little bit."

"I was very lucky in my unluckiness that Johan was home, that he knew the signs of stroke, I was taken to the right hospital, where a team of neurosurgeons could be assembled and could perform successful surgery." Right after surgery, Stacie could not walk, talk, or feed herself. During the first year of stroke recovery, Stacie spent 1,000 hours in therapies. Still to this day, almost four years in, she is spending a minimum of 10 hours a week on speech therapy and another three hours a week on physiotherapy.

➔ *More on Stacie's story: Meet Stacie – a writer, a mama, and a young stroke survivor - YouTube*



It is striking that globally, fewer than 5% of patients with an AIS can receive timely and adequate treatment³⁸. Optimizing the pathway upstream provides more treatment options and a greater chance at recovery.

When seconds count, technology alone is not enough to transform stroke care. It is for this very reason that Philips is connecting the dots between caregivers – wherever they are – at every vital step in the stroke care pathway. The result is smart stroke solutions designed to support connected care. Our innovations facilitate better collaboration, providing the information and tools that help everyone involved in the pathway to deliver time-sensitive, life-saving care. Next to solutions, Philips also offers consultancy to streamline workflow efficiency, improve utilization of resources, advise on technology strategy, and integration. To ensure we are addressing the right challenges for our innovations, we conduct care pathway assessments which flag the following key opportunities to improve the stroke care pathway.

As first patient contacts, they can provide valuable assistance in streamlining the initial stages of the care pathway. Providing tailored tools and resources that enable confident decision-making can help to reduce the time-to-treatment window. It is of utmost importance to incorporate technology that can assist all caregivers with diagnosing a possible event more accurately, either independently or with the assistance of an expert.

Our solutions can alleviate uncertainty at first contact to reduce transfers, support faster time-to-treatment, improve treatment outcomes and help caregivers beat the clock for acute stroke patients. Live data sharing or consultations can help first responders quickly corroborate an initial diagnosis and alert the appropriate personnel during patient transfer.

Simple, fast, and conclusive diagnosis

Current modalities and workflows need improvement and innovation, especially in the context of MT as forms of treatment. Some of the frustrations felt with current diagnostic imaging include decreased reliability with very early presenters (<90 minutes from symptom onset), limited brain coverage for CT perfusion imaging, issues with prep time, monitoring patient status and, in the case of MRI, movement. These factors clearly have a significant impact on patient outcomes because of the nature of the disease being treated.

Improvements in the speed and accuracy of diagnostic imaging can create a significant advantage in the care pathway and help make up for lost time during other phases. Features of these imaging modalities also have a role to play in how seamlessly they can be used and integrated with other systems and devices. Our solutions aim to automate imaging processes to provide fast high-quality imaging results to drive timely and confident diagnostic decisions and also support end-to-end sharing so that everyone in the multidisciplinary team (MDT) has timely access to the results.

Improve treatment outcomes

At Philips, we are seeing a strong increase in MT as a first-line treatment for patients with AIS. We see the shift from time-based to image-based patient selection for AIS treatment and accommodate our solutions to support the change.

4. Economic challenges in stroke care

Optimizing stroke management, will require significant investments in healthcare worldwide. Some question whether the benefits will outweigh the risks, the costs, and other disadvantages; the lack of specialized staff and Information and Communication Technologies (ICT) experts that are needed are also a serious limitation. How and where do we get enough training spots and make them more attractive?

The estimated global cost of stroke is over \$891 billion. In the US, stroke-related costs amounted to almost \$53 billion between 2017 and 2018³⁴. This total includes the cost of healthcare services, medicines to treat stroke, and missed days of work. Between 2017 and 2040, the costs

of stroke are projected to increase by 44%³⁵, with some countries expected to see rises of nearly 100 % in stroke-related costs. This is due to the increasing cases of new strokes and the number of people living with stroke due to an aging population, as age is a significant risk factor for stroke.

MT has been found to be cost-effective compared to standard care³⁶, but even this option presents a challenge due to the huge variation in delivery of this treatment across Europe³⁷. The economic impact of strokes, the number of strokes that are preventable and the cost savings must be assessed against the investments required.

5. Advancing stroke care to save lives

The time-to-treatment window is critical in managing stroke, and directly determines the effectiveness of revascularization therapy.

Collaboration with experts, review of current literature in the space and our own assessments, show that there is a need to address the current barriers at various points in the care pathway:

- To raising awareness with the public, so people closest to patients will recognize signs and symptoms faster
- To reducing uncertainty at first medical contact touching upon the ambulance/prehospital phase
- To a collaborative, rapid diagnostic pathway within the hospital that ensures patients are in the right hospital (and transfer them quickly elsewhere if needed)
- To receiving treatment, such as MT
- And extending care to the rehabilitation center, and monitoring in the patient's home

The FAST acronym³⁹

- F** acial drooping
- A** rm weakness
- S** peech difficulties
- T** ime to call emergency services

Improving public awareness

The majority of first aid caregivers, like family members, colleagues, and incidental bystanders, are not empowered to diagnose and act decisively on a potentially acute event. Strengthening public awareness campaigns, such as promoting the F.A.S.T. acronym, is a vital first step.

Improving emergency care awareness – reducing first contact uncertainty

There is an urgent need to improve training and tools for emergency medical services providers.

Our solutions aim to improve procedural efficiencies and redefine outcomes for stroke patients by supporting care early in the morning, or late at night, when most cases arrive to the hospital. By providing fast system start-ups, simplified workflows, and 3D imaging guidance, the goal is to support care providers with what they need, when they need it, as quickly and accurately as possible.

Post stroke patient monitoring & risk management

Managing the risks involved further downstream in the stroke care pathway are also becoming more difficult. The recovery to post-discharge phase is particularly impacted because patients are not able to regain function that will allow them to transition back to the community with minimal sequelae. Additionally, managing the underlying causes of stroke become highly relevant. For example, secondary stroke prevention in patients with atrial fibrillation is crucial as recurrence rates of stroke are very high (high risk of recurrence rate renders secondary prevention as mandatory).

Team collaboration, data sharing and local hospital networks

The care necessary for favorable outcomes in stroke management requires a large MDT which includes the caregiver, first responder, emergency physician, emergency nurse, diagnostic experts, such as a radiologist and later interventionalists, through to the post-acute care team and rehab. Each member of the MDT needs access to relevant, accurate and timely data for clinical decision-making at different points in time. And for such complex care, each member plays a significant role, so clear and easy communication is required to streamline care.

Measures that maximize the MDT's ability to collaborate and integrate patient data can speed up diagnosis, allow for more treatment options, and therefore enable better clinical outcomes and chances of patient recovery. Streamlining care with these measures also eases pressure on the MDT to help avoid staff burnout. Current technology is well positioned to deliver these potential benefits. One study⁴⁰ evaluating the diagnostic performance of AI technology noted a 20% reduction in initially undetected stroke, which in turn can increase the number of patients that are eligible for MT.

“Not all stroke patients have access to a comprehensive stroke center at the time of the event and often need to be transferred, losing valuable time.”



Setting up a system that supports MDTs 24/7 is also important. Strokes can occur at any time, and being prepared for the “when” is necessary to maximize clinical outcomes as it allows teams to focus on timely decision making.

This is particularly important as not all stroke patients have access to a CSC at the time of the event and often need to be transferred, losing valuable time. A well-integrated, automated system that can calculate and share key data seamlessly could help ease the burden associated with miscommunication, repeat testing and more.

Centralized networks will give a greater number of eligible patients access to all potential treatment options.



Philips has already made great headway in this area. In addition to our recently expanded stroke capabilities, we have partnered up with a MedTech stroke care company to create a solution that significantly advances our commitment to improving outcomes for people who suffer a stroke. This medical device aims to improve clinical outcomes by optimizing the stroke workflow. It analyzes CT scan data with AI, and automatically detects large vessel occlusion (LVO) and its location. This analysis is then shared with physicians at both PSCs and CSCs where the patient will eventually be treated.

Evidence also points towards the benefits of having a centralized stroke network to allow more eligible patients to access MT as a viable treatment option, again while reducing door-to-needle time. Centralized networks will give a greater number of eligible patients access to all potential treatment options.

Angio Suite optimization

The Angio Suite is designed to provide an environment for healthcare practitioners to be able to do what they do best, without anything getting in the way. Achieving a consistent first pass effect (FPE) ensures superior outcomes every time the procedure is done and gives patients a better outlook in the post-treatment phase of the pathway. The Philips Angio Suite aims to provide easy access to relevant patient information and an integrated way of reviewing diagnostic information and imaging, all while minimizing unnecessary movement or breaking a sterile field. This level of support minimizes errors and maximizes clinical outcomes.

Evaluation of the MR CLEAN study⁴¹ in the Netherlands concluded that outcomes have already improved in recent years, due to better workflow times and successful reperfusion rates. This study provides insight into whether MT is safe and effective for patients treated outside the currently known time-window, based on the presence of collateral flow on CTA. Promising initiatives to reduce the amount of time between symptom onset and treatment, are also being further developed.

Direct-to-Angio

Philips is heavily involved in supporting pioneers that explore new care pathways for stroke patients, for example through the Direct to Angio Suite (DTAS) approach. This workflow⁴² provides valuable, time-saving, and cost-effective support⁴³ for transfer, as well as direct patients who arrive at the CSC. Time-to-reperfusion is fundamental in reducing morbidity and mortality in AIS. In patients presenting directly to an endovascular-capable center, emphasis has now been placed on fast door-to-imaging times and fast imaging-to-groin access times. DTAS workflows allow for comprehensive stroke diagnosis to be performed directly in the Angio Suite.

This provides valuable, time-saving support for critical patients in acute need of MT therapy. For example, a single center study was able to show a reduction in door-to-needle time of almost one hour (70 vs 16 minutes) when using a DTAS approach versus a conventional one. This is directly associated with better 90-day patient outcomes. Thus, by optimizing the Angio Suite and reducing the time-to-treatment, we can potentially give patients a greater chance at reintegrating back into the community with minimal sequelae. Currently, the WE-TRUST clinical trial⁴⁴, which is sponsored by Philips, is underway to take a closer look at this approach, and its impact on stroke patient outcomes.

6. Summary

Together, we can reduce the impact of stroke events, potentially returning patients to a normal healthy life after a stroke.

Complexity adds time in stroke patient management. A network of separate, yet highly interdependent workflows must work fluidly together. Because gaps in information, communication and access to stroke expertise can cause delays that have tragic consequences for stroke patients.

Philips is committed to strengthening the stroke care system and playing our part in building one that better serves patients across their entire care experience. To do so, we are dedicated to partnering with you to continue breaking down physical, clinical, and operational barriers to care. The burden of stroke is huge and continues to rise worldwide.

Demands to become both more efficient and deliver better outcomes will become even more important. There are many opportunities for innovation that can streamline and optimize the entire care pathway. Optimizing the pathway upstream provides greater access to treatment options and a greater chance at recovery. Thanks to these innovations we will save precious time, and with that, lives.

Philips is committed to understanding your challenges and processes and will collaborate with you to identify solutions across every department that touches stroke care.

Are you interested in learning more? Let's talk about the future of stroke care that we can create together. For more information, visit

www.philips.com/stroke

Abbreviations

AIS	Acute ischemic stroke
HCP	Healthcare professional
MT	Mechanical thrombectomy
EVT	Endovascular thrombectomy
PCI	Percutaneous coronary intervention
STEMI	ST-segment elevation myocardial infarction
LVO	Large vessel occlusion
ICU	Intensive care unit
CSC	Comprehensive stroke center
PSC	Primary stroke center
TSC	Thrombectomy-capable stroke center
ESO	European Stroke Organization
SAFE	Stroke Alliance for Europe
AI	Artificial Intelligence
CI	Confidence Interval
EU MDR	European Union Medical Device Regulation
ICT	Information and Communication Technology
IS	Ischemic Stroke
IV	Intravenous
MSU	Mobile Stroke Unit
DTAS	Direct-to-Angiosuite
DALY	Disability-Adjusted Life Years
AHA	American Heart Association
ASA	American Stroke Association
CAD	Coronary Artery Disease
MR CLEAN	Multicenter Randomized Clinical Trial of Endovascular Treatment of Acute Ischemic Stroke in the Netherlands
IVT	Intravenous Thrombolysis
INR	Interventional Neuroradiologist
IT	Information Technology
CT	Computed Tomography
CTA	Computed Tomograph Angiography
MRI	Magnetic Resonance Imaging
MDT	Multi-Disciplinary Team
FPE	First-Pass Effect
WE-TRUST	Workflow Optimization to Reduce Time to Endovascular Reperfusion in Stroke Treatment

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