

# Past & Future of Stroke Care in Europe

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## ABSTRACT

Cardiovascular diseases, including stroke, are the leading cause of death in the European Union (EU), responsible for more than 4 million deaths in 2013 and accounting for 45% of all deaths. Coronary heart disease (CHD) and stroke account for the majority CVD-related deaths, with 1.8 million deaths from CHD and 1 million from stroke annually.

In the past 20 years, there have been significant advances in the prevention and treatment of primary and secondary stroke. Yet there are wide disparities in the incidence of stroke and stroke-related morbidity and mortality throughout the EU, with quality dependent on a region's uptake of these best practices. Imbalances include the percentage of patients who receive thrombolysis, are treated in stroke units, and have access to mechanical thrombectomy.

To address these disparities, several organizations throughout the EU are implementing the use of registries as part of continuous quality improvement efforts designed to improve the quality of stroke care. Registries include those from the Safe Implementation of Thrombolysis in Stroke-Monitoring Study (SITS-MOST), which contains data on 6,500 stroke patients; the European Stroke Organisation's registry, which sets criteria hospitals must meet to receive enhanced levels of care designation; and the Registry of Stroke Care Quality (RES-Q), a multinational, registry-based study to document the impact of improving the uptake of evidence-based interventions shown to improve the quality of stroke care and outcomes.

These and other efforts to improve stroke care in the EU face numerous challenges, however, particularly the diversity of resources and health system structures in member countries. Overcoming these barriers will require that representatives of various countries learn to work together towards the common goal of reducing strokes and improving outcomes.

**Key words:** Stroke, Registries, Continuous Quality Improvement, European Stroke Organisation, tPA, stroke unit, quality, disparities, thrombolysis, ESO-EAST

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## INTRODUCTION

Cardiovascular diseases, including stroke, are the leading cause of death in the European Union (EU), responsible for more than 4 million deaths in 2013 and accounting for 45% of all deaths in the EU. Coronary heart disease (CHD) and stroke account for the majority CVD-related deaths, with 1.8 million deaths from CHD and 1 million from stroke annually.<sup>1</sup> Stroke is also a major contributor of disability, imposing a significant burden on patients, caregivers, and health systems.

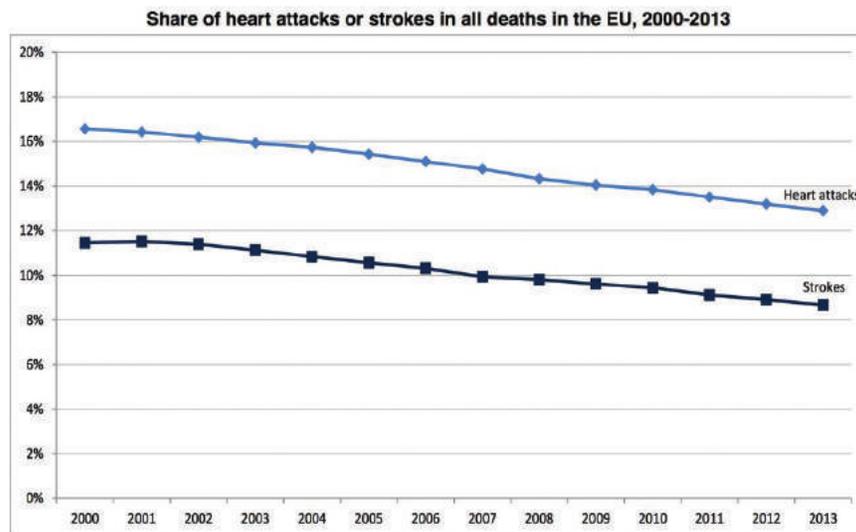
While the majority of those deaths occur in people over 75 years of age, an estimated 700,000 occur prematurely in those 65 or younger.<sup>1</sup> Indeed, approximately 94,000 stroke-related deaths in people under 75 could be avoided if patients receive care based on the latest medical knowledge and technology.<sup>2</sup>

The quality of stroke care varies widely throughout the EU, with death rates ranging from approximately

about 6% in France to nearly 20% in Bulgaria.<sup>3</sup> Other disparities include gender imbalances and the number of hospital discharges and lengths of stay for patients treated for CVD.<sup>4</sup> Across Europe it is estimated that only 30% of stroke patients are treated in a stroke unit, which means that 70% of patients with acute stroke receive care in the wrong setting.

The rate of stroke-related deaths and stroke prevalence is slowly declining in some countries (Figure 1).<sup>3</sup> In Sweden, for instance, estimates from 2000 predicted a 50% increase in stroke incidence by 2050 from less than 30,000 to about 43,000 strokes a year. Today, thanks primarily to improved primary and secondary prevention, that estimate has dropped to about 23,500, primarily the result of fewer secondary strokes.<sup>5,6</sup>

However, the incidence of stroke and stroke-related deaths is higher and even increasing in some countries, particularly those in Eastern Europe (Figure 2).<sup>7</sup> Thus, there is a need to reduce the burden of stroke throughout



**Figure 1. Share of attacks or strokes in all deaths in the European Union, 2000-2013**

Source: Eurostat. Over a million persons died in the EU from a heart attack or a stroke [press release]. May 4, 2016.

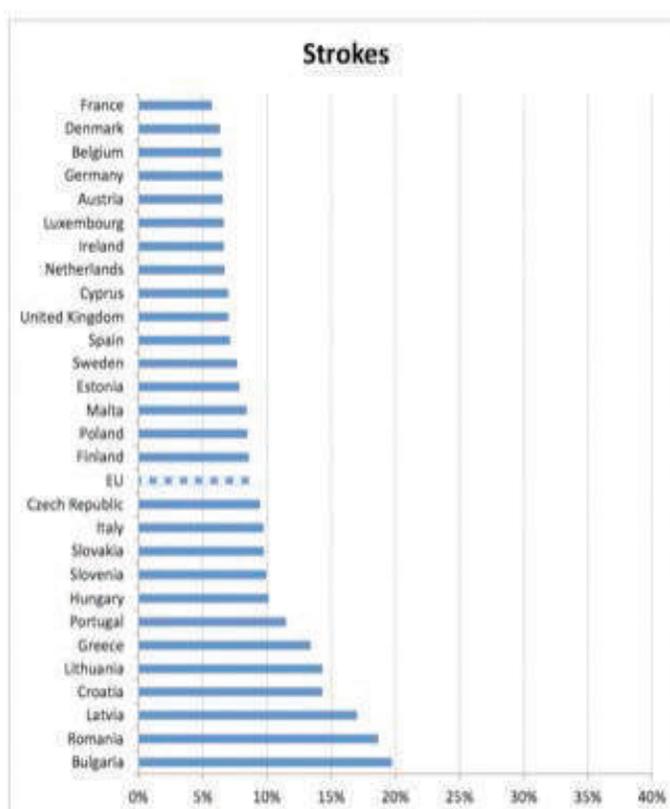
the EU through prevention and improved treatment of primary stroke.

**STROKE CARE: THEN AND NOW**

Just a few decades ago, before the advent of computed tomography (CT) patients suspected of having a stroke were diagnosed based on the presence of hemoglobin derivatives in the spinal fluid obtained through a lumbar

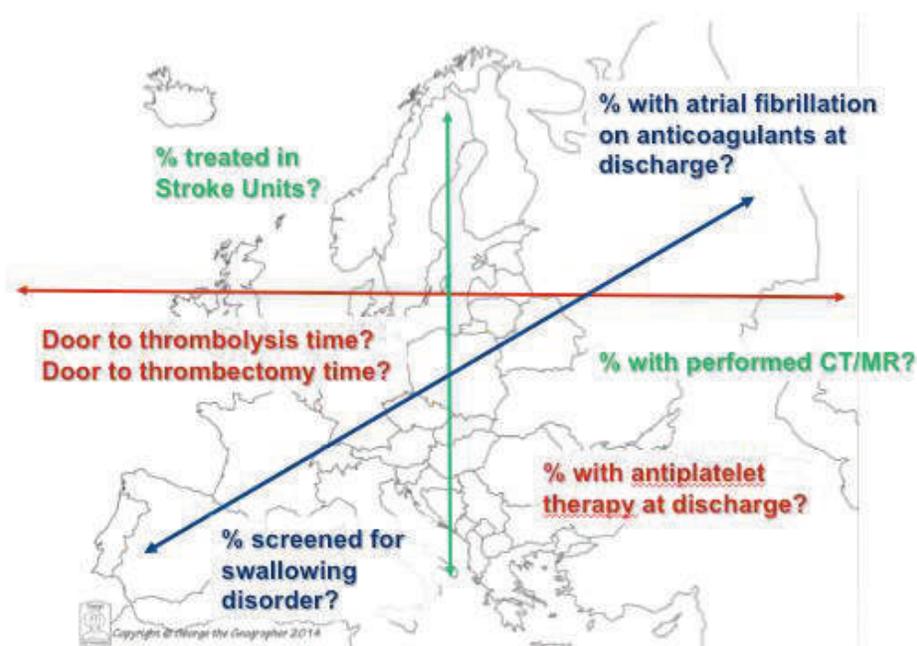
puncture. If this examination was negative, they received no treatment or were put on a heparin drip. Neither approach, however, was evidence-based.

Since then, large, randomized clinical trials have provided a strong evidence base for the treatment of stroke, including the use of antiplatelet therapy for secondary prevention; carotid surgery for high-grade symptomatic carotid stenosis; stroke unit care; intravenous thrombolysis (tPA) in ischemic stroke; lipid lowering and antihypertensive drugs for secondary prevention; hemicraniectomy for



**Figure 2. Share of deaths due to strokes in the EU member states: 2013**

Source: Eurostat. Over a million persons died in the EU from a heart attack or a stroke [press release]. May 4, 2016.



**Figure 3. Stroke Care Between and Within European Countries**

malignant expanding cerebral infarction; and mechanical thrombectomy in large artery occlusion.<sup>8</sup>

This has significantly changed the quality of care provided to stroke patients in many countries. For instance, an analysis of data from the Swedish stroke registry Riks-Stroke found that 87.5% of stroke patients in 2010 were treated in stroke units compared to 53% in 1995. In addition, the percentage of patients discharged to geriatric or rehabilitation hospitals fell by half between 2001 and 2010 (23.6% vs 13.4%) while the percentage discharged directly home with or without home health services increased (44.2% vs 52.4%). The registry also shows that more patients received heparin, anti-hypertensives, and statins before and after the index stroke. Overall, functional outcomes increased slightly between 2001 and 2010, up from 81.2% to 84.1% for toileting; 78% to 80.4% for dressing; and 83.8% to 85.6% for walking independently.<sup>5</sup>

While there is no question that the quality of stroke care has improved overall, there remain wide variations throughout Europe, even within individual countries (Figure 3).<sup>9</sup> Imbalances include the percentage of patients who receive thrombolysis, are treated in stroke units, and have access to mechanical thrombectomy.

### NEED FOR QUALITY IMPROVEMENT

Continuous quality improvement is an essential component of any effort to improve the quality of stroke care. It begins with agreement on the outcomes to be measured followed by the structured collection of clinical data in clinical registries (Table 1). That information is then used to identify gaps in care, followed by education and the implementation of processes designed to improve care.

The success of the American Heart Association/American Stroke Association's (AHA/ASA) Get With the Guidelines (GWTG)-Stroke initiative and the Safe Implementation of Thrombolysis in Stroke-Monitoring Study (SITS) international initiatives are testaments to the potential of such programs.<sup>10-21</sup>

However, the EU has numerous registries, all collecting varied data using different methods. Improving care requires greater coordination between registries and a standardized method of reporting.

### THE SITS-MOST AND THE SITS REGISTRY

The Safe Implementation of Thrombolysis in Stroke-Monitoring Study (SITS-MOST) registry is the result of a large trial assessing the safety and efficacy of intravenous alteplase as thrombolytic therapy within the first 3 hours of onset of acute ischemic stroke in 6,483 stroke patients.<sup>22</sup>

A comparison of the results with several randomized clinical trials on alteplase found nearly identical outcomes between the real-world results and the clinical trials. In addition, there was little difference in outcomes between centers that were experienced in the use of thrombolysis and those that were new to its use.<sup>23</sup>

Since then, the SITS registry has grown to include over 160,000 stroke patients from more than 70 countries, primarily those who received thrombolysis and thrombectomy. Mining the data within SITS can help hospitals improve their door-to-needle time as well as other parameters, including the 3-month modified Rankin score for stroke patients, thrombolysis and thrombectomy rates, mortality, symptomatic hemorrhage rates, and NIH Stroke Scale scores before and after treatment.

Reported to be collected in the majority of registries (>14 registries) <sup>a</sup>
Intravenous thrombolysis (recombinant tissue plasminogen activator)
Antithrombotic therapy during hospitalization
Discharge on antithrombotic medication
Managed on a stroke unit
Collected in multiple registries (2–14 registries) <sup>a</sup>
Adequate fluid and nutrition
Assessment of nutritional risk
Assessment for rehabilitation
Brain or vascular imaging
Carotid endarterectomy/stenting
Continence plan
Craniectomy
Discharge on antihypertensive medication
Discharge on statin/lipid-lowering medication
Discussion with relative/carer
Dysphagia screening
Educational (materials) provided
Length of stay
Rehabilitation services in hospital, including early mobilization
Smoking cessation counselling
Stroke unit team management
Time between onset, door, scan and needle (e.g. tPA bolus or groin puncture)
Transport to hospital

Note: Some metrics were re-worded or combined to simplify presentation.  
<sup>a</sup>Provided as a qualitative description of the most common aspects of stroke care monitored in national stroke registries.

**Table 1. Most commonly reported areas of focus collected to measure quality**

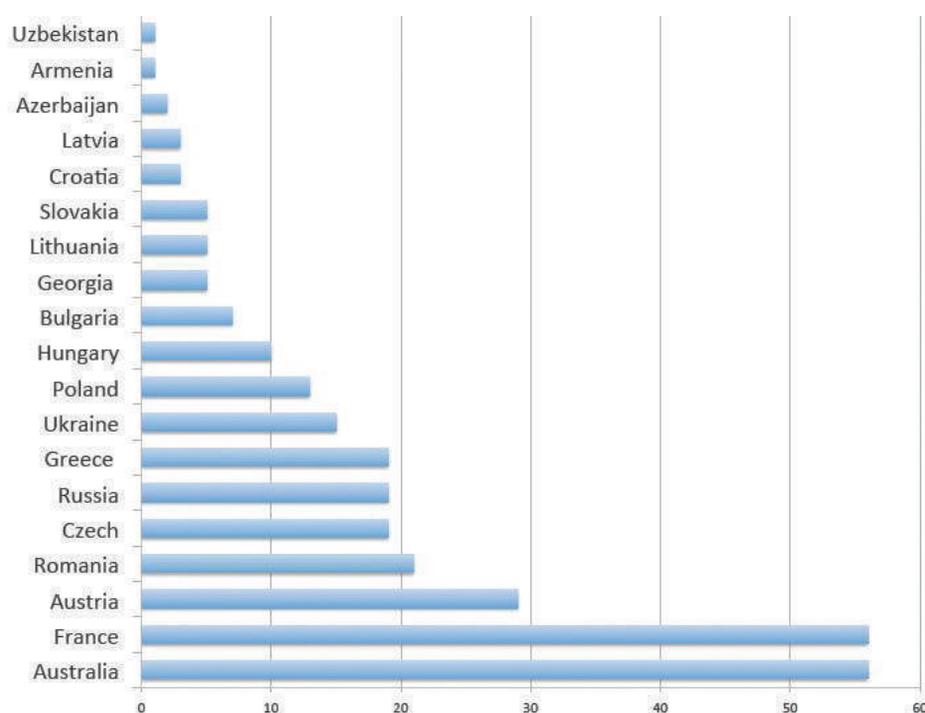
Source: Cadilhac DA, Kim J, Lannin NA, et al. National stroke registries for monitoring and improving the quality of hospital care: A systematic review. *Int J Stroke*. 2016;11(1):28-40.

### THE EUROPEAN STROKE ORGANIZATION

The European Stroke Organization (ESO) (<http://eso-stroke.org>), founded in 2007, works to reduce the burden of stroke by providing education to physicians, researchers, stroke societies, and patient organizations on current European standards of stroke care; supporting

the provision of uniform stroke treatment throughout the continent; and garnering public funding for research and treatment.<sup>24</sup>

However, as Figure 4 shows, hospital membership in the ESO varies greatly by country, representing a significant challenge to quality stroke care.



**Figure 4. ESO membership in selected countries**

Source: European Stroke Organization (updated in May 2016)

- European Stroke Organization
- Cerebrovascular Section of Czech Neurology Society
- Cerebrovascular Section of Slovak Neurology Society
- Hungarian Stroke Society
- The National Association for Combating Stroke (Russian)
- The Romanian Society of Neurology
- The Scientific-Practical Society of Neurologists, Psychiatrists And Narcologists of Ukraine,
- The Ukrainian Anti-Stroke Association
- The Ukrainian Association of Neurosurgeons
- The Association of Internal Medicine Doctors of Ukraine
- The Polish Society of Neurology and National Consultant in Neurology
- The Sociedade Espanola de Neurologia
- The Sociedade Espanola de Enfermeria de Neurologia
- The Sociedade Portuguesa de AVC
- The Italian Stroke Organization

**Table 2. Stroke Societies Endorsing the ANGELS Initiative**

#### **THE ACUTE NETWORKS STRIVING FOR EXCELLENCE IN STROKE (ANGELS)**

The Acute Networks Striving for Excellence in Stroke (ANGELS) initiative ([www.angels-initiative.com](http://www.angels-initiative.com)) provides national stroke societies and stroke teams with the tools, resources, and support they require to develop and optimize stroke care. Boehringer Ingelheim established the initiative in 2015 in collaboration with international stroke experts to develop acute stroke care centers and increase the provision of care based on ESO Guidelines. It is officially endorsed by 2 leading global stroke organizations, the ESO and the World Stroke Organization (WSO), as well as numerous national stroke societies (Table 2).<sup>25</sup>

Physicians and stroke centers register with the ANGELS initiative and receive support to develop their stroke units. This includes a dedicated ANGELS' consultant, a startup kit to reduce complexity, access to the ANGELS academy for targeted education on treating stroke patients, and membership in the ANGELS community, a place for sharing, motivation, and support.

ANGELS works with the hospital to provide feedback on current protocols and stroke care, then recommends changes, ranking them by priority. Figure 5 depicts the type of analytics provided.

The program is a partnership: The ESO provides guidance and invites centers to join a quality improvement program based on their stroke registry data; experts in each country provide leadership; the ANGELS provide consultancy and facilitate education; and the steering committee provides overall coordination.

The ESO will establish an award system based on its stroke unit guidelines.

#### **ESO-EAST**

The ESO recently developed another initiative, ESO-EAST (<http://eso-stroke.org/eso-east/>) to improve and optimize stroke management in central and Eastern Europe. The group began in the spring of 2015 by bringing together national leaders in stroke care from several countries to identify gaps in care.

The team identified several challenges, including differences in baseline levels of stroke care between countries. For instance, some countries, like the Czech Republic, have very robust stroke systems, while others do not even have access to CT scanners.<sup>26</sup> Data from the SITS registry also shows wide differences in reporting rates of thrombolysis, either due to lack of access of thrombolysis or lack of interest in collecting the data (Figure 6).

There are also differences in healthcare systems, available resources, and motivations between countries. In addition, local politics and current governance of stroke care, ie, the role of professional societies, ministry advisors, and country and county leaders, adds another layer of complexity.

Thus, the first goal of ESO-EAST is to measure the current quality of care provided. Once this baseline data is available, the ESO, national professional organizations, physicians, and others will have a tool to evaluate quality of stroke care and identify disparities.

The project has many challenges, however. To move ESO-EAST forward, it is necessary to engage key opinion leaders and professional societies in each country; convince them of the utility of the program; develop a system of data collection, analysis, and presentation; market the program to individual hospital systems; and motivate stakeholders to participate.

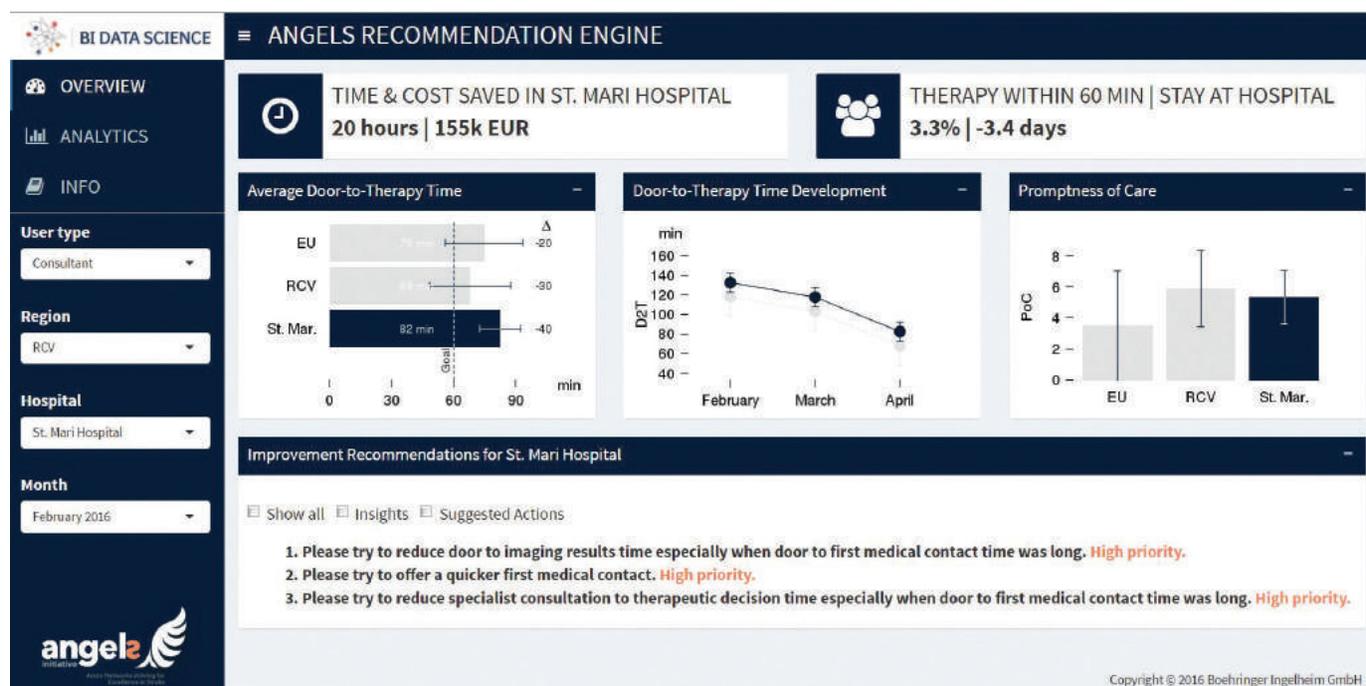


Figure 5. Analytics to improve door-to-therapy



Figure 6. Thrombolysis in SITS from Eastern European countries: 2003-2016

Source: SITS Registry. <https://sitsinternational.org>

**IMPROVING NURSING CARE**

One of the first ESO-EAST initiatives is to improve the quality of nursing care provided to stroke patients. Current guidelines recommend that stroke units have specialized nursing dedicated to stroke patient care and receive formal training.<sup>9</sup> A scientific statement from the AHA also highlights the importance of the role of the nurse in providing the optimal management of stroke patients.<sup>27</sup> Key responsibilities of nurses are shown in Table 3.

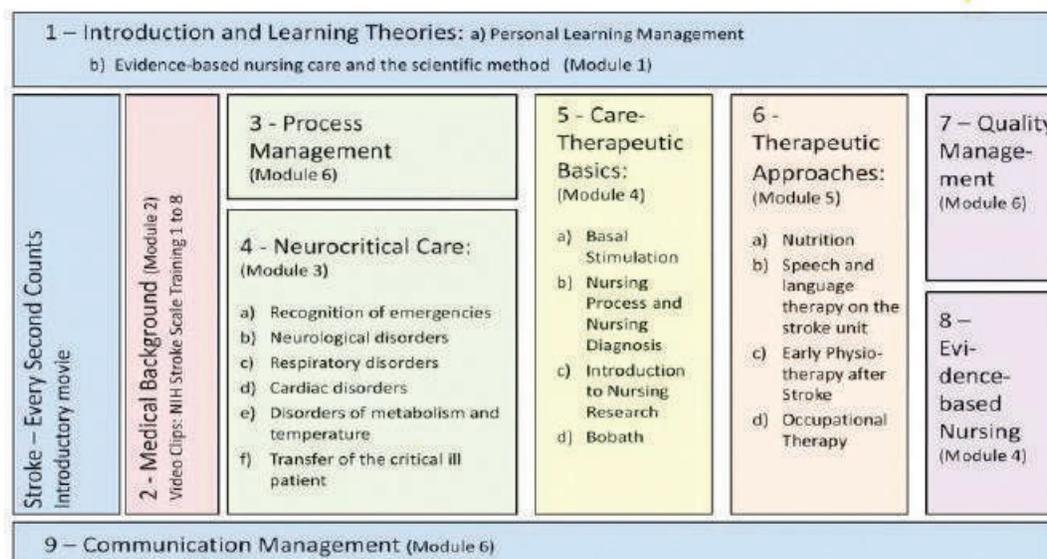
To improve nursing care in the eastern countries in the EU, ESO-East created a nurse education project using an

already developed online model from the German Society of Stroke. Figure 7 depicts the components of “Stroke Nurse.” The program was piloted with 20 participants (14 nurses, 5 physicians, and 1 physical therapist) from 17 institutions in 12 ESO-East countries. It kicked off with a 3-day workshop in Kiev in March 2016.

The course covered numerous topics, including therapeutic concepts in stroke management, organizational aspects in stroke care, and the role of nursing care on stroke units. In addition, participants discussed challenges in providing stroke care in low-income countries.

- Provide communication, assessment and monitoring
- Detect and report problems including blood pressure changes, neurological deterioration, fever, hypoxia, cardiac arrhythmia, hypoglycemia, bleeding, cerebral edema, hyperglycemia, dehydration, deep vein thrombosis, seizure, delirium, pain, infections, and risk of falling.
- Provide oral hygiene and skin care to prevent pressure sores
- Monitor nutritional intake
- Monitor medication side effects
- Provide bowel and bladder care
- Enhance sleep and comfort
- Ensure and participate in early rehabilitation (ROM etc.)
- Provide patient and family education

**Table 3. Key components of stroke-related nursing care<sup>9</sup>**



**Figure 7. “Stroke Nurse” modules**

**THE REGISTRY OF STROKE CARE QUALITY (RES-Q)**

The Registry of Stroke Care Quality (RES-Q) is the most important project within ESO EAST. It is a prospective, multi-national, registry-based study designed to document the quality of stroke care and the ability of evidence-based care to remove disparities in stroke care at the country

and hospital level, and to improve morbidity and mortality outcomes.

Its goal is to provide physicians, managers, professional societies, insurance companies, ministries of health, the European Commission, and other policymakers with a tool that informs them about unmet needs stroke care in their regions and the need for evidence-based practices. It

will identify country-specific and hospital-specific targets and set baselines for interventions to improve stroke care quality. These interventions may differ between countries given different resources.

Measurements include the availability of stroke units, brain imaging, vascular imaging, cardiac arrhythmia detection, thrombolytic therapy, prevention of complications, secondary prevention, and other factors. All have significant evidence supporting their use and have been shown to improve short- and long-term outcomes.

## CONCLUSION

Although the overall mortality rate from stroke has declined in the EU in the past decade, the disparity between mortality rates within the EU suggests the need for significant quality improvement. Indeed, a substantial number of stroke-related deaths could be avoided if patients received evidence-based care.

The use of data-focused continuous quality improvement approaches can improve the quality of stroke care delivery and outcomes. However, the use of such methods in the EU are mixed. In addition, there are several registries currently in use throughout the continent, which makes benchmarking quality indicators throughout the EU difficult.

Several initiatives, however, including ESO and its ESO-EAST and ANGELS initiatives, have the potential to improve the delivery of evidence-based stroke care and preventive approaches. Yet these efforts face numerous challenges, ranging from the availability of resources within and between countries to political and organizational barriers.

Overcoming these barriers requires that representatives of the various countries learn to work together towards the common goal of reducing strokes and improving outcomes.

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