# The ANGELS Initiative: More and better Stroke-ready hospitals across the globe

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**A B S T R A C T**

Established by Boehringer Ingelheim in 2015, in collaboration with international stroke experts and the European Stroke Organisation (ESO), the **A**cute **N**etworks Strivin**G** for **E**xce**L**lence in **S**troke (ANGELS) project has had a major impact on expanding available treatment for acute stroke patients and improving outcomes in Europe. The principal objective of ANGELS is to increase the number of acute stroke patients treated in stroke units and to optimize the quality of treatment by providing stroke teams with the tools, training and support they need for hospitals to attain accredited stroke-ready status. The ANGELS initiative also seeks to optimize stroke networks between individual hospitals and countries. ANGELS-led interventions in European countries have resulted in a significant reduction in door-to-needle times (DNTs), and other delays that impede rapid and most appropriate treatment. The ANGELS project has encouraged expansion of European stroke patient registries, use of standardized best-practice treatment protocols, and increased reporting of outcomes at the level of individual stroke centres.

In many parts of the world, the availability of acute stroke treatments continues to be limited or non-existent. Stroke patient assessments are often not consistent or guideline-compliant, and effective treatments such as thrombolysis and mechanical thrombectomy cannot be accessed. In contrast, in Europe and the USA, acute stroke treatment has moved from an era of no or limited treatments, to the use of some of the most effective treatments and interventions available in medicine. This report summarizes the important progress and some of the measurable successes that are being made through the adoption of the ANGELS initiative in non-European countries. The ANGELS project model, with some appropriate language and local country cultural adaptions, is making significant improvements in the extent and quality of acute stroke treatments. Objective measurable successes include: reduced hospital transfer times, increased i.v. thrombolysis rate, reduced DNT, compilation of stroke registry data, and increased public awareness of the signs and symptoms of acute stroke.

**Key words:** acute stroke, ANGELS initiative, stroke-ready hospitals, thrombolysis

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## INTRODUCTION

The ANGELS initiative was established and launched in 2015 by Boehringer Ingelheim, under the collective guidance of the European Stroke Organization (ESO) and international opinion-leading stroke experts who have formed the ANGELS Steering Committee. The ANGELS acronym stands for: The **A**cute **N**etworks strivin**G** for **E**xce**L**lence in **S**troke. The ANGELS initiative is a non-promotional, international collaborative project; it is endorsed by the World Stroke Organization (WSO), ESO, and a growing number of national stroke societies and patient organisations e.g. the Stroke Alliance for Europe (SAFE). The ANGELS initiative is collaborating with and supported by companies including Medtronic and Brainomics, who contribute value for patients via evidence-based treatments and diagnostic tools. The focus, scope, and priorities of ANGELS-led projects are shaped by the steering committee and driven by ESO and American Heart Association/American Stroke Association (AHA/ASA) guidelines. The principal objective of the ANGELS initiative is to increase the numbers of patients treated successfully in stroke-ready hospitals, and to optimize the quality of treatment in all existing stroke centres.

The two main problems faced by physicians and healthcare professionals treating patients with acute stroke are complexity and time. The disease is complex and the available time for effective intervention is very limited. In Europe, every 30 minutes, a stroke patient who could have been saved, dies or is left permanently disabled, not just because of the stroke, but because he or she was treated in the wrong hospital. Only one-third of stroke patients in Europe have access to organized stroke care, while just one per cent of stroke patients in developing countries are provided with life-saving treatments. The ANGELS initiative aims to improve the treatment of acute ischaemic stroke by providing stroke teams with the tools, resources, and support, based on evidence-based guidelines, needed to set up and to optimize stroke networks and establish more stroke-ready hospitals.

## BACKGROUND

Stroke is the second biggest cause of death worldwide. WHO data indicate over 6 million individuals died as a result of stroke in 2015. The global disease burden imposed by stroke continues to increase in terms of the absolute number of people affected, or who remain disabled, in both men and women of all ages. There are significant geographical differences in the stroke burden across the world, with the majority of the burden borne by low and middle-income countries. Despite the devastating impact and consequences of stroke, until recently, its treatment has not been a top priority for healthcare authorities. Unfortunately, this continues to be the case in some regions of the world. In many countries, the availability of emergency ambulance services, stroke-ready hospitals, interventional neurologists, neuroimaging facilities, and effective treatments for acute stroke are still very limited. Furthermore, the implementation of evidence-based treatments for acute stroke is not universally consistent within and across different countries.

Stroke is placing an increasingly heavy socioeconomic burden on the world's populations. The global prevalence of stroke is likely to continue to rise significantly, leading to spiralling healthcare costs, and associated rising indirect costs such as lost productivity due to absenteeism from the workplace. It is increasingly evident that stringent measures to reduce the major risk factors for stroke, increase prevention, and provide effective treatments need to be introduced and co-ordinated on an international scale. The ANGELS project vision is for stroke patients to receive the same consistent level of treatment wherever they live, in order to prevent disability and death. To achieve this, we need to increase the number of stroke-ready hospitals and we need to optimize the quality of treatment in all existing stroke centres.

## OVERVIEW OF THE ANGELS PROJECT MODEL

The ANGELS initiative has been established based on six key founding principles or platforms:

### *Dedicated consultancy*

ANGELS consultants are highly trained, dedicated, non-promotional project management professionals. Their role is to encourage and recruit hospitals to participate in a programme of activities that will lead to an accredited and recognized stroke-ready status for each hospital. Typically, this may involve the consolidation of emergency ambulance services, accident and emergency physicians, nurses, radiologists, and neurologists into an integrated, functional, multidisciplinary acute stroke response team. Initial audits provide a starting point for identifying areas where improvements in acute stroke care can be made in the hospital. ANGELS consultants will establish whether treatment protocols reflecting current evidence-based guidelines and stroke care recommendations are in place, and what treatment options are available. Audits will also identify how patients are hospitalized, assessed and diagnosed, how treatment is decided, timed, and administered, and how patients' outcomes recorded. ANGELS consultants will record the presence or absence of any in-hospital key performance indicators (KPIs) or metrics used to define the effectiveness of the hospital's work-flow processes, and what post-treatment follow-up procedures may be in place for their stroke patients. Detailed review and gap analysis of these audit findings in ANGELS-led workshops and meetings identifies problem areas where hospitals can make improvements in their care and treatment of acute stroke patients.

### *Education and training*

Leading comprehensive acute stroke treatment centres, with a reputation for clinical excellence and successful outcomes, provide the starting point for ANGELS education and training programmes. These centres have successfully minimized delays in patient hospital transfer, and have optimized their guideline-compliant in-hospital work-flows and treatment protocols. Consequently, these leading centres provide a template *par excellence* for adoption in hospitals seeking to improve their acute stroke care. Accordingly, the primary aim of the ANGELS acute stroke educational programmes, and training materials, is to facilitate the transfer of skills and knowledge, and the successful work-flow *modus operandi*, honed by leading stroke centres, to those hospitals seeking to achieve stroke-ready status. The ANGELS acute stroke training programme is experiential, multimodal, and heavily simulation based. Video footage of a highly trained, experienced acute stroke response team, from a leading stroke centre, performing well-practiced, streamlined, and precisely timed in-hospital workflow sequences, provides a benchmark point of reference. Against this, aspiring hospitals can compare their own performance and in-hospital process optimization, in-practice simulations, and in real life hospital practice.

### *Standardization*

Standardization of patient assessment parameters, in-hospital work-flow procedures, performance indicators, timings, and collected patient data is important because it reduces variation in clinical stroke assessment and treatment processes. In addition, standardization allows comparisons to be made between patients, between hospitals, and between regions and countries. The ANGELS initiative provides and encourages the implementation of standardized check lists, with a focus on NIHSS assessments and contraindications for i.v. thrombolysis, to help ensure consistency in the quality of care provided to hospitalized acute stroke patients. The ANGELS stroke bag allows stroke teams to carry all the medication, tools and checklists needed to treat acute stroke patients in the CT imaging room. Inclusion of a glucometer and an international normalised ratio (INR) point of care device ensures the coagulation and blood glucose status of all stroke patients can be immediately ascertained, and these measurements routinely incorporated at initial assessment.

### *Building the stroke community*

The ANGELS project aims to build a community stroke centres and stroke-ready hospitals across the globe. Expansion of the stroke network community is providing a platform for peer-to-peer exchange and access to the world's leading stroke specialists. The ANGELS project is intended to act as a common denominator across all participating hospitals, fostering a sense of community and belonging, and providing the motivation and positive mind-set required for change and improvements in the delivery of acute stroke care. A "top-down" approach to establishing the ANGELS initiative in each new country or region is followed. This begins with a partnering process with leading stroke experts in established stroke centres and the formation of a steering committee, to develop a national strategy, and to oversee and guide the introduction and maintenance of ANGELS-led activities in participating hospitals.

### *Quality Monitoring and benchmarking*

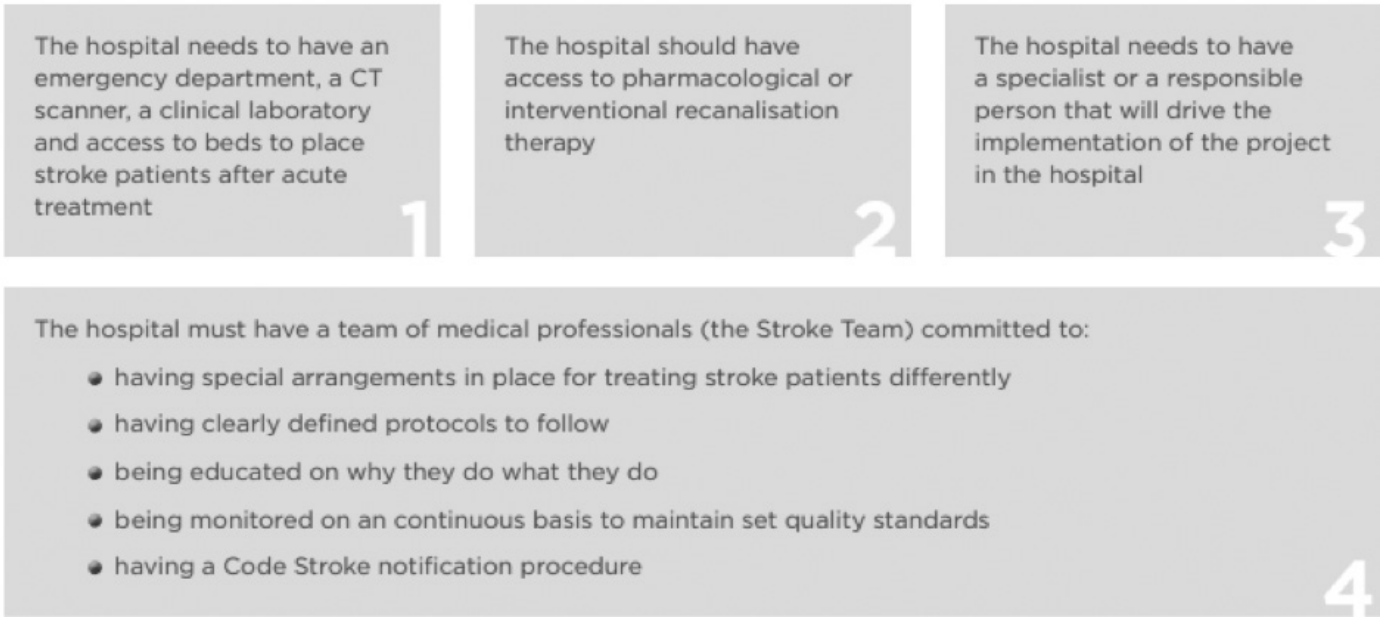
Change can only be measured if the project starting position is known and has been clearly defined. Consequently, establishing a culture of in-hospital continuous quality monitoring is an ANGELS imperative. Consistently recorded patient records, assessments, timings, and metrics are essential if progress is to be made and measured objectively. The ANGELS project provides an array of forms, calendar format wall posters, and spreadsheet templates to participating hospitals for capturing all their salient stroke patient data.

All hospitals recruited into the ANGELS initiative are strongly encouraged to contribute their data to approved stroke patient registries. By doing so, individual hospitals will be able to compare their performance with other participating centres. Two approved national registries are incorporating and collating patient data from hospitals participating in the ANGELS project. The SITS (Safe Implementation in the Treatment of Stroke) registry is a well-established leading repository of high quality stroke data. More recently, the RES-Q registry (Registry of Stroke Care Quality) was launched in November of 2016. As at the beginning of October 2018, there are now 500 participating hospitals, in 50 countries, which have contributed data for more than 50,000 patients. Registry data, because it allows identification of those hospitals showing the greatest degree of improvement, as illustrated by e.g. thrombolysis and thrombectomy rates, door-to-needle (DTN) time, extent of dysphagia and AF screening, provides a quantitative and objective basis for the ESO-ANGELS awards. This award system has been adopted recently by the Ibero-American Stroke Society for Stroke-ready Hospitals in South America, and the WSO ANGELS Award will be launched in 2019 for all hospitals across the world.

### *ESO/ANGELS Acknowledgment of achievement and awards*

The ESO ANGELS Awards are based on the submission of performance data based on ESO quality measures from participating centres. Based on these different measures, individual hospitals are recognized as stroke-ready, and with demonstrable increasing expertise, awarded Gold, Platinum, or Diamond status. This certification process provides an objective assessment of clinical excellence, and by reducing variation in the hospital's work-flow processes, the overall quality of stroke patient care will be improved. The ESO-ANGELS award also provides an important benchmark for assessment of the quality of stroke management. This recognition of achievement may also be a motivational factor for those hospitals seeking to improve the standard of their acute stroke care. The eligibility criteria for registration of a hospital as stroke-ready, the entry tier level for the awards, are summarized in the following table.




**ESO/ANGELS eligibility criteria for stroke-ready certification**

## OUTCOMES AND IMPACTS

As a result of hospital recruitment and participation in the ANGELS initiative, rapid, significant, and objectively measurable improvements in acute stroke care performance parameters have been achieved. The ANGELS initiative, initially established in European countries in collaborative partnership with the ESO, is now a global force for change and improvement in the extent and quality of acute stroke management and care. Examples of recent outcomes and impacts achieved by the ANGELS initiative in non-European countries are summarized in the following sections.

### *India*

The Angels Initiative was launched in mid-August 2017 in India. Within the first three months, 94 hospital centres had been recruited for participation within the initiative. It quickly became apparent, that for acute stroke patients, quality monitoring and performance data were not being consistently reported and monitored in many hospitals. During the initial three months, 54 in-hospital procedural simulation exercises were conducted with the designated stroke teams, in the participating hospitals, with increased emphasis on the use of consistent work flow protocols, check lists, and recorded procedural timings to allow important performance statistics e.g. door-to-needle (DTN) time to be measured and recorded. Analyses of the simulation exercises has identified important areas where crucial time savings can be gained. In seven centres where the second simulation was conducted post-adoption of the ANGELs checklists and the stroke kit, an average reduction of 10 minutes in the DTN times has been observed compared with baseline (baseline mean DTN: 43 mins; second simulation mean DTN: 33 minutes). The reduction in DTN in these hospitals was brought about by simple measures, including: immediate transfer of the patient to the imaging room for an early CT scan, eliminating the step of changing the patients' clothes on admission, and initiating thrombolysis in the CT scan room itself.

As at February 2018, the ANGELS initiative has been established in 35 cities in 11 states in India. A total of 127 hospitals have been enrolled; of these, observation and procedural assessments have been completed in 105, and in-hospital simulation procedures have been conducted in 65 hospitals. Simulation workshops have made use of the Body Interact software programme available on the ANGELS website (angels-initiative.com). For hospitals that have just started a stroke service, focussing only on reducing treatment delays is only one part of the training required. These hospitals often require much more in-depth training in performing initial assessments on acute stroke patients, including NIHSS, interpreting the CT image, and identifying important patient characteristics, or eligibility criteria, that need to be considered in treatment and stroke management decision making processes. The different case scenarios in the Body Interact programme allows stroke teams and clinicians to challenge themselves, build confidence, and develop patient evaluation skills and improved decision making in a safe virtual environment.

The hospital nurse is often the first healthcare professional that a patient suffering an acute stroke sees. Hence, a key focus of the ANGELS initiative, in India, is the provision of dedicated stroke training for nurses. As at February 2018, stroke training for nurses with a focus on the importance of reducing fever, dysphagia screening, and glucose control, leading to ANGELS certification has been completed at 47 participating hospitals in India.

***Mexico***

The ANGELS Initiative was launched in Mexico in June 2017 with four Angels consultants connecting with stroke treatment teams in both public and private hospitals. Stroke is the biggest cause of disability in Mexico, and a leading cause of mortality; however, effective treatment for stroke patients is limited due to several factors. Significant delays in hospitalization are evident; public awareness of stroke symptoms is low, and only 17% of patients with an acute stroke arrive at hospital within three hours. Approximately 90% of stroke patients arrive at the hospital independently. There are limited resources and infrastructure; CT scanning is not widely available. Only 189 public and 132 private hospitals in Mexico have CT scanning facilities. No standardization in acute stroke treatment protocols and work flow processes exists, and there are no well-established comprehensive stroke centres in Mexico. Data are limited, but the 2010 PREMIER study estimated the national thrombolysis rate is <1%.

By the end of 2017, 71 hospitals were enrolled into the ANGELS project. Phase I ANGELS activities based on baseline assessment, observation and comparison of actual practice versus evidence-based acute stroke guidelines, and initial simulation training exercises, were conducted in these hospitals. Analysis of the hospitals' performance and work flow efficiency led to finalization of Phase 2 action plans in 53 (75%) of these hospitals. Phase 2 activities are tailored to the needs of individual hospitals and include: identification of areas for improvement, secondary simulation exercises to allow progress monitoring, implementation of standardized protocols, quality monitoring, and further training exercises until stroke-ready hospital certification performance criteria have been met. The content and scope of ANGELS continuing medical education (CME) training, in acute stroke, implemented in Mexico is summarized in the following table.

| | |
|---|---|
| *Stroke basics*<br>• Epidemiology (National and worldwide)<br>• Risk factors and stroke types<br>• Primary prevention. | *Acute stroke management*<br>• Transient ischaemic attack<br>• Thrombolysis treatment; Indications, contraindications, doses, and treatment preparation<br>• Endovascular therapy -thrombectomy<br>• Complications. |
| *Diagnosis*<br>• Pre-hospital stroke scales (Cincinnati, FAST)<br>• NIHSS<br>• Glasgow Coma Scale. | *Secondary prevention*<br>• Antiplatelet, statins, anticoagulation, endartectomy<br>• Life style changes. |
| *Neuroimaging*<br>• Basic neuroanatomy<br>• CT, Perfusion CT, Angio CT, ASPECTS<br>• Angio MRI and Perfusion MRI. | *Rehabilitation*<br>• Types and when to initiate<br>• Training. |

*Examples of ANGELS impact in participating hospitals*

Despite the challenging environment and limited resources available for treating patients with acute stroke in many Mexican hospitals, the ANGELS project is making a difference in improving the quality of stroke care and the efficiency of delivering this care. Examples of notable individual hospital achievements are summarized in the following table.

| | |
|---|---|
| ***PEMEX Norte Hospital***<br>✓ Written stroke protocol implemented and regularly reviewed<br>✓ DTN time reduced from 26 to 7 minutes<br>✓ 50 stroke patients treated in 2017<br>✓ 4 patients in time window for tPA; 4 successful thrombolysis interventions conducted without complications.<br>✓ June 2018: First Thrombectomy procedure<br>✓ July 2018: Primary Stroke Centre Certification. | ***Angeles Lindavista Hospital***<br>✓ Written stroke protocol implemented<br>✓ DTN time of 15 minutes achieved<br>✓ 2018: Joint Commission Certification and ANGELS Primary Stroke Centre Certification |
| ***Irapuato General Hospital***<br>No previous thrombolyis experience but training undertaken<br>✓ DTN time of 30 minutes achieved<br>✓ YTD 2018: 3/3 patients in window successfully thrombolysed<br>✓ Now recognized as a pre-hospital stroke training centre<br>✓ Now recognized as referral stroke hospital centre for CT Scanner / Treatment | ***La Raza General Hospital***<br>✓ tPA treatment made available (alteplase)<br>✓ Door to MRI time: 25 minutes<br>✓ DTN time of 30 minutes achieved<br>✓ First thrombolysis reduced patient's NIHSS score from 10 to 1<br>✓ Now 4/4 patients successfully thrombolysed with no complications.<br>✓ Now recognized as a referral centre for acute stroke patients. |

YTD = year to date; DTN = Door-to-needle time; tPA = tissue plasminogen activator; MRI = Magnetic resonance imaging.

*Digital tools for stroke physicians, patients and the general public*

To support stroke physicians' treatment and management decisions, the ANGELS team in Mexico have developed the Trombolyse mobile phone app. This allows patient data to be entered for progress tracking, quality monitoring, and follow-up. The app includes a wealth of information including an index of stroke assessment scales to aid diagnosis. The user can use the app to invite physicians in other hospitals to share the information, comment, and offer suggestions. This app is helping to generate a more connected stroke community between different hospitals. As at end of February 2018, 135 hospitals have registered for Tombolyse and a user community of 450 stroke team members from these hospitals has already been established. Training of dispatchers and ambulance responders to stroke 9-1-1 calls is a recent government initiative and ANGELS, together with the Mexican Stroke Association, will be heavily involved in the provision of this training in 2018/19.

***Middle-East, Turkey and Africa (META region)***

The ANGELS META region comprises a group of 69 countries each characterized by different healthcare systems, where approximately 3.2 million individuals become stroke patients annually. Stroke treatment is not a healthcare priority in most of these countries; this is reflected in an estimated overall thrombolysis rate of approximately 0.1% across the region. Currently, ANGELS activities are focussed on seven countries: Egypt, Turkey, Saudi Arabia, GCC (Gulf Co-operation Council) countries, Iran, South Africa and Algeria. In each of these countries the ANGELS project is endorsed by its Ministry of Health and the leading national neurological/stroke society for the country. Key 2017 milestones have been the formation of the ANGELS Steering Committee for the META region, and the formation of the META Stroke Academy. This organization provides a platform for neurologists and cardiologists to convene, take part in structured workshops, and take of stock of emerging insights and developments in acute stroke.

Initial ANGELS activities, at the individual hospital level, were concentrated on capturing baseline data so that quantitative (number of patients, target versus actual thrombolysis rate, DTN timing) and qualitative improvements (KPIs, stroke protocol in place, availability of a code stroke team, stroke beds) at individual hospitals could be tracked. Initially, this was a laborious collection procedure with monthly templates filled by hand for each participating hospital, but data input has now been automated to give a data-locked, monthly, "ANGELS dashboard view" of where each participating hospital is on the journey to achieve stroke-ready status and beyond.

During the 2015-2016 period, the ANGELS strategy was to establish at least one stroke treatment centre of excellence in each of the seven key META countries, and during the period 2016-2017, encourage a cascade of this expertise to other hospital centres. In total, during 2016-2017 period, 391 hospitals were recruited within the seven countries. The quantitative progress and achievements recorded over the period 2015-2017, in those META region hospitals participating in the ANGELS project, are summarized in the following table.

| | 2015 | 2016 | 2017 |
|---|---|---|---|
| **Centres** | **3** Centres of Excellence | **19** Centres of Excellence | **35** Centres of excellence |
| | **5** Centres contributing to SITS registry | **7** Centres contributing to SITS registry | **25** Centres contributing to SITS registry |
| | **< 20** Centres conducting thrombolysis | **198** Centres conducting thrombolysis | **305** Centres conducting thrombolysis |
| Stroke patients hospitalized | **1,411** | **3,988** | **10,192** |
| Thrombolysis rate: | **1.5%** | **4%** | **6.5%*** |

* Growth rate of 158% compared with previous year.

Current ANGELS targets are to increase recruitment to 723 hospitals in the META region by 2019, and to ensure all participating hospitals contribute their patient data to either the RES-Q or SITS -QR stroke registries. Progress achieved by the ANGELS initiative in some individual META region countries has been both rapid and encouraging. Some of the important developments in individual META region countries are provided in the following sections.

*Turkey*

Historically, the expectations of physicians in Turkey regarding the ability to treat acute stroke successfully has been low. Stroke management in Turkey has been hampered by a lack of guidelines and regulation. As an initial step, the ANGELS team collaborated with the Turkish Neurological Society to form the Turkish National Stroke Board. On October 25 2017, a delegation from the Stroke Board presented the case for stroke treatment to receive much higher priority to the Ministry of Health to enable the expansion and improvement of acute stroke services in Turkey. Other recent initiatives include the ANGELS-supported formation of The Annual Summit of Thrombolysis and Neurovascularization. The first 2017 meeting attracted 300 neurological participants. Thrombolysis was a major topic at this meeting and the adoption of the SITS stroke registry was recommended and accepted. Subsequently, the Turkish Neurological Society has published its Stroke Treatment Clinical Quality Guide and i.v. tPA usage Guide.

In response to an ANGELS request, the Turkish Neurological Society has established supervised thrombolytic training for selected physicians at five comprehensive centres. Following this training, participant physicians can apply for approval to perform 10 tele-assisted thrombolyis procedures at their own hospitals. Successful completion of these procedures results in certified accreditation by the society. During 2017, 15 neurologists received this training and 25 are due to complete training in 2018.

*South Africa*

The ANGELS Initiative was launched in South Africa in November 2016 with the formation of an ANGELS Steering Committee involving the country's leading stroke specialists. This now meets regularly to review all ANGELS plans and activities. To involve and build the stroke community in South Africa, ANGELS have initiated an annual ANGELS conference with participants from public and private hospital sectors. Validated well-documented stroke patient data in South Africa are scarce. To generate and publish data, ANGELS are collaborating with Witwaterstrand University Hospital in Gauteng Province. A pilot, prospective, multicentre, cohort study to evaluate and record standardized stroke care, based on the ANGELS processes and materials, has now been started.

Local stroke unit accreditation by the South African Stroke Society is due to commence in 2018, and the ANGELS target is to have 150 stroke-ready hospitals operational by the end of 2018. ANGELS-led simulation exercises have proven to be the quickest and most effective way to improve an individual hospital's stroke treatment processes in South Africa. In recognition of this, private sector hospital organizations in South Africa generally request their management teams to run at least two ANGELS-led simulations as a key performance indicator for individual hospitals.

Recent public stroke awareness campaigns in South Africa have been accompanied by highly visible ANGELS branding on local transport mini-bus taxis. In addition to promoting the F.A.S.T message, blood-pressure and blood glucose checks were provided at the taxi ranks, and the public were informed of where individuals with suspected stroke symptoms should be urgently dispatched to.

*Egypt*

Until recently, stroke treatment in Egypt has been severely curtailed due to the lack of effective treatments, notably i.v. thrombolysis. In 2015, only five hospitals were performing thrombolysis on stroke patients in Egypt. Following ANGELS recruitment, in 2016, 25 hospitals were thrombolysing patients. Government support and intervention provided a significant breakthrough in 2016: The Ministry of Health announced the formation of a National Steering Committee and partnership with ANGELS to implement stroke management across the country. State funded thrombolytic treatment (alteplase) was made available to public hospitals, and the SITS stroke registry was adopted as the national stroke registry for Egypt. At the end of 2017, 44 hospitals were thrombolysing stroke patients. Over 1,000 stroke patients were hospitalized over a 12-month period and the average thrombolyis rate is now approximately 3%.

The Ministry of Health has announced that 50 stroke centres will be opened in ministry hospitals in 2018, and all new hospitals built in Egypt will now include a stroke unit. ANGELS protocols and checklists, translated into Arabic, will provide standardization and introduce quality monitoring of the stroke care delivered in these hospitals.

### *South East Asia and South Korea (SEASK region)*

An ANGELS Steering Committee under the initial direction of prof Dr Werner Hacke has been established. ANGELS-led activities are now underway in this region following the launch of ANGELS in SEASK on 4th March 2017. As at June 2018, a total of 422 hospitals have been enrolled. Currently, there are no stroke registry data available in this region. Therefore, a key focus of the ANGELS Initiative in SEASK is to collate stroke patient data through the processes of quality data monitoring, and the standardization of protocols, procedures and recording of outcomes. The resulting data can then be included in stroke registries and used to monitor performance at an individual hospital, local region, country, or overall SEASK regional level.

## CONCLUSIONS AND LESSONS LEARNED

### *The ANGELS project model: applicability outside Europe*

The ANGELS initiative was established by Boehringer Ingelheim under the auspices and guidance of the European Stroke Association (ESO). The motivation for this project was to increase the number of stroke-ready hospitals in Europe, and to improve both the availability and standard of care and treatments for acute stroke patients. The success of the ANGELS project in Europe has fostered a realisation that the ANGELS project model is broadly applicable and transferable internationally to countries outside Europe. Some flexibility to accommodate country-specific cultural sensitivities may be necessary, and there may be language barriers to overcome; however, the process of hospitals adapting to standardized treatment processes, based on best-practice evidence-based guidelines, is essentially the same in all countries. The challenges faced by hospitals in low-to-middle income countries seeking to improve their standard of acute care, are usually common across countries, and solutions that can be made to work in one country, can be adapted for success in others. Key factors for success in establishing ANGELS as a global initiative are summarised in the following sections.

### *The importance of the in-hospital ANGELS project champion*

Initial approaches by ANGELS consultants to some hospitals were met with scepticism. The achievements and impact of ANGELS interventions in Europe are often not seen to be applicable locally by hospital physicians in low income countries. Progress has been made when ANGELS consultants have convinced physicians interested in improving the quality of acute stroke care in their hospital of the merits of the ANGELS initiative. In particular, the implementation of evidence-based protocols, standardization, and commitment to recording metrics data and continuous quality monitoring. When the positive impact of consistently applied, often relatively small changes become evident, this generates the enthusiasm and motivation to drive change within the hospital. The ANGELS initiative therefore relies on physicians and co-workers to act as project champions in their hospital. Project impetus then builds when ANGELS project champions communicate their successes and growing confidence to their peers in other hospitals.

### *Barriers to success*

Achievement of stroke-ready hospital status relies on the availability of CT scanning facilities and effective acute stroke treatments i.e. i.v. thrombolysis and endovascular procedures such as mechanical thrombectomy. Where these barriers exist, governments need to be convinced of the long-term savings in stroke-related healthcare costs that can be realised by preventing disability with early, effective intervention in acute stroke. The ANGELS initiative has an important role in providing publicity and helping to make the case for investment in hospital stroke facilities, achieving reimbursement, and encouraging the availability of thrombolytic treatments on national formularies. The growing volume of stroke registry patient data, encouraged by the ANGELS initiative, provides outcome data that can utilized to make these arguments. It is vitally important to feedback the success of ANGELS interventions to governments and their health ministers, to encourage investment in well-resourced, effective acute stroke management facilities.

### *Transferring skills, developing expertise, building confidence*

The ANGELS overall approach is to look to best-practice examples of acute stroke management in world-leading comprehensive stroke centres and encourage developing hospitals seeking stroke-ready certification to adopt, as closely as they can, these proven protocols and strategies for success. Action plans for participating hospital centres are based on baseline performance gap analyses, to identify areas for improvement and any knowledge deficits or incomplete skill sets that can be addressed with specific training.

### *Persistency pays: one hospital at a time*

The ANGELS initiative is a long-term project, not a quick fix. In countries where stroke treatment is virtually unobtainable, the task of building a stroke treatment programme is both daunting and formidable. Making a start is the most important step. Even small changes, over time, can make a significant difference. The ANGELS project builds on initial successes. Achievements and success stories are recognised and held up as examples of what can be achieved, so other hospital teams can follow these examples, and, in the process, become part of an expanding and evolving stroke community.

### *Increasing public awareness*

Very little can be done for an individual having a stroke until they become a stroke patient. The process of becoming an acute stroke patient usually starts with a call to emergency services triggered by a concerned relative, companion, or member of the public. However, in many countries, public awareness of the signs and symptoms of stroke is low, and the urgent need for immediate medical attention is not universally recognized. As a result, patients arrive at hospital outside the time-window for effective treatment too often. The availability of improved in-hospital stroke treatment facilities is of limited benefit to the patient who cannot access them in time. The ANGELS project therefore has two parallel objectives: (1) to increase public awareness and recognition of stroke symptoms and generate emergency calls from the public without delay, and (2) to improve the quality and extent of in-hospital acute stroke care. Staggered solutions must be avoided. Because both challenges are inter-connected, both challenges need to be addressed in parallel and simultaneously. Accordingly, the ANGELS project approach is to co-ordinate solutions and problem solving driven by these parallel requirements.

## KEY MESSAGE

The ANGELS initiative has been successfully transferred to non-European countries and is being developed as a long-term global project. There is a growing body of evidence to demonstrate measurable success in establishing acute stroke hospital care and treatment facilities, based on standardization of best-practice protocols, in non-European countries where, previously, these resources were extremely limited or non-existent. The ANGELS initiative is making a difference, on an international basis, in improving and making available standardized best-practice care, and effective treatment, for a growing number of acute stroke patients.

## REFERENCES

Stevens E, Emmett E, Wang Y, McKevitt C, Wolfe C. The burden of stroke in Europe. Commissioned report, Stroke Alliance for Europe, May 2017.

Cantú-Brito C, Ruiz-Sandova JL, Murillo-Bonilla LM, et al. Acute care and one-year outcome of Mexican patients with first-ever acute ischaemic stroke: the PREMIER study. Rev Neurol 2010; 51 (11): 641-649.