Improving stroke care across the world: the ANGELS Initiative

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A B S T R A C T

Stroke is today one of the leading causes of death and, after dementia – often caused by a previous stroke - the 2nd leading cause of disability globally, and the burden of stroke is increasing. Early intervention is well established as a critical factor in successful patient treatment, management, and outcomes. Funded by Boehringer Ingelheim International GmbH, and endorsed by the European Stroke Organisation, the non-promotional ANGELS (Acute Networks Striving for Excellence in Stroke) Initiative has been the motivation and driving force for significant achievements by participating nations. This article presents examples of successful implementation of improved stroke care with the support and involvement of the ANGELS Initiative in numerous countries in different continents.

Key words: stroke 2020; quality; benchmarking; DNT; IV thrombolysis; thrombectomy

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INTRODUCTION

Every 30 minutes across Europe, a stroke patient who could have been saved either dies or is permanently disabled because he or she did not have access to a stroke-ready hospital. Outside of Europe, specifically in low and middle income countries, the situation is much worse. Within Europe, different patterns of stroke burden are evident with a rise in incidence in Eastern European countries. Stroke is now the 2nd leading cause of disability globally, and the age at first onset of symptoms appears to be decreasing with significant implications for patients of working age. The extent of national care differs across countries and treatments such as thrombolysis and thrombectomy are underused. In particular, stroke units which are known to benefit 100% of stroke patients are not used effectively. An action plan for stroke in Europe 2018-2030, organised by the European Stroke Organisation (ESO) and in collaboration with the Stroke Alliance For Europe (SAFE), the leading patient organisation in Europe, has been developed with the aim of treating ≥90% of patients in stroke units.[1] This action plan sets out to fully implement national strategies for multisector public health interventions to promote and facilitate a healthy lifestyle, and to reduce environmental, socioeconomic, and educational factors associated with an increase in the risk of stroke.

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Support for the implementation of change comes from the ANGELS Initiative, a non-promotional, pan-European healthcare initiative which aims to improve stroke care. The ANGELS Initiative is an alliance and officially endorsed by the World Stroke Organisation (WSO), the ESO, and by National Societies; the Initiative is fully embedded in the ESO Quality Improvement Project and provides support in implementing standards of treatment in stroke patients. ANGELS quality indicators have been instrumental in addressing quality monitoring of stroke treatment and hospitals that capture data in either the RES-Q or SITS Registries are eligible for an ESO ANGELS Award. These awards are based on ESO quality measures and recognise the contribution of a stroke centre in achieving improved stroke care (Figure 1).

	GOLD STATUS	PLATINUM STATUS	DIAMOND STATUS
Registration requirements	Registration criteria met	Registration criteria met	Registration criteria met
% of patients treated with door to recanalisation therapy time < 60 minutes	50%	75%	75%
% of patients treated with door to recanalisation therapy time < 45 minutes			50%
% recanalisation procedure rate out of total ischaemic stroke incidence in the hospital	5%	15%	25%
% of all suspected stroke patients undergoing CT or MRI imaging procedure	80%	85%	90%
% of all stroke patients undergoing dysphagia screen	80%	85%	90%
% of ischaemic stroke patients discharged with antiplatelets	80%	85%	90%
% of atrial fibrillation related stroke patients discharged with anticoagulants	80%	85%	90%
Stroke patients treated in a dedicated stroke unit or ICU during their hospital stay			Yes

Figure 1. The tier system denoting status eligibility and criteria for the ESO ANGELS Award.

In Q2/2018, 85 hospitals have been awarded at the ESOC Conference; 17 received the Diamond Award during the presidential session.

THE EGYPTIAN SCENARIO

In Egypt, stroke is now the 3rd most common cause of death, after heart and liver disease. In Upper Egypt, there are ≤250 000 cases each year, and at least 75% of patients will be left with a marked disability.[2,3] There are more cases of intracranial than extracranial atherosclerosis as a cause of stroke, similar to the pattern in Asia and Africa; a recent study found that 50% of patients had either intracranial occlusive disease or critical symptomatic stenosis.[4]

In 2015, an action plan was developed to overcome the obstacles in using thrombolysis. Delays in treatment were attributable to a lack of knowledge in patients and physicians regarding availability of acute stroke treatment. In-hospital delays and insufficient drug availability were also fundamental problems (Table 1).

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In-hospital delay	N=46	Percentage
Unavailability of the drug	26	56.5
The attending physician did not take proper action at the proper time	8	17.4
Delay during imaging and lab work	7	15.2
Unavailabilitiy of beds in the intermediate care unit	5	10.9

Table 1. Main causes of in-hospital delay contributing to the obstacles in using thrombosis

To improve stroke care a training programme for reperfusion therapies in ischaemic stroke was established, and funding was raised to make treatment available for all patients. Guidelines were established for the management of thrombolysis and thrombectomy. In a 6-month period from January-June 2016, 284 patients were admitted with acute ischaemic stroke, and almost 95% were treated within the critical timeframe (Table 2).[5] This is in stark contrast with a previous study (N = 269) before the guidelines were introduced, where only 13% of patients received the necessary treatment in time. The initiative led to the Ministry of Health approval in June 2016 of IV thrombolysis as a reimbursed treatment for all eligible patients.

	First study	Second study
Total number of admitted patients	269	284
Total number of eligible patients for acute treatment	53	37
Total number of patients who received acute treatment	7	35
Percent of total ischaemic stroke patients who received acute reperfusion treatment	2.7%	12.3%
Percent of eligible patients who received acute treatment	13.2%	94.6%

Table 2. Comparison between stroke patient numbers before and after corrective action plan

Between 2016 and 2017, the number of stroke patients treated increased from 586 to 1050 and further increased in 2018 to around 1200 patients (Table 3). The thrombolysis rate is now 4.5%, and there are 52 centres that provide thrombolysis, half of which are university hospitals and 10 are Ministry of Health centres.

No. of thrombolising centres, YTD	52
No. of patients thrombolised, 2018	1200
No. of patients thrombolised, 2016 to present	2836
TR%	4.5%

Table 3. Total numbers of patients undergoing thrombolysis in Egypt 2018, and to date.

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Two Centres of Excellence were established in 2017, and the success of the initiative resulted in two awards, a Diamond and Platinum ESO ANGELS Award, for Cairo University Hospitals and Ain Shams University Hospitals (Figure 2).

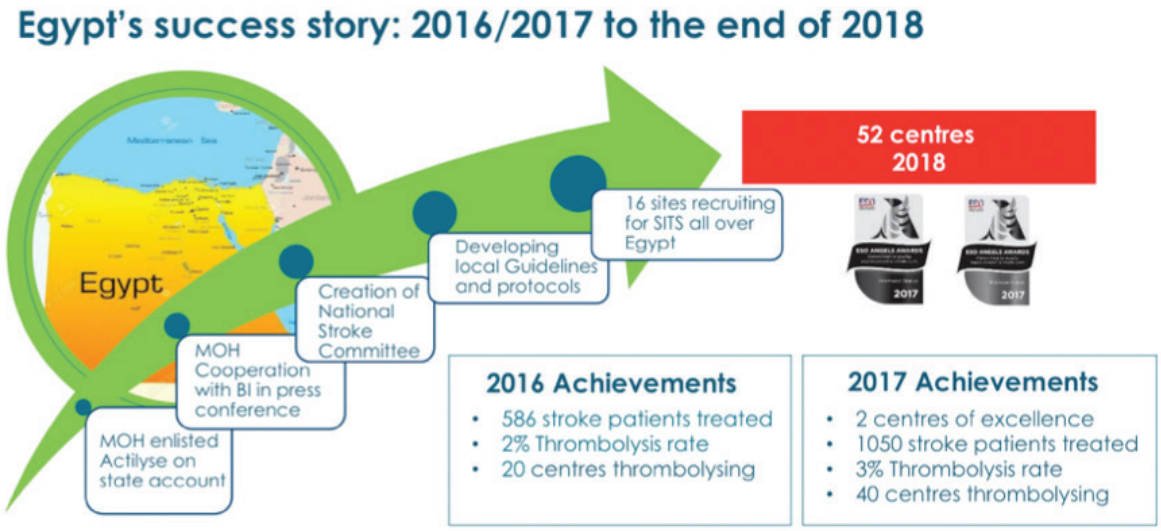

Figure 2. Achievements of Egypt as a participating nation in the ANGELS Initiative from 2016-2018.

THE CZECH SCENARIO

It is essential for everyone to follow clinical practice guidelines if we are to provide quality care management for patients with acute stroke.[6] High level monitoring of patients requires an in-depth knowledge of every patient and constant analysis of the data to determine how to improve. From the Czech perspective, team members should also be quality auditors and standards should be continually raised as soon as targets are met.

Czech Stroke Network

Before 2010, there was no central accreditation of stroke centres. With the help of the Czech government and EU structural funds, a system of stroke care has been established since 2010. Accreditation was provided by the Ministry of Health and Stroke Society, and of 80 centres that applied, 45 successfully met the criteria.

From 2013, quality improvement programmes were established using three datasets to provide evidence of current standards of stroke care (Figure 3). Admitted patients are monitored twice a year during March and October, and data recorded in the RES-Q registry. Data on all patients with recanalisation therapy (IV thrombolysis and/or thrombectomy) are continuously collected, in addition to annual data for all centres across 12 quality-of-care indicators. Before these measurements were established, less than 10% of the population were thrombolised. With compulsory triage in 2013, the rate began to increase, and in 2016 a population-based thrombolysis rate of 20% was achieved, with an additional 5% of all ischaemic stroke patients receiving thrombectomy.

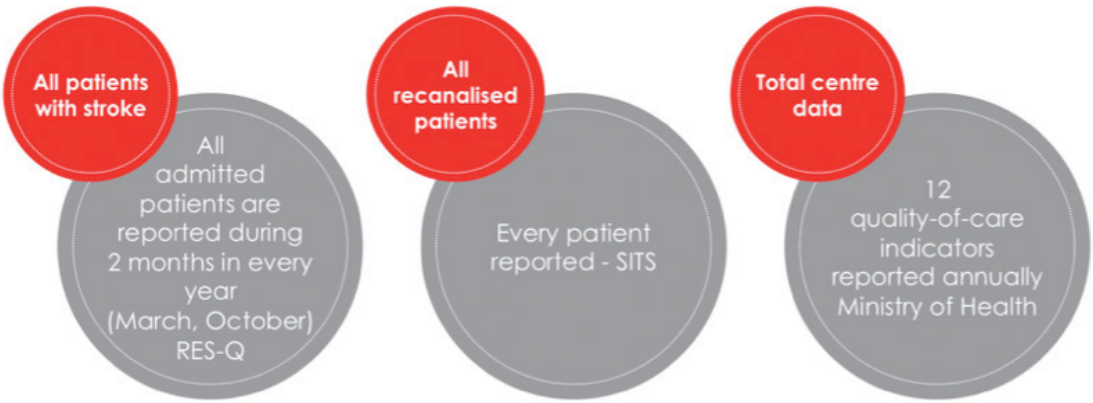

Figure 3. Sources of quality-monitoring data in the Czech Republic since 2013.

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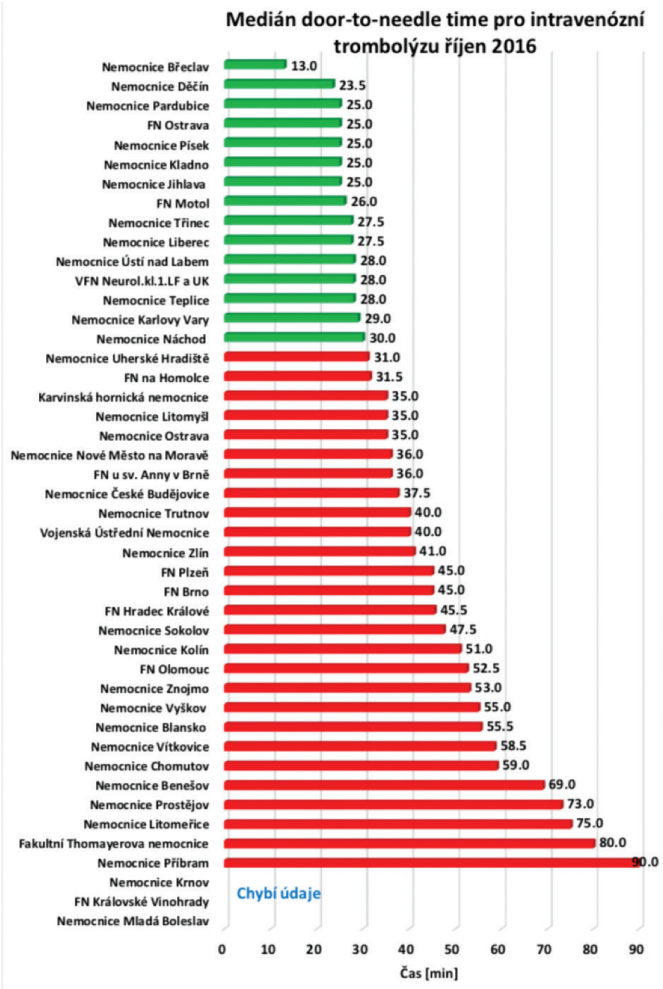
By providing a quality benchmark for all accredited stroke centres, a system is now in place for monthly reporting of data on key time points:

1) onset-to-hospital for EMS
2) door-to-needle time (DNT)
3) secondary transfer, i.e. primary centre to secondary centre
4) door-to-groin times (DGT)

By the end of 2016, data was submitted by all centres for these categories, but the majority revealed a mean time of >30 minutes for DNT. Through education and training initiatives these rates improved substantially, and by the end of 2017 more than half had improved the mean DNT to <30 minutes (Figure 4).

(a)



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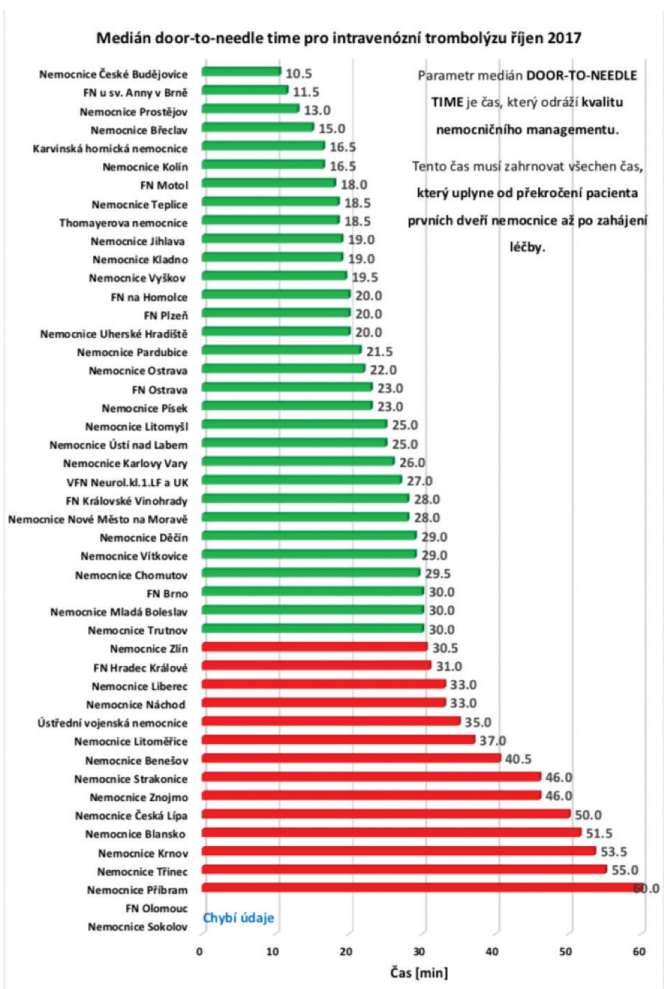

Figure 4. Monthly quality-indicator reports highlighting that in the Czech Republic more than half of stroke centres had a median door-to-needle time (DNT) of <30 minutes (green) between (a) 2016 and (b) December 2017.

The effect of monthly benchmarking since 2016 has been a reduction of >10 minutes in DNT for all strokes within the Czech Republic. The Czech Stroke Society has now created the Campaign Stroke 2020, the aim of which is for at least 20% of ischaemic strokes to be treated by thrombolysis by the year 2020, and for the time from hospital admission to treatment to be <20 minutes. The treatment target has already been achieved for 20% of the stroke patients, and today, around one-third of centres have also reached the ≤20-minute threshold for median time to treatment. Quality monitoring is beneficial in identifying weak centres that can benefit from the attention of ANGELS consultants; importantly, regions are compared and encouraged to raise their standards. Biannual reports also provide quality indicators on all areas of stroke care, such as dysphagia screening and secondary prevention, ensuring that centres remain aware of their performance levels (Figure 5).

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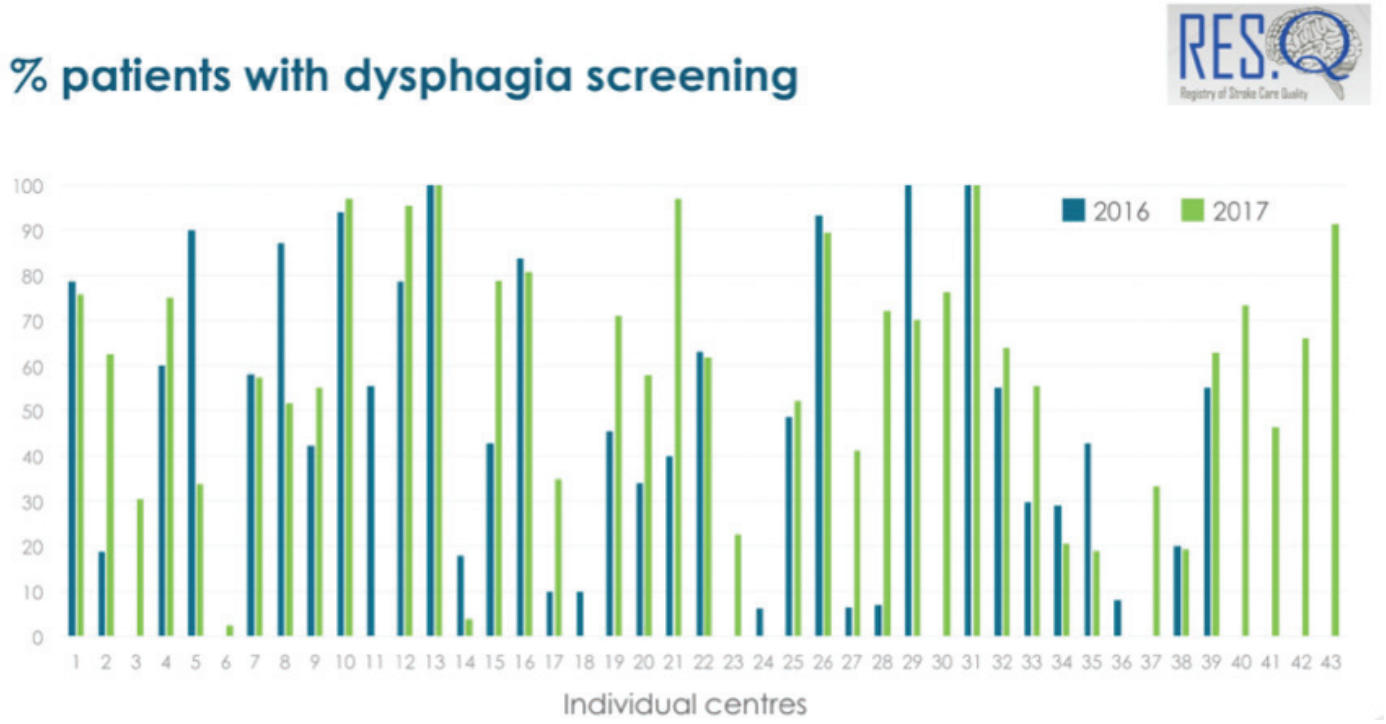

Figure 5. Comparison of dysphagia screening rates in 2016 and 2017 in the Czech Republic.

Important factors influencing the Czech Republic include a centrally-organised accredited network and the effect of indicator results presented annually in scientific meetings. Future targets for quality improvement include a median DNT of <20 minutes by the year 2019. The Czech stroke care system demonstrated improved rates for time-to-treatment, recanalisation therapy, and admission to stroke centres, highlighting the importance of key interventions in raising the standard of stroke care.

Strategy based on the concept of 20 20 20

Through Campaign Stroke 2020, there are two implementation goals which could define standards at a national level for IV thrombolysis. The proposal is for a thrombolysis rate of >20% and a DNT of <20 minutes, with targets achieved by the year 2020. Campaign Stroke 2020 will set out to define the status of thrombolytic treatment, identify gaps in its implementation, and bring all relevant parties together to optimise the treatment management of stroke. The quality registry website contains all information on how to join the campaign.[7] It has been shown that better outcomes are achieved when treatment is delivered faster, and the biggest challenge will be how to change practice nationwide. The Czech Stroke Society have already addressed this, using data from real cases to deliver simulation training and providing invaluable feedback.

THE LATIN AMERICAN SCENARIO

Around 640,000,000 inhabitants across 20 countries provide many multiple ethnicities and cultures within Latin America. The life expectancy ranges from 62 years in Haiti to 79 years in Chile; stroke is one of the leading causes of death in most countries, and around 10% of stroke patients are under the age of 45 years.[8] There are several identified gaps in stroke care; lack of funding for research and education, limited access to care, inadequate hospital resources with too few neurologists to treat acute stroke, and a lack of t-PA in some Latin American countries.[9]

In 2001, Brazil's National Agency approved t-PA for stroke although treatment was not free. By 2008 there were 35 public and private stroke centres treating patients with thrombolysis. The Ministry of Health in Brazil approved the financing of t-PA in 2012, and national policy stimulated the creation of stroke units in the country with t-PA as the minimum standard of stroke care. Between 2008 and 2018, the number of stroke centres has increased from 35 to 156, of which 64 are advanced centres offering thrombectomy, and 2 are public hospitals. The number of stroke units has also increased during this time, and there are now 78 in 2018, compared with only five units in 2008 (Figure 6).

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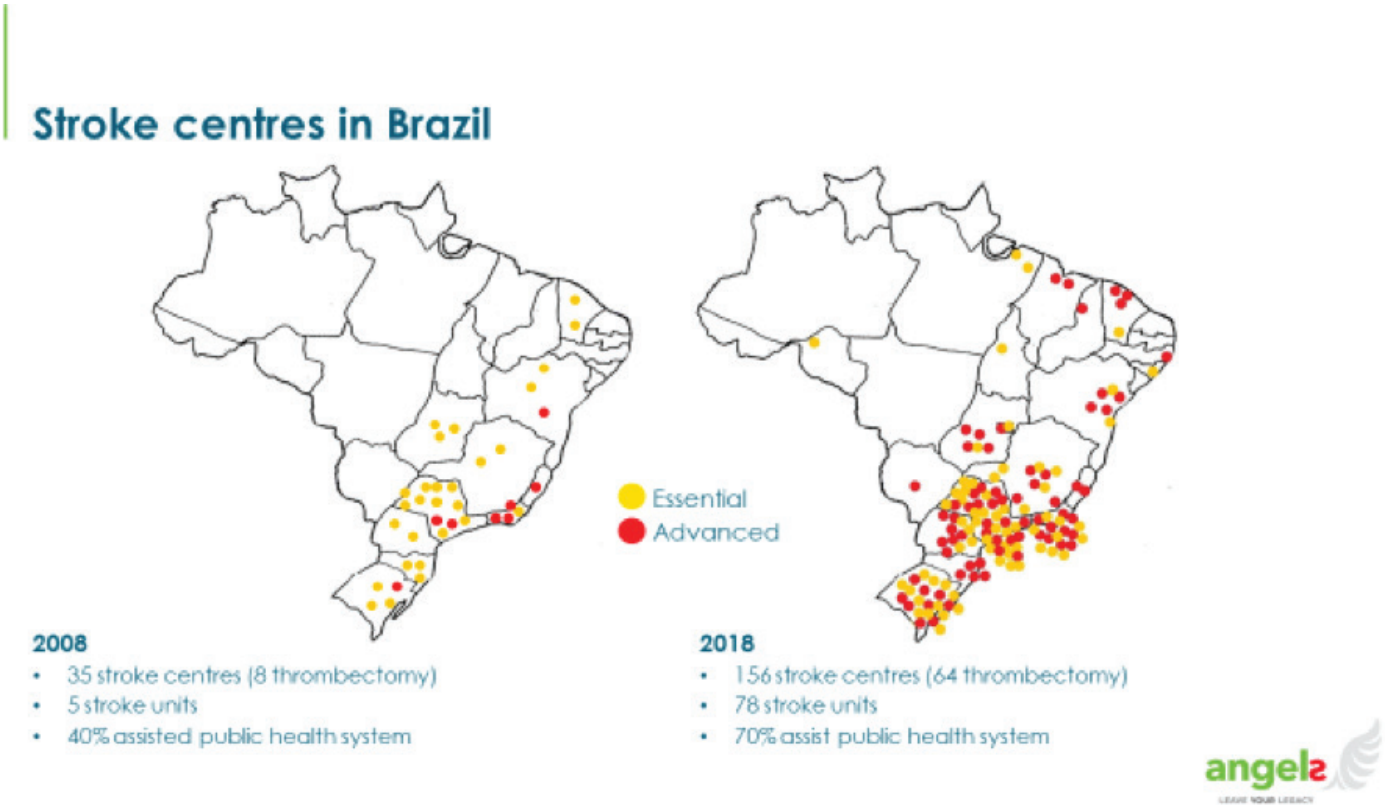

Figure 6. An illustration of the increase in the number of essential and advanced stroke centres in Brazil between 2008 and 2018.

The annual national survey for 2017 was based on the WSO Global Stroke Guidelines, and 140 of a total of 156 stroke centres in Brazil completed the survey. The results show that hospitals have 81% of neurologists available 24h/7 days of which 42% are on duty, 45% are on call, and 13% assist by telemedicine (Figure 7). Neurologists perform 64% of thrombolysis, and this figure is improving through telemedicine (Figure 8). Several hospitals in Brazil have their own registry to monitor quality indicators; a stroke registry is maintained with quality indicators monitored monthly. Data revealed that when using MRI before thrombolysis there was an increase in DNT of up to one hour; this information is now used to retrain emergency staff. A Standard Set of post-stroke outcomes was developed and is used in 5 hospitals in Brazil, directly and by telemedicine. Working with the National Association of Private Hospitals in Brazil, this Standard Set will soon be applied to 10 additional private hospitals, and extended to public hospitals.[10]

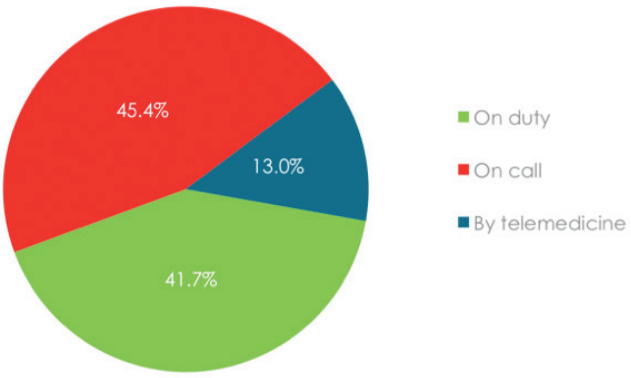

Figure 7. Percentage distribution showing the availability of neurology specialists in Brazil.

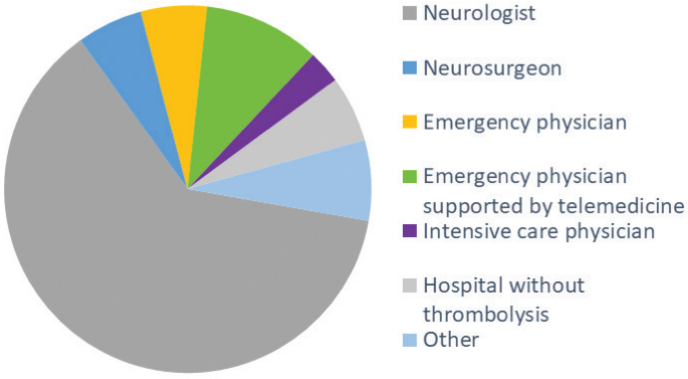

Figure 8. Breakdown of medical personnel performing thrombolysis in Brazil.

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The ANGELS Initiative has been instrumental in helping Brazil improve the quality of stroke services. Since 2017, the number of hospitals has increased from 80 to 110, and the implementation of new stroke services is now possible. The Stroke Management Acute Reference Training (SMART) preceptorship was launched recently for health professionals, and provides training in treating patients with stroke. At the 21st Ibero-American Stroke Organisation Congress 2018 meeting, the ANGELS Award in Latin America was launched, based on either SITS-QR or RES-Q quality indicator registries. A total of 8 countries have agreed to participate, and this will create an excellent opportunity to establish a national registry across Latin American countries.

Another important initiative came from the Latin American stroke ministerial meeting, where stroke experts and MOH representatives from Latin American countries discussed the impact of stroke in their regions. WSO and AHA supported the initiative; 13 countries participated, one attended via teleconference, and one (Minister of Health for Guatemala) provided a report on the initiatives in that country. The meeting culminated in the signing of the Gramado Declaration – a commitment to implement evidence-based policies for the prevention and treatment of stroke in Latin America.

THE VIETNAM SCENARIO

In 2010, stroke was the leading cause of death by disease in Vietnam. Although the economic situation has improved recently, the health budget is limited at only 126USD/person/year. Data published by the Ministry of Health in 2008 revealed stroke mortality rates of 18% in males and 23% in females, highlighting the stroke burden in Vietnam.

The People's 115 Hospital

In 2006 the first stroke unit was established, and today there is a stroke centre with 140 beds, 16 neurologists, 52 nurses, and five physical therapists. Between 2005 and 2017, the number of stroke patients admitted has increased from 1210 to 11,244 (Figure 9). The rate of IV thrombolysis increased from 0.6% in 2006 to 3.0% in 2016, reflecting an increase of 255 patients treated by rt-PA. At this time, 3% was accepted as a reasonable rate due to limited resources and a large population of patients. In addition, traffic congestion which is common to many Asian cities is a significant problem for transporting patients to a hospital quickly, and over 90% of stroke patients arrive by public transport.

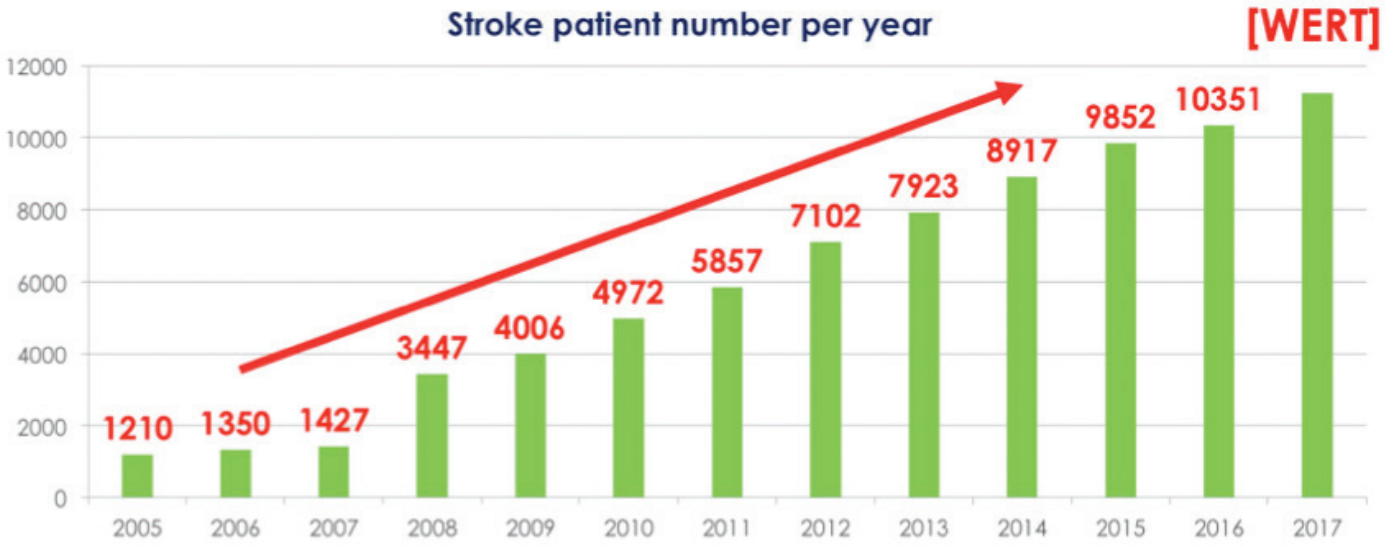

Figure 9. Stroke admission numbers in The People's 115 Hospital, Vietnam between 2005-2017.

In March 2017, ANGELS Vietnam was launched, and significant changes in stroke care practice were adopted; a fundamental change was the introduction of checklists for medical staff. For EMS personnel, the increased training helped to identify stroke symptoms and checklists ensured that patient information is hospital-ready on arrival. In addition to the medical training they received, the provision of stroke maps can now direct EMS to the nearest hospital that can provide IV thrombolysis. Emergency nurses received the same training in stroke recognition and were set a target time of <25 minutes for door-to-CT scan times. For stroke physicians, the protocol was standardised for how to treat with IV t-PA, for follow-up procedures, and how to deal with any post-treatment complications. The ANGELS Stroke Bag is used to minimise time and to encourage physicians to treat t-PA in the CT scan room.

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Quality monitoring has been implemented through regular stroke team meetings and by joining the RES-Q registry. Data for stroke characteristics of 6599 patients were collected between October 2017 and August 2018; median age was 62 years (56% male, 44% female), 99% were transferred to ICU, 80% were ischaemic strokes, and 20% were intracranial and subarachnoid haemorrhage patients. The NIHSS median score was 7 and was calculated for 92% of patients who received the assessment. However, from symptom onset to admission, the majority of stroke patients still arrive at a hospital outside the recommended therapeutic window for treatment. Most patients had a CT/MRI performed within one hour of admission, and the rate of recanalisation treatment has increased from 3% in 2016 to 11% more recently, with the number of rt-PA cases more than double that of 2016.

In August 2018, 9% of patients were treated with IV thrombolysis compared with 0.6% in 2006, with a much-improved median DNT time of 44 minutes (Figure 10). Appreciably, there are still long delays for door-to-groin time as patients take around 130 minutes to arrive at a hospital that can provide thrombectomy. A key factor in this delay is the high cost of thrombectomy; the government pays around 50% of the total cost, and the patient has to fund the difference before admission. Also, rehabilitation provision is extremely limited in Vietnam, and 94% of patients are discharged directly to their home. Stroke care in Vietnam has significantly improved since adopting the ANGELS Initiative, and with a current thrombolytic rate of around 3.8%, data will continue to be collected through the ongoing RES-Q registry and the addition of more stroke centres.

Year	Ischaemic stroke patients	rt-PA cases	Rate
2006	1350	9	0.6%
2007	1427	15	1%
2008	2193	31	1.4%
2009	2775	59	2.2%
2010	3620	108	3.5%
2015	7896	226	2.9%
2016	7900	264	3.0%
2017	8800	552	6.3%
Aug 2018	7411	667	9.0%

Figure 10. IV thrombolysis rate at The 115 People's Hospital, Vietnam from 2006-2018.

THE SOUTH AFRICAN SCENARIO

In South Africa, stroke is the 4th leading cause of death and is more prevalent in black, African females. Before 2016, there was only one stroke unit located in Cape Town. Treatment protocols were not standardised, staff were poorly trained, and there were no means of evaluating the treatment service.

Implementation of the ANGELS Initiative in 2016 saw a concentrated effort to improve pre-hospital education for medical professionals and the general public, and to establish Centres of Excellence. Patient awareness literature was provided for all medical staff and patients, but the main focus was the need to act fast. Strategies were then developed to optimise training for junior doctors in decision-making for CT interpretation, and on patient selection for t-PA (Figure 11).

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Figure 11. Patient literature for medical professionals and the general public to create awareness of the symptoms of stroke.

In 2018, the ANGELS Initiative Roadshow was launched in South Africa to provide training for nine province regions and to promote the social media hashtag, #savinglives. There are currently around 125 hospitals where training has taken place and is supported by ANGELS consultants. The campaign is well on the way to reaching the target of 165 hospitals by December 2019. Innovative branding of the ANGELS Initiative on local taxi buses has given the campaign public attention, and awareness campaigns have also been carried out in schools.

Frere Hospital

The Stroke Readiness Programme was launched in 2016 which used existing challenges to initiate change.[11] The 4R approach – Recognise, Report, React, rt-PA – helped to identify where acute stroke was not being recognised, and where activation of stroke protocol failed. The 4R approach revealed that response times were too slow and there was an issue with t-PA availability within the hospital. Stroke symptom onset-to-door time remains variable due to the late arrival of patients. EMS responder training has been established with both public and private service providers to encourage pre-notification and improve stroke care services. However, the biggest challenge comes from the South African triage manual where stroke is not considered a priority. An updated triage scorecard is now implemented in the Frere Hospital, which places stroke as a higher priority.

After tackling arrival times and triage, it was necessary to improve doctor-to-imaging reaction times; this was achieved through bypassing casualty for the radiology suite, and imaging-to-needle times were dramatically improved by moving t-PA to the CT room (Figure 12). Around 95% of patients have a DNT of <60 minutes with an average time of 47 minutes. "Target Stroke" aims to achieve DNT of <60 minutes in at least 50% of acute ischaemic stroke patients; currently around 55% of patients are within a DNT of <45 minutes, and this area will undergo continual improvement. NIHSS scores are being reduced, dysphagia screening has increased to 75% of patients within 24 hours, and adequate training has resulted in junior doctors capable of thrombolysis. The South African scenario shows us that hyperacute and acute in-patient management is possible in an under-resourced area, but there is still a need to standardise quality-of-care indicators and stroke registries in the country.

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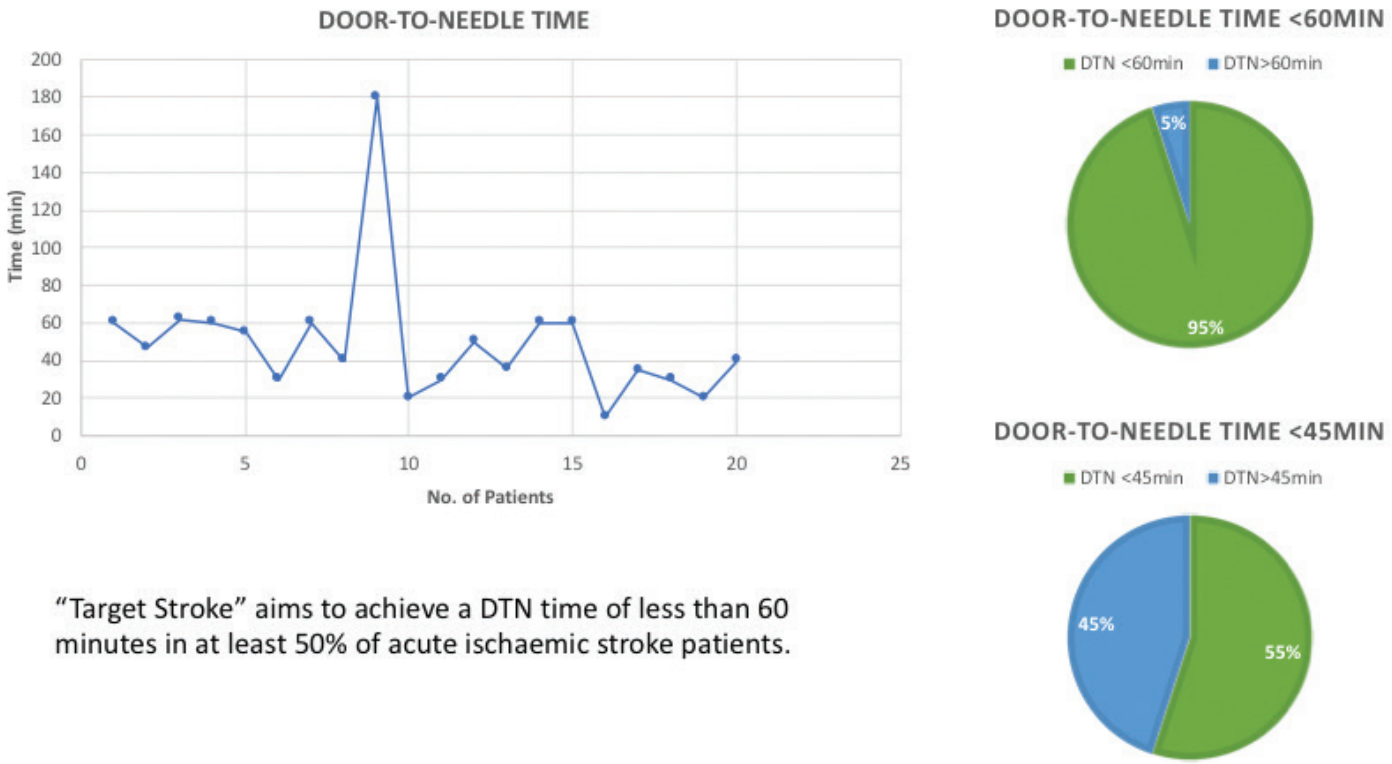

Figure 12. Door-to-Needle times (DNT) statistics at the Frere Hospital, South Africa since the launch of the 2016 4R approach to stroke care.

CONCLUSION

The improvement in stroke care since 2016 emphasises the value of the ANGELS Initiative and highlights how strategic changes in clinical practice can create an environment of better trained medical staff and better treated patients. This is achieved through commitment and a belief in high standards of quality monitoring with ongoing improvement to stroke care. Outcomes are continuing to improve, although there is still a need for standardisation of quality registries in some countries. The ANGELS Awards have been highly successful in acknowledging significant improvements to patient treatment and care, and are widely appreciated by all involved in raising the standard of stroke care around the world.

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