



وزارة الصحة
Ministry of Health

SAUDI STROKE PATHWAY STANDARDS

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STROKE CLINICAL ADVISORY GROUP

Vision Realization Office

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Foreword

Stroke has been defined as a sudden interruption in the blood supply of the brain. Most strokes are caused by an abrupt blockage of arteries leading to the brain (ischemic stroke). Other strokes are caused by bleeding into brain tissue when a blood vessel bursts (hemorrhagic stroke). Because stroke occurs rapidly and requires immediate treatment, stroke is called a brain attack and sometimes referred to as 'earthquake in the brain'. When the symptoms of a stroke last only a short time (less than 24 hours), this is called a transient ischemic attack (TIA) or mini-stroke.¹ There are approximately 24,000 strokes in Saudi Arabia annually.²

Inefficient use and distribution of available resources, inconsistent provision of services and sometimes lack of evidence-based urgent stroke care services impacts on patient outcomes across the Kingdom. Urgent and acute care is not the only aspect of care that needs to improve, lack of inpatient and community rehabilitation, long term care and community support services has a significant impact on the patients with non-acute phase of stroke, this also impacts on the providers of acute services who are unable to transfer the patient to a safe environment to receive appropriate care. Lack of long term and community services limits the capacity in our existing acute hospitals to treat those most in need of acute care. Yet we know that for months or even years after a stroke, there may be a need for specialized therapeutic help – for example to improve speech or mobility – and that enabling people to participate in work, leisure and education improves well-being, combats depression and often aids recovery. The input and commitment of rehabilitation services, primary care teams, of social care professionals and wider community services is absolutely critical to delivering improved outcomes for people with stroke. These standards aim to address the urgent care and wider aspects of stroke care.

Medical and technological advances have transformed our understanding of stroke, there have been advances in the treatments available for restoring blood flow and improving brain function. However, time is critical for restoring brain function following a stroke – the faster someone reaches expert help, the greater their chances of making a full recovery. We need to make use of the latest advances in stroke treatment, implement evidence-based stroke care, and improve quality, efficiency and consistency of the services to improve patient outcomes. We need to develop the rapid response systems that get people to a hospital of expertise quickly and onwards to provide appropriate treatment and stroke unit care. We need to develop stroke networks to ensure improved access of services to the patients and better utilization of resources. Working across the stroke networks, we need to deliver integrated stroke care that liberates rather than constrains the talents and energies of the doctors, nurses, therapists and their wider teams.

The stroke standards create a strong foundation, supported by expert guidance, for continued innovation and progress in stroke care. Many strokes are preventable, most are treatable, and the harm done by stroke can be greatly reduced if we act quickly on important warning signs like transient ischemic attacks or 'minor strokes', deploy effectively

¹ <https://stroke.org.sa/understand-stroke/>

² Based on expert opinion and available data:

<https://journals.sagepub.com/doi/full/10.1177/2396987316654338>

the power of modern imaging, and ensure all patients can benefit from expert, multidisciplinary care.

This document presents a number of quality markers outlining the features of a good service. Each quality marker is distilled into a number of standards which aim to improve the quality of service across the stroke pathway. In addition, there are several key performance indicators (KPIs) associated with the standards. Collectively, these markers set an ambitious agenda to deliver the best in class stroke services, from prevention right through to life-long support. It will take time to deliver, and stroke networks will need to work with service users to determine the early priorities for their local areas. These stroke care standards will help commissioners, stroke networks and service providers judge the quality of their local services and plan for the improvements needed.

This document is designed for all health care professionals including administrators. A panel of stroke specialist Doctors and other clinical professionals was set up to form a Clinical Advisory Group (CAG) to develop this document. A range of national and international guidelines, standards and evidence was reviewed and expert opinion from the CAG was used to develop these standards for Saudi Arabia. While the document is a great starting point, there are still areas where further recommendations are needed from a consensus of the experts. We need the research to confirm or refute these views. The work involved in developing clinical standards is enormous, and the resources to undertake the searching, critical appraisal, drafting and editing are constrained. We are very grateful to all the CAG members and others who volunteered their time outside of their day job to undertake these tasks.

This standards document has been developed as a result of a great deal of hard work by many people, in particular, the clinical advisory group which has led on the development of this document so well to this point. It is equally important to note that many other people have been involved too - responding to the consultation and surveys and providing valuable feedback. As a result, these stroke standards are a reflection of all of the knowledge, perspectives, and efforts put forth by the group. This document marks a point in our journey, but we have a long way to go yet, it is now that the hard work begins. We look forward to working with clinicians, managers and patients to tackle the challenge of stroke.

Contributions

Contributions from diverse stakeholders to the development of this standards documents are noted with gratitude. Particularly, contributions from the CAG membership are noted. The members of the development group include:

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In addition, support from Stroke team members including Amar sharma, , Mohamed Bin Saleh and Shatha Alsaidan is noted.

Executive Summary

Stroke is the second leading cause of death in Saudi Arabia and a leading cause of disability in adults. The physical, emotional and financial consequences are felt by the patient, his/her family, the community and the country. Stroke is a preventable and treatable disease. The gap between evidence-based stroke medicine and care in Saudi Arabia is high. The Ministry of Health has identified stroke as a high priority disease that needs to be managed more appropriately.

We will prevent strokes by empowering the person and developing a healthy community by encouraging people to live a healthy lifestyle, free of smoking, obesity and high blood pressure. Developing healthy food choices and increasing physical activity will lower the incidence and prevalence of strokes.

We understand that when a stroke or transient ischemic attack happens, patients will require many services from the healthcare system, and we will ensure that all stroke patients get treated in the highest quality manner with minimal variability. The stroke pathway will be patient-centered and done in a timely manner to improve patient outcomes and reduce costs. We will ensure that when a stroke does happen the stroke system will react quickly and efficiently, the stroke patient will be taken to the most appropriate hospital, and admitted to an acute stroke unit, that will manage the patient according to current stroke standards. Stroke patients with disabilities will be managed and treated in rehabilitation units with the aim of returning maximum function as close to the patients' home as possible.

Purpose and Scope

Vision 2030 has committed to improving to health and outcomes for the population of Saudi Arabia. To support this, a number of strategic programs of work were identified and are being piloted across the Kingdom. To support some of these programs of work, specifically in relation to the New Models of Care, it has been identified in some of the projects, that to achieve success for new clinical pathways, and particularly in relation to urgent care treatment in Stroke, clinical Standards would be needed. These Standards will take into account the patient journey and will work across the boundaries of ministries.

Guiding Values and Principles

Guiding values and principles are important if the new pathways are to be successful. When developing the pathway, a set of guiding principles were developed to ensure that the focus of the work was undertaken consistently.

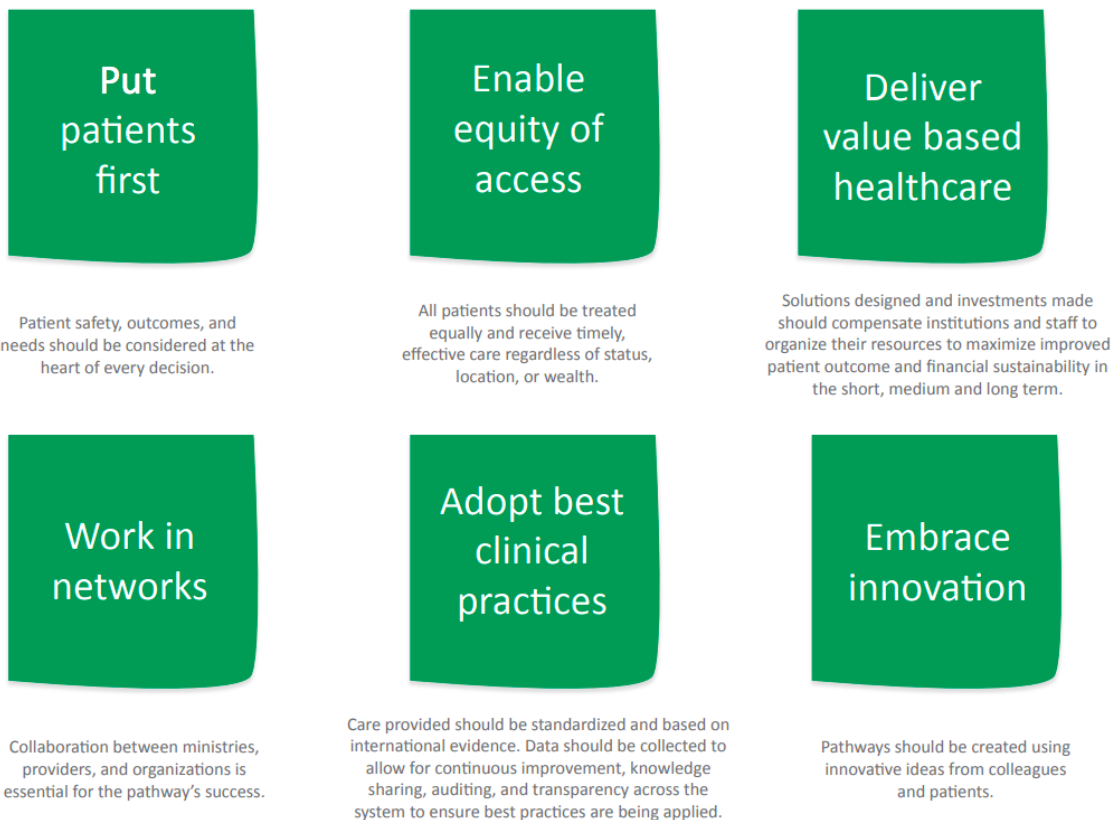


Figure 1: Overarching guiding principles

In addition to the guiding principles for developing the pathway (fig. 1), with input from wider clinical colleagues, the Stroke Clinical Advisory Group (CAG), values and principles for the development of a clinical network has been developed that will help form the foundation on which the strategic clinical network for stroke should be designed, and should now guide its development and operation:

Purpose of this document

This document was developed as a part of the 'Models of Care' Urgent Care pilots project to support the design and implementation of a comprehensive evidence-based stroke pathway. These standards are a work in progress and are meant to be used primarily for the stroke pathway pilots, these standards will evolve as a result of the lessons learnt from implementation of the pathways and protocols. It is expected that this document will feed into a national policy document in future.

The stroke standards are intended to:

- Provide a guide against which providers and commissioners of services can secure improvements to stroke services and address health inequalities relating to stroke;
- Provide advice, guidance and support for clusters, and other commissioners of health and care services, in the planning, development and monitoring of services; and
- Inform the expectations of stroke patients and their families, by providing a guide to high-quality health and social care services.

How this document is structured

Chapter 1 describes the different types of stroke hospitals based on the level of complexity of stroke care provided.

Chapter 2 sets out the principles and components of a stroke network.

Chapters 3 to 5 set out a number of quality markers, which outline the features of a good service. Under each marker are a number of standards and indicators.

Chapter 6 sets out standards and actions needed to develop leadership and workforce and to ensure capacity and capability is built for providing a high-quality stroke care.

Appendix 1 includes the Key Performance Measures which are linked to each of the six chapters in the document.

Appendix 2 sets out the patient selection criteria for rehabilitation. It is intended that this will be moved to an implementation guide at a later stage.

Chapter 1. The Saudi Stroke Hospitals classification system

A network of hospitals may be needed to adequately manage acute stroke patients. Since 80% of Saudi stroke patients self-refer to emergency rooms³, therefore all hospitals within the stroke network will be classified according to their ability to acutely manage and treat acute stroke patients. This classification system will allow acute stroke patients to be treated adequately according to the best evidence-based standards. The classification system allows hospitals within stroke networks to be developed, where urgent identification of acute stroke patients occur and urgent transfers to appropriate stroke hospitals are pivotal to properly manage these patients.

Individual hospitals and stroke networks will be able to properly allocate resources and develop high quality, value-based improvement initiatives.

Table 1: Proposed hospital classification

	Comprehensive Stroke Hospital (CSH)	Primary Stroke Hospital (PSH)	Acute Stroke Ready Hospital (ASRH)
Typical bed size	>300 beds	100-400 beds	<200 beds
Typical acute stroke admissions per year	More than 1,000	More than 200	Less than 100
Stroke program director	Yes, Stroke trained physician	Yes, Physician with stroke expertise	Yes, a physician with sufficient knowledge on acute stroke management
Acute stroke team	Yes, usually stroke neurology, nurse and multi-disciplinary therapy team	Yes, usually stroke neurology consultant, nurse and multi-disciplinary therapy team	Yes, usually ED or IM consultant & nurse
EMS collaboration	Yes	Yes	Yes, to divert to a PSH or CSH
Stroke Unit	Yes	Yes	No
Initial assessment of patient	Triage nurse & ED consultant	Triage nurse & ED consultant	Triage nurse & ED physician
Diagnostic testing capabilities	CAT, CTA, MRI, MRA, penumbral imaging (CTP &/or MRP) & DSA 24/7. TTE, TEE, TCD, labs, pathology	CAT, CTA, MRI, MRA, penumbral imaging (CTP &/or MRP) & TTE, Holter & labs.	CAT (optional CTA & penumbral imaging preferred to assess LVO transfer destination)

³ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5966841/>

		DSA 24/7 if IA thrombolysis capabilities available.	
Strokologist availability	Yes, 24/7	Yes, maybe by telemedicine 24/7*	Available by telemedicine 24/7*
Neurosurgical availability	Yes, 24/7	Yes, within 2 hours by transfer	Yes, within 2 hours by transfer
Telemedicine	Provide telemedicine to other centers/hospitals	Yes, if needed	Yes**
Treatment capabilities	IV & IA thrombolytics, aneurysmal clipping & coiling, ICA stenting & CEA, neurosurgical procedures	IV r-tPA & probably IA thrombolytics	IV thrombolytics
Transfer protocols	Yes, accepting from other centers/hospitals	Yes, for neurosurgical consults & MT if not available	Yes, with PSH & CSH. Diversion protocol to PSH/CSH if within 60km
Staff stroke education requirements	Yes	Yes	Yes
Clinical performance measures	Yes	Yes	Yes

* If stroke physician consultation is needed.

**In rural areas, if the distance from the nearest Primary or Comprehensive Stroke Hospital is more than 60 Km. Within city limits, tele-stroke should be available if IV r-tPA may be delayed for more than 20 minutes.

Acute Stroke Ready Hospitals

Acute stroke ready hospitals (ASRH) are usually smaller hospitals without acute stroke units and without the capability of performing mechanical thrombectomy. Since acute stroke patients can self-refer to any hospital the ASRH should develop a stroke code system to rapidly identify acute stroke patients and manage them appropriately. An acute stroke code team should be available 24 hours, that has sufficient knowledge on acute stroke symptoms and follows and pre-approved stroke code protocol.

The stroke code team

A team consisting of a physician and nurse with sufficient acute stroke management knowledge should be available 24 hours a day and should assess an acute stroke patient

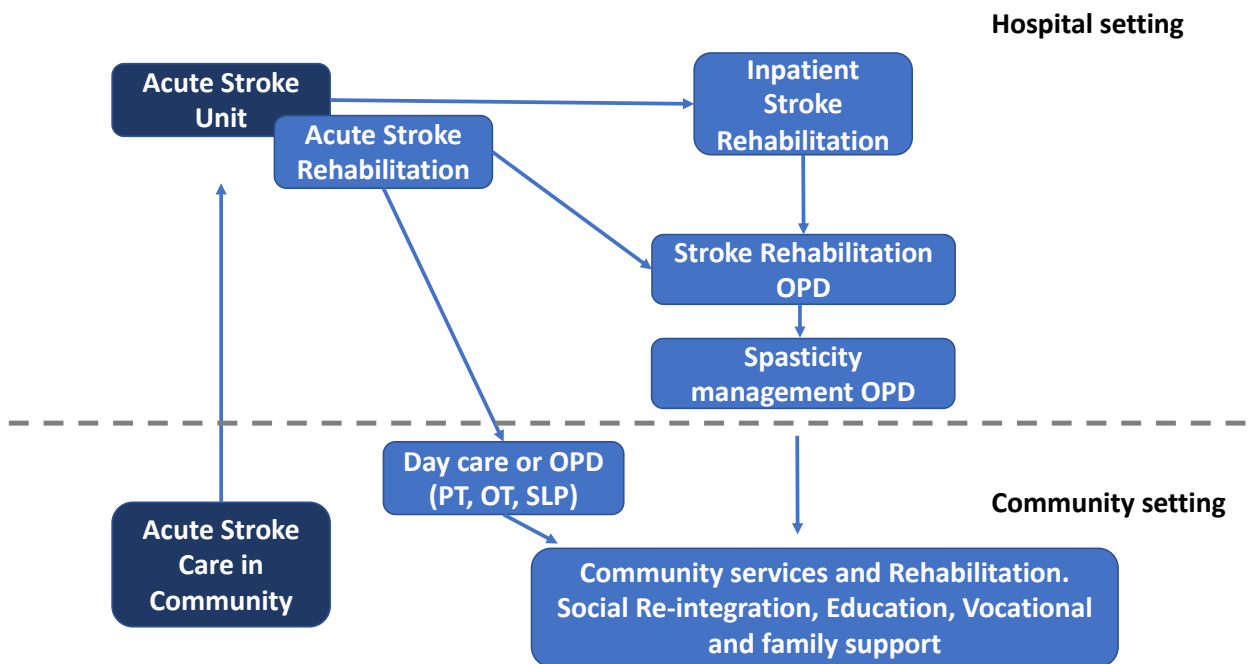
within 15 minutes of arrival in an emergency room and within the hospital, as an inpatient. All team members should be trained in using the National Institute of Health Stroke Scale (NIHSS) for all acute ischemic stroke patients. Members of the stroke code team should receive at least 4 hours of stroke training every year.

The protocol

A written stroke protocol will be developed to standardize acute stroke management in the emergency department and hospital, which should be revised yearly. Protocols should include management of acute ischemic stroke, intracerebral hemorrhage and subarachnoid hemorrhage. Specific aims of the protocols should include medical stabilization of the stroke patient in terms of airway and blood pressure management, decisions on the acute use of IV r-tPA for selected acute ischemic stroke patients and transfer protocols with PSHs and CSHs. Predetermined acute management and transfer protocols should be established based on many factors including distance between the ASRH and the PSH/CSH, and current transportation condition.

Safe and fast transportation before or after giving IV r-tPA for selected acute ischemic stroke patients is further discussed elsewhere (

Stroke Rehabilitation Care Pathway



QM 4.5 **Transfer of care**).

Stroke physician consultation via tele-stroke.

Different levels of stroke expertise may be needed at the ASRH ranging from diagnosis to management. Live, synchronous videoconferencing with access to the ASRH picture archiving system (PACS) is standard practice. The use of tele-stroke and decision for IV r-tPA for selected acute ischemic stroke patients, should be standardized and be part of the protocol.

In rural areas, if the distance from the nearest Primary or Comprehensive Stroke Hospital is more than 60 km, the use of tele-stroke and the ship and drip method is preferred. Within city limits, tele-stroke should be available if IV r-tPA may be delayed for more than 20 minutes.

Emergency management services (EMS)

EMS should be available 24 hours a day for immediate transfer of acute stroke patients to PSHs or CSHs. Acute management protocols during the transfer should be available and will include communication strategies, acute blood pressure management, oxygenation, hydration and swallowing protocols.

Laboratory services

Basic laboratory testing, including blood glucose, complete blood count, chemistry studies, coagulation profile, pregnancy testing, toxicology, and ECG will be available in the ASRH on an immediate basis and reported within 45 minutes.

Radiology

Emergency CAT scan of the brain should be available and done within 20 minutes of arrival in the emergency room. CAT scans should be read within 10 minutes of completion of the CAT scan. If indicated, CT angiogram (arch to vertex) should be performed on selected acute ischemic stroke patients after IV r-tPA is given. CT perfusion scanning may be considered in selected acute ischemic stroke patients within 24 hours of symptom onset.

MRI and MRA may be used as a substitute for CAT and CTA, if they can be done in a timely fashion.

Pharmacy

Medications for the acute management of hypertension, hyperglycemia, hypoglycemia, seizures and coagulopathies should be readily available in the emergency department. Intravenous thrombolytics (IV r-tPA) should be quickly available. Sublingual nifedipine should **NOT** be given to manage acute hypertension in stroke patients.

Transfers

Predetermined written transfer protocols to PSHs and CSHs should be available and based on written agreements. Repatriation agreements should also be included.

Data collection

In addition to participating in the Saudi stroke registry, the ASRH may choose to collect data for continuous quality improvement measures. The stroke team should meet at least quarterly to discuss its KPIs and improvement measures.

Primary Stroke Hospitals

Primary stroke hospitals are located in medium sized hospitals and are able to treat 70-80% of acute stroke patients, excluding subarachnoid hemorrhages. PSHs are able to acutely diagnose and manage acute stroke patients in the emergency room, give IV r-tPA for selected acute stroke patients and admit patients to a dedicated acute stroke unit (ASU). PSHs are able to determine stroke pathophysiology and start secondary stroke prevention measures. ASUs in PSHs are able to prevent stroke complications. PSHs are able to provide all needed rehabilitation services including physical therapy medicine consultation, physical therapy, occupational therapy and speech therapy consultation.

The stroke code team

A team consisting of a physician and nurse with significant acute stroke management knowledge, should be available 24 hours a day and should assess an acute stroke patient within 15 minutes of arrival in an emergency room and within the hospital, as an inpatient. The physician leader is usually a neurologist with significant training in managing acute ischemic strokes. A reliable notification system (pager, mobile phone, overhead page) must be implemented in each PSH. The stroke team may be used to assist ASRH's manage acute stroke patients, which may include diagnosis, recommendation to give IV r-tPA, perform further tests, and transfer patients to PSH or CSH as needed. The team will be able to decide which patients should be transferred to CSHs and be able to stabilize and make transfer arrangements as needed; examples may include patients with large vessel occlusion, eligible for mechanical thrombectomy, patients needing urgent neurosurgical consultation or neuro-intensive care management.

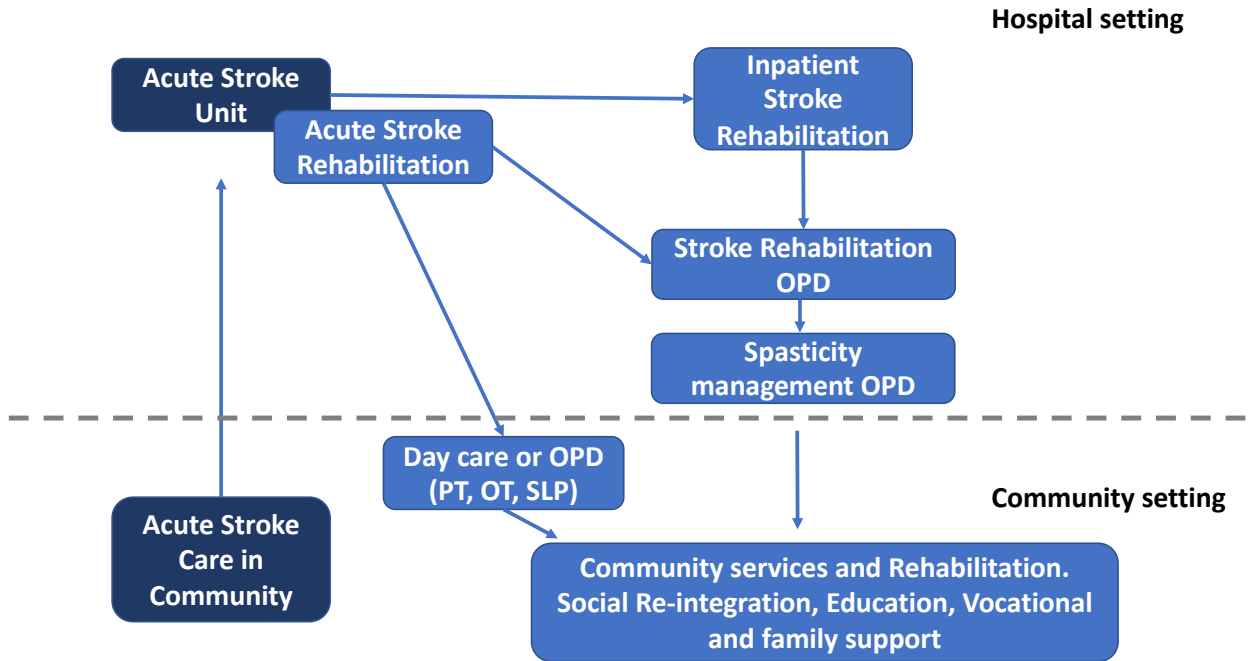
All team members should be trained in using the National Institute of Health Stroke Scale (NIHSS) for all acute ischemic stroke patients. Members of the stroke code team should provide and receive stroke training every year. A code stroke policy should be available in each PSH designating the duties of the code stroke team and a log of each stroke code KPI should be collected and shared with all departments involved in the stroke code (mainly emergency department, neurology, radiology and administration).

The protocol

A written stroke protocol will be available to standardize acute stroke management in the emergency department and hospital, which should be revised yearly. Protocols should include management of acute ischemic stroke, intracerebral hemorrhage and subarachnoid hemorrhage. Specific aims of the protocols should include medical stabilization of the stroke patient in terms of airway and blood pressure management, decisions on the acute use of IV r-tPA for selected acute ischemic stroke patients and transfer protocols with CSHs.

Predetermined acute management and transfer protocols should be established based on many factors including distance between the PSH and the CSH, and current transportation condition, with the aim of fast and safe transport to a CSH. Transportation after giving IV r-tPA for selected acute ischemic stroke patients is further discussed elsewhere (

Stroke Rehabilitation Care Pathway



QM 4.5 **Transfer of care**).

Stroke physician consultation via tele-stroke.

Different levels of stroke expertise may be needed at ASRH ranging from diagnosis to management. PSH physicians may be able to provide consultations to ASRH with respect to diagnosis, acute management (including drip and ship), and transfer decisions. Live, synchronous videoconferencing with access to the ASRH picture archiving system (PACS) is standard practice. The use of tele-stroke and decision for IV r-tPA for selected acute ischemic stroke patients should be standardized and be part of the protocol. PSH physicians may also connect to CSH stroke experts by tele-stroke for urgent consultations and transfer decisions to CSH for selected patients, like mechanical thrombectomy, neurosurgical procedures or neuro-ICU transfers.

Emergency management services (EMS)

EMS should be available 24 hours a day for immediate transfer of acute stroke patients to CSHs. Acute management protocols during the transfer should be available and will include communication strategies, acute blood pressure management, oxygenation, hydration and swallowing protocols.

Laboratory services

Basic and advanced laboratory testing, including autoimmune and hypercoagulable disease testing and toxicology will be available in the PSH. Basic laboratory testing, like CBC, electrolytes, coagulation profile and glucose will be available on an immediate basis and reported within 45 minutes.

EKG and long term Holter monitoring testing will be available.

Transthoracic echocardiography will be available. Transesophageal echocardiography (TEE) and cardiac MRI will be available for selected stroke patients, either in house or by urgent referral to another facility.

Radiology

Emergency CAT scan of the brain should be available and done within 20 minutes of arrival in the emergency department. CAT scans should be read within 10 minutes of completion of the CAT scan. If indicated, CT angiogram (arch to vertex) should be performed on selected acute ischemic stroke patients after IV r-tPA is given. CT perfusion scanning will be available and may be done in selected acute ischemic stroke patients, within 24 hours of symptom onset.

Emergency MRI and MRA may be used as a substitute for CAT and CTA, if they can be done in a timely fashion.

Diagnostic cerebral angiography may be present in PSHs.

The Acute Stroke Unit

The ASU is a dedicated, geographically distinct area in the hospital that admits the vast majority of stable stroke patients. It is staffed by stroke trained personnel (physicians, nurses, rehabilitation staff and others). Continuous telemetry recording is needed for the first few days of admission, including pulse rate, blood pressure, temperature, oxygenation and respiratory rate.

Hospital policies documenting the ASU admission, transfer and discharge policy will be available. The policies should also document the interaction with other needed specialties, mainly the emergency department, radiology, rehabilitation services, case manager, social services and others. Hospital policies will also be available for acute stroke unit management of the stroke patient which will include prevention of deep venous thrombosis, pressure ulcers, aspiration pneumonia and urinary tract infections. A policy documenting the management strategy for any changes in patients neurological and cardiovascular status will be available.

The ASU is commonly referred to as a step-down unit, but higher levels of management may be considered, such as arterial blood pressure monitoring, vasoactive medication use or mechanical ventilation, which will need appropriate manpower, competencies and training.

Pharmacy

Medications for the acute management of hypertension, hyperglycemia, hypoglycemia, seizures and coagulopathies should be readily available in the emergency department and the inpatient area. Intravenous thrombolytics (IV r-tPA) and vasoactive medications (like IV labetalol) should be readily available, preferably in the emergency room. Sublingual nifedipine should **NOT** be given to manage acute hypertension in stroke patients.

Neurosurgical care should be available within 2 hours of consultation either inhouse or by rapid transfer to another hospital. Pre-written agreements should be in place to avoid ad hoc decisions in urgent situations.

Rehabilitation services

PSHs will be able to perform a rehabilitation assessment and start most rehabilitation services. Well trained staff in rehabilitation are a requirement for all PSH and will include a physical medicine and rehabilitation doctor (physiatrist), a speech therapist, a swallow therapist, a physical therapist and an occupational therapist.

Transfers

Predetermined written transfer protocols to CSHs should be available and based on written agreements. Repatriation agreements should also be included.

Data collection

In addition to participating in the Saudi stroke registry, the PSH may choose to collect data for continuous quality improvement measures. The stroke team should meet at least quarterly to discuss its KPIs and improvement measures.

Comprehensive Stroke Hospitals

Comprehensive Stroke Hospitals (CSH) are located in medium to large sized hospitals and are able to treat all acute and subacute stroke patients. Significant differences between CSHs and PSHs is the availability of stroke trained experts able to perform invasive interventional vascular procedures, the ability to perform all cerebrovascular neurosurgical procedures, the ability to perform vascular surgical procedures and the availability of an intensive care unit with advanced neuroscience competencies.

CSHs are able to acutely diagnose and manage all acute stroke patients in the emergency room, give IV r-tPA for selected acute stroke patients, perform CTA and CT perfusion scans, provide mechanical thrombectomies for ischemic strokes with large vessel occlusions (LVO) and admit patients to a dedicated acute stroke unit (ASU). CSHs are able to determine stroke pathophysiology and start secondary stroke prevention measures. ASUs in CSHs are able to prevent stroke complications. CSH are able to provide all needed rehabilitation services including Physical Medicine and Rehabilitation consultation, physical therapy, occupational therapy and speech therapy consultation.

CSH are frequently the hub of the stroke network that accept referrals from PSHs and ASRHs. Frequently the stroke network is administered from the CSH.

CSH are typically hospitals where stroke education is provided to all healthcare staff, including nurses, physicians and the public. CSH are typically hospitals undertaking research at many disciplines (clinical, preclinical and administrative).

The stroke code team

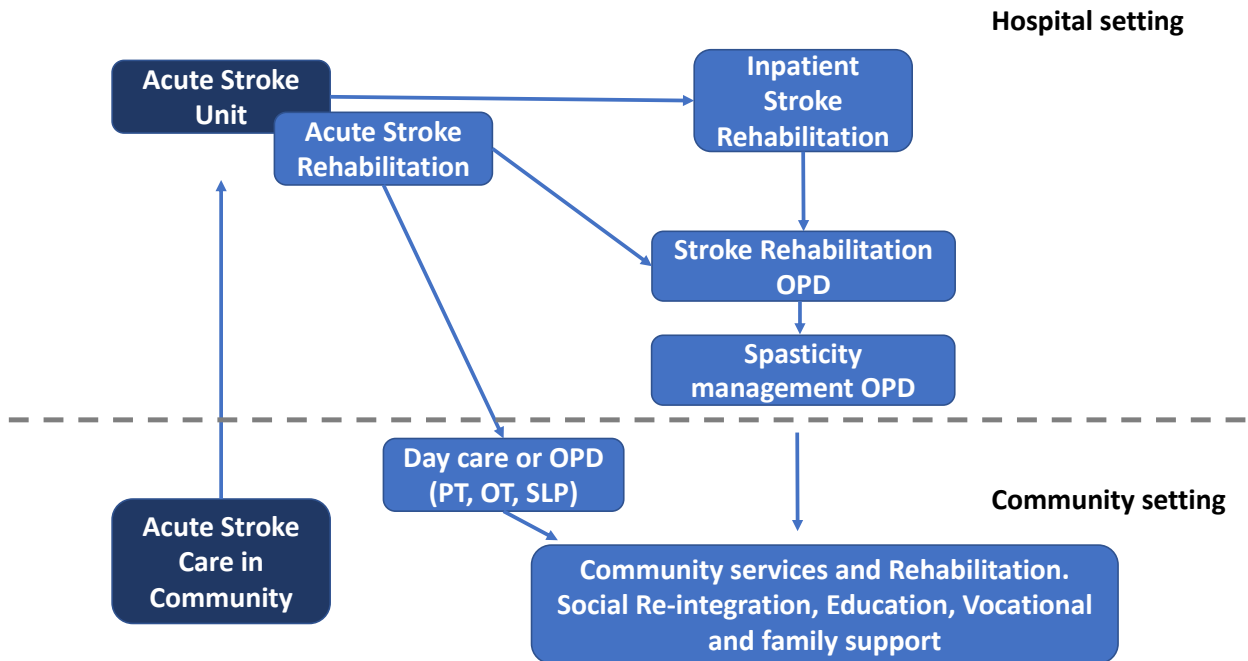
A team of stroke trained physicians and nurses should be available 24 hours a day and should assess an acute stroke patient within 15 minutes of arrival in an emergency room and within the hospital as an inpatient. The physician leader is usually a neurologist with 1-2 years of dedicated stroke training in managing acute ischemic strokes. A reliable notification system (pager, mobile phone, overhead page) must be implemented in each CSH. The stroke team may be used to assist PSH and ASRHs to manage acute stroke patients, which may include diagnosis, recommendation to give IV r-tPA, perform further tests, and transfer patients to CSH, as needed. The team will be able to decide which patients should be transferred to CSHs and be able to stabilize and make transfer arrangements as needed; examples may include patients with large vessel occlusion, eligible for mechanical thrombectomy, patients needing urgent neurosurgical consultation or neuro-intensive care management.

All team members should be trained in using the National Institute of Health Stroke Scale (NIHSS), the modified Rankin score and the Barthel index for all acute ischemic stroke patients. Members of the stroke code team should provide and receive stroke training every year. A code stroke policy should be available in each CSH designating the duties of the code stroke team, and a log of each stroke code KPI should be collected and shared with all departments involved in the stroke code (mainly emergency department, neurology, radiology and administration).

The protocol

A written stroke protocol will be available to standardize acute stroke management in the emergency department and hospital, which should be revised yearly. Protocols should include management of acute ischemic stroke, intracerebral hemorrhage and subarachnoid hemorrhage. Specific aims of the protocols should include medical stabilization of the stroke patient in terms of airway and blood pressure management, decisions on the acute use of IV r-tPA for selected acute ischemic stroke patients and transfer protocols with CSHs. Predetermined acute management and transfer protocols should be established based on many factors including distance between the PSH and the CSH, and current transportation condition, with the aim of fast and safe transport to a CSH. Transportation after giving IV r-tPA for selected acute ischemic stroke patients is further discussed elsewhere (

Stroke Rehabilitation Care Pathway



QM 4.5 **Transfer of care**).

Stroke physician consultation via tele-stroke

Different levels of stroke expertise may be needed at PSHs and ASRHs ranging from diagnosis to management. CSH physicians will be able to provide consultations to PSHs and ASRHs with respect to diagnosis, acute management (including drip and ship), and transfer decisions. Live, synchronous videoconferencing with access to the PSHs and ASRHs picture archiving system (PACS) is standard practice. The use of tele-stroke and decision for IV r-tPA for selected acute ischemic stroke patients should be standardized and be part of the protocol between the 2 hospitals.

PSH physicians may also consult CSH stroke physicians by tele-stroke for urgent consultations and transfer decisions to CSH for selected patients, like mechanical thrombectomy, neurosurgical procedures or neuro-ICU transfers.

Laboratory services

Basic and advanced laboratory testing, including autoimmune and hypercoagulable disease testing and toxicology will be available in the CSH. CBC, electrolytes, coagulation profile and glucose will be available on an immediate basis and reported within 45 minutes. Pathology testing for vasculitis will be available either inhouse or outsourced.

Cardiac testing

EKG and long term Holter monitoring testing will be available.

Transthoracic (TTE) and transesophageal echocardiography (TEE) and cardiac MRI will be available for selected stroke patients.

Long term cardiac monitoring should be available (loop recorders) for detecting cardiac arrhythmias in cryptogenic strokes.

Radiology

Emergency CAT scan of the brain should be available and done within 20 minutes of arrival in the emergency room. CAT scans should be read within 10 minutes of completion of the CAT scan. If indicated, CT angiogram (arch to vertex) should be performed on selected acute ischemic stroke patients after IV r-tPA is given. CT perfusion scanning will be available and may be done in selected acute ischemic stroke patients within 24 hours of symptom onset. Emergency MRI and MRA may be used as a substitute for CAT and CTA, if they can be done in a timely fashion.

Diagnostic cerebral angiography will be available. A Comprehensive Stroke Hospital will be able to provide mechanical thrombectomies urgently 24 hours a day. The ability to perform all urgent neuro-endovascular procedures will be available urgently, like coiling of cerebral aneurysms. Endovascular angioplasty and stenting of carotid stenosis will be available. Management of arteriovenous malformations will be available, including endovascular embolization, radiation therapy and surgical management.

Pharmacy

Medications for the acute management of hypertension, hyperglycemia, hypoglycemia, seizures and coagulopathies should be readily available in the emergency department and the inpatient area. Intravenous thrombolytics (IV r-tPA) and vasoactive medications (like IV labetalol) should be quickly available, preferably in the emergency room. Sublingual nifedipine should **NOT** be given to manage acute hypertension in stroke patients.

Transfers

Predetermined written transfer protocols between stroke Hospitals should be available and based on written agreements with prespecified transfer criteria. Repatriation agreements should also be included.

Surgical procedures

Surgical expertise should be available immediately upon consultation. The surgical team will be able to provide care for all cerebrovascular neurosurgical disorders, including clipping of cerebral aneurysms, surgical management of AVMs, insertion of ventricular drains, hematoma removal and drainage, and carotid endarterectomies.

Data collection

In addition to participating in the Saudi stroke registry, the CSH may choose to collect data for continuous quality improvement measures. The stroke team should meet at least quarterly to discuss its KPIs and improvement measures.

The Acute Stroke Unit (ASU)

The ASU is a dedicated, geographically distinct area in the hospital that admits the vast majority of stable stroke patients. It is staffed by stroke trained personnel (physicians, nurses, rehabilitation staff and others). Continuous telemetry recording is needed for the first few days of admission, including pulse rate, blood pressure, temperature, oxygenation and respiratory rate.

Hospital policies documenting the ASU admission, transfer and discharge policy will be available. The policies should also document the interaction with other needed specialties, mainly the emergency department, radiology, rehabilitation services, case manager, social services and others. Hospital policies will also be available for acute stroke unit management of the stroke patient which will include prevention of deep venous thrombosis, pressure ulcers, aspiration pneumonia and urinary tract infections. A policy documenting the management strategy for any changes in patients neurological and cardiovascular status will be available.

The ASU is commonly referred to as a step-down unit, but higher levels of management may be considered, such as arterial blood pressure monitoring, vasoactive medication use or mechanical ventilation, which will need appropriate manpower, competencies and training.

Intensive Care Management

Some stroke patients will require a higher level of medical care that may be unavailable in the ASU, requiring patients to be admitted to Intensive Care Units (ICUs) or neuro-ICUs. Both units should follow a unified hospital stroke management protocol.

Chapter 2. Network

Introduction

Stroke is the 2nd leading cause of death in Saudi Arabia and a leading cause of adult disability. Managed well, stroke treatment results in better patient outcomes and is cost-saving. Stroke and transient ischemic attacks (TIA) are complex diseases that are treated by a multidisciplinary stroke team sometimes in multiple sites according to each stroke patients' specific journey in a pre-specified stroke pathway.

The Saudi stroke pathway is a patient-centered, value-based initiative that has been developed to set standards for appropriate stroke treatment methods that will result in better patient outcomes.

The stroke network is a group of institutions and individuals (an integrated stroke care network) that seamlessly deliver the objectives of the stroke pathway to all stroke patients within that catchment area.

The stroke network is responsible for delivering the objectives of the National Stroke Pathway to all patients within its prespecified catchment area, throughout the journey of the patient through the stroke pathway, in an integrated care approach.

The network is ultimately responsible for all stroke patient outcomes within its catchment area.

The stroke patients' journey through the stroke pathway

Excluding primordial and primary prevention, the stroke patients journey starts with the onset of stroke/ TIA symptoms. The ability of the patient and bystanders to recognize stroke symptoms and activate the stroke pathway is paramount in reducing the delay to treatment; stroke management is time-dependent, where patients treated earlier have better outcomes, and cost less to the stroke network.

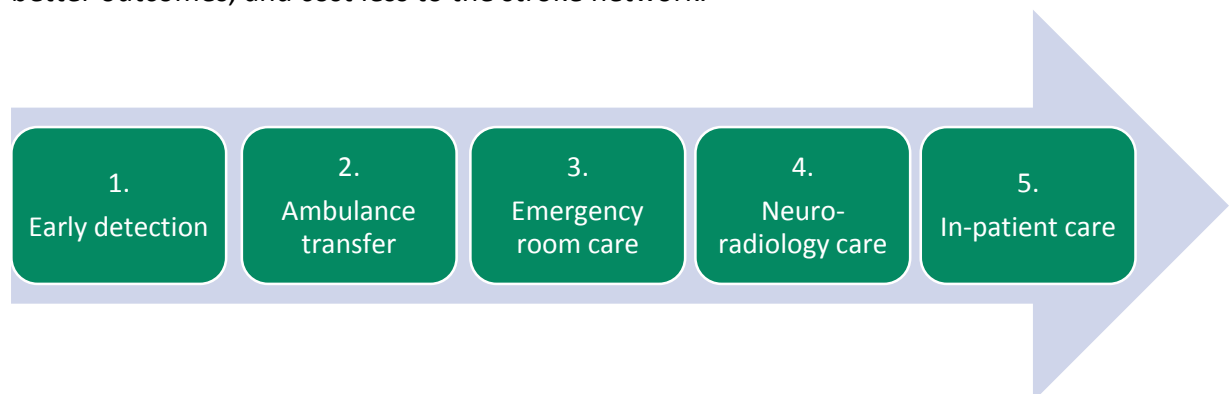


Figure 2: Stroke patient's journey, through the acute phase of the stroke pathway

The end to end journey of a stroke patient would include:

1. Community education of stroke symptoms and how to activate the stroke pathway e.g. calling the ambulance service
2. Ambulance transfer
3. Emergency room care
4. Neuroradiology care
5. Inpatient care
6. Out-patient care (including TIA clinics)
7. Rehabilitation
8. Reintegration into the society

The components of the stroke network

A stroke network will consist of all the components of stroke care from stroke onset, through to reintegration into society for a period of 4 months. The objectives of the stroke network are to ensure access to high quality, value-based stroke care to all patients in the network.

It is in the best interest of the patient and the network providers for all stroke care to be provided by one network. The network should ensure that all patients who suffer a stroke within its catchment area, follow a prespecified “stroke patient journey” in the stroke pathway; this should result in less variability and better patient outcomes. Service level agreements between departments within a hospital, between hospitals within a network and between outsourced service providers ensure seamless provision and transfer of care, reduce fragmentation of care, results in less variability of care and high quality, value-based stroke care.

Pre-specified agreements between networks will ensure that patients entering another network will receive the highest possible care and be safely repatriated.

Component 1. Community Education Services

The network should educate its catchment area on stroke/TIA symptoms and methods to immediately activate the stroke pathway since stroke/TIA is a time dependent disease. The network should also work closely with EMS services to educate them on acute stroke diagnosis and the networks’ method of acute stroke patient transfer to the appropriate emergency room.

Component 2. Emergency Medical Services (ambulance services)

Ideally all acute stroke patients should activate the EMS system; this usually ensures timely diagnosis and transfer to the appropriate stroke hospital, and thus to better stroke outcomes. EMS staff should evaluate all potential stroke patients using a unified pre-hospital stroke screening tool (like FAST, LAPSS etc). Using a pre-written algorithm to recognize patients that will benefit from comprehensive or primary stroke hospital care, EMS staff can triage patients to identify which would be the best hospital to transfer the patient to, depending on their symptoms and transfer times to the appropriate hospital. All stroke patients should be quickly assessed by a stroke trained team for their eligibility for urgent reperfusion therapies (intravenous R-TPA and endovascular mechanical

thrombectomy). These therapies are usually done in primary or comprehensive stroke hospitals. An urgent communication system should be developed between EMS personal and stroke experts to triage the patients to the appropriate stroke hospital.

Component 3. Emergency Department and Neuroradiological Services

Emergency departments should be accepting all patients that come pre-triaged through EMS and be capable of triaging all patients that self-present with stroke symptoms in a timely fashion. A stroke triage screening tool should be used (like FAST or ROSIER). An emergency department stroke code pathway should be developed. A stroke-code system should be in place to activate the stroke team. The stroke team's responsibility is to quickly assess patients with stroke symptoms, rule out stroke mimics, and clinically manage patients.

Neuroradiological expertise is central to clinical decision making. For all strokes (ischemic and hemorrhagic) an urgent non-contrast CAT scan of the brain is needed. For ischemic strokes, urgent brain imaging (usually non-contrast CAT scan or MRI) is needed for IV r-tPA decision making. Urgent neurovascular imaging (usually CTA or MRA) is needed for endovascular mechanical thrombectomy decision making. Penumbral imaging will be needed for specific ischemic stroke patients, especially those presenting between 6 to 24 hours after stroke symptom onset.

An urgent decision for IV r-tPA or endovascular mechanical thrombolysis should be made and initiated quickly.

For subarachnoid hemorrhages an urgent CTA usually confirms the cause of the bleed and subsequent conventional angiography would be needed.

Component 4. Inpatient care

The Stroke Network Provider should classify all hospitals in its system, based on their ability to manage stroke patients into Comprehensive Stroke Hospitals, Primary Stroke Hospital and Acute Stroke Ready Hospitals. The Saudi Stroke Hospital classification system will be used. Most strokes and some TIA patients should be admitted to an acute stroke unit; others may require ICU admission. Acute stroke units are located in primary or comprehensive stroke hospitals. Each stroke network should develop a system of acute stroke care so that most stroke and some TIA patients are admitted to a stroke unit for the first few days after their stroke (usually 72 hours). The immediate stay of most stroke patients and some TIAs will be in Acute Stroke Units (ASU). Patients usually spend less than 5 days in ASUs. Some patients may require further medical care requiring daily physician assessments and management, usually not by a neurologist, these patients may be transferred to a Skilled Medical Unit (SMU). SMUs may be a general medical or neurological ward and stroke patients are treated by internists or neurologists with expertise in subacute stroke care. SMUs will also provide subacute rehabilitation services as needed.

Prewritten admission and transfer criteria between ASUs and SMUs should be available and seamless.

A stroke network may consist of one comprehensive stroke hospital and a few primary stroke hospital and/or ASRHs. All other hospitals should be classified, and a triaging and transportation system should be in place for timely transfers to and from hospitals according to the stroke patient's requirements.

The appropriate inpatient rehabilitation services will be discussed in component 6.

The organization of the acute inpatient hospital stay may differ from network to network, depending on available resources, geographical issues and transport times within the networks. Some networks may prefer to develop a single CSH, where all patients in the network are admitted to one CSH. Others may prefer a more multifaceted approach of hub and spoke model (figure 2).

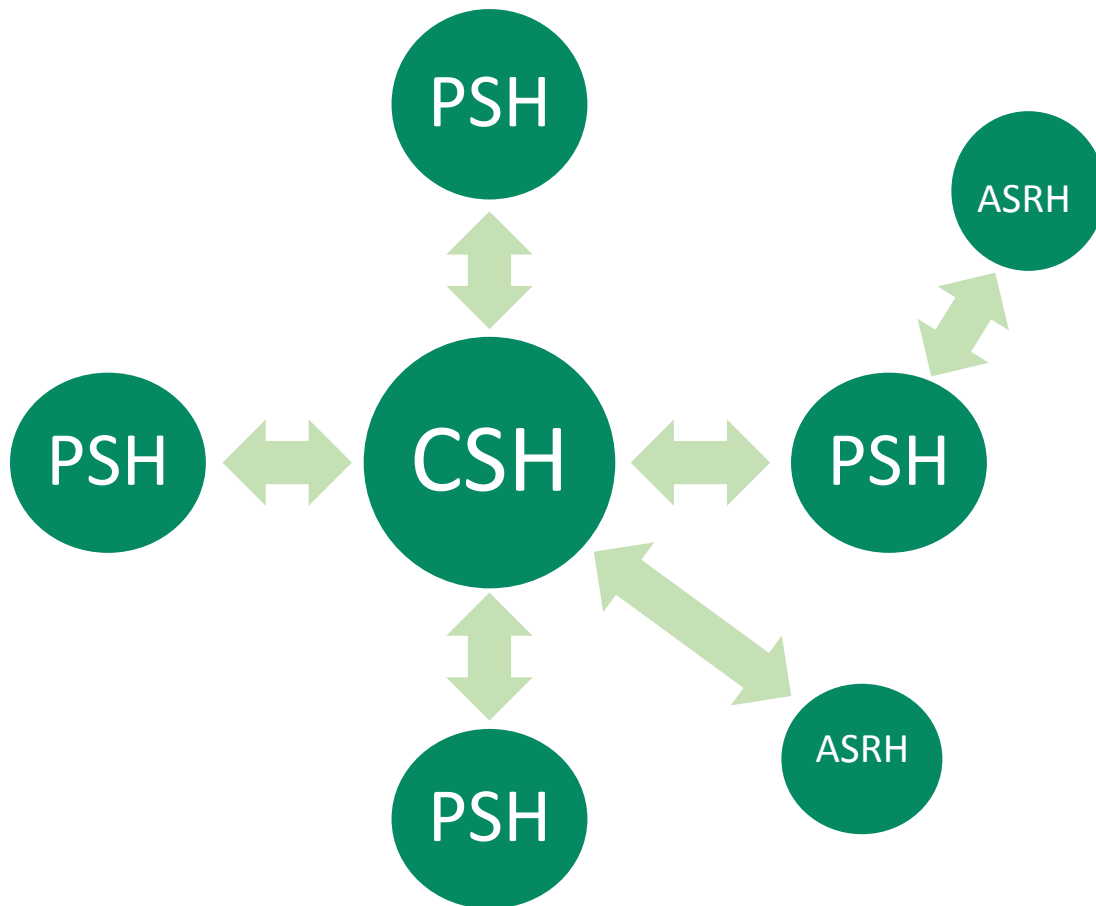


Figure 3: Hub and spoke model of stroke hospitals

Component 5. Outpatient care (including TIA clinics)

All networks will develop an outpatient care program to follow-up acute strokes and TIAs according to the National Stroke Standards. Most stroke patients care can be transferred to his/her family medicine physician within 6 months of his 1st diagnosis of stroke/TIA. Some TIA patients will require emergency workup for carotid stenosis or atrial fibrillation within 24 hours and thus weekend coverage should be available.

Component 6. Rehabilitation

The network should make available appropriate rehabilitation services for all stroke patients according to their disability. Acute inpatient care, acute outpatient care, subacute rehabilitation and long-term rehabilitation requirements should be developed and integrated into the stroke patient's pathway. Early supported discharge (ESD) is a method of

discharging stroke patients earlier than usual to complete their nursing and rehabilitation requirements at their home.

Component 7. Reintegration to society and end of life care

Depending on the physical or mental disability, the stroke/TIA patient will need assistance in returning to become an active member of society. Vocational training/retraining, social work support, financial support, disability assistance for the family and/or caregiver may be needed. Approximately 25-35% of all stroke patients will require some form of assistance 1 year after their stroke⁴; this may be as simple as assistance with shopping for food or as severe as complete dependence of a bedbound patient requiring full care. Chronic long-term facilities, nursing homes or home health care measures should be implemented according to the patient's need. Palliative care and end of life care should be an integral part of the acute stroke care for appropriate patients.

QM 2.1 Networked care delivery

Purpose: To deliver integrated stroke care for standardized, seamless and cost effective stroke care to patients within a specific catchment area.

Rationale:

- Evidence from other countries suggests networked delivery of care is cost effective and improves patient outcomes
- Networks can improve the utilization of resources and reduce unwarranted variation in care

Standards:

1. Each network should establish at least one Comprehensive Stroke Hospital along with a network of either Primary or Acute Stroke Ready Hospitals or both.
2. Each network should develop a public and patient education campaign to help improve timely diagnosis and transfer to appropriate stroke hospitals.
3. Each network should develop links with out of hospital services such as Primary care, EMS (ambulance services), Rehabilitation, Long Term and Palliative care services to ensure consistent use of standards and sharing of patient data.
4. Each network should set up a multi-disciplinary clinical committee, to oversee the delivery of stroke care, this committee should include professionals from all appropriate stroke care facilities, including hospitals and other relevant facilities.

⁴ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3751976/>

Chapter 3. Community activation

Objectives

1. To improve public and professional awareness of the risk factors and symptoms of a stroke, and what action to take.
2. To ensure that people who experience a stroke are at the center of decisions about their treatment and are involved in the design of services.

Key facts

- Stroke is the second largest cause of deaths in the Kingdom of Saudi Arabia.
- Based on expert opinion, it is estimated that the 2018 incidence of stroke is (75/100,000) in Saudi Arabia.
- There are approximately 24,000 strokes per year in Saudi Arabia.
- There has been a 103% increase in the incidence of stroke between 1990 and 2018.
- High blood pressure (26.1%) and Diabetes (13.1%) are the biggest preventable risk factors for stroke.

Introduction

Lack of awareness of stroke is a significant problem. People do not know what a stroke is, what the symptoms are, or that it is a treatable condition that warrants the same response as a heart attack. Additionally, people are unaware of the potential risk of themselves having a stroke, how to reduce that risk, or that stroke is largely preventable. Knowledge about stroke is also low among health and social care professionals. A study into 'Knowledge and Attitude of Stroke Among Saudi Population in Riyadh', suggested that cultural and educational strategies to improve knowledge about stroke in Riyadh community was needed. Considerable efforts should be planned to increase awareness about stroke, especially with low income and low-educated population.⁵

To initiate an emergency response to a suspected stroke, it is crucial that staff who have contact with the public (including GP receptionists, EMS call handlers, hospital triage staff, social care staff and allied health professionals) are able to recognize the symptoms of stroke or TIA, even when they cannot see the individual, and that they all share a common understanding of the importance of dealing with stroke as rapidly as possible.

⁵ <http://www.ijasjournal.org/wp-content/uploads/2017/03/MS36xx-17.pdf>

QM 3.1 Early Detection

Purpose

To ensure that signs and symptoms of stroke are recognized by the public and healthcare professionals to facilitate rapid detection of stroke and enable quick initiation of treatment in an appropriate setting.

Rationale

- Fast response to stroke reduces the risk of death and disability.
- Both public and professional awareness of stroke are crucial for patients to receive appropriate care.

Standards

1. Public and professional (including physicians, healthcare facilities personnel, and EMS personnel) stroke education campaigns should be regular and frequent to increase awareness of stroke and the need for urgent diagnosis and treatment.
2. Networks should ensure that people who have had a stroke, and their families and care givers, are informed and empowered, by providing information, advice and support and ensuring that services are in place to support people.
3. All healthcare professionals should be trained to recognize signs and symptoms of stroke indicating an acute stroke as an emergency, requiring immediate transfer to a stroke unit.
4. Patients seen by community-based healthcare professionals with the sudden onset of focal neurological deficit should be screened for hypoglycemia with a capillary blood glucose and for stroke or TIA using a validated tool such as FAST, as soon as possible.
5. Patients with an acute focal neurological deficit suspected to be a stroke should be moved directly to an appropriate stroke hospital.
6. EMS should be activated as soon as possible to ensure that patients with a positive stroke screen and/or a strong suspicion of stroke are transported rapidly to the closest stroke care unit that can administer IV Alteplase.
7. Standardized written protocol and standing orders for the emergency evaluation of patients with suspected stroke is recommended.
8. Telemedicine services can be used appropriately where necessary to ensure urgent management.
9. Patients who have had a suspected TIA should be assessed as soon as possible for their risk of subsequent stroke using a validated scoring system such as ABCD2.

Chapter 4. Integrated stroke care

Objectives

- To improve speed, accuracy and consistency of stroke assessment and treatment for all patients.
- To improve the speed of patient transfer to an appropriate stroke facility so that patients can receive rapid diagnosis and treatment.
- To treat people with suspected stroke as a medical emergency in order to provide optimal treatment and maximize the chances of independent living after stroke.

- To assess people experiencing a transient ischemic attack (TIA) or minor stroke rapidly in order to minimize the chances of a full stroke occurring.
- To ensure that all the patients that can benefit from reperfusion therapy are identified as soon as possible and appropriate therapy is administered in an evidence-based manner.

Key facts

- There is a 20 per cent risk of a full stroke within the first four weeks after a TIA.⁶
- Approximately 69% of the strokes are ischemic strokes and IV r-tPA rates are 0.5%.
- Stroke is a common emergency seen in the Kingdom of Saudi Arabia.
- Most stroke patients are transferred by private mode such as private car.
- EMS transferred around 20% of stroke patients between 2017-2018.

Introduction

A more urgent response to both stroke and TIA will save lives and reduce long-term disability. Intensive physiological and neurological monitoring in the early phase of a stroke supports early treatment that stops or slows stroke progression and prevents more brain cells being damaged. Investigating and treating high-risk patients with TIA within 24 hours could produce a significant reduction in the number of people who go on to have a full stroke.⁷

A. Components of acute stroke care

QM 4.1 EMS transfer

Purpose

To improve EMS transfer of stroke patients in terms of speed of response, consistency of assessment and intervention and conveyance to the appropriate facility in a timely manner.

Rationale

- Stroke is a major emergency seen in prehospital care. EMS stroke performance indicators have not been established. This document is designed to standardize the care and EMS response to all stroke patients.
- Urgent detection and treatment of stroke is crucial to the final outcomes. Typically, 1.9 million neurons are lost for each minute a stroke goes untreated.
- The first steps to accessing emergency treatment is a rapid response to an EMS call or ED conveyance for suspected acute stroke; rapid assessment utilizing a pre-hospital assessment tool (e.g. FAST) by the ambulance crew and emergency transfer with pre-alert to a receiving hospital able to offer hyper-acute services with appropriate 24-hour expertise for all those who are likely to benefit from immediate treatment, including intravenous thrombolysis.

⁶ Ibid

⁷ Rothwell PM, et al., 2007, 'Effect of urgent treatment of transient ischemic attack and minor stroke on early recurrent stroke (EXPRESS study): a prospective population-based sequential comparison', Lancet 370, 1432–42

- Ambulance services should work on proposals for improving the ability of ambulance medical dispatch systems to determine stroke calls that meet the FAST criteria and allow ambulance control staff to make a more appropriate response, which might be a category A response, within 15 minutes, where indicated.
- Thrombolysis for treatment of stroke must be started as soon as possible and within 4 ½ hours of the onset of the stroke symptoms at the latest and after prior exclusion of intracranial hemorrhage by means of appropriate imaging techniques.
- For ischemic stroke patient's thrombolysis can be an effective treatment where it can be delivered within 4 ½ hours; the patient should be triaged to a hospital which can deliver the drug. If the 4 ½ hour window has passed, it may be more appropriate to transfer to the nearest hospital with an acute stroke unit. (This time window may change as the evidence base increases.)

Standards

1. All stroke patients are recommended to be transferred via the EMS system.
2. EMS dispatchers should make stroke a priority, dispatch and transport times should be minimized.
3. EMS personnel should provide prehospital notification to the receiving hospital that a suspected stroke patient is on-route so that the appropriate hospital resource is mobilized prior to the patient arrival.
4. Stroke patients should be attended by the highest level of care available (If highest level of care will delay response, available EMS unit should be dispatched).
5. EMS response time should be < 15 minutes, and ambulance response should be code 1 (with lights and sirens).
6. EMS scene time should be ≤ 10 minutes.
7. EMS personnel must use a validated tool to detect stroke patients (i.e. FAST).
8. EMS should evaluate for the presence of stroke mimics
 - a. Hypoglycemia
 - b. Seizure
 - c. Sepsis
 - d. Migraine
 - e. Intoxication
9. EMS unit should bypass acute stroke ready hospitals if a Primary Stroke Hospital or Comprehensive Stroke Hospital is available within 45 minutes or 60 km.

QM 4.2 Emergency Stroke Assessment and Care

QM 4.2.1 ED assessment

Purpose

To ensure that immediate assessment is carried out in the ED to diagnose stroke and TIA, to enable urgent and accurate treatment. To standardize the stroke pathway that reflects up to date clinical practice guidelines; and to shorten the duration for obtaining timely brain imaging-based decisions for management of stroke patients.

Rationale

- Acute Stroke Protocol (stroke identification, ED evaluation, stroke team activation, stroke decision of care, post stroke care) can be used to improve outcomes.
- Hypoglycemia can mimic stroke symptoms and early identification of hypoglycemia can help to provide appropriate management.
- Effective clinical assessment of the patient with acute stroke, and decision making for timely appropriate therapy, is paramount for improving patient outcomes.
- Rapid and standardized ED assessment is important to provide safe and appropriate treatment.
- NIHSS is a standardized scale that quantifies the degree of neurological deficit, facilitates communication between different groups of healthcare providers, assists the decision for reperfusion therapy, and is an objective measure of clinical outcome.
- Immediate ED assessment of stroke related swallowing problems can help reduce the risk of aspiration in an acute stroke patient.
- It is important to increase staff knowledge and improve the quality of stroke care.

Standards

1. All hospitals must implement a protocol for acute stroke care assessment.
2. All hospitals must have an immediate triage process in ED for patients with acute stroke symptoms.
3. All patients with acute stroke symptoms must have blood glucose checked.
4. All hospitals must have a designated stroke team to assess and manage acute stroke.
5. Every patient with FAST positive results must have urgent access to neurological expertise.
6. All patients with stroke symptoms must be evaluated by using a standardized evaluation for stroke assessment tool (FAST).
7. National Institution of Health Stroke Scale (NIHSS) should be used by all hospitals to determine the severity of the stroke.
8. All patients with acute stroke symptoms will be restricted from having oral intake until they pass the swallowing assessment. See
- 9.
10. QM 4.2.4 Swallow screening .
11. ED staff must be trained to detect acute stroke symptoms. For example, in neurological assessment - STARS competencies:
(<http://www.strokecorecompetencies.org/node.asp?id=home>)

QM 4.2.2 Protocol for acute stroke screening

Purpose

Acute stroke symptoms are frequently missed in the ED or inpatient area; standardized tools used for screening suspected stroke patients ensures patients enter the stroke pathway quickly and receive appropriate treatment in a timely manner. To ensure that all hospitals have implemented a protocol for acute stroke screening. . To ensure patient safety and accuracy in the treatment plan

Rationale

- Timely assessment of suspected stroke patients is crucial to enable timely and appropriate therapy.
- The duration for obtaining timely brain imaging is crucial for making timely decision for management of stroke patients.
- Identification of hypoglycemia that may mimic stroke symptoms, is key to ensure that the patients receive appropriate timely treatment.

Standards

1. All hospitals must implement a protocol for acute stroke screening in the ED and inpatient areas.
2. All hospitals must have an immediate triage processes in ED for patients with acute stroke symptoms.
3. Use of a standardized scale for screening and quantifying the impact of stroke is recommended. All patients with stroke symptoms must be evaluated by using a standardized evaluation for stroke assessment tool (FAST).
4. Every patient with FAST positive results must have urgent access to neurological expertise.
5. All patients with acute stroke symptoms must have blood glucose checked.
6. All hospitals treating stroke patients must have a designated stroke team to assess and manage acute stroke.
7. NIHSS is such a standardize scale which quantifies the degree of neurological deficit, facilitates communication between different groups of healthcare providers, assists the decision for reperfusion therapy, and it is an objective measure of clinical outcome. The NIHSS will be used in all hospitals.
8. All patients with acute stroke symptoms will be restricted from having oral intake until they pass the swallowing assessment. See section QM 4.2.4 Swallow screening.
9. ED staff must be trained to detect acute stroke symptoms.
10. IV r-tPA will be given where clinically indicated unless the patient refuses it.

QM 4.2.3 Protocol for stroke code pathway

Purpose

- a. To ensure standardization of acute stroke patient care
- b. Have protocols with facilities for transfers to more specialized centers when needed.
- c. Have facilities for telemedicine when necessary.

Rationale

- Standardized medical care results in better outcomes and less variability in healthcare provision.
- To standardize the acute stroke imaging protocol.
- Utilization of tele-stroke allows early and effective clinical assessment and support treatment decision for reperfusion therapy.
- Acute stroke management is time dependent, it is useful to provide initial emergency stroke care in ED and initiate the decision for transfer.
- Evidence for utilization of tele-stroke is well established in acute stroke management.

Standards

1. An acute code stroke pathway will be developed in all hospitals, which will include recognition of acute stroke symptoms, urgent diagnosis, treatment and transfer.
2. Non-contrast CT imaging should be used to determine the decision about acute stroke management.
3. All patients with suspected acute stroke must have con-contrast CAT scan of the brain completed as soon as possible and within 25 minutes maximum on arrival.
4. Patient must have brain imaging obtained and interpreted as soon as possible and within 45 minutes of arrival into the hospital.
5. Brain imaging must support the decision for timely appropriate therapy. The aim of early CT imaging is to shorten the duration for decision of treatment.
6. Brain imaging to exclude ICH is recommended as part of initial evaluation for stroke patients who are potentially eligible for reperfusion therapy.
7. Using tele-stroke is recommended for hospitals with limited in-house expertise for diagnosis and treatment of stroke patients.
8. All hospitals must have a transfer protocol if advanced stroke care is not available.

QM 4.2.4 Swallow screening

Purpose

The purpose of dysphagia screening is to identify patients potentially at risk of aspiration. Delays in screening for and assessing dysphagia after stroke, are associated with higher risk of stroke-associated aspiration pneumonia. Swallow screening may help identify dysphagia early, thereby ensuring timely referrals to speech and language therapy and dietetics, thereby minimising the impact on the patient. Since stroke-associated aspiration pneumonia is one of the main causes of mortality after acute stroke, an early dysphagia assessment may contribute to preventing deaths from acute stroke and could be implemented even in settings without access to high-technology specialist stroke care.⁸

Rationale

- Dysphagia is a common consequence of stroke, affecting approximately 37% to 78% of patients with acute stroke and is associated with increased risk of aspiration, pneumonia, prolonged hospital stay, disability, and death
- Evidence supports that early identification of dysphagia reduces the risk for aspiration pneumonia, and there is also emerging evidence of an association between a failed screening and severe disability, discharge to long-term care, and 1-year mortality. Stroke patients with dysphagia therefore may experience a combination of these possible negative health complications. Accurate and early identification of dysphagia is critical and can facilitate a better recovery.

⁸ Bray, B. D., Smith, C. J., Cloud, G. C., Enderby, P., James, M., Paley, L., ... & Rudd, A. G. (2017). The association between delays in screening for and assessing dysphagia after acute stroke, and the risk of stroke-associated pneumonia. *J Neurol Neurosurg Psychiatry*, 88(1), 25-30.

- Patients with dysphagia often do not receive sufficient caloric intake, which may result in poorer outcomes as a result of malnutrition.

Standards

- 1) All acute stroke patients should be nil per oral until swallow screening is completed.
- 2) All acute stroke patients should have a swallow screen test within 4 hours by an appropriately trained clinician (typically a trained nurse).
- 3) Patients should be screened for swallowing deficits as soon as they are alert and ready for trialing oral intake, using a valid screening tool, by an appropriately trained professional.
- 4) Patients who fail the swallowing screening should be kept nil per oral (NPO) and referred to a speech pathologist for a comprehensive assessment.
- 5) Comprehensive assessment by a speech language pathologist should be done within 72 hours of referral. An instrumental evaluation is required to verify the presence/absence of aspiration and to determine the biomechanical swallowing function to guide the treatment plan.⁹
- 6) The choice of instrumental evaluation may be based on instrument availability or other considerations (i.e. fiberoptic endoscopic evaluation of swallowing, video fluoroscopy).¹⁰
- 7) For stroke survivors with swallowing difficulties, behavioral approaches such as swallowing exercises, environmental modifications, safe swallowing advice, and appropriate dietary modifications should be used early.
- 8) Until a safe swallowing method is established for oral intake, patients with dysphagia should have their nutrition and hydration managed with early consideration of alternative non-oral routes.
- 9) Swallow screening may be repeated if medical status changes.

QM 4.2.5 Intracerebral Haemorrhage

Purpose To ensure that immediate, appropriate assessment is carried out for hemorrhagic stroke to ensure that the patient can receive the required treatment.

Rationale

Approximately 15-20% percentage of total strokes are due to hemorrhage. Timely management of hemorrhagic stroke improves patient outcomes.

Standards

⁹ Powers, W. J., Rabinstein, A. A., Ackerson, T., Adeoye, O. M., Bambakidis, N. C., Becker, K., ... & Jauch, E. C. (2018). 2018 guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*, 49(3), e46-e99.

¹⁰ Powers, W. J., et al., (2018).

1. All adult patients with suspected hemorrhagic stroke must have immediate assessment and investigations to establish a diagnosis, initiate treatment and determine eligibility for surgical interventions.
2. All health care facilities caring for patients with primary intracerebral hemorrhage should have an evidence-based protocol outlining blood pressure control, reversal of coagulopathy and indication for neurosurgical intervention.
3. All Patients with spontaneous bleed should be managed using standardized guidelines and protocols.
4. All Patients with intracerebral hemorrhage related to anticoagulation use should have their coagulation profile checked immediately and correction of coagulopathy should be initiated rapidly, as per the established guidelines and protocols.
5. All patient with primary intracerebral hemorrhage must have urgent access to neurological expertise when needed.
6. All patients with acute spontaneous intra-cranial hemorrhage should be admitted to a stroke unit or equivalent.

QM 4.2.6 Door to needle time

Purpose

To ensure that timely intravenous thrombolytic therapy is delivered to those stroke patients who can benefit from it. To ensure that intravenous thrombolytic therapy is delivered in an evidence-based manner by qualified staff in appropriately equipped facilities.

Rationale

Evidence shows that intravenous thrombolytic therapy (recombinant tissue plasminogen activator [rt PA]) is beneficial for selected patients with ischemic stroke. It should be delivered in well-equipped centers/hospitals with adequate expertise and infrastructure for monitoring, rapid assessment and investigation of acute stroke patients.

Standards

1. All adult patients with suspected ischemic stroke must have immediate assessment and investigations to establish a diagnosis, rule out stroke mimics, determine eligibility for reperfusion therapy within 24 hours (IV thrombolysis within 4.5 hours; mechanical thrombectomy within 24 hours) from last time patient known to be normal.
2. All hospitals capable of administering thrombolysis should have an evidence-based driven protocol outlining indications, contraindication, post thrombolysis care, and complication management.
3. Laboratory investigation should be conducted as part of the initial evaluation which includes: random glucose, coagulation status (INR, aPTT), complete blood count (CBC), electrolyte and creatinine. IV r-tPA should not be delayed due to pending lab results unless there is a clinical suspicion of a contraindication such as (patient on warfarin or a history of leukaemia with possible low platelets).
4. If clinically indicated additional investigations such as Cardiac enzymes, ECG and chest X ray should be considered.

5. Point of care testing is recommended for Glucose, Direct Oral Anti-Coagulants (DOACs) and INR.
6. All patients with suspected acute stroke should get brain imaging with CT or MRI as soon as possible.
7. Within 4.5 hours of the onset of stroke symptoms, all eligible patients with disabling ischemic stroke should receive intravenous Alteplase.
8. For patients considered for mechanical thrombectomy, a noninvasive craniocervical vascular study is recommended, however, it should not delay IV thrombolysis if indicated. R-tPA and TNK are the only thrombolytic agents currently approved for IV thrombolysis.
9. All patient who had reperfusion therapy should be admitted to a stroke unit for at least 24 hours

QM 4.2.7 Mechanical Thrombectomy (MT)

Purpose

To quickly identify ischemic stroke patients with large vessel occlusion (LVO) appropriate for recanalization procedure. To quickly recanalize an occluded cerebral large vessel by quickly activating the interventional neuroradiology team.

Rationale

- Timely mechanical thrombectomy is associated with improved patient outcomes for large vessel occlusion¹¹.
- Emergency assessment of suspected stroke patients upon arrival in ED can facilitate timely mechanical thrombectomy.

Standards

1. All hospitals will develop a protocol for identifying ischemic stroke patients with LVO.
2. All ischemic stroke patients presenting within 24 hours will be screened for LVO.
3. All hospitals will develop a protocol to treat appropriate patients with LVO or to transfer them as soon as possible to a MT capable center/hospital.
4. All ambulances are encouraged to have a screening protocol for LVO (NIHSS of 11 or more, or another scale such as C-STAT etc.) and transfer them to a MT capable center/hospital.

QM 4.2.8 Decompressive Hemi Craniectomy for acute ischemic stroke

Purpose

To treat brain swelling and mass effect secondary to a middle cerebral artery (MCA) territory infarction by decompressive hemicraniectomy.

Rationale

¹¹ https://www.strokeassociation.org/idc/groups/stroke-public/@wcm/@hcm/@sta/documents/downloadable/ucm_499252.pdf

- In patients <60 years of age with unilateral MCA infarctions that deteriorate neurologically within 48 hours despite maximal medical therapy, decompressive craniectomy with dural expansion is effective.¹²
- Although the optimal trigger for decompressive craniectomy is unknown, it is reasonable to use a decrease in level of consciousness and its attribution to brain swelling as selection criteria.
- The efficacy of decompressive craniectomy in patients older than 60 years of age and the optimal timing of surgery are uncertain.
- Clinicians may discuss with family members that a third of the patients with massive hemispheric infarctions, even after decompressive craniectomy, are severely disabled and fully dependent on care.¹³
- Decompressive craniectomy reduces mortality from avoiding the progression to brain death.

Standards

1. Identification of patients with or at high risk for infarction and swelling should be made using clinical data, including vessel occlusion status.
2. Patients with large MCA infarcts and potential herniation should be referred for neurosurgery urgently.
3. Patients with middle cerebral artery infarction who meet all of the criteria below should be considered for decompressive hemicraniectomy.
 - Patients aged 60 years or under.
 - Clinical deficits suggestive of infarction in the territory of the middle cerebral artery, with a score on the NIHSS of above 15.
 - Decrease in the level of consciousness to give a score of 1 or more on item 1a of the NIHSS.
 - Signs on CT of an infarct of at least 50% of the middle cerebral artery territory, with or without additional infarction in the territory of the anterior or posterior cerebral artery on the same side, or infarct volume greater than 145 cm³ as shown on diffusion-weighted MRI.
4. Patients who are referred for decompressive hemicraniectomy should be monitored by appropriately trained professionals skilled in neurological assessment.

QM 4.2.9 Cerebral Venous Thrombosis

Purpose

To ensure that patients presenting with suspected Cerebral venous thrombosis (CVT) are diagnosed and treated promptly to improve their prognosis.

¹² https://professional.heart.org/idc/groups/ahamah-public/@wcm/@sop/@smd/documents/downloadable/ucm_460163.pdf

¹³ <https://www.ncbi.nlm.nih.gov/pubmed?term=3975967>

Rationale

- CVT is an uncommon and frequently unrecognized type of stroke, it is more common in younger stroke patients¹⁴.
- In a series of intracerebral hemorrhage (ICH) in young people, CVT explained 5% of all cases¹⁵.
- Neurologic worsening may occur in 23% of the patients, even several days after diagnosis

Standards

1. Routine blood studies consisting of a complete blood count, chemistry panel, prothrombin time and activated partial thromboplastin time should be performed for patients presenting with suspected CVT.
2. In patients with lobar intracerebral hemorrhage of otherwise unclear etiology or with cerebral infarction crossing typical arterial boundaries, imaging of the cerebral venous system should be performed.
3. In patients with the clinical features of idiopathic intracranial hypertension, imaging of the cerebral venous system should be performed.
4. A venographic study (either CT or MR venogram) should be performed in suspected CVT if the plain CT or MRI is negative, or, to define the extent of CVT if the plain CT or MRI suggests CVT. A plain CT or MRI does not rule out CVT.
5. Repeat CT or MR venogram should be performed in patients presenting with recurrent symptoms of CVT.
6. In patients with CVT and a single seizure with parenchymal lesions, early initiation of anti-epileptic drugs for a defined duration should be performed.
7. Patients with CVT and a suspected bacterial infection should receive appropriate antibiotics and surgical drainage of purulent collections of infectious sources associated with CVT when appropriate.
8. In patients with CVT, visual fields should be monitored for progressive deterioration and when this is observed, increased intracranial pressure should be urgently treated.
9. In patients with a past history of CVT who complain of new, persisting or severe headache, evaluation for CVT recurrence and intracranial hypertension should be considered.
10. For patients with CVT, initial anticoagulation with adjusted-dose unfractionated heparin or weight-based low molecular weight heparin in full anticoagulant doses should be considered, followed by vitamin K antagonists, regardless of the presence of intracerebral hemorrhage.
11. For women with CVT during pregnancy, LMWH in full anticoagulant doses should be continued throughout pregnancy, and LMWH or vitamin K antagonist with a target INR 2.0-3.0 should be continued for at least 6 weeks post-partum (for a total minimum duration of therapy of 6 months).

¹⁴ <https://www.ncbi.nlm.nih.gov/pubmed/14976332>

¹⁵ <https://www.ahajournals.org/doi/full/10.1161/01.STR.0000117571.76197.26>

QM 4.2.10 Subarachnoid hemorrhage

Purpose

To ensure that immediate, appropriate assessment is carried out for spontaneous subarachnoid hemorrhage to ensure that the patient can receive the required treatment.

Rationale

Spontaneous subarachnoid hemorrhage, which is usually attributable to rupture of an intracranial aneurysm, is accountable for 3% of all strokes.¹⁶ There is some evidence that the mortality associated with SAH may have decreased during the past few decades, but it is still >25%.¹⁷ Immediate treatment for spontaneous subarachnoid hemorrhage patients can improve patient outcomes. The longer the patients are left without any treatment, the higher the chance he/she may get re-rupture from the vascular lesion or develop complications from the initial bleed (e.g. hydrocephalus, seizures, vasospasm, etc.) leading to mortality or long-term permanent damage.

Standards

1. All adult patients with suspected spontaneous (non-traumatic) subarachnoid hemorrhage must have immediate assessment and investigations to establish a diagnosis, initiate treatment and determine eligibility for surgical or endovascular interventions.
2. All health care facilities will have a protocol outlining initial assessment, management and transfer protocols for SAH.
3. All patients with spontaneous subarachnoid hemorrhage should be managed using standardized guidelines and protocols in a comprehensive stroke hospital.
4. All patient with spontaneous subarachnoid hemorrhage must have immediate access to neuro-surgical expertise.
5. All patients with spontaneous subarachnoid hemorrhage should have rapid access to neurological imaging including vascular imaging and timely access to neuro-vascular expertise.
6. All patients with spontaneous subarachnoid hemorrhage should be admitted to a neurocritical care unit or equivalent.
7. All patients with spontaneous subarachnoid hemorrhage –regardless of their clinical status- should be immediately assessed then transferred to a comprehensive stroke hospital, where established guidelines and protocols are used to manage these patients in a multi-disciplinary therapy team.

QM 4.3 Acute stroke unit

Purpose

¹⁶ Lloyd Jones D et al, Circulation. 2010

¹⁷ Lovelock CE et al, Neurology. 2010.

To improve stroke patient's outcomes & reduce mortality by providing multi-disciplinary treatment by specialist clinicians and professionals in the acute phase of stroke.

Rationale

- Acute stroke and some TIA patients admitted to stroke units have less morbidity and mortality, better functional outcomes and better quality of life.
- Acute medical management, discovering the pathophysiology of the stroke and starting secondary stroke prevention measures occurs in the acute stroke unit.
- Common comorbidities are prevented by following unified stroke protocols.
- Co-ordinated multidisciplinary acute rehabilitation is started in the stroke unit and connects the patient and family to further short- and long-term stroke services.
- A multidisciplinary team that consists of physicians, nurses and rehabilitation staff (physiotherapy, occupational therapy, speech therapy), social work, nutrition, psychology and other staff with stroke expertise, manage the patients in a holistic manner.

Standards

1. All primary and comprehensive stroke hospitals will have an acute stroke unit (ASU).
 - a. Acute stroke unit is a dedicated location within a hospital where stroke specialist, multidisciplinary management of stroke patients is provided by a dedicated team.
 - b. During the ASU admission:
 - i. An understanding of the stroke patient's pathophysiology will be established
 - a. Carotid imaging will be performed for anterior circulation strokes in a timely fashion
 - ii. Appropriate acute medical management documented
 - iii. Secondary stroke prevention advice given
 - c. Prewritten protocols and policies will be followed for all stroke and TIA patients
 - i. To prevent deep venous thrombosis
 - ii. For acute antiplatelet/anticoagulant use
 - iii. Discharge medications for antiplatelet/anticoagulants, statins and hypertensive medications
 - iv. Stroke education
 - v. Connection with smoking cessation program
 - vi. Management of blood pressure
 - d. Daily clinical reviews are performed by stroke trained consultants.
2. The majority of stroke and some TIA patients will be admitted to ASUs unless other conditions requiring immediate specialist care elsewhere, dominate.
3. The patient will be assessed by appropriate rehabilitation specialties within 48 hours, and a long-term rehabilitation plan will be developed.
4. All medical staff caring for stroke patients shall be competent in stroke medicine, stroke rehabilitation and stroke nursing (*see guidance on staff training* - Chapter 6. Human resource development).

5. Appropriate staffing ratios shall be met (*see guidance on types of stroke units - Chapter 2. Network*).
6. Some stroke units may choose to further divide their unit into acute stroke units, skilled nursing units and rehabilitation stroke units. (*see guidance on types of stroke units*).
7. Continuous physiological monitoring will be done during the acute phase.
8. All patients admitted with suspected acute stroke have a swallow screening assessment performed on admission, by appropriately trained and competent staff, and a protocol for short- and long-term management of swallowing will be made.
9. All stroke patients should have a nutritional screening assessment performed within 24 hours of admission. A protocol for short- and long-term management of nutrition will be made.
10. Conscious patients admitted with suspected acute stroke are mobilized out of bed on the day of admission. A protocol for early mobilization will be followed.
11. A protocol for the promotion of bladder and bowel continence including a policy to avoid urinary catheters.
12. Multidisciplinary team meeting occurs at least weekly to discuss progress and plan goals for patients as well as timely and appropriate transfers of care.

QM 4.4 Acute Stroke Rehabilitation

Purpose

The purpose of acute stroke rehabilitation is to improve the overall function of patients in the acute stroke unit since the initial three months is the period when the most recovery is expected after stroke. In addition, it will minimize complications of bed rest and psychosocial distress which potentially decreases the length of stay in the acute and/or sub-acute units¹⁸.

To minimize complications of bed rest and psychosocial distress of hospitalization, to ensure safe discharge with better utilization of outpatient rehabilitation, and inpatient rehabilitation.

Rationale

- The quality of life of stroke patient in Saudi Arabia is generally low compared with other developed countries. Stroke rehabilitation standards are aimed at improving patient function and encourage independence.
- The functional level of stroke patients has a strong influence on Health-related quality of life among stroke survivors.
- Improving acute stroke rehabilitation can help to prevent complication
- Improving acute stroke rehabilitation will prepare the stroke patient to transfer from stroke unit to inpatient rehabilitation or discharge home with outpatient rehabilitation program, Early Supported Discharge Team or community rehabilitation.

¹⁸http://www.strokeassociation.org/STROKEORG/LifeAfterStroke/ForFamilyCaregivers/CaringforYourLovedOne/15-Things-Caregivers-Should-Know-After-a-Loved-One-Has-Had-a-Stroke_UCM_310762_Article.jsp#.XDxkO88zaqA

- Development of Stroke Rehabilitation Standards is to provide timely rehabilitation intervention to stroke patients to improve their outcomes, function and enhance their independence.
- Currently the provision on acute inpatients rehabilitation is very limited to very few centres in the Kingdom of Saudi Arabia.
- Rehabilitation is a holistic process that should begin the first day after stroke with an aim to maximize participation of the patient in the community. To achieve this tailored intervention that focus on impairment, activity and participation levels (based on WHO classification of functioning model should be considered).¹⁹

Standards

1. A specialist and dedicated rehabilitation team for providing acute rehabilitation to stroke patients should consist of the following disciplines:
 - i. Medical lead
 - ii. Speech and Language Pathologist
 - iii. Physical therapist
 - iv. Occupational therapist
 - v. Social worker
 - vi. Clinical pharmacist
 - vii. Dietician
 - viii. Orthotist
 - ix. Nurse
 - x. Clinical Psychology (competent in managing stroke patients)
 - xi. Orthoptist
2. The stroke rehabilitation Pathway starts in the stroke unit with 24-48 hours of admission to the stroke unit by comprehensive assessment of all patient physical, cognitive, swallowing and communication functions. (For post-acute inpatient and outpatient stroke rehabilitation please see **QM 5.1 Post-Acute Stroke Rehabilitation**)
3. All patients who are medically stable should receive rehabilitation therapy within 48 hours of admission
4. Stroke patients who were identified by the stroke multidisciplinary team to have complex rehabilitation needs should be immediately referred to inpatient rehabilitation and transfer for inpatient rehab when they are medically stable
5. Each patient diagnosed with acute stroke and admitted to acute stroke unit should be screened for speech and language, physical, functional and cognitive functions by a multidisciplinary rehabilitation team within 24 to 48 hours, to identify the cases eligible for the rehabilitation services.
6. Stroke patients should receive the acute rehabilitation management carried by the specialist multi-disciplinary team when the patient meets the inclusion criteria (please see the suggested inclusion criteria in appendix 2).²⁰

¹⁹ <https://www.who.int/classifications/drafticfpracticalmanual2.pdf?ua=1>

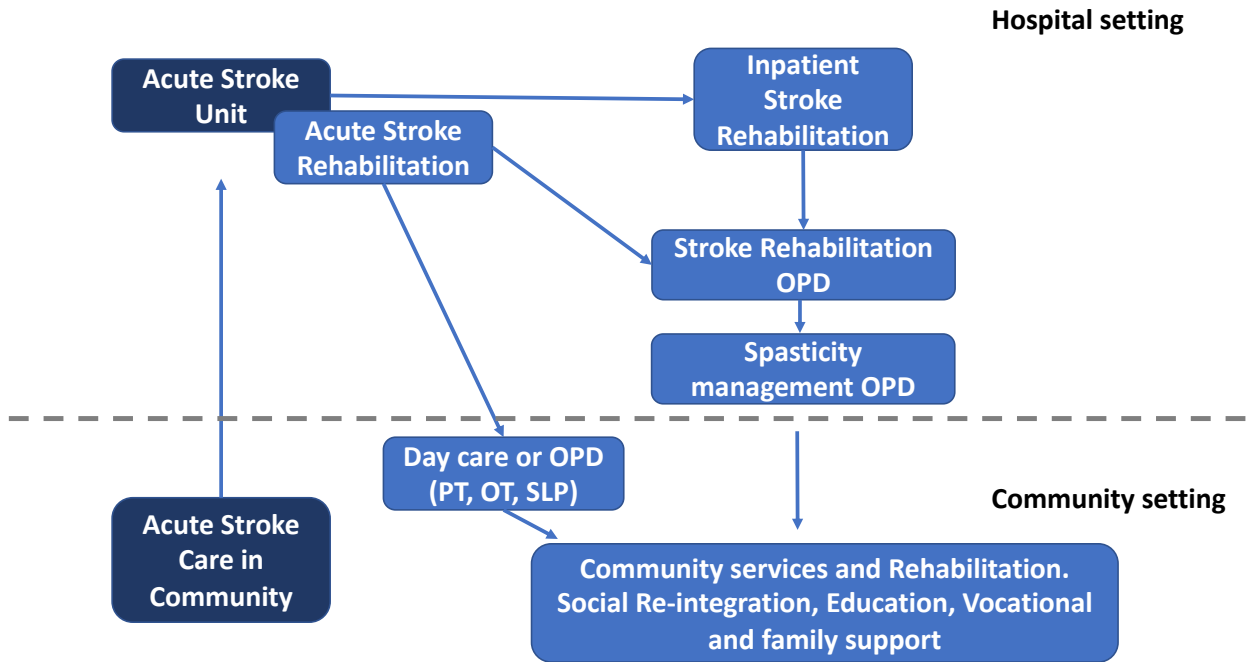
²⁰ <https://www.clinicalguidelines.gov.au/portal/2585/clinical-guidelines-stroke-management-2017>

7. A valid and reliable tool must be used to assess the disability level of the stroke patient by the multidisciplinary rehabilitation team in the acute stage (i.e. within 24 to 48 hours post onset).
8. The multidisciplinary rehabilitation team should set specific recovery goals to meet the expected outcomes for each patient as early as possible, and update it on a regular basis, based on the prognosis of the stroke patient.
9. Stroke patients suffering from muscle spasticity need to have access to specialised treatment for management of symptoms including Botulinum Toxin for treatment of spasticity.
10. When the stroke patient is medically stable, the multidisciplinary rehabilitation team should create an evidence-based comprehensive management plan.
11. The multidisciplinary rehabilitation team should regularly reassess the stroke patient to identify the effectiveness of the rehabilitation plan.
12. Each stroke patient should be reassessed before discharge to identify his or her disability level and the need for follow-up support services.
13. The multidisciplinary rehabilitation team should prepare a transfer plan prior to discharge of the stroke patient from the stroke unit (e.g. home with outpatient rehabilitation, admission to a rehabilitation center/hospital, long term or palliative care) based on certain eligibility criteria for each facility.
14. The multidisciplinary rehabilitation team should report the continuity of care recommended for the stroke patient, this should be communicated to the stroke patient, patient's family members and receiving clinicians.
15. The multidisciplinary rehabilitation team should have an agreed-upon method to maintain communication between its team members.
16. The multidisciplinary rehabilitation team should involve the stroke patient and/or their family in setting goals, expected outcomes, medication management and discharge plan.
17. All patients should be assessed for Physiotherapy within 24 hours of admission, unless contraindicated, for example, due to being medically unstable. Rehabilitation management should begin within 24/48 hours. This should include:
 - I. early mobilization
 - II. prescribing the right amount of exercise
 - III. prescribing the right assistive device
 - IV. educating the staff, patients and caregiver to regular turning, provide special mattresses and cushions to prevent skin breakdown
 - V. educating the staff, patients and caregiver to transfer the patient safely to prevent shoulder dislocation.
 - VI. determining whether the orthosis was appropriate to the patient
 - VII. stroke patient should receive therapy for one hour, 5 days per week as tolerated
 - VIII. following up on patient's functional level within 30 days post discharge.
- 1) All patients must receive swallowing screening from a qualified professional upon emergency room admission prior to receiving any oral intake (medication or nutrition).
 - I. All patients who pass the screening to monitor safety and tolerance of regular diet and refer to SLP if concerns arise.

- II. All patients that fails the screening, NGT must be inserted and referral to SLP for swallowing bedside assessment within 24 hours of admission to determine the candidacy/safety of oral feeding.
18. All patients who fail the swallowing screening should receive a full swallowing assessment by speech pathologist prior to starting any oral intake (oral medication/feeding).
19. Instrumental/ diagnostic swallowing evaluation should be carried out following the bedside evaluation as needed.
20. Swallowing and speech and language intervention should begin within 72 hours post assessment or once the patient is medically stable. This should Include:
 - I. Conducting swallow instrumental evaluation to assess oropharyngeal biomechanical function and dysfunction, determine swallowing safety and efficiency, identify effectiveness of compensatory strategies, establish an appropriate diet, and construct an evidence-based rehabilitation plan.
 - II. Increasing awareness about communication severity level and its effect on patient's current communication skills.
 - III. Increasing awareness about patient's strengths and weakness in communicating his/her needs by educating patient/family.
 - IV. Increasing patient's orientation skills to self, place, situation and time.
 - V. Initiating treatment focusing on patient's ability to effectively communicate his/her basic needs via various communication modalities (gesture, communication board, writing) Train patient/family to use communicative strategies to assist patient in meeting his/her goals
 - VI. Educating the medical staff about strategies to support patient's cognitive communication skills in routine situations (e.g., medication, bathroom).
 - VII. Follow unified standardized measures to document the disability level start from the acute stage and progress over the recovery phase.
 - VIII. Providing therapy to the stroke patient for 20-30 minutes daily as tolerated.
 - IX. Discharge report should include recommendations on aspiration precautions, diet modifications, communication facilitation strategies, needed swallowing and/or speech follow-up at discharge destination.
21. All stroke patients should be screened for cognitive and perceptual deficits by a trained person (e.g. neuropsychologist, occupational therapist or speech pathologist) using validated and reliable screening tools, ideally prior to discharge from hospital.
22. Stroke patients identified during screening as having cognitive deficits should be considered for comprehensive clinical neuropsychological investigations.
23. The multidisciplinary rehabilitation team prepare the transfer plan for discharge of the stroke patient from stroke unit to home without patient rehabilitation, admitted to rehabilitation center/hospital, long term or palliative care, based on certain eligibility criteria for each facility.
24. Patients who are deemed unsafe or dependent in personal activities of daily living after stroke should be referred to an occupational therapist with experience in neurological disability; patients should be assessed within 72 hours of referral and be offered treatment for identified problems (e.g. feeding, toileting) by the occupational therapist.

25. Stroke multidisciplinary team should refer stroke patients who were assessed to be safe and appropriate to day care, to outpatient and to community rehabilitation services after discharge from stroke unit
26. All acute stroke patients should be offered, as needed, specific treatments that include:
dressing practice for people with residual problems with dressing as many opportunities as appropriate to practice self-care; assessment, provision and training in the use of equipment and adaptations that increase safe independence; training of family/care givers in how to help the person with stroke.
27. Patient's home environment should be assessed by a visit with an occupational therapist. If a home visit is not considered appropriate, they should be offered a visit and advice on how to adapt the home environment to improve patient's functional independence and safety in the home environment, this could include equipment for the care givers and family members, to support the patient e.g. moving and handling equipment.
28. Acute stroke patients who are dependent in personal activities (e.g. dressing, toileting) should be offered support before being transferred home that includes:
 - a. visits/leave at home prior to the final transfer of care with or without occupational therapist or care staff
 - b. training and education for their care givers specific to their needs
 - c. telephone advice and support for three months.

Stroke Rehabilitation Care Pathway



QM 4.5 Transfer of care

4.5.1 QM ToC1: Interfacility transfer

Purpose

To ensure that every patient has timely access to reperfusion therapy regardless of which health care facility they visit.

Rationale

- Reperfusion therapies for ischemic stroke have been proven effective and safe in several randomized controlled trials and metanalysis and endorsed by several international guidelines to improve stroke outcomes.
- The efficacy and safety of IV r-tPA for ischemic stroke are well established within 4.5 hours of stroke onset.
- Thrombectomy has been proven effective and safe for acute ischemic stroke with large vessel occlusion, salvageable brain tissues, within the first 24 hrs of symptoms onset.
- Time to reperfusion therapy is a crucial determinant of patient outcome (the earlier the intervention, the better the outcome).
- Timely administration of such therapies requires robust systems in place, and stroke expertise which may not be available in each hospital due to financial constraints, limited distribution and availability of neurological, neurosurgical, and radiological expertise, or other reasons. Therefore, establishment of interfacility timely transfer agreement, protocols and reimbursement mechanism can overcome such limitations and ensure every patient receives equal standards of care.

Standards

In the event a stroke patient is received by a hospital without current capacity or appropriate resources to provide reperfusion therapies, the patient should be transferred to a hospital with increased level of stroke capabilities that can provide such therapies.

1. All hospitals caring for stroke patients that are not capable to administer IV r-tPA, mechanical thrombectomy or both should develop, adopt, and adhere to protocols to transfer candidate patients to stroke hospitals capable to administer and perform these therapies.
2. In order to determine the best transportation option, key factors are the geographic location of the primary stroke hospitals and the comprehensive stroke hospitals in relation to the patient origin, as well as regional infrastructure and available expertise.
3. For acute stroke ready hospital not capable to administer IV t-PA, direct transfer to stroke hospital capable of performing thrombectomy is standard of care.
4. For acute stroke ready hospitals not capable to administer IV t-PA, the time for emergency assessment and arrangement of transfer should not exceed 20 minutes. (the time from emergency arrival (door in) to the time when the patient physically leaves the emergency (Door out) should be less than 20 minutes (door in-door out time <20 minutes).
5. Hospitals that adapt the “Drip and Ship” model for a patient (that is administer IV r-tPA then transfer thrombectomy candidate patient to thrombectomy capable

hospital), should access the thrombectomy within 120 minutes from arrival to the first emergency room. Patient safety and local circumstances should be taken into consideration.

6. Each hospital should conduct continuous improvement initiatives to cut unnecessary delays of transfer and benchmark with other peer hospitals.
7. Each hospital should be engaged in quality initiative and collect data for performance measurement and benchmarking.
8. IV r-tPA should be administered to candidate patients within 60 minutes of emergency arrivals (door-to-needle-time <60 min).
9. Thrombectomy should be performed for candidate patients within 90 minutes of emergency arrivals (door-to-groin-time <90 min).

4.5.2 QM ToC 2: Interfacility transfer for management of non-traumatic subarachnoid hemorrhage

Purpose

To ensure that every patient who suffers from spontaneous subarachnoid hemorrhage, has timely access to expertise in diagnosis and management.

Rationale

- Subarachnoid hemorrhage carries a significant mortality (greater than 25%) and morbidity.
- Prompt diagnosis, identification of source of bleeding, timely securing of the aneurysm (by coiling or clipping), management of hydrocephalus and other complications improve patient's outcome.
- Management of such patients require high level of expertise which may not be available in all hospitals. Therefore, establishment of interfacility timely transfer agreement, protocols and reimbursement mechanism can overcome such limitations and ensure every patient receive standard of care.

Standards

1. All hospitals should develop, adopt, and adhere to protocols to transfer SAH patients to a comprehensive stroke hospital immediately.
2. All non-comprehensive hospitals will have transfer agreements with comprehensive stroke hospitals for immediate transfer.

4.5.3 QM ToC 3: Transfer from a higher complexity to lower complexity stroke hospital

Purpose

- To ensure timely and safe transfer of patients from a comprehensive stroke hospital to a primary stroke hospital and then to rehabilitation facility, long term care facility or home.
- To ensure availability of beds in Primary and Comprehensive Stroke Hospitals whenever needed.

Rationale

- For a stroke network to function effectively, a constant flow of patients out of each designated hospital to the other, is needed.
- There is good evidence from the critical care literature that patients can get harmed if they are not appropriately accompanied by the right personnel and if the right procedures were not followed appropriately.
- The number of beds at any facility are limited and should be utilized appropriately.
- Seamless transfer of patients from one stroke hospital to another stroke hospital or other facility will allow patients to be treated in the appropriate place during their journey through the stroke pathway.

Standards

1. All hospitals should have protocols of inter-hospitals and intra-hospital transfer of patients with the designated staffing, equipment and standards for EMS.
2. **For comprehensive stroke hospital:**
 - a. If a patient comes from acute stroke ready hospital or primary stroke hospital for possible thrombectomy and then deemed to be not eligible for the intervention, this patient may be transferred back to the sending hospital or another appropriate hospital closer to patient's home; except if medically indicated to be kept in a higher facility.
 - b. The duration of stay should be determined in agreement between the two hospitals based on clinical pathways and protocols.
 - c. There has to be urgent versus non-urgent protocols established within each hospital according to best practices and local circumstances.
 - d. For patients who have had their intervention/thrombectomy done in the comprehensive stroke hospital, admission to the acute stroke unit within that facility is advised for stabilization and monitoring.
 - e. After stabilization and monitoring, the patient should be transferred back to the same hospital, if his clinical condition is judged to be eligible to be transferred, and in accordance with the agreement of hospitals within the same network or repatriated to patient's network.
 - f. If the patient is stable to be discharged home, rehabilitation facility, or to long term care facility, then the comprehensive stroke hospital will ensure timely transfer.
3. **For primary stroke hospital:**
 - a. All patients with acute stroke that did not need thrombectomy (hence did not need transfer to comprehensive stroke hospital) should be transferred from the emergency department to an acute stroke unit within the same facility, in a timely fashion, following hospital protocols.
 - b. Patients who are clinically ready to be transferred to rehabilitation or long-term facility should do so based on the protocols within the hospital.
4. **For the transfer of patients from stroke facility to rehabilitation, long term care, or home:**
 - a. Prior to discharge home, all patients should be assessed to determine the need for a home visit, which may be carried out to minimize safety risks and facilitate provision of appropriate aids, support and community services.
 - b. Patients and families/care giver should have the opportunity to identify and discuss their post- discharge needs (e.g. physical, emotional, social,

- recreational, financial and community support needs) with relevant members of the multi-disciplinary team making decisions for discharge.
- c. All medications, equipment and support services necessary for a safe discharge should be organized and documented in the discharge summary.
 - d. A documented post-discharge care plan is developed in partnership with the patient and family/care giver and a copy provided to them. This may include relevant community services, self-management strategies (e.g., including medications information and compliance advice, goals and therapy to continue at home), stroke support services (e.g., Stroke Foundations if available), any further rehabilitation or outpatient appointments, and an appropriate contact number for any queries.
 - e. A discharge planner can be used to coordinate a comprehensive discharge program for people with acute stroke.
5. Each hospital should have clearly written protocols of the patient criteria that they can be admitted from and to another hospital within the same cluster.
 6. EMS protocols have to be clear and easy to apply clinically.
 7. Bed status in each hospital has to be known for both parties in each direction of care.

B. TIA

QM 4.6 TIA assessment

Purpose

All TIA patients should be risk stratified and receive expedited care based on their risk score to ensure prompt treatment and prevention of a stroke or other complications.

Rationale

- The risk of stroke is highest in the first few hours and days after a TIA and some of which could be potentially fatal or disabling.
 - I. Two non-randomized studies supported rapid assessment and management of TIA in order to prevent recurrent strokes.
 - II. Two studies in UK and France using historical controls reported an 80% risk reduction in recurrent stroke at 90 days with establishment of rapid referral, assessment and initiation of secondary prevention medications.
- The detection of vascular stenosis or occlusion is important to categorize patients who are at risk of recurrent events or stroke.²¹ It also guides intensive secondary prevention.²²
- Urgent detection and treatment of atrial fibrillation is important in secondary prevention.
- Delayed secondary prevention is associated with worse outcomes, including a higher rate of early stroke recurrence.

Standards

²¹ (Coutts et al. 2012).

²² (Kamal et al. 2015).

For all patients with suspected TIA

1. All patients with suspected TIA should be assessed by a professional with neurological expertise urgently.
2. All patients with suspected TIA should commence secondary prevention therapy immediately.
3. All patients with suspected TIA should have detailed history and clinical examination, prognostic (e.g. ABCD2 score) and investigative tests (e.g. basic blood tests, brain and carotid imaging and ECG) at the initial point of healthcare contact, whether first seen in primary or secondary care.

A) For patients with suspected TIA and high risk of subsequent stroke

Patients with suspected TIA with high risk of stroke (ABCD2 score of 4 or above) should have:

1. Neurological expert assessment should be done within 24 hours of symptoms onset for exclusion of stroke mimics, identification of vascular stroke treatment, identification of likely causes, and appropriate investigation (vascular imaging) and treatment once the diagnosis is confirmed.
2. Patients with crescendo TIA (two or more TIAs in a week) should be treated as being at high risk of stroke and to be assessed within 24 hours, regardless of ABCD2 score.
3. Patients with high risk of stroke should have vascular imaging obtained and they should be seen in a specialist TIA clinic within 24 hours if available
4. If urgent assessment and intervention is not available as an out-patient for high risk patients, then they should be admitted to the hospital.

For patients with suspected TIA and low risk of subsequent stroke

Patients with suspected TIA who are at lower risk of stroke (ABCD2 score of 3 or below) should have:

1. Neurological expert assessment can be done within one week of onset of symptoms for exclusion of stroke mimics, identification of vascular stroke treatment, identification of likely causes, appropriate investigation and treatment
2. Patients with TIA and presents late (more than 1 week after their clinical symptoms) should be treated as having lower risk of stroke.
3. Vascular imaging should be carried out in 48 hours of onset of symptoms and TIA clinic appointment should be completed within 1 week of onset of symptoms.

For all patients with confirmed TIA

1. All patients with a confirmed TIA should have ECG, brain imaging and ABCD2 scores completed.
2. All anterior circulation TIA patients should undergo early Carotid imaging with carotid doppler ultrasound, CT angiography, or MR angiography.
3. Carotid imaging ideally has to be done during the initial assessment in the ED but should not be delayed more than 48 hours.
4. Imaging for other types of TIA's is recommended when it is deemed clinically appropriate.

5. All patients with confirmed TIA should receive education and their family members for stroke prevention via life style modification, preventative treatment and signs and symptoms of stroke requiring emergency treatment.

QM 4.7 TIA treatment

Purpose

To assess and manage people experiencing a transient ischemic attack (TIA) or minor stroke rapidly, in order to minimize the chances of a full stroke occurring.

Rationale

- There is a 20% risk of a full stroke within the first four weeks after a TIA.
- Stroke is a treatable and preventable when TIA is appropriately addressed and treated
- Investigating and treating high-risk patients with TIA within 24 hours could produce an 80 per cent reduction in the number of people who go on to have a full stroke.²³

Standards

Management of TIA

Imaging

1. All patients with suspected stroke should have an urgent brain CT or MRI (within 24 hours)
2. Echocardiography should be performed in patients with abnormal ECGs, history or heart disease and suspected cardioembolic source
3. Long term Holter monitoring should be performed in patients with suspected cardioembolic strokes.
4. Further, brain, cardiac or carotid imaging should be undertaken in selected patients: when initial assessment does not identify the likely source of the ischemic event

Antithrombotic Therapy

- a. Anti-platelet therapy should be given, unless contraindicated
 1. A loading dose of aspirin (160-325 mg may be given as the 1st dose), followed by 81-100mg daily.
 2. Clopidogrel alone can be used in a dose of 75mg once daily
 3. Dual antiplatelets (aspirin and clopidogrel) may be used in high risk TIA patients (ABCD2 score greater than 4) for 21-30 days, followed by a single antiplatelet (initial loading dose of clopidogrel of 300mg then 75 mg daily in addition to Aspirin)

²³ [https://www.thelancet.com/journals/lancet/issue/vol370no9596/PIIS0140-6736\(07\)X6044-6](https://www.thelancet.com/journals/lancet/issue/vol370no9596/PIIS0140-6736(07)X6044-6)

- b. The routine use of early anticoagulation in unselected patients following ischemic stroke/TIA is NOT recommended.
- c. A statin is recommended with a target LDL cholesterol of less than 1.7mmol/L and HDL cholesterol of greater than 1 mmol/L.
- d. Hypertension should be managed appropriately according to guidelines.
- e. All vascular risk factors should be addressed and appropriately treated accordingly.

Chapter 5. Post stroke care

Objective

Patients who suffered stroke may develop a range of physical symptoms and complications as a sequel of the stroke which will impact on their function and care provision. These symptoms include muscle spasticity, joint contractures, pain, fatigue. For stroke patients and their family members to achieve a good quality of life, maximize independence, well-being and choices a holistic approach for their physical, psychological and social needs is required.

Key facts

1. At present, provision of rehabilitation and long-term care is inconsistent across Saudi Arabia, with lack of consistent standards of care and lack of facilities to provide support and care to the patients and their families.
2. There is lack of support for the younger stroke patients who want to return to work.
3. A large proportion of stroke patients develop depression and long- term support needs to account for this.
4. A large proportion of stroke patients experience language difficulties.
5. Mortality rate is high in stroke patients within three months of a stroke.
6. One out of four stroke survivors may have recurrent stroke within 5 years
7. Stroke is preventable and a treatment plan that includes dietary modification, exercise, statin therapy, an antihypertensive medication and antiplatelets/anticoagulants could result in a cumulative risk reduction of another ischemic stroke by 80%.
8. Designing a stroke educational plan to improve health awareness is associated with increase health-related self-care and healthier lifestyle.
9. Effective behavioral and motivational strategies to achieve a healthy lifestyle are recommended for stroke secondary prevention.
10. Prevalence of spasticity after stroke ranging from 30-80% of stroke survivors and the incidence among paretic patients is reported to be 27% and 43% 1 month and 6 months post stroke respectively.
11. Currently there is limited expertise in assessment and management of post stroke muscle spasticity and other physical and psychosocial symptoms at a national level in Saudi Arabia.

Introduction

The Ministry of Health, health regulators, commissioners and providers of healthcare need to ensure delivery of appropriate level of health care and support to stroke patients and their families, to ensure that they can achieve the best possible quality of life. Integrated care is essential to provide continuity of care for patients who receive care from different organizations throughout their life due to the long-term nature of their illness.

Stroke patients and their families need to receive good-quality, appropriate, tailored and flexible long-term care and rehabilitation; this will affect long-term recovery and reduce long-term disability.

Symptoms related to stroke can improve over many years, so people need both a focus on rehabilitation to help them improve and recover and support to help them manage the disabling factors caused by a stroke that may continue in the long term. High quality and comprehensive non-medical services, support, and advocacy can be provided by the voluntary sector which can be extremely useful for the stroke patients and their families. This could include support for working age stroke patients to help them to get back to appropriate employment, day care services to support patients and their families or advice and support to patients to integrate back in the community.

QM 5.1 Post-Acute Stroke Rehabilitation

Purpose

Stroke patients need rehabilitation to maximize their function performance, this needs to be provided by specialist multidisciplinary rehabilitation team in inpatient, outpatient or community settings based on patient needs.

Rationale

- Several studies indicate that stroke rehabilitation can improve functional status in patients who are elderly and those have severe neurologic and functional impairment.
- Some stroke patients would benefit from early discharge from the stroke unit and receive multidisciplinary rehabilitation at day care, at outpatient or at home. This benefit is related to intensity of the therapy and the expertise of the multidisciplinary team which should match the professionals in the stroke unit.
- In Saudi Arabia there is limited provision of rehabilitation therapy for stroke patients after discharge from acute hospitals in both outpatients and in the community. Such provision will facilitate early hospital discharge, reduce the length of stay, increase efficiency of stroke beds and enhance community reintegration

Standards

1. Stroke patients who were assessed by the stroke unit multidisciplinary team and identified to be suitable for early discharge should continue their rehabilitation at outpatient, at day care or receive community rehabilitation at home
2. Health care providers should establish rehabilitation services at inpatient, outpatient and community settings for stroke patients after discharge from strokes units in their areas
3. Stroke patients and their carers should be well informed about their rehabilitation plan after discharge from the stroke units

QM 5.1.2 In-patient rehabilitation

Purpose

To ensure that those patients who have complex medical needs and require ongoing medical or nursing support can benefit from rehabilitation in an inpatient setting once their

acute medical management has been completed and they are able to leave the acute stroke unit safely.

Rationale

- There are limited inpatient rehabilitation facilities to meet the rehabilitation needs of the stroke patients in the kingdom of Saudi Arabia.
- Some stroke victims may suffer very severe stroke that may lead to multiple impairments with more complex physical and cognitive rehabilitation needs.
- Due to the limited number of inpatient rehabilitation beds in Saudi Arabia, stroke patients tend to wait in acute hospitals. Some of the stroke patients also develop many preventable complications by the time they are transferred to rehabilitation.
- Stroke patients tend to have the longer hospital stay, require long term care and are frequently discharged to long term-care facilities with added cost implications.
- Post stroke depression, fatigue and spasticity could become a problem after discharge from acute stroke units and has a negative impact in the function and quality of life of stroke survivors.

Standards

1. The inpatient rehabilitation should be provided in an environment in which rehabilitation care is well coordinated
2. Inpatient rehabilitation should be delivered by skilled multidisciplinary team with expertise in complex physical, cognitive and neurobehavioral impairments.
3. Stroke patient should receive a comprehensive assessment to determine:
 - I. Pre-stroke functional abilities;
 - II. Level of physical impairment;
 - III. Impairment of cognition, swallowing, communication, vision and perception, selfcare and continence status;
 - IV. Symptoms related to depression, pain, spasticity, fatigue etc;
 - V. Activity limitations and participation restrictions;
 - VI. Social and environmental factors.
4. All stroke patients who are medically stable and identified to benefit from in-patient rehabilitation should be referred to an inpatient rehabilitation facility immediately after the assessment by the stroke team or inpatient rehabilitation program.
5. All patients who meet the criteria for a comprehensive inpatient rehabilitation program should be transferred with in 48 hours from acceptance.
6. The inpatient rehabilitation multidisciplinary team should include the following disciplines:
 - I. Consultant in Physical Medicine and Rehabilitation;
 - II. Rehabilitation nurses;
 - III. Physiotherapists;
 - IV. Occupational therapists;
 - V. Speech and language therapists;
 - VI. Clinical psychologists;
 - VII. Case managers;
 - VIII. Social workers;
 - IX. Health educators.

7. The inpatient stroke rehabilitation team should have access to the following services:
 - I. Dietetics;
 - II. Orthotics and functional electric stimulation;
 - III. Respiratory therapist;
 - IV. Continence service;
 - V. Wheelchair services and equipment;
 - VI. Assistive technology;
 - VII. Psychiatry support;
 - VIII. Podiatry.
8. All symptoms that develop after the stroke which impact on the rehabilitation e.g. hemiplegic shoulder and neuropathic pain, muscle spasticity, fatigue and depression should be managed appropriately. In addition, complications e.g. pressure injury, venous thrombo-embolism and joint contractures should be prevented.
9. Inpatient rehabilitation therapy should provide a range of interventions and high-intensity training to promote and improve motor recovery.
10. Patients should be given at least 45-60 minutes of rehabilitation by each discipline, five days per week if they are able to tolerate this level of therapy.
11. Patients who are unable to participate in 45-60 minutes of daily therapy should receive up to 30 minutes of therapy 5 days per week.
12. Multidisciplinary rehabilitation team should be collecting regular outcome measures using valid tools on admission and discharge.
13. Multidisciplinary team should set agreed goals with patients and their families on admission and update them about progress towards those goals.
14. Stroke patients and their families /carers should be provided with information related to their condition and its management.
15. Appropriate equipment and training should be provided for stroke patients and their families/carer after assessing the suitability of the home environment.
16. Prior to discharge from hospital to home or long-term facilities, a follow up plan should be agreed with stroke patients and their families in relation to their health and social care needs.
17. Arrangements should be made to meet the educational and vocational rehabilitation needs of young stroke patients after their discharge from inpatient rehabilitation program.
18. Criteria for a patient's admission to a comprehensive inpatient rehabilitation program may include the following:
 - I. Medical stable;
 - II. Significant unresolved neurologic deficit;
 - III. Impairment affecting at least 2 of the following functions:
 - Mobility
 - self-care activities
 - swallowing
 - Communication
 - bowel or bladder control
 - IV. Cognitive and communicative abilities to learn and participate in therapy;
 - V. Ability to tolerate the active intensive therapy program;

VI. Achievable rehabilitation goals.

QM 5.1.3 Outpatient Rehabilitation

Purpose

Studies demonstrated significant functional gains with intensive outpatient therapy at 3- 6-months post stroke. The greatest benefits were achieved in the first three months. Those patients who are ready for discharge from inpatient facility can continue to receive rehabilitation as outpatient to improve their functional status.

Rationale

- Stroke patients are having difficulty accessing outpatient rehabilitation clinics early after discharge from hospital due to limited availability of these facilities. When they get the opportunity tend to be late by then they developed multiple secondary complication related to their stroke.
- There is no formal hospital transport system for outpatient treatment
- Limited and expensive disability assessable private vehicles

Standards

1. Stroke patients should have access to outpatient rehabilitation within two weeks of stroke if they are medically stable. This is to maximize their functional improvement during first six to twelve months after the stroke, when maximum recovery is expected.
2. Patients suitable for outpatient rehabilitation should be able to be transferred to the outpatient therapy clinic for treatment 1-3 times per week.
3. The outpatient treatment should be carried out by multidisciplinary professionals who have expertise in stroke rehabilitation.
4. Stroke rehabilitation clinics should address secondary prevention of stroke, management of physical, cognitive and communication difficulties as well as changing care needs.
5. Stroke patients should have access to affordable and appropriate transport to be able to attend outpatient rehabilitation.
6. The rehabilitation clinics should include range of specialist clinics and therapy which include:
 - I. Physical therapy to improve mobility, strengthen muscles and maintain the range of movement;
 - II. Occupational therapy to improve independence with self-care, as well as assessment of educational, vocational and driving abilities;
 - III. Spasticity clinic for management of muscle spasticity secondary to stroke using range of oral and focal injections like Botulinum Toxin;
 - IV. Stroke rehabilitation clinics to address secondary prevention of stroke and manage other symptoms that can develop as a sequel of the stroke;
 - V. The need for wheelchairs, equipment and other assistive devices;
 - VI. Assessment of care support and carers review and training.

QM 5.2 Psycho-social, emotional and cognitive support

Purpose

It is well recognized in the medical literature that people who have suffered stroke experience cognitive and neuropsychiatric issues. One of these issues is post stroke depression which was found to be associated with lesions in the left-side of the cortex, basal ganglia and lesions closer to the frontal lobe than on the left posterior or right frontal lesions. Beside this, other risk factors for depression have been identified such as non-fluent aphasia, significant motor deficit, age less than 60 years, female gender, and residency in nursing homes. The risk of post stroke depression is found to be between 20-79% from the first month up to 18 months post stroke. It has a negative impact on their physical wellbeing, their rehabilitation gains, functional recovery and social reintegration. It is imperative that stroke survivors, at various healthcare settings during their treatment journey, are screened and assessed to identify post stroke depression so they can receive appropriate and timely management. Furthermore, stroke can lead to behavioral and cognitive impairment which vary in severity from amnesia to dementia, with loss of mental capacity and inability to make decisions in life. Therefore, they will require assessment by expert professionals.

Rationale

- The risk of neuropsychiatric manifestation is high following stroke including a range of mood and cognitive disorders.
- Post stroke depression has been reported between 20-79% starting after the first month and up to 18 after the stroke.
- There are risk factors associated with post stroke neuropsychiatric problems.
- Mood problems and cognitive impairment delay rehabilitation progress, reduce functional gain and they are a hindrance for social reintegration.

Standards

1. All patients should be screened for post stroke cognitive and mental health issues along the care pathways from hospital to community setting.
2. Patients at high risk of mood, behavioral and cognitive problems need evaluation using validated measures, including patients with aphasia.
3. For patients with depression, severity of their depressive or cognitive symptoms need to be identified, as well as any potential risks and impact on their functional ability. These patients need to be referred to mental health for further evaluation and management.
4. Patients with severe cognitive impairment affecting their mental capacity require screening followed by expert professionals' assessment to ensure their care & legal rights are met.
5. Patients and their care givers/ family should be given education and should also be provided with the information related to mood and cognitive problems post stroke, and the support available for them.

QM 5.3 Secondary Prevention

QM 5.3.1: Counselling for lifestyle modification

Purpose

Stroke is preventable and the best defense against recurrent stroke is to increase awareness about stroke prevention. Stroke survivors should be managed within a stroke program that

focuses on managing stroke symptoms, reducing risk factors, and promoting healthy lifestyle to prevent recurrent stroke. Lifestyle modification that focuses on dietary modification, weight reduction and increased physical activity is essential for stroke occurrence prevention. Lifestyle modifications including daily physical activity and weight management are associated with risk reduction in stroke and cardiovascular diseases.

Rationale

- Incidence of stroke is rising rapidly in Saudi Arabia and local data, suggests that 23.3% of all strokes were recurrent ones.
- The trend is significant; without increased prevention, the incidence of stroke will increase. The 10-year forecast for Riyadh region is 8,00 – 9,200 per year, similar increase in stroke prevalence is expected nationally (Unpublished data).
- Adherence to medication and lifestyle regimen is a key for stroke prevention.
- Studies show that 25% of stroke survivors stop taking one or more of
- prescribed stroke prevention medications within the first three months.
- Diet that has five serving vegetables and fruits per day may reduce the risk of stroke

Standards

1. All patients should be counselled regarding the need for lifestyle modification.
2. All patients with stroke should have identified risk factors for stroke documented and communicated to the patients.
3. Each risk factor should be managed for effective control and prevention of recurrent stroke (a plan for managing each risk factor should be documented).
4. The patient must be actively engaged in the plan of stroke prevention.
5. Increased physical activity with a structured exercise program should be recommended for adult patients with stroke.
6. Technology should be incorporated into interventions and programs may offer novel opportunities to increase physical activity and improve health fitness.
7. Counselling for lifestyle modification should be considered for all stroke patients, this may include:
 - Receiving stroke education
 - Visits for nutritional specialist clinic
 - Follow up visits to specialist clinic
 - Referral to primary care physician
 - Set up target blood glucose level 140-180 mg/dL (Normoglycemia)
 - Assessment of smoking history in each follow up visit
 - Counselling for smoking cessation
 - Discharged on statin therapy
 - Number of follow up visits to lifestyle modification clinic.

QM 5.3.2: Blood pressure management in patient with acute ischemic stroke

Purpose

Because of the high prevalence of hypertension among a patient with stroke and its association of increased risk of CHD, recurrent stroke, and end-stage renal disease, patients

should receive treatment and education about blood pressure management. These standards focus on the blood pressure management 48 hours after the onset of stroke.

Rationale

- Patients with high blood pressure can have 1.5 up to fold increase risk of stroke
- To reduce the risk of recurrent stroke and other vascular events
- To improve long-term blood pressure control
- To improve medications adherence

Standards

1. Adult patients with hypertension who experience a stroke or transient ischemic attack should be restarted on antihypertensive treatment immediately after a stroke event.
2. Adult patients who experience a stroke or TIA and have not been treated for hypertension previously should have targeted blood pressure management.
3. When initiating a new or adjusted hypertensive regime patients should have follow-up evaluation of adherence and response to treatment at monthly intervals until target blood pressure is achieved.
4. Chronic stroke patients with normal blood pressure should have their blood pressure monitored at least annually.

Action Needed

Stroke education that includes teaching the patient how to measure their blood pressure and when to seek medical help.

QM 5.3.3: Prevention of future stroke among patients with stroke or transient ischemic attack

Purpose

To prevent recurrent stroke by controlling risk factors and identify the mechanism of the stroke and initiate effective secondary prevention to prevent future vascular events.

Rationale

- Up to 23.3% of stroke are recurrent stroke. Similarly, one out of five people with stroke have TIA preceding their stroke.
- Recurrent stroke carries higher mortality and morbidity.
- Up to 80% of stroke can be prevented by controlled risk factors and identifying underlying etiologic mechanism that lead to stroke and treated promptly.
- In multivariable analyses, multiple infarctions on brain imaging, large-artery atherosclerosis, and an ABCD2 score of 6 or 7 were each associated with more than a doubling of the risk of stroke.²⁴

Standards

²⁴ <https://www.nejm.org/doi/full/10.1056/NEJMoa1412981>

1. All patients with stroke or TIA should be evaluated by a health care professional with expertise in stroke care, who can initiate appropriate investigations and management.
2. Risk of recurrent stroke should be assessed, and stroke subtype should be classified through prompt identification of the underlying cerebrocardiovascular cause.
3. All patients with ischemic stroke or TIA should be on an antiplatelet agent unless there is an indication for anticoagulation:
 - 3.1. Acetylsalicylic Acid (80 mg – 325 mg) or Clopidogrel (75 mg) are all appropriate options and selection should depend clinical judgment and tailored according patient characteristics.
 - 3.2. Combined use of Acetylsalicylic Acid and Clopidogrel for short duration up to 28 days, is more effective to prevent recurrent stroke following **minor** stroke (NIHSS less than 3) or transient ischemic attack.
4. All patients with ischemic stroke or TIA and non-valvular atrial fibrillation should receive oral anticoagulation, unless contraindicated.
5. For all patients with ischemic stroke or TIA and a mechanical heart valve, warfarin is recommended for stroke prevention with careful INR monitoring; non-vitamin-K oral anticoagulants should **not** be used.
6. All patients with non-disabling ischemic stroke or TIA and an ipsilateral moderate to severe extracranial internal carotid stenosis (50 to 99 %) should be offered carotid revascularization:
 - 6.1. Selection of revascularization option through carotid endarterectomy or carotid stenting should be based depends clinical judgment and tailored according patient anatomic or medical characteristics and technical reasons.
 - 6.2. Revascularization should be done within two weeks.
7. All patients with ischemic stroke or TIA and a severe intracranial carotid stenosis of 70% to 99%, medical therapy is recommended. Intracranial angioplasty (with or without stenting) is **not** routinely recommended.

QM 5.4 Community Assessment and Review

Purpose

Stroke patients and their family members/care givers should be offered a review from primary care services of their health and social care status and secondary prevention needs, typically within six weeks of discharge home or to care home, and again before six months after leaving hospital.

This should be followed by an annual health and social care check, which facilitates a clear pathway back to further specialist review, advice, information, support and rehabilitation, where required.

Rationale

- Stroke patients and their family members/care givers would need information, advice and advocacy in accessing the right kind of support.
- It will be important to bear in mind that those who have had a stroke may have additional communication or cognitive support needs to be able to participate in the assessment.

- In addition, those affected want to know how to seek further support when they need it.

Standards

1. Stroke patients should receive a multidisciplinary person-centered assessment of the individual's needs and signposting to other services, such as housing or transport.
2. Family members or friends who may be taking on a caring role are entitled to an assessment of their needs in their own right.
3. Stroke patients should be reviewed for their community living skills and support needs upon discharge from acute hospital; these should be reviewed at least once a year to provide appropriate support.

QM 5.5 Participation in the Community

Purpose

To enable stroke patients and their family members to live a full life in the community. Good level of community participation by stroke sufferers will be enhanced by improving their functional ability to be more independent and by making the community services more accessible to them.

Rationale

- Stroke patients and their family members need support to be able to return to varied roles they had before a stroke and to be involved in their local communities again.
- Long-term assistance, review and rehabilitation are essential for patients to lead independent lives and overcome physical, psychological and attitudinal barriers and to engage and participate in community activities. To maximize emotional recovery, people need information and advice about local opportunities and resources, including hobbies, leisure, education and sports facilities.
- Opportunities for peer support can also enable and empower patients, especially in relation to rebuilding the confidence that many stroke patients lose.

Standards

1. Transport authorities and local governments should undertake accessibility planning and how they meet the needs of stroke patients, for example through their local transport plans process.
2. Stroke networks and specialist professionals in the clusters should provide training to providers of community services. Stroke networks should also consider providing training on stroke to a wider range of organizations that come into contact with individuals who have had a stroke. Allied health professionals and stroke voluntary organizations are particularly well placed to carry out this training.
3. Clusters should ensure that there are a range of services available locally for people to choose from when agreeing their care plan.

QM 5.6 Vocational Therapy

Purpose

Stroke patients and their family members should be enabled to participate in paid, supported and voluntary employment.

Rationale

- Studies show that work is good for physical and mental health. There is a strong inter-relationship between health, work and well-being.
- Workplaces could offer simple, reasonable adjustments to enable stroke patients to return to work where possible.
- The workplace is also one of the best forms of rehabilitation. Many stroke patients will not be ready to return to work in the short term but may be able to do so in the longer term, and so can benefit from arrangements to give access to rehabilitation and support for return to work for weeks, months or years post-stroke, as appropriate for the individual patient. There is evidence that this can be achieved by offering vocational rehabilitation to people after a stroke, and this may need to begin when they are in hospital. It will also include access to government schemes for return to work. Volunteering can also provide both a means of trialing return to work and a satisfying alternative to paid employment for some people.
- It may also be important to offer support for employers and voluntary organizations in adapting working conditions, especially for people with physical, communication and cognitive difficulties. This may include offering guidance on how to educate co-workers about the condition and what it means in practice for the individual's role in an organization. Alternatively, support may be needed to facilitate, for example, reduced hours, and part-time working, initially.

Standards

1. Ensure support is offered to stroke patients and their family members to enable them to return to work or to other opportunities such as volunteering.
2. Establish a partnership between voluntary organizations and employers to support patients and employers to adapt to patient's needs.

QM 5.7 Long term care

Purpose

A range of services are in place and easily accessible to support the individual long-term needs of individuals and their care givers. This support should be at home or in long term care facilities, when home is not an option.

Rationale

- Support for stroke patients and their family members needs to be tailored based on the individual circumstances. A coordinated approach is needed, not just between health and social care, but also involving housing, transport, employment, education and leisure services, as well as the voluntary sector.

- Stroke patients can find that the accommodation they are in is no longer suitable. There are a range of solutions to this: for example, simple pieces of equipment to aid independence.
- Many stroke patients suffer from emotional difficulties, and this can have an impact on their long-term physical recovery and lead to depression and isolation. Family members are also vulnerable to difficulties of coping with loved ones who have suffered a stroke, and to depression. This may make returning to activities and roles that were part of normal life before the stroke difficult.
- Patients who find it difficult to adjust to the longer-term effects need support from emotional support services.
- Stroke can lead to a range of pain symptoms and physical consequences like spasticity which require monitoring and management.
- Professionals who are in charge of stroke patients need to train the paid care givers to avoid preventable physical or emotional harm to both the patients and care givers.

Standards

1. All stroke patients should be screened to check if they would benefit from mental health and psychological services before discharge from the acute hospital.
2. All staff working with stroke should provide emotional and psychological support to the patient and family/ care givers. These can range from access to good peer support or local counselling services through to referral for psychiatric and psychological services. Ideally, services need to develop long-term psychological and emotional support, with coordinated programs starting with psychological support in hospital and longer-term support involving the voluntary sector.
3. Rehabilitation teams at different settings along the stroke care pathway need to address various physical issues related to pain, spasticity, continence, mobility, selfcare and mental capacity.
4. All stroke patients should be assessed to check whether equipment and adaptations can make their home environment more accessible for them, improve their independence and make it easier for their families to look after them. Increasingly, telecare and telehealth solutions can help people to live in their own homes for longer.
5. Younger stroke patients may have different needs. For example, they may have a family to support. Specific attention should be paid to the communication difficulties experienced by many individuals and the need to commission long-term support services from voluntary organizations that are able to meet these long-term needs.
6. Paid care givers should be trained to deal with stroke patients.
7. Stroke patients in long term facilities need to be reviewed regularly to identify their changing needs.

QM 5.8 End of Life Care

Purpose

Stroke is one of the leading causes of death and disability; 1 in 20 patients die within 72 hours following admission and 1 in 7 of stroke patients will die in hospital. Furthermore 20%

of stroke sufferers die within 30 days of a stroke. People who are not likely to recover from their stroke and at risk of dying should receive care at the end of their lives in hospital or the community. This should take account of their needs and choices and is delivered by a workforce with appropriate skills and experience in all care settings.

Rationale

- Providing high-quality end-of-life care to stroke patients can be challenging and requires a skilled and experienced workforce.
- Deciding when it might be more appropriate for someone who has had a stroke to receive end-of-life care rather than active rehabilitation and providing such care when communication is difficult is a considerable challenge and requires skilled decision-making and interaction from an experienced workforce.
- The needs and wishes of both the patient and their family, if appropriate, should be considered as part of this process and should be reviewed regularly to ensure that their needs continue to be met throughout the last phase of life and into bereavement. This includes the management of pain and other symptoms, and the provision of psychological, social, spiritual and practical support.
- People in need of this care will often already be in hospital, but they may also be at home, in care homes or other care settings.

Standards

1. Patients with stroke who are reaching end of life need to be identified and referred to palliative care in the hospital or the community.
2. Holistic approach to be taken to manage the patient's physical and psychological symptoms and will identify family needs and support during this period.
3. Acute stroke patients should be referred to palliative care specialists if they meet three out of the four conditions on day three of being in coma below:
 - i. Abnormal brainstem response
 - ii. Absent verbal response
 - iii. Absent withdrawal response to pain
 - iv. Serum creatinine more than 1.5gm/dl
4. Chronic stroke patients should be referred to palliative care if they meet one of the following criteria:
 - i. If the rating on Karnofsky performance scale is less than 50% or,
 - ii. If the score of less than 40% is achieved on palliative performance scale, or
 - iii. If weight loss of more than 10% is observed in the last six months or,
 - iv. If weight loss of more than 7.5% is observed in the last three months or,
 - v. If serum albumin is less than 2.5gm/dl or,
 - vi. If there is current history of pulmonary aspiration not responsive to SLP intervention or,
 - vii. If there is sequential calorie count documenting inadequate calorific intake.²⁵

²⁵ AHA guidelines

5. All the patients meeting criteria for palliative care should be transferred to palliative care team within 24 hours of assessment.

Chapter 6. Human resource development

Objective

- To improve capacity and capability among the organizations providing stroke care
- To ensure quality and safety of patient care
- To increase productivity and efficiency
- To improve the work environment

Key facts

- Human resources development (HRD) decisions are known to be associated with patient outcomes.
- Increased staffing or skill mix is related to key clinical outcomes, such as, lower infection rates, increased probability of survival and better continuum of care indicators.
- Other aspects of HRD, including strategic planning and training and development, have been found to relate to a reduction in medical errors.
- HRD can impact on patient care by influencing how professionals apply their technical knowledge and skills, and their relationships with patients.

Introduction

Human resources standards refer to the minimum and appropriate mix of human resources that is required to serve the expected populations at the different levels of the system, with the defined health services, to ensure comprehensive health service delivery in an efficient, equitable and sustainable manner.

All of the elements of a stroke system of care will operate in a highly complex and multidisciplinary environment, with many elements and stakeholders, each with their own rules and regulations. In terms of the many controlling authorities, it is paramount that the “best interests of the patient” be the primary concern and driving factor when any rules and regulations are made and implemented.

The Acute Stroke Ready Hospitals (ASRH), Primary Stroke Hospital (PSH) and comprehensive Stroke Hospital (CSH) should also provide education to its employees, regional healthcare providers, EMS, and lay groups. Public education should focus on stroke risk factors (screenings for hypertension and other risk factors), as well as the recognition of acute stroke symptoms. A minimum of 2 professional and 2 public programs each year are suggested. These programs should be integrated across the spectrum of care within a stroke system.

QM 6.1 Leadership and Skills

Purpose

To provide care givers with the skills and knowledge on how to support and care for a patient with stroke.

Rationale

- A stable, qualified workforce contributes effectively and efficiently to patient/family satisfaction and positive service delivery results.
- Personnel satisfaction and retention reflect positively on outcome.
- Cluster/network wide workforce leadership supports integrated teamwork.
- There is unwarranted variation in distribution and availability of neurological, neurosurgical, and radiological expertise.

Standards

1. All stroke patients, and those at risk of stroke should receive care from skilled, competent and experienced doctors and other healthcare professionals.
2. Clusters, networks, cities and regions should develop an organizational infrastructure and decision-making body to assist in addressing care issues, decision making, implementation, and problem solving. This is typically in the form of a stroke committee defined by a cluster, region or other overseeing body.
3. The use of telemedicine/tele-stroke resources and systems should be supported by healthcare institutions, government, payers, and vendors as one method to ensure adequate 24/7 coverage and care of stroke patients in a variety of settings.
4. Stroke education programs for general physicians, hospital personnel, and EMS personnel should be planned and regularly run to increase both the number of patients who are treated and the quality of care.
5. Multi-component quality improvement initiatives, which include ED education and multidisciplinary teams with access to neurological expertise, are recommended to safely increase the capacity and capability of hospitals providing stroke care.
6. The cluster should develop a uniform and fairly applied credentialing process that assesses and confirms the qualifications of licensed professionals who provide network services.
7. All organizations involved in stroke care should promote open communication and collaboration among disciplines and staff levels by:
 - a) holding regular team, organizational, and divisional meetings, as appropriate to the organization.
 - b) Providing feedback to personnel about their suggestions and recommendations.
8. All hospitals providing stroke care should establish a program of ongoing professional education which should include:
 - a) A program of interprofessional education rounds within the stroke unit.
 - b) Process for stroke unit staff to participate in regional, national and international educational opportunities in the care and management of stroke patients.
 - c) Networking with interprofessional stroke teams in other facilities, networks, clusters and nationally. This will facilitate knowledge sharing, problem solving, collaboration, and increase consistency of stroke care delivery across clusters and nationally.

9. Regular meetings should be held between stroke physicians, vascular surgeons, vascular technologists and radiologists to monitor service performance, discuss clinical cases and provide feedback and education.

Action needed

- **For patients:** If you are the care giver of a patient with stroke, you are offered education on stroke, practical training on how to provide care, as well as contact details of support services before the patient with stroke leaves hospital.
- **For clinicians:** Support care givers by offering them education on stroke, practical training on how to provide care, contact details of support services, and other information to support their own wellbeing before patients with stroke leave hospital.
- **For health services:** Ensure processes and resources are in place to provide family members and care givers with education about stroke, practical training on how to provide care, access to support services (e.g. respite care), and other information to support care givers, before patients with stroke leave hospital.
- **Ministry of Health:** Consider establishing the National HRD Standards Working Group or similar as a vehicle for the implementation of these standards.
- **SCFHS:**
 - I. Monitor and evaluate training programs to ensure compliance with standards for their respective professions
 - II. Establish competencies required for licensing of health care professionals
 - III. Grant licenses and license renewals to qualified health care professionals
 - IV. Maintain an inventory of health care professionals currently licensed or certified to practice in KSA in the training databases established (database establishment)
 - V. Collaborate with MOH divisions of standards & quality assurance, health regulation & legislation and the health training institutions in the implementation of these standards.
- Organized system of stroke care including stroke units with a critical mass of trained staff (interprofessional team). If stroke unit not feasible, then mechanisms for coordinating the care of stroke patients to ensure application of best practices and optimization of outcomes.
- All patients with moderate and severe stroke should be admitted to a geographically defined stroke rehabilitation unit that is staffed by an interprofessional team of healthcare providers. When post-acute stroke patients receive coordinated, interprofessional evaluation and intervention on a stroke rehabilitation unit there is a reduction in death and disability.

QM 6.2 Workforce

Purpose

All employers should undertake a review of the current workforce and develop a plan for development and training to create a competent and skilled workforce and define critical cadres with shortages and develop plans for urgent attention to resolve these.

Additionally, to define the numbers of new health workers required to be produced for effective service delivery over a given period of time; to define competencies required by the team in collaboration with regulatory bodies.

To identify training needs and gaps for basic and post-basic levels by team and by location, and to develop training plans at the facility, cluster/network and national levels.

To establish and maintain effective linkages with the health training institutions, other relevant ministries and regulatory boards, councils, development & implementation partners, and others as needed, for effective implementation of this standard.

Rationale

- Outstanding stroke care does not exist in a vacuum solely focused on the procedure but instead is part of a successful multidisciplinary team.
- The stroke team comprises fully trained stroke physicians (vascular neurologists or neurointensivists), allied professionals, and nurses that are all led by a stroke physician with a strong background in the management of neurovascular disease.

Standards

1. All organizations involved in stroke care should assess the type and number of personnel needed to accomplish its mission, goals, and objectives. Human resources planning should occur in conjunction with strategic planning, budget development, training and professional development.
2. All organizations involved in stroke care should assess its workforce as part of annual planning and prepare for future needs by:
 - a. comparing the composition of its current workforce, including number of employees, skills, and demographics, with projected workforce needs; and
 - b. determining how to close gaps, when possible, through recruiting, training or outsourcing.
3. The levels of nursing staff relate directly to the provision of good stroke unit care. Nursing staffing levels and skill mix should be appropriate to the size of the stroke unit and dependency of the patients.
4. Stroke intervention team: each stroke hospital should ensure 24/7 on-call schedule is available to provide acute stroke intervention. The acute stroke intervention team should have a minimum of three clinicians with training and qualifications in Acute Ischemic Stroke Interventions (AISI). This should include:
 - I. The team should organize 24/7 acute emergency large vessel occlusion (ELVO) stroke coverage (possibly in a rotation system organized within a cluster/network).
 - II. The stroke neurovascular interventionist, in collaboration with the stroke team, should have shared responsibility for preoperative and postoperative patient care with input from the appropriate specialties.
 - III. AISI should ideally be practiced in neurovascular interventional teams with the possibility to exchange experience and knowledge. With regard to individual procedures, each acute stroke hospital will ensure appropriate staff coverage is available for safe and effective urgent stroke treatment.
5. Anesthesia team: there shall be 24/7 in hospital anesthesia coverage with anesthesiologists who have experience in caring for patients undergoing AISI.

6. The core interdisciplinary stroke team should consist of clinicians with appropriate levels of expertise in medicine, nursing, occupational therapy, physiotherapy, speech–language pathology, social work and clinical nutrition. Additional disciplines may include pharmacy, (neuro)psychology and recreation therapy.
7. The interdisciplinary rehabilitation team may consist of a physician, nurse, physical therapist, occupational therapist, speech–language pathologist, psychologist, recreation therapist, patient and family/care givers. For children, this would also include educators and child-life workers.
8. A dedicated core interprofessional team which includes physiatry, nursing, occupational therapy, physiotherapy, speech-language pathology, social work, and clinical nutrition should be in place for every hospital providing stroke care. The team may also include other disciplines such as internal medicine, pharmacy and (neuro)psychology. The team should have a special interest in stroke and advanced training in stroke management.
9. Stroke Unit Staffing ratio: all hospitals and other organizations providing stroke care should ensure that they have sufficient capacity and capability among all disciplines to provide high quality and safe patient care.

Glossary

ABCD2 system

The ABCD2 score is calculated using the patient's age (A); blood pressure (B); clinical features (C); duration of TIA symptoms (D); and presence of diabetes (2). Scores are between 0 and 7 points. Age (>_60 years, 1 point); Blood pressure at presentation (>_140/90 mm Hg, 1 point); Clinical features (unilateral weakness, 2 points; speech disturbance without weakness, 1 point); Duration of symptoms (>_60 minutes, 2 points; 10–59 minutes, 1 point); and presence of diabetes (1 point). Low risk = 0–3 points; moderate risk = 4–5 points; high-risk = 6–7 points. Acute care – Care for a disease or illness with rapid onset, severe symptoms and brief duration.

Acute Ischemic Stroke Interventions

Any current or future practice interventions such as IA thrombolysis, emergency carotid or intercranial angioplasty and stenting etc.

Allied health professionals

Allied health professionals (arts therapists, chiropodists/ podiatrists, dietitians, occupational therapists, operating department practitioners, orthoptists, physiotherapists, prosthetists and orthotists, psychologists, psychotherapists, radiographers and speech and language therapists) are part of a healthcare team with a range of different skills, each bringing their particular expertise to caring for the patient. Allied health professionals have their own caseloads of patients and are key members of a skilled multidisciplinary team.

Aphasia

Partial or total loss of the ability to articulate ideas or comprehend spoken or written language, resulting from damage to the brain.

FAST

The Face-Arm-Speech-Test, which helps people to recognize the symptoms of a stroke or TIA in others.

Hemorrhagic stroke

Stroke caused by the bursting of a blood vessel leading to bleeding in the brain, which causes damage.

Ischemic stroke

Stroke caused by a clot narrowing or blocking a blood vessel so that blood cannot reach the brain, causing brain cells in the area to die due to lack of oxygen.

Rehabilitation

Combined and coordinated use of medical, social, educational and vocational measures for training or retraining the individual to their highest level of functional ability.

Reperfusion Therapy

IV r-tPA and endovascular mechanical thrombectomy (MT)

ROSIER

Tool to assist in the recognition of stroke in the emergency room.

Stroke

A 'brain attack' caused by a disturbance of the blood supply to the brain. See also 'Ischemic stroke' and 'Hemorrhagic stroke'.

Transient ischemic attack (TIA)

Sometimes also known as a minor stroke, in which symptoms of a stroke subside within 24 hours.

Appendix 1 – Key Performance Indicators

High Priority Key Performance Indicators:

High priority Key Performance Indicators as identified by the clinical advisory group recommended for measuring during 2019 pilot phase:

KPI 1: Median time interval from door to CAT scan

Computation method: Median time interval from patient entry in emergency room to non-contrast CAT scan of the brain.

The median will be the $\{(n + 1) \div 2\}^{\text{th}}$ value, where **n** is the number of values for all the time intervals for patients arriving into ED and receiving a CAT scan.

Inclusions: All patients with a final diagnosis of stroke or TIA.

Exclusions: Nil

Reference Benchmark:

Maximum Acceptable	Achievable	Excellent
20 min	15-20 minutes	Less than 15 minutes

KPI 2: Median time interval from door to IV r-tPA

Computation method: Median time interval from patient entry in emergency room/department and TPA bolus time.

The median will be the $\{(n + 1) \div 2\}^{\text{th}}$ value, where **n** is the number of values for all the time intervals for patients arriving into ED and receiving IV r-tPA.

Inclusions: Patients with a final diagnosis of ischaemic stroke that arrive within 4 hours to the emergency department.

Exclusions: Patients with unknown time of symptom onset.

- Patients less than 18 years of age
- Patients with a documented reason for extending the initiation of IV thrombolytics
- Patients with a documented reason for not initiating IV thrombolytics²⁶

Reference Benchmark:

Maximum Acceptable	Achievable	Excellent
45-60 minutes	30-45 minutes	Less than 30 minutes

KPI 3: Time from presentation to emergency care unit to stroke/TIA identification (code activation)

Computation method: Median time from presentation to stroke/TIA identification (code activation).

²⁶ <https://manual.jointcommission.org/releases/TJC2018B1/MIF0129.html>.

The median will be the $\{(n + 1) \div 2\}^{\text{th}}$ value, where **n** is the number of values for all the time intervals between patient arriving in emergency care unit and stroke/TIA code activation.

Inclusions: All patients with a final diagnosis of stroke or TIA.

Exclusions: Nil

Reference Benchmark:

Maximum Acceptable	Good	Excellent
15 min	15 min-10 min	Less than 10 min

KPI 4: Proportion of hospitals within a network that have established ED protocol for acute stroke management (including IVr-tPA, swallow assess etc.)

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Number of hospitals with established ED protocol for acute stroke management.

Inclusions: Hospitals admitting acute stroke patients in ED.

Exclusions: Nil

Denominator: Total number of hospitals accepting stroke patients in ED.

Inclusions: Hospitals admitting acute stroke patients in ED.

Exclusions: Nil

Reference Benchmark:

Minimum Acceptable
100%

KPI 5: Proportion of hospitals with designated acute stroke team to manage and assess acute stroke

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of hospitals with a designated team to assess and manage acute stroke in ED (per cluster)

Inclusions: All hospitals admitting acute stroke patients

Exclusions: Nil

Denominator: Total number of hospitals accepting acute stroke patients in ED (per cluster).

Inclusions: All hospitals admitting acute stroke patients

Exclusions: Nil

Reference Benchmark:

Minimum Acceptable	Good	Excellent
90%	91 - 99%	100%

KPI 6: Swallowing screening on within 4 hours of presentation to ED

Computation method: Proportion of acute stroke patients who received swallow screening within 4 hours on presentation to ED (Numerator ÷ Denominator) × 100.

Numerator: Total number of stroke patients who received swallowing screening within 4 hours of presentation to ED

Inclusions: All patients brought into ED with a final diagnosis of stroke.

Exclusions: Nil.

Denominator: Total number of stroke patients admitted to the hospital/ED.

Inclusions: All patients brought into ED with a final diagnosis of stroke.

Exclusions: Comatose patients.

Reference Benchmarks:

Minimum Acceptable	Good	Excellent
85%	86-95%	96-100%

KPI 7: Proportion of acute ischemic stroke patients who received IV-Alteplase²⁷

Computation method: (Numerator ÷ Denominator) X 100

Numerator: Total number of patients with a final diagnosis of ischaemic stroke who presented to hospital within 4.5 hours (i.e. within 270 minutes) of symptom onset, with documentation that intravenous thrombolysis was administered.^{28,29}

Inclusions: Patients with a final diagnosis of ischaemic stroke.

Exclusions: Patients with unknown time of symptom onset.

Denominator: Total number of patients with a final diagnosis of ischaemic stroke.

Inclusions: Patients with a final diagnosis of ischaemic stroke.

Exclusions: Patients with Hemorrhagic stroke. Patients with unknown time of symptom onset. Patients for whom thrombolysis is contraindicated, and for whom the contraindication is documented.

Comments:

Thrombolysis within 4.5 hours of symptom onset is indicated for ischaemic stroke. However, it is recognised that in many cases patients and their families or carers will not be able to describe with precision the time from symptom onset.³⁰

Contraindications for thrombolysis include:

- Presentation >4.5 hours from stroke onset or uncertain onset time
- Evidence of intracranial haemorrhage on the CT-scan

²⁷ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4839134/>

²⁸ https://www.ahajournals.org/doi/full/10.1161/STROKEAHA.109.577106?url_ver=Z39.88-2003&rft_id=ori%3Arid%3Acrossref.org&rft_dat=cr_pub%3Dpubmed

²⁹ <https://www.sciencedirect.com/science/article/pii/S0140673607601494>

³⁰ Wardlaw JM, Murray V, Berge E, del Zoppo GJ. Thrombolysis for acute ischaemic stroke. The Cochrane database of systematic reviews 2014;7.

- Persistent high blood pressure on repeated measures (systolic blood pressure ≥ 185 mmHg or diastolic blood pressure >110 mmHg)
- INR >1.7 if patient is taking warfarin or other anticoagulation therapy
- Heparin given within the last 24 hrs , or direct thrombin inhibitors or direct factor Xa inhibitors given in the last 48 hours or thrombocytopenia with platelets count $100,000/\text{mm}^3$ with aPTT >40 s, or PT >15 s elevated PTT or has a known hereditary or acquired haemorrhagic diathesis (e.g. PT or APTT greater than normal) IV alteplase should not be administered to patients who have received a treatment dose of LMWH within the previous 24 h³¹
- Recent (within 2 weeks) major surgery is a contraindication
- Major co-morbidity or receiving palliative care
- Clinical suggestion of intracranial haemorrhage even if CT scan normal or recent or past history of haemorrhage that, in the opinion of the clinician, the increased risk of intracranial bleeding would outweigh the potential benefits of treatment
- Other absolute and relative contraindications as per the Product Information may also apply.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
5%	6-15%	More than 15%

KPI 8: Proportion of eligible ischemic or hemorrhagic stroke patients who received Venous Thromboembolism prophylaxis

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator:

Total number of ischemic or hemorrhagic stroke patients who received any form of VTE prophylaxis or have documentation why no VTE prophylaxis was given on the day of or the day after hospital admission.

Inclusions: All patients brought into ED with a final diagnosis of stroke

Exclusions: Nil

Denominator:

Total number of Ischemic or hemorrhagic stroke patients admitted to the hospital.

Inclusions: All patients brought into ED with a final diagnosis of stroke

Exclusions: Nil

Reference Benchmark:

Minimum Acceptable	Good	Excellent
80%	81 - 90%	91 - 100%

³¹ PTT is partial thromboplastin time; PT is prothrombin time; APPT is activated partial thromboplastin time.

KPI 9: Proportion of ischemic stroke and TIA patients receiving antithrombotic therapy administered by the end of day 2 of hospital stay

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of ischemic stroke and TIA patients who had antithrombotic therapy e.g. antiplatelet or anticoagulant, administered by end of day 2 of hospital stay.

Inclusions: All patients with a final diagnosis of ischemic stroke or TIA

Exclusions: Patients with haemorrhagic stroke or those patients in whom antithrombotic therapy is contraindicated.

Denominator: Total number of Ischemic stroke and TIAs admitted to the hospital.

Inclusions: All patients with a final diagnosis of ischemic stroke or TIA

Exclusions: Patients with haemorrhagic stroke or those patients in whom antithrombotic therapy is contraindicated.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
80%	81 - 90%	91 - 100%

KPI 10: Proportion of all stroke and TIA patients and their family members who received information about stroke education, stroke management, support services before hospital discharge

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of stroke patients and TIAs who received information at hospital discharge.

Inclusions: Patients diagnosed with stroke or TIA

Exclusions: Nil

Denominator: All strokes and TIAs

Inclusions: Patients diagnosed with stroke or TIA

Exclusions: Patients and family members refusing to receive the information and education.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
90%	91 - 95%	96 - 100%

KPI 11: Proportion of TIA patients who received documented urgent ABCD2, ECG and brain imaging within 2 hours of ED presentation

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of suspected TIA patients with documented ABCD2, ECG and brain imaging within 2 hours of ED visit.

Inclusions: All patients with a confirmed diagnosis of TIA presenting in ED

Exclusions: Nil

Denominator: Total number of suspected TIA patients seen.

Inclusions: All patients presented to ED with symptom suggestive of TIA diagnosis

Exclusions: Nil

Reference Benchmark:

Minimum Acceptable	Good	Excellent
70-79%	80-89%	90-100%

KPI 12: Proportion of acute ischemic stroke patients with atrial fibrillation who are treated with anticoagulant therapy upon discharge from hospital

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of acute ischemic stroke patients who have atrial fibrillation treated with anticoagulation therapy.

Inclusions: Patients diagnosed with acute ischemic stroke patients and non-valvular atrial fibrillation for whom anticoagulation is not contraindicated.

Exclusions: Patients for whom anticoagulation is contraindicated.

Denominator: Total number of acute ischemic stroke patients diagnosed with atrial fibrillation.

Inclusions: Patients diagnosed with ischemic stroke and Atrial Fibrillation.

Exclusions: Patients for whom anticoagulation therapy is contraindicated and for whom the contraindication is documented.

Comments:

Contraindications for oral anticoagulants may include patient refusal or where there are limitations of therapy (i.e. advance care directive is enacted or the patient is on a palliative care pathway). Oral anticoagulants include warfarin, apixaban, rivaroxaban or dabigatran.

Reference Benchmark:

To be determined (this KPI will be measured during the initial phase and then benchmarks agreed by the end of 2019).

KPI 13: Proportion of patients who received rehabilitation assessment at admission to the acute stroke unit

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of patients admitted to a stroke unit for whom there is documented evidence of an assessment from the rehab team within defined working days of patient admission.

Numerator criteria:

Inclusions: Total number of patients with the diagnosis of stroke admitted to the hospital.

Exclusions: Nil

Denominator: Total number of patients admitted to the stroke unit.

Denominator criteria:

Inclusions: Patients with a diagnosis of stroke who were admitted to the hospital.

Exclusions: Patients who refused assessment.

Reference Benchmark:

Minimum Acceptable

100%

List of all the key performance indicators by chapter:

Chapter 1: Saudi Stroke Hospital Classification System

KPI – ASR1: Median time interval from door to physician.

Computation method: Median time interval from patient entry in emergency room to physician evaluation.

Reference Benchmark:

Maximum Acceptable	Achievable	Excellent
Up to 15 min	7-15 minutes	Less than 7 minutes

KPI – ASR2: Median time interval from door to CAT scan

Computation method: Median time interval from patient entry in emergency room to non-contrast CAT scan of the brain.

The median will be the $\{(n + 1) \div 2\}^{\text{th}}$ value, where **n** is the number of values for all the time intervals for patients arriving into ED and receiving a CAT scan.

- 1) Rank the total values of time in minutes between acute stroke patient arriving in ED and receiving CAT scan.
- 2) If the number of values of time in minutes is odd, the middle value in ranked order of values is the median time in minutes.
- 3) If the number of values of time in minutes is even, then the **median** is found by taking the mean (average) of the two middlemost numbers.

Inclusions: All patients with a final diagnosis of stroke or TIA.

Exclusions: Nil

Reference Benchmark:

Maximum Acceptable	Achievable	Excellent
20 min	15-20 minutes	Less than 15 minutes

KPI – ASR3: Median time interval from door to IV r-tPA

Computation method: Median time interval from patient entry in emergency room to IV R-tPA bolus.

The median will be the $\{(n + 1) \div 2\}^{\text{th}}$ value, where **n** is the number of values for all the time intervals for patients arriving into ED and receiving IV r-tPA.

- 1) Rank the total values of time in minutes between acute stroke patient arriving in ED and receiving IV r-tPA.
- 2) If the number of values of time in minutes is odd, the middle value in ranked order of values is the median time in minutes.
- 3) If the number of values of time in minutes is even, then the **median** is found by taking the mean (average) of the two middlemost numbers.

Inclusions: Patients with a final diagnosis of acute ischemic stroke who received r-TPA within 3-4.5 hours from symptoms onset.

Exclusions: Patients with unknown time of symptom onset.

Reference Benchmark:

Maximum Acceptable	Achievable	Excellent
45-60 minutes	30-45 minutes	Less than 30 minutes

KPI – ASR4: Median time interval from door-in to door-out.

Computation method: Median time interval from patient entry in ASRH emergency room to leaving ASRH.

The median will be the $\{(n + 1) \div 2\}^{\text{th}}$ value, where **n** is the number of values for door in door out of ED for acute stroke patients:

- 1) Rank the total values of time in minutes between acute stroke patient arriving in ED and leaving ED.
- 2) If the number of values of time in minutes is odd, the middle value in ranked order of values is the median time in minutes.
- 3) If the number of values of time in minutes is even, then the **median** is found by taking the mean (average) of the two middlemost numbers.

Reference Benchmark:

	Maximum Acceptable	Achievable	Excellent
With IV r-tPA capabilities	100-120 minutes	80-100 minutes	Less than 80 minutes
Without IV r-tPA capabilities	30-40 min	20-30 minutes	Less than 20 minutes

Chapter 2: QM Community Activation

KPI-CA 1: Time from presentation to emergency care unit to stroke/TIA identification (code activation)

Computation method: Median time from presentation to stroke/TIA identification (code activation).

The median will be the $\{(n + 1) \div 2\}^{\text{th}}$ value, where **n** is the number of values for all the time intervals between patient arriving in emergency care unit and stroke/TIA code activation.

- 1) Rank the total values of time in minutes between acute stroke patient arriving in ED and stroke/TIA identification.
- 2) If the number of values of time in minutes is odd, the middle value in ranked order of values is the median time in minutes.

- 3) If the number of values of time in minutes is even, then the **median** is found by taking the mean (average) of the two middlemost numbers.

Inclusions: All patients with a final diagnosis of stroke or TIA.

Exclusions: Nil

Reference Benchmark:

Maximum Acceptable	Good	Excellent
15 min	15 min-10 min	Less than 10 min

KPI-CA 2: Proportion of stroke/TIA cases identified (code activated) successfully

Computation method: Percentage of stroke/TIA cases identified successfully. Percentage of facility pre-notification. $(\text{Numerator} \div \text{Denominator}) \times 100$.

Numerator: Number of stroke/TIA cases identified at triage and upon EMS response (arrival or telehealth engagement).

Denominator: Total number of stroke/TIA cases identified.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
75%	76 - 90%	91 – 100%

KPI-CA 3: Mean time from symptoms onset to first professional contact

Computation method: Mean time interval between time of symptom onset and first professional contact for suspected stroke patients.

Reference Benchmark:

Maximum Acceptable	Good	Excellent
40 min	20 min - 40 min	Less than 20 min

Chapter 3: QM EMS Response

KPI - EMS 1: Proportion of stroke patients who received advance life support as a primary response unit

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$.

Numerator: Total number of stroke patients who received advance life support as a primary response via the EMS.

Denominator: Total number of stroke patients transported by EMS.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
10%	11 - 30%	31 - 100%

KPI - EMS 2: Ninetieth percentile of ambulance response time to stroke

Computation method:

1. Order all the values in the data set of ambulance response times from smallest to largest.
2. Multiply 90 percent by the total number of values, n .
This number is called the index.
3. If the index obtained in Step 2 is not a whole number, round it up to the nearest whole number and go to Step 4a. If the index obtained in Step 2 is a whole number, go to Step 4b.
4. 4a. Count the values in your data set from left to right (from the smallest to the largest value) until you reach the number indicated by Step 3.

The corresponding value in your data set is the 90th percentile.

4b. Count the values in your data set from left to right until you reach the number indicated by Step 2.

The 90th percentile is the average of that corresponding value in your data set and the value that directly follows it.

Reference Benchmark:

Maximum Acceptable	Good	Excellent
11 - 15 minutes	9 - 10 minutes	0 – 8 minutes

KPI - EMS 3: Ninetieth percentile of ambulance scene time to stroke patients

Computation method:

1. Order all the values in the data set of ambulance scene times from smallest to largest for stroke patients.
2. Multiply 90 percent by the total number of values, n .
This number is called the index.
3. If the index obtained in Step 2 is not a whole number, round it up to the nearest whole number and go to Step 4a. If the index obtained in Step 2 is a whole number, go to Step 4b.
4. 4a. Count the values in your data set from left to right (from the smallest to the largest value) until you reach the number indicated by Step 3.

The corresponding value in your data set is the 90th percentile.

5. 4b. Count the values in your data set from left to right until you reach the number indicated by Step 2.

The 90th percentile is the average of that corresponding value in your data set and the value that directly follows it.

Reference Benchmark:

Maximum Acceptable	Good	Excellent
15 minutes	11 – 14 minutes	0 - 10 minutes

KPI - EMS 4: Proportion of patients with documented use of a validated stroke detection tool

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of stroke patients that have had a documented assessment using a validated stroke detection tool by the EMS.

Denominator: Total number of stroke patients assessed by EMS.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
80-89%	90-94%	95-100%

KPI - EMS 5: Proportion of stroke patients screened for mimics

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of stroke patients assessed for stroke mimics by the EMS.

Denominator: Total number of stroke patients assessed by the EMS.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
60-69%	70-79%	80-100%

KPI - EMS 6: Proportion of transfers where advance notification was performed by EMS

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of advance notifications performed by the EMS.

Denominator: Total number of stroke patients transferred by the EMS.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
80-89%	90-95%	96-100%

KPI - EMS 7: Proportion of transfers with 'false positive' activation

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of 'false positive' activation performed by EMS.

Denominator: Total number of stroke patients transferred by the EMS.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
80-89%	90-95%	96-100%

KPI - EMS 8: Proportion of patients where ambulance bypassed local non-stroke hospitals

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of ambulances to bypass local non-stroke hospitals.

Denominator: Total number of stroke patients transferred by the EMS.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
80-89%	90-95%	96-100%

Chapter 4: QM ED Assessment

KPI-ED 1: Proportion of hospitals within a network that have established ED protocol for acute stroke management (including IVr-tPA, swallow assess etc.)

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Number of hospitals with established ED protocol for acute stroke management.

Inclusions: Hospitals admitting acute stroke patients in ED.

Exclusions: Nil

Denominator: Total number of hospitals accepting stroke patients in ED.

Inclusions: Hospitals admitting acute stroke patients in ED.

Exclusions: Nil

Reference Benchmark:

Minimum Acceptable
100%

KPI-ED 2: Proportion of patients for whom stroke code response was triggered in ED

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Number of stroke code responses triggered in ED.

Denominator: Total number of acute stroke patients admitted in ED.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
100%	100%	100%

KPI-ED 3: Proportion of hospitals with established door to imaging and door to needle time.

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of hospitals with established door to imaging and door to needle time.

Denominator: Total number of hospitals accepting stroke patients in ED.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
100%	100%	100%

KPI-ED 4: Proportion of patients with acute stroke who have point of care glucose check upon arrival to ED

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of suspected acute stroke patients receiving point of care glucose check upon arrival in ED.

Denominator: Total number of acute stroke patients admitted in the ED.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
100%	100%	100%

KPI-ED 5: Proportion of hospitals with designated acute stroke team to manage and assess acute stroke

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of hospitals with a designated team to assess and manage acute stroke in ED (per cluster)

Inclusions: All hospitals admitting acute stroke patients

Exclusions: Nil

Denominator: Total number of hospitals accepting acute stroke patients in ED (per cluster).

Inclusions: All hospitals admitting acute stroke patients

Exclusions: Nil

Reference Benchmark:

Minimum Acceptable	Good	Excellent
90%	91 - 99%	100%

KPI-ED 6: Proportion of documented NIHSS at ED neurological assessment for patients with acute stroke (prior treatment and 24 hours after treatment).

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of documented NIHSS at ED neurological assessment for patients with acute stroke (prior treatment and 24 hours after treatment).

Denominator: Total number of acute stroke patients seen in the ED.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
80%	81-90%	91-100%

KPI-ED 7: Proportion of competent ED staff in neurological stroke assessment e.g. STARS competencies

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of ED staff competent in neurological stroke assessment.

Denominator: Total number of ED staff involved in assessing acute stroke patients.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
90%	90%	100%

Chapter 4a: QM Protocol for Acute Stroke Screening

No KPI as ED assessment covers the KPIs for this chapter.

Chapter 4b: QM Protocol for Acute Stroke Pathway

KPI- SCP 1: Proportion of acute stroke patients admitted to ED that have brain image study obtained and interpreted

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of acute stroke patients who had their treatment decisions made in ED based on brain imaging.

Denominator: Total number of acute stroke patients admitted to ED.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
95%	96-100%	96-100%

KPI- SCP 2: Median time interval between ED arrival and CT Brain for suspected stroke patients

Computation method: $\{(n + 1) \div 2\}^{\text{th}}$ value, where **n** is the number of values for time interval between ED arrival and CT brain image being obtained for acute stroke patients.

- 1) Rank the total values of time in minutes between acute stroke patient's arrival in emergency department and CT brain being documented as completed.
- 2) If the number of values of time in minutes is odd, the middle value in ranked order of values is the median time in minutes.
- 3) If the number of values of time in minutes is even, then the **median** is found by taking the mean (average) of the two middlemost numbers.

Reference Benchmark:

Maximum Acceptable	Good	Excellent
Up to 25 min	24 - 20 min	19 - 15 min

KPI- SCP 3: Median time interval for brain image interpretation

Computation method: $\{(n + 1) \div 2\}^{\text{th}}$ value, where **n** is the number of values for time interval between brain image being obtained and interpreted for acute stroke patients.

- 1) Rank the total values of time in minutes between acute stroke patient's brain imaging being completed and interpreted.
- 2) If the number of values of time in minutes is odd, the middle value in ranked order of values is the median time in minutes.
- 3) If the number of values of time in minutes is even, then the **median** is found by taking the mean (average) of the two middlemost numbers.

Reference Benchmark:

Maximum Acceptable	Good	Excellent
Up to 45 min	44 – 30 min	Less than 29 min

Chapter 4c: QM Swallow Screening

KPI SA 1: Swallowing screening on within 4 hours of presentation to ED

Computation method: Proportion of acute stroke patients who received swallow screening within 4 hours on presentation to ED (Numerator ÷ Denominator) × 100.

Numerator: Total number of stroke patients who received swallowing screening within 4 hours of presentation to ED

Inclusions: All patients brought into ED with a final diagnosis of stroke.

Exclusions: Nil.

Denominator: Total number of stroke patients admitted to the hospital/ED.

Inclusions: All patients brought into ED with a final diagnosis of stroke.

Exclusions: Comatose patients.

Reference Benchmarks:

Minimum Acceptable	Good	Excellent
85%	86-95%	96-100%

KPI SA 2: Proportion of eligible acute stroke patients who received a comprehensive assessment by a speech–language pathologist.

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of acute stroke patients receiving a comprehensive assessment by a Speech-Language Pathologist.

Denominator: Total number of acute stroke patients failing initial dysphagia screening.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
100%	100%	100%

KPI SA 3: Proportion of stroke patients that have developed aspiration pneumonia in hospital

Computation method: Proportion of stroke patients who developed aspiration pneumonia within 7 days of admission. $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of stroke patients who developed stroke related aspiration during hospital stay.

Denominator: Total number of stroke patients admitted to the hospital.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
10%	5%	0%

KPI SA 4: Percentage of stroke patient diagnosed with dysphagia who received swallowing exercises

Computation method: Proportion of stroke patients who are diagnosed with dysphagia and swallowing exercises were given. $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of stroke patients who received swallowing exercises.

Denominator: Total number of stroke patients diagnosed with dysphagia.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
40%	41 - 80%	81 - 100%

Chapter 4d: QM Hemorrhagic Stroke assessment and treatment

KPI- H1: Proportion of patients with Intra Cerebral Hemorrhage admitted to acute stroke unit

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of hemorrhagic stroke patients admitted to acute stroke unit.

Denominator: Total number of hemorrhagic stroke patients discharged from hospital.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
90%	91-95%	96-100%

Chapter 4e: QM Door to Needle Time

KPI DN 1: Proportion of acute ischemic stroke patients who received IV-Alteplase

Computation method: (Numerator ÷ Denominator) X 100

Numerator: Total number of patients with a final diagnosis of ischaemic stroke who presented to hospital within 4.5 hours (i.e. within 270 minutes) of symptom onset, with documentation that intravenous thrombolysis was administered.

Inclusions: Patients with a final diagnosis of ischaemic stroke.

Exclusions: Patients with unknown time of symptom onset.

Denominator: Total number of patients with a final diagnosis of ischaemic stroke.

Inclusions: Patients with a final diagnosis of ischaemic stroke.

Exclusions: Patients with Hemorrhagic stroke. Patients with unknown time of symptom onset. Patients for whom thrombolysis is contraindicated, and for whom the contraindication is documented.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
5%	6-15%	More than 15%

KPI DN 2: Proportion of hospitals with evidence-based protocols for administration of intravenous thrombolytic therapy

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of hospitals in the cluster with evidence-based protocols for administration of intravenous thrombolytic therapy.

Denominator: Total number of hospitals in the cluster that accept and treat acute stroke patients.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
95%	95%	96 - 100%

Chapter 4f: QM Mechanical Thrombectomy

KPI MT1: Mean door to groin time for a "MT-capable center/hospital"

Computation method: $\{(n + 1) \div 2\}^{\text{th}}$ value, where **n** is the number of values for door to groin time for acute stroke patients in MT capable center/hospital who received mechanical thrombectomy.

- 1) Rank the total values of time in minutes between acute stroke patients arriving in ED and receiving mechanical thrombectomy.
- 2) If the number of values of time in minutes is odd, the middle value in ranked order of values is the median time in minutes.
- 3) If the number of values of time in minutes is even, then the **median** is found by taking the mean (average) of the two middlemost numbers.

Reference Benchmark:

Maximum Acceptable	Good	Excellent
91 - 120 min	61 – 90 min	Less than 60 min

KPI MT2: Mean IIb/III TICI scores

Computation method: $\{(n + 1) \div 2\}^{\text{th}}$ value, where **n** is the number of values for IIb/III TICI scores for acute stroke patients.

- 1) Rank the total values of time in minutes between acute stroke patient arriving in ED and leaving ED.
- 2) If the number of values of time in minutes is odd, the middle value in ranked order of values is the median time in minutes.
- 3) If the number of values of time in minutes is even, then the **median** is found by taking the mean (average) of the two middlemost numbers.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
60%	70 – 80%	More than 80%

KPI MT3: Number of mechanical thrombectomy procedures performed at each hospital per year

Computation method: Calculate the total number of MT procedures performed at each hospital per year.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
25	26 - 35	More than 35

KPI MT4: Proportion of Ischemic stroke patients who receive mechanical thrombectomy

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of acute stroke patients receiving mechanical thrombectomy per year.

Denominator: Total number of acute ischemic stroke patients admitted at the hospital.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
At least 10%	11-15%	More than 15%

KPI MT5: Number of mechanical thrombectomies per interventionalist per year

Computation method: Count the total number of mechanical thrombectomy interventions being carried out by each interventionalist per year.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
At least 10	11-20	More than 20

Chapter 4g: QM Acute Stroke Unit

KPI-ASU 1: Proportion of eligible ischemic or hemorrhagic stroke patients who received Venous Thromboembolism prophylaxis

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator:

Total number of ischemic or hemorrhagic stroke patients who received any form of VTE prophylaxis or have documentation why no VTE prophylaxis was given on the day of or the day after hospital admission.

Inclusions: All patients brought into ED with a final diagnosis of stroke

Exclusions: Nil

Denominator:

Total number of Ischemic or hemorrhagic stroke patients admitted to the hospital.

Inclusions: All patients brought into ED with a final diagnosis of stroke

Exclusions: Nil

Reference Benchmark:

Minimum Acceptable	Good	Excellent
80%	81 - 90%	91 - 100%

KPI-ASU 2: Proportion of ischemic stroke and TIA patients receiving antithrombotic therapy administered by the end of day 2 of hospital stay

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of ischemic stroke and TIA patients who had antithrombotic therapy e.g. antiplatelet or anticoagulant, administered by end of day 2 of hospital stay.

Inclusions: All patients with a final diagnosis of ischemic stroke or TIA

Exclusions: Patients with haemorrhagic stroke or those patients in whom antithrombotic therapy is contraindicated.

Denominator: Total number of Ischemic stroke and TIAs admitted to the hospital.

Inclusions: All patients with a final diagnosis of ischemic stroke or TIA

Exclusions: Patients with haemorrhagic stroke or those patients in whom antithrombotic therapy is contraindicated.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
80%	81 - 90%	91 - 100%

KPI-ASU 3: Proportion of ischemic stroke patients prescribed anticoagulation therapy at hospital discharge

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of ischemic stroke patients prescribed anticoagulation therapy at hospital discharge.

Denominator: Total number of Ischemic stroke patients and TIAs with documented atrial fibrillation/flutter.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
80%	81 - 90%	91 - 100%

KPI-ASU 4: Proportion of eligible ischemic stroke patients prescribed antithrombotic therapy at hospital discharge.

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of ischemic stroke patients prescribed antithrombotic therapy at hospital discharge.

Denominator: Total number of Ischemic stroke patients discharged from hospital.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
100%	100%	100%

KPI-ASU 5: Proportion of eligible Ischemic stroke patients and TIAs prescribed statin medication at hospital discharge

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of Ischemic stroke patients and TIAs prescribed statin medication at hospital discharge.

Denominator: Ischemic stroke and TIA patients with a low-density lipoprotein cholesterol (LDL-C) ≥100 mg/dL, or LDL-C not measured, or who were taking a lipid-lowering medication before hospital arrival.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
90%	91 - 95%	96 - 100%

KPI-ASU 6: Proportion of all stroke and TIA patients and their family members who received information about stroke education, stroke management, support services before hospital discharge

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of stroke patients and TIAs who received information at hospital discharge.

Inclusions: Patients diagnosed with stroke or TIA

Exclusions: Nil

Denominator: All strokes and TIAs

Inclusions: Patients diagnosed with stroke or TIA

Exclusions: Patients and family members refusing to receive the information and education.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
90%	91 - 95%	96 - 100%

KPI-ASU 7: Proportion of all eligible acute ischemic stroke and TIA patients that have carotid imaging reported

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of Patients with ischemic stroke or TIAs who have carotid imaging reported (based on either ultrasound, CT angiography, magnetic resonance imaging angiography, or conventional angiography) by the end of hospital day 2.

Denominator: All ischemic strokes and TIAs.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
90%	91 - 95%	96 - 100%

KPI-ASU 8: Proportion of ischemic stroke patients who received cardiac rhythm monitoring within 2 hours of arrival at hospital

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of patients who receive continuous cardiac rhythm monitoring within 2 hours of arrival on a hospital unit and for whom rhythm monitoring is continued through the first 24 hours of hospital admission.

Denominator: Total number of patients admitted with ischemic stroke.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
90%	91-95%	96-100%

KPI-ASU 9: Proportion of stroke patients assessed for rehabilitation within the acute stroke unit

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of Patients who were screened, assessed for, or who received, rehabilitation services during the first 72 hours of admission.

Denominator: Total number of stroke patients admitted

Reference Benchmark:

Minimum Acceptable	Good	Excellent
70%	71-80%	More than 80%

KPI-ASU 10: Proportion of acute stroke patients admitted directly to an acute stroke unit from ED or home

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of acute stroke patients admitted directly to an acute stroke unit from ED or home.

Denominator: Total number of patients admitted to acute stroke unit.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
80%	81-90%	91-100%

KPI-ASU 11: Proportion of stroke patients discharged home from acute stroke unit

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of stroke patients discharged home from an acute stroke unit.

Denominator: Total number of stroke patients discharged from an acute stroke unit.

Inclusion criteria: All stroke patients discharged from an acute stroke unit.

Exclusion criteria: Total number of deaths in an acute stroke unit or discharge to hospice.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
40%	41 - 50%	More than 50%

KPI-ASU 12: Proportion of stroke patients receiving bedside swallowing assessment by SLP within 72 hours of the referral from Primary team

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of stroke patients who have a documented bedside swallowing assessment completed by a SLP within 72 hours of referral.

Denominator: Total number of acute stroke patients referred to SLP for an assessment.

Inclusion criteria: All patients with Glasgow Coma Scale of 12 or higher. In case of Tracheostomy, patients with Glasgow Coma Scale of at least 11.

Exclusion criteria: All patients with Glasgow Coma Scale of 11 or lower, with exception to Tracheostomy patients (less than 10).

Reference Benchmark:

Minimum Acceptable	Good	Excellent
100%	100%	100%

KPI-ASU 13: Proportion of stroke patients requiring NGT upon discharge from acute stroke Unit

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of stroke patients who required NGT on the acute stroke unit.

Denominator: Total number of acute stroke patients admitted to the acute stroke unit.

Inclusion criteria: All patients with Glasgow Coma Scale of 12 or higher. In case of Tracheostomy patients those with Glasgow Coma Scale of at least 11.

Exclusion criteria: All patients with Glasgow Coma Scale of 11 or lower, with exception to Tracheostomy patients (less than 10).

Reference Benchmark:

Minimum Acceptable	Good	Excellent
6 - 10%	1 - 5%	0%

Chapter 4h: QM Acute in-patient Stroke Rehabilitation

KPI-Rehab 1: Proportion of patients who received rehabilitation assessment at admission to the acute stroke unit

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of patients admitted to a stroke unit for whom there is documented evidence of an assessment from the rehab team within defined working days of patient admission.

Denominator: Total number of patients admitted to the stroke unit.

Inclusion criteria:

All patients with Glasgow Coma Scale of 12 or higher. In case of Tracheostomy patients those with Glasgow Coma Scale of at least 11.

Exclusion criteria: All patients with Glasgow Coma Scale of 11 or lower, with exception to Tracheostomy patients (less than 11).

Reference Benchmark:

Minimum Acceptable
100%

KPI-Rehab 2: Proportion of acute stroke patients with a discharge plan before discharge from acute hospital

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of stroke patients who were discharged from stroke unit with discharge plan.

Denominator: Total number of stroke patients discharged from the stroke unit.

Inclusion criteria: All patients with Glasgow Coma Scale of 12 or higher. In case of Tracheostomy, patients with Glasgow Coma Scale of at least 11.

Exclusion criteria:

All patients with Glasgow Coma Scale of 11 or lower, with exception to Tracheostomy patients (less than 10).

Reference Benchmark:

Minimum Acceptable	Good	Excellent
100%	100%	100%

KPI-Rehab 3: Patient and family satisfaction rates from acute stroke rehabilitation

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Sum of stroke patients/their family satisfaction who receive rehabilitation care in stroke unit.

Denominator: Total number of stroke patients who receive rehabilitation care in stroke unit.

Inclusion criteria: All stroke patient who receive rehabilitation care in stroke unit.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
50	51 - 65	More than 65%

KPI-Rehab 4: Proportion of acute stroke patients developing secondary complications such as pressure ulcer, DVT, or contractures in the rehabilitation unit.

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of acute stroke patients who developed any secondary complications such as pressure ulcer, DVT, or contractures. Each patient with any secondary complication that developed during the stay in rehabilitation unit will be counted as one patient with secondary complication.

Denominator: Total number of stroke patients who receive rehabilitation care in stroke unit.

Exclusion criteria: Patients arriving in the rehabilitation unit with pre-existing secondary complication.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
Up to 6-10%	Up to 1-5%	0%

KPI-Rehab 5: Mean time interval between acute stroke patients being referred for a comprehensive swallowing assessment and receiving an instrumental swallowing assessment

Computation method: $\{(n + 1) \div 2\}^{\text{th}}$ value, where **n** is the number of values for time intervals between acute stroke patients being referred for a comprehensive swallowing assessment after failing a swallow screen and actually receiving an instrumental swallowing assessment.

- 1) Rank the total values of time in hours between acute stroke patients being referred for a comprehensive swallowing assessment and actually receiving an instrumental swallowing assessment.

- 2) If the number of values of time in minutes is odd, the middle value in ranked order of values is the median time in minutes.
- 3) If the number of values of time in minutes is even, then the **median** is found by taking the mean (average) of the two middlemost numbers.

Inclusion criteria: All patients with Glasgow Coma Scale of 12 or higher. In case of Tracheostomy, patients with Glasgow Coma Scale of at least 11.

Exclusion criteria: All patients with Glasgow Coma Scale of 11 or lower, with exception to Tracheostomy patients (less than 11).

Reference Benchmark:

Maximum Acceptable	Good	Excellent
Up to 72 hours	72 - 48 hours	48 - 24 hours

KPI-Rehab 6: Proportion of stroke patients discharged from acute stroke Unit on long-term alternative form of nutrition.

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of stroke patients who discharged on long-term alternative form of nutrition from the acute stroke unit.

Denominator: Total number of patients discharged with any alternative form of nutrition from the acute stroke unit.

Inclusion criteria: All stroke patients discharged from acute stroke unit.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
Up to 20%	21 - 50%	51 - 80%

Chapter 4i: QM Transfer of Care

KPI-ToC 1: Proportion of hospitals caring for stroke patients that have established transfer mechanisms and protocols in the cluster

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of hospitals caring for stroke patients that have established transfer mechanism and protocols across the cluster.

Denominator: Total number of hospitals across the cluster accepting stroke patients.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
90%	90%	91 - 100%

KPI-ToC 2: Proportion of eligible patients transferred for reperfusion therapy from hospitals that can't administer reperfusion therapy

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of candidate patients for reperfusion therapies who are transferred for reperfusion therapies.

Denominator:

Total number of acute stroke patients eligible for reperfusion therapies arrived at the hospital (candidate and transferred+ candidate but not transferred).

Reference Benchmark:

Minimum Acceptable	Good	Excellent
100%	100%	100%

KPI-ToC 3: Mean length of stay in Acute Stroke Unit for Ischemic and ICH

Computation method: Mean length of stay in acute stroke unit for all types of stroke patients.

Reference Benchmark:

Maximum Acceptable	Good	Excellent
Up to 6 days	4-5 days	0-3 days

Chapter 4j: QM Transient Ischemic Attack

KPI-TIA 1: Proportion of TIA patients who received documented ABCD2, ECG and brain imaging within - 2 hours of ED presentation

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of suspected TIA patients with documented ABCD2, ECG and brain imaging within 2 hours of ED visit.

Inclusions: All patients with a confirmed diagnosis of TIA presenting in ED

Exclusions: Nil

Denominator: Total number of suspected TIA patients seen.

Inclusions: All patients presented to ED with symptom suggestive of TIA diagnosis

Exclusions: Nil

Reference Benchmark:

Minimum Acceptable	Good	Excellent
70-79%	80-89%	90-100%

KPI-TIA 2: Proportion of high-risk TIA inpatients referred to TIA clinic within 24 hours from symptom onset and for low risk TIA patients, within 48 hours of symptom onset

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of high-risk TIA patients (ABCD2 scores of 5 or above) referred to TIA clinic or equivalent within 24 hours or within 48 hours if deemed low risk (ABCD2 scores 3 or below).

Denominator: Total number of high risk and low risk TIA patients identified.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
60-69%	70-79%	80-100%

KPI-TIA 3: Proportion of patients with anterior circulation symptoms who have documented carotid imaging within 48 hours

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$.

Numerator: Total number of patients with acute anterior circulation symptoms with documented carotid imaging within 48 hours.

Denominator: Total number of documented patients with acute anterior circulation issues eligible for carotid surgery.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
80-89%	90-99%	100%

KPI-TIA 4: Proportion of patients who have suffered from a TIA with high risk of stroke receiving specialist assessment within 24 hours of onset of symptoms

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of high-risk TIA patients with ABCD2 scores of 5 or above with documented specialist assessment and investigations within 24 hours of onset of symptoms.

Denominator: Total number of high-risk TIA patients seen.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
60-69%	70-79%	80-100%

KPI-TIA 5: Proportion of TIA patients who have had an out-patient clinic appointment completed within 1 week of onset of a TIA with low risk of stroke

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of suspected TIA patients at low risk (ABCD2 score of 3 or below), with a documented outpatient clinic appointment within 1 week of symptoms onset.

Denominator: Total number of suspected TIA patients at low risk seen.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
60-69%	70-79%	80-100%

KPI TIA 6: Proportion of TIA patients who have received specialist assessment and brain scan within 24 to 48 hours of symptom onset.

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of acute stroke patients who received specialist assessment including a brain scan within 24 to 48 hours.

Denominator: Total number of acute stroke patients admitted to hospitals

Reference Benchmark:

Minimum Acceptable	Good	Excellent
70-79%	80-89%	90-100%

KPI TIA 7: Mean time taken for Carotid Imaging for high risk TIA patients

Computation method: Mean time interval between patient arriving in ED and Carotid imaging being completed.

Reference Benchmark:

Maximum Acceptable	Good	Excellent
90-100 minutes	80-89 minutes	60-79 minutes

Chapter 5: QM Psycho-social, cognitive and support

KPI-SS 1: Percentage of patients screened for post stroke mood and cognitive issues

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Patient screened for post stroke mood & cognitive issues.

Denominator: Total number of stroke patients in a health care setting along the care pathway.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
70%	71 - 80%	81 - 90%

KPI-SS 2: Percentage of patients given education and information related to post stroke mood and cognitive issues before discharge from hospital

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number patients/care givers who received education and were given information about post stroke mood and cognitive issues, prior to discharge.

Denominator: Total number of stroke patients in stroke units in a given timeframe.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
85%	86 - 95%	96 - 100%

Chapter 5: QM Secondary Prevention

KPI SP1: Proportion of stroke patients receiving counselling for lifestyle modification including counselling for smoking cessation and assessment from a primary care physician

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Number of patients referred to specialty clinic for lifestyle modification.

Denominator:

Total number of stroke survivors with identified stroke risk factors.

Inclusion criteria:

Stroke survivors with risk factors identified.

Exclusion criteria:

No clear identification for the reason of the initial stroke.

Reference Benchmark:

KPI Title	Minimum acceptable	Good	Excellent
Received stroke education	80%	81 - 90%	91 - 100%
Number of visits for nutritional specialist clinic	80%	81 - 90%	91 - 100%
Referral to primary care physician	80%	81 - 90%	91 - 100%
Counselling for smoking cessation Yes No	100%	100%	100%

KPI: SP2 Proportion of stroke patients discharged on antihypertensive medications

- Target Blood Pressure documented and communicated to the patient.
- Referral made to primary care physician.

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Number of stroke patients with history of hypertension

Denominator: Total number of stroke patients

Reference Benchmark:

KPI title	Minimum acceptable	Good	Excellent
Discharge on antihypertensive medication	60%	61 - 80%	81 - 100%
Target Blood Pressure achieved			
Yes			
No			

KPI-SP3: Proportion of acute ischemic strokes classified using TOAST sub-type classification³²

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of acute ischemic strokes classified using TOAST classification method.

Denominator: Total number of acute ischemic strokes seen at the hospital.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
80%	81 - 90%	91 - 100%

KPI-SP 4: Proportion of patients with ischemic stroke or transient ischemic attack prescribed antiplatelet therapy on discharge from secondary prevention clinic care

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of ischemic stroke or TIA patients prescribed antiplatelet therapy on discharge from secondary prevention clinic.

Denominator: Total number of ischemic stroke or TIA patients seen in secondary prevention clinic.

³² <https://www.ahajournals.org/doi/pdf/10.1161/01.STR.24.1.35>

Reference Benchmark:

Minimum Acceptable	Good	Excellent
90%	90%	91 - 100%

KPI-SP 5: Proportion of acute ischemic stroke patients with atrial fibrillation who are treated with anticoagulant therapy

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of acute ischemic stroke patients who have atrial fibrillation treated with anticoagulation therapy.

Denominator: Total number of acute ischemic stroke patients diagnosed with atrial fibrillation.

Reference Benchmark:

To be determined (this KPI will be measured during the initial phase and benchmarks will be agreed by the end of 2019).

KPI-SP 6: Proportion of stroke or TIA patients with moderate to severe (50 – 99%) symptomatic carotid artery stenosis who had a carotid revascularization procedure following an index stroke/TIA event.

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of patients with carotid artery stenosis who had revascularization surgery.

Denominator: Total number of acute strokes diagnosed in patients with carotid artery stenosis.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
80%	81 - 90%	91 - 100%

KPI-SP 7: Proportion of patients who underwent revascularization, who experience perioperative in-hospital stroke, acute myocardial infarction or death

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of patients with moderate to severe stenosis who underwent surgery.

Denominator: All patients who underwent revascularization surgery.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
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Up to 6%	3-6%	Less than 3%
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Chapter 5b: QM Community Assessment and Review

KPI-CA 1: Proportion of stroke patients who received a multidisciplinary assessment of health and care needs within six weeks, six months and one-year post discharge from hospital

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of stroke patients who received multidisciplinary assessment for their changing needs after discharge home/care home after six weeks, six months and one year.

Denominator: Total number of stroke patients discharged from hospital.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
50%	51 – 65%	More than 65%

Chapter 5c: QM Participation in the community

No KPIs

Chapter 5d: QM Vocational Therapy

KPI-VT 1: Percentage of stroke patients below 60 years old who returned to employment

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Number of stroke patients below 60 years old who returned to any form of employment.

Denominator: Total number of stroke patients below 60 years.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
40%	41 - 60%	More than 60%

Chapter 5e: QM Long Term Care

KPI-LTC 1: Proportion of stroke patients monitored for any changes in their physical and psychological condition

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Number of stroke patients in Network receiving regular reviews by specialized services per year.

Denominator: Total number of stroke patients living at home or long-term care facilities in Network.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
50%	51 - 60%	More than 60%

Chapter 5f: QM End of Life Care

KPI-EoL 1: Proportion of patients screened for palliative care if comatose for more than three consecutive days

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of patients screened for palliative care if comatose for more than three consecutive days.

Denominator: Total number of patients recorded to be comatose for more than three consecutive days.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
90%	90%	91 - 100%

KPI-EoL 2: Proportion of patients whose care is transferred to palliative care team within 24 hours of decision to transfer care to palliative care team being made

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of patients who are transferred to the palliative care team within 24 hours of the decision to transfer care to palliative care is made.

Denominator: Total number of patients transferred to palliative care team.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
90%	90%	91 - 100%

KPI-EoL 3: Proportion of stroke patients who are supported to die in a place of their choice

Computation method: $(\text{Numerator} \div \text{Denominator}) \times 100$

Numerator: Total number of stroke patients who died supported in a place of their choice.

Denominator: Total number of patients identified as died from stroke in a period of time.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
50%	51 - 65%	More than 65%

KPI-EoL 4: Evidence that the end of life service was supportive to meet the need of the dying person and the family

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Number of the positive replies to the questionnaire from bereaved families/care givers.

Denominator: Total number of completed responses to the questionnaire from bereaved families/care givers.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
65%	66 - 80%	More than 80%

Chapter 5g: QM Leadership and Skills

KPI-LS 1: Proportion of acute stroke patients assessed by physiotherapist, occupational therapist, speech–language pathologist and social workers during inpatient rehabilitation.

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of stroke patients assessed by physiotherapist, occupational therapist, speech and language therapist and social workers during inpatient rehabilitation.

Denominator: Total number of stroke patients admitted into inpatient rehabilitation.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
90%	95%	100%

KPI-LS 2: Proportion of Doctors and other Healthcare professionals working in acute stroke unit who receive appraisal of their skills and knowledge at least once per year

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of Doctors and other Healthcare professionals working on acute stroke unit who have received an annual appraisal (performance review).

Denominator: Total number of Doctors and other Healthcare professionals working on acute stroke unit.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
95%	100%	100%

Chapter 5h: QM Workforce

KPI-W 1: Distribution of stroke workforce professionals by sector of activity (public vs private)

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Number of stroke workforce employed in the public (versus private or non-governmental) sector.

Denominator: Total number of stroke workforce professionals.

Inclusion criteria:

Definitions of labor force participation and employment status.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
>50 % are employed within the cluster	> 75% are employed within the cluster	> 90% are employed within the cluster

KPI-W 2: Distribution of workforce by geographical location

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Number of health workers in a given geography (rural areas or large cities or clusters/networks).

Denominator: Total number of health workers.

Inclusion criteria: Definition of rural (or other geographical delimitation).

Reference Benchmark:

Minimum Acceptable	Good	Excellent
Not more than 50% of the available stroke-care professionals are in the large cities.	Not more than 60% of the available stroke-care professionals are in the large cities.	Not more than 75% of the available stroke-care professionals are in the large cities.

KPI-W 3: Stock (and density) of stroke workforce: Total number of stroke care professionals (relative to the population)

Computation method: (Numerator ÷ Denominator) × 100

Numerator: Total number of stroke workforce professionals in a given cluster/network.

Denominator: Total population of the same cluster/network catchment area.

Inclusion criteria:

Definition and boundaries of stroke workforce, such as by occupation (e.g. physicians, nurses, etc.), industry or training – with distinction between headcounts versus job positions.

Reference Benchmark:

Minimum Acceptable	Good	Excellent
50% - 74% of the needed staff as shown in the standards	75% - 89% of the needed staff as shown in the standards	90% - 100% of the needed staff as shown in the standards

Appendix 2 - Patient Selection Criteria for Rehabilitation Team

Inclusion criteria

1. Stroke inpatients at acute setting.
2. Have an impairment likely to be responsive to enhanced therapy with identifiable and realistic rehabilitation goals
3. Be sufficiently clinically stable to tolerate 60 mins of therapy daily.
4. Have the desire and ability to actively participate in the rehabilitation program.
5. Patients over 65 will have MMSE conducted at the discretion of the Rehabilitation Consultant.
6. Possess a level of independence prior to the onset of the impairment that allowed them the ability to actively participate in the community and / or at home
7. Require at least two of the following therapies:
 - a. Physiotherapy
 - b. Occupational Therapy
 - c. Speech Therapy
 - d. Clinical Psychology
 - e. Social Work
 - g. Orthotics

Exclusion Criteria

1. Currently a patient in the Intensive Care unit
2. Febrile > 38.5oC in last 24 hours.
3. Glasgow Coma Scale < 13 or 12 if patient is non-verbal.

Process:

Initial Assessment Identification by Rehabilitation Resident or Registrar in accordance with the Rehabilitation Selection criteria.

- Upon identification of/or referral of the patient to Rehabilitation Team, the Rehabilitation CNC and Registrar will assess the patient , discuss suitability with Rehabilitation consultant and document in the patients notes.
- The Rehabilitation Registrar will review patients daily, liaise with the acute treating team and Rehabilitation Team members, and conduct ward rounds with the rehabilitation consultant
- Education will be provided to the patient, carers and significant others by members of the Rehabilitation Team.
- Patients who are assessed to require inpatient rehabilitation should be referred to the inpatient rehabilitation ward or outpatient clinic.

Initial Assessment by Rehabilitation Team members

On advice of admission of the patient to the Rehabilitation Team program, allied health team members will;

- Liaise with the acute treating team therapist to ascertain therapy needs and goals.
- Perform initial assessment and plan goals with the patient.
- Conduct a FIM and Goal Attainment Scale (GAS) and document in patient's notes.

Ongoing Patient therapy

- Goals should be attainable in the first week of assessment.
- Goals should be set in conjunction with the patient and monitored for achievement.
- Each patient progress and ongoing therapy / management plan will be discussed in the multidisciplinary team meeting on a weekly basis.
- Patients who require inpatient rehabilitation will be discussed at the weekly rehabilitation case conference.

Responsibility of a Physiotherapist includes:

- Get the patient to mobilize as early as possible
- Help the patient to regain muscle power and joint mobility
- Prevent falling and dislocation
- Educate the caregiver, patient and staff about the proper body position and transfer.

Responsibility of a Speech and Language Therapist includes:

- Initiate the safest way of nutrition (oral or tube)
- Recommend oral feeding diet modification if needed
- Initiate methods of communicating with non-verbal patient
- Educate the caregiver, patient, and health care provider regarding patient diet and communication method
- Initiate swallowing therapy when needed
- Monitor swallowing function
- Monitor and initiate speech, language, and cognitive therapy

Action Needed:

- Every stroke program must have written SLP stroke manual including protocols, policies, procedures, and referral guidelines.
- Every Stroke program should be located in a facility that has at least One operating fluoroscopy Unit or portable Fibrotic Endoscopic Evaluation of Swallow station.
- Availability of ENT services for primary team (for tracheostomy patients)
- A minimum of One SLP required for any 12 active beds.

References:

ACHS Equip/Aged Care Standards:

- 1.1.1 Assessment ensures current and ongoing needs of the consumer/patient are identified
- 1.1.2 Care is planned in collaboration with the consumer/patient and when relevant, the Carer, to achieve the best possible outcomes
- 1.1.5 Processes for clinical handover, transfer of care and discharge address the needs of the consumer/patient for ongoing care
- 1.1.6 Systems for ongoing care of the consumer/patient are coordinated and effective

Version control

Version	Date	Author(s)	Comments/ updates
V0.1	11/22/18	Amar Sharma	Drafted initial skeleton document and table of contents for review by the Clinical Advisory Group (CAG).
V0.2	11/30/18	Amar Sharma	Added Community Activation and Integrated stroke care chapters.
V0.3	12/14/18	Amar Sharma	Added Network and Stroke Hospital Classification chapters.
V0.4	01/02/19	Amar Sharma	Added chapters on Post stroke care, Human Resource Development and Glossary
V0.5	01/18/19	Amar Sharma	Addressed comments from the CAG, added Foreword, Executive Summary, Purpose and Scope
V0.6	01/25/19	Amar Sharma	Completed KPIs and benchmarks, updated the high priority KPIs based on CAG members survey
V0.7	01/28/19	Victoria Hughes	Revised grammar, formatting and commented on various sections
V0.8	01/28/19	Amar Sharma	Revised and re-formatted based on comments from Victoria Hughes
V0.9	01/29/19	Dr Fahmi M Al-Senani	Edited Purpose and scope, chapters 1,2 and 3
V1.0	01/29/19	Amar Sharma	Addressed comments from Dr Fahmi M. Al-Senani and re-formatted the document.
V1.1	02/05/19	Amar Sharma	Added Hemicraniectomy and CVT
V1.2	02/11/19	Amar Sharma	Added placeholders for post-acute rehabilitation and sub-arachnoid hemorrhage
V1.3	02/17/19	Dr Salwa Ali Ahmad	Updated rehabilitation standards
V1.4	02/19/19	Amar Sharma	Updated KPIs with time intervals from minimum acceptable to maximum acceptable
V1.5	02/23/19	Dr Omar Ayoub	Updated TIA assessment and management standards
V1.6	03/03/19	Amar Sharma	Added Sub arachnoid hemorrhage section and edited several sections, deleted all indicators.
V1.7	03/11/19	Amar Sharma	Added inclusion and exclusion criteria to the 13-high priority KPIs.
V1.8	04/02/19	Amar Sharma	Added QM2.1 and standards for Networked stroke care
V1.9	28/10/19	Shatha Alsaidan	Add the CAG member , External review and support team, Change the name of the Document, remove Riyadh word in the KPI and replace with Network.

