ORGANISATIONAL MODEL OF CARE

Telestroke model of care

JANUARY 2020

NSW GOVERNMENT

AGENCY FOR CLINICAL INNOVATION

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Preferred citation: NSW Agency for Clinical Innovation. Telestroke Model of Care. Sydney: ACI; 2020.

SHPN (ACI) 190820
ISBN 978-1-76081-309-3

Version: V1; ACI_0305 [01/20] Date amended: January 2020

TRIM: ACI/D19/4223

Telestroke model of care – at a glance

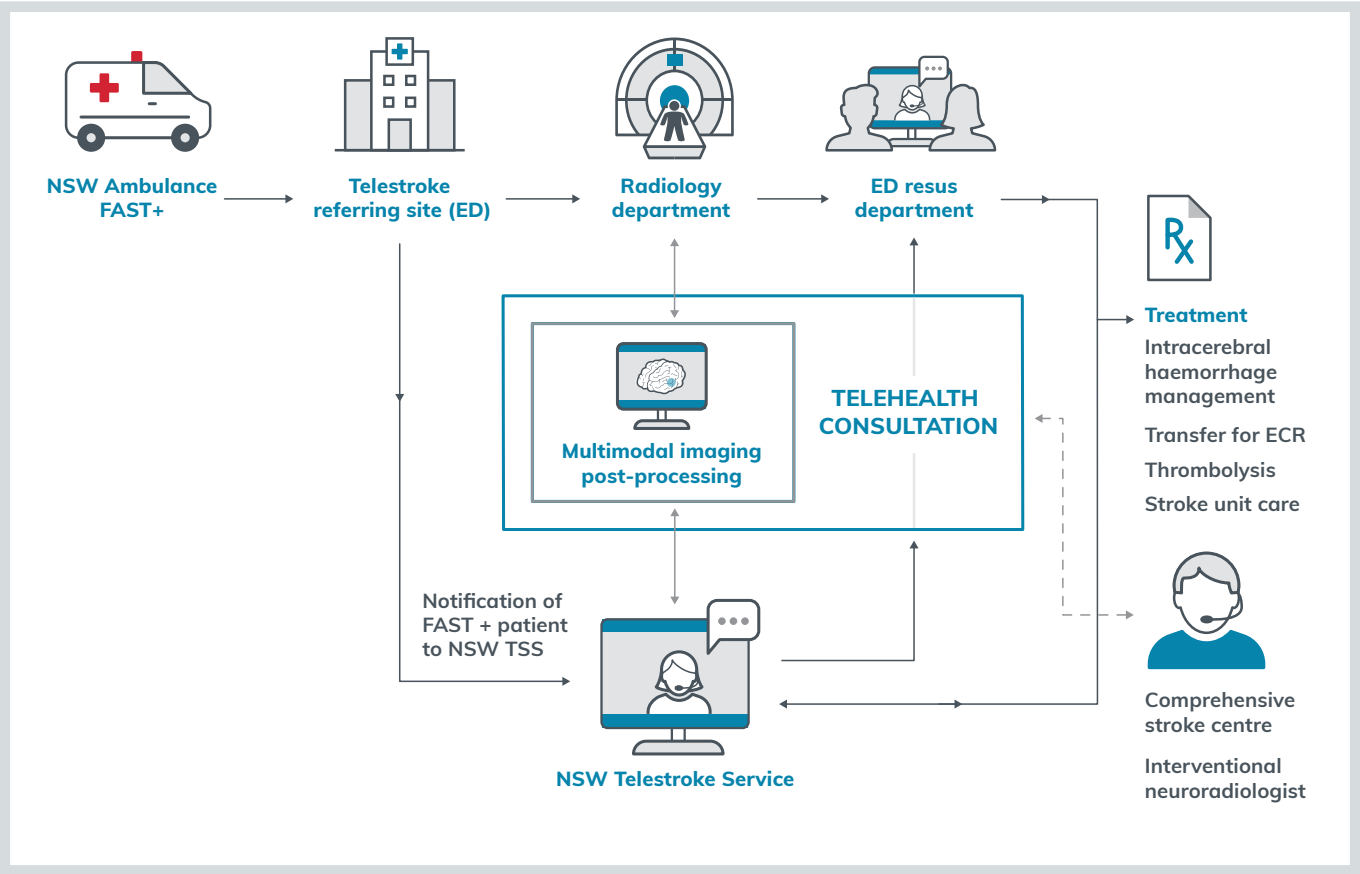
Stroke is a medical emergency requiring timely access to specialist clinical diagnostics and management.

In 2018, there were over 16,000 hospital episodes with stroke or transient ischaemic attack (TIA) as the principal diagnosis. While deaths from stroke in the NSW population have been decreasing in recent years[1], rates of access to timely specialist care are lower in NSW than rates in many other jurisdictions[2].

Within the state, people who live in regional and rural areas are more likely to have a stroke than those in metropolitan areas. However, those patients in rural and regional NSW have less access to time critical therapies.

The NSW **telestroke model of care** offers a way to deliver access to timely specialist diagnostics and management and deliver evidence-based treatment closer to patients' homes.

Telestroke involves linking specialist stroke physicians to regional sites to support the provision of care via telehealth technology.



Summary

The NSW telestroke model of care provides the NSW Ministry of Health, pillars, statewide services, NSW Ambulance and local health districts guidance to implement world-class, hyperacute stroke care (care delivered in the initial 24 hours after the onset of stroke symptoms) for patients with suspected stroke in NSW, regardless of their location.

Stroke is a medical emergency that requires organisation of pre-hospital services and rapid access to diagnostics and specialist management. Approximately 80% of strokes are caused by a blood clot that blocks a blood vessel in the brain (ischaemic stroke).[1] Effective hyperacute care relies on timely reperfusion – either using thrombolysis (sometimes referred to as 'clot-busting' drugs) or endovascular clot retreival (ECR). These therapies are time-critical and can only be provided in the hours immediately following symptom onset.

The significant advances in stroke treatment internationally have improved patient survival and reduced disability. The earlier treatment is delivered, the better the outcome for patients. Best practice hyperacute care for stroke involves reperfusion therapies for ischaemic stroke and active blood pressure management for haemmorhagic stroke. For all stroke, care should be provided by a multidisciplinary team led by a physician experienced in acute stroke management.

Stroke telemedicine services (known as telestroke) improve access to stroke physicians and timely treatment, irrespective of the patient's location. Telestroke models have been shown to improve access to stroke therapies and improve patient outcomes. Currently access to time-critical treatment in NSW is relatively low in light of international and national standards.

The lack of access is more pronounced in rural and regional areas of NSW. The NSW telestroke model of care has been developed to facilitate the establishment of a world-class stroke care service throughout NSW.

Description of the model of care

The NSW Telestroke Service (TSS) consists of a single virtual service 'hosted' by a facility and serviced by a roster of specialist stroke physicians – the virtual telestroke team.

At telestroke referring sites, the model is facilitated by early notification of FAST+ (face, arm, speech, time) patients by NSW Ambulance using standardised assessment protocols. On arrival at the telestroke referring site, the patient is triaged and assessed using a standardised protocol prior to calling the NSW TSS. The patient is sent for acute stroke imaging and the virtual telestroke clinician prepares for the consult.

Using a unified communications platform, the TSS virtual team provides remote specialist assessment, diagnosis and treatment planning for patients with a suspected stroke. The platform supports communication across hospital and district boundaries and its screen sharing and collaboration functions enable remote viewing of electronic medical records, real-time scanning review of images and live patient assessment. The platform also enables teams to include patients, carers and additional clinicians (e.g. from ECR centres) into the consultation and decision-making process.

Telestroke supports clinical decision-making and access to appropriate care pathways including identification of patients requring transfer to tertiary referral centres, local stroke unit care or ongoing neurological/medical care locally.

The telestroke patient journey is continued locally with access to ongoing care, including multidisciplinary stroke unit care, access to rehabilitation, transition to community, and secondary prevention strategies with tailored patient education.

The NSW telestroke model of care aims to:

- improve equitable access for NSW residents to time-critical hyperacute stroke services with specialist stroke diagnosis and treatment, closer to home
- increase reperfusion rates for NSW patients
- provide access to evidence-based, high quality clinical care in assessment, diagnosis and treatment for patients with stroke symptoms
- improve patient outcomes and experiences
- support health practitioners to deliver evidence-based care for hyperacute stroke
- deliver better value in stroke care delivery in NSW Health.

This document incorporates six core principles, all of which must be implemented. Each principle is underpinned by a number of key elements. These elements are either standardised across NSW, or able to be adapted to meet local context.

Telestroke principles

- **Local governance and leadership:** Patients receive high quality care, underpinned by sound governance structures and clinical leadership.
- **Access:** Timely provision of access to hyperacute stroke care coordinated across pre-hospital, emergency and specialist services.
- **Protocols and procedures:** Patients receive timely care from clinicians who are supported by standardised protocols and procedures.
- **Local data collection:** High quality data are routinely collected and used to ensure patient safety and quality improvement.
- **Workforce education and training:** Patients receive high quality hyperacute stroke care delivered by a local stroke team and virtual specialist practitioners that are trained in the delivery of telestroke.
- **Information technology:** Time-critical specialist stroke assessment and care is enabled by information technology and telestroke consultations.

The NSW telestroke model of care has been informed by the existing Hunter New England Local Health District (LHD) and Mid North Coast LHD telehealth models.

Telestroke model of care

Contents

Evidence for telestroke

Introduction

Stroke is a medical emergency and time-critical condition requiring organisation of pre-hospital services and rapid access to diagnostic and specialist management.

In 2016-17, acute stroke care in NSW cost $219.5 million.[4] About two-thirds of stroke survivors are living with a disability.[5]

In NSW, there were 16,000 episodes with stroke or TIA as the principal diagnosis in 2018. The incidence of strokes varies geographically, with people who live in regional and rural areas more likely to have a stroke than their metropolitan counterparts.[6] However, for those living in rural NSW, access to timely, state-of-the-art care is limited.

For ischaemic stroke, effective hyperacute stroke care relies on timely reperfusion - either using thrombolysis (tPA – sometimes referred to as 'clot-busting' drugs) or endovascular clot retreival (ECR).

Reperfusion therapies are acknowledged internationally as best practice treatment for ischaemic strokes, proven to reduce disability and improve survival. Approximately 25% of all ischaemic strokes are eligible for medical thrombolysis (tPA) and 10-12% are eligible for endovascular treatment.[10]

According to The Stroke Foundation, NSW is home to 12 of the nation's top 20 'hot spots' for stroke incidence; 10 of which are in regional and rural areas.[8] NSW thrombolysis rates are 11% and Victorian rates, where an established telestroke model exists, are greater than 19%.[7] NSW ECR rates are also lower than anticipated.

Access to the ECR pathway starts with hyperacute stroke assessment from a physician experienced in stroke management.

The challenges of providing timely hyperacute care to all stroke patients across the state include:

- limited access to best practice rapid assessment, diagnosis and treatment planning of suspected stroke patients
- distances travelled to reach imaging and thrombolysis centres (NSW Ambulance is limited by drive time)
- minimal support for regionally-based administration of thrombolysis treatment and/or identification of patients suitable for transfer to an ECR centre for thrombectomy 24/7
- poor access to real-time review of imaging and cross-LHD image viewing
- limited access to stroke care units.

The case for telestroke

Reperfusion therapies are acknowledged internationally as best practice treatment for ischaemic strokes, proven to reduce disability and improve survival. The *Australian Clinical Guidelines for Stroke Management 2017* [3] recommend that ischaemic stroke patients who meet eligibilty criteria:

- receive intravenous alteplase (dose of 0.9mg/kg, maximum of 90mg)
- receive thrombolysis as early as possible and up to 4.5 hours after stroke onset
- with symptom onset over 4.5 hours are considered for reperfusion therapy based on clinical criteria and advanced imaging
- are assessed for and appropriately referred for endovascular clot retrieval.

The *Australian Clinical Guidelines for Stroke Management 2017* [3] also support:

- access to an interdisciplinary acute care team with expert knowledge of stroke management, trained in delivery of thrombolysis and the monitoring of patients receiving thrombolytic therapy
- optimisation of the ambulance matrix to preferentially transfer suspected stroke patients a hospital capable of delivering reperfusion therapies as well as stroke unit care
- a streamlined acute stroke assessment workflow (including ambulance pre-notification, code stroke team response and direct transport from triage to CT scan), and protocols to guide medical, nursing and allied health acute phase management
- immediate access to imaging facilities and round the clock availability of staff trained to interpret images
- routine data collection into a central register that allows monitoring, benchmarking and improvements of patient outcomes over time.

Telestroke offers a way to provide more patients with timely access to reperfusion therapy.

Telestroke models have been shown to:

- improve patient outcomes[14,15]
- are effective and safe [9,14-21]
- improve access to reperfusion therapies – thrombolysis and ECR[22]
- reduce length of hospital stay[16,23]
- reduce the time from stroke onset to treatment[8,16-20,24]
- support rural teams in clinical assessment, diagnosis and treatment planning for patients with suspected stroke[25]
- provide patient care closer to home[9]
- improve system efficiencies[26]

Despite evidence that telemedicine is acceptable to patients and clinicians[9], telestroke is currently underutilised in NSW.

There are a number of existing and established models for telestroke nationally and internationally, that demonstrate the effectiveness and cost-effectiveness of telestroke.

Victoria	The Victorian Stroke Telemedicine (VST) program operates across 16 rural and regional hospitals.[11] It has led to standardisation of stroke management, stroke care coordination[9], expedited access to thrombolysis and a reduction in symptomatic intracerebral haemorrhage[12].
Western Australia	The Western Australia Country Health Services (WACHS) Acute Telestroke Service delivered 200 acute stroke consultations in 2017-18, significantly increasing thrombolysis and ECR rates and improving clinical outcomes.[13]
South Australia	The SA Telestroke Service was established June 2018, providing 24/7 protocolised acute stroke advice to all 61 SA country hospitals (eight with neuroimaging), as well as Broken Hill Hospital and Alice Springs. It has provided substantial cost savings, more than doubling country SA reperfusion treatment rates, reducing unnecessary metro transfers and optimising statewide patient flow.

Key elements of the model

Organisational roles, principles, statewide standardised elements

The NSW telestroke model of care comprises three main organisational elements:

NSW Telestroke Service (TSS)	The NSW Telestroke Service is a single virtual service 'hosted' by a facility and serviced by a roster of specialist stroke physicians who provide remote specialist assessment, diagnosis and treatment planning for patients with a suspected stroke. • **Host site:** The NSW Telestroke Service host hospital. This hospital provides the central administrative functions of the NSW Telestroke Service including rostering and human resources. • **Virtual telestroke team:** A team of stroke physicians support the 24/7 roster and provide remote clinical advice supported by a Medical Director, Operations Manager and clerical support.
Telestroke referring site (TRS)	A local telestroke-enabled hospital that refers stroke patients to the NSW Telestroke Service and provides physical care. Not all local hospitals will have the equipment or staffing to provide telestroke. Telestroke referring sites must meet a list of criteria including access to appropriate imaging, technology and staffing.
eHealth	A statewide shared service. eHealth is responsible for embedding new technologies in care to improve outcomes for patients. eHealth works together with teams to deliver training, and to troubleshoot, review and refine processes as the telestroke program is implemented.

At telestroke referring sites, care is facilitated by early notification of FAST+ patients by NSW Ambulance using standardised assessment in emergency department protocols. The patient is triaged and assessed using a standardised protocol prior to calling the NSW Telestroke Service. Patients are sent for acute stroke imaging and the service prepares for the consult.

Using a unified communications platform, the TSS virtual team provide specialist assessment, diagnosis and treatment planning for patients with a suspected stroke. The platform supports communication across district boundaries and its screen sharing and collaboration functions enable remote viewing of electronic medical records, real-time scanning review of images and live patient assessment. The platform also enables teams to include patients, carers and additional clinicians (e.g. from ECR centres) in the consultation and decision-making process.

Principles

The NSW telestroke model of care incorporates six core principles, all of which must be implemented:

- **Local governance and leadership**
- **Access**
- **Protocols and procedures**
- **Local data**
- **Workforce, education and training**
- **Information technology**

Key elements

Each principle is underpinned by a number of key elements. These elements are either standardised across NSW, or able to be adapted to meet local context. Throughout the tables standardised elements are highlighted as grey bars in the telestroke principles tables.

Operationalising telestroke

NSW Telestroke Service (TSS)

- Establish Medical Director and Operations Manager roles; implement a rostering system to ensure 24/7 stroke physician coverage; install and maintain a centralised telestroke number
- Provide appropriate NSW Health IT equipment including rolling out access to a high quality imaging viewer for virtual consultants
- Implement standardised assessment and documentation tools
- Establish real-time clinical analytics to support quality improvement

Telestroke referring site (TRS)

- Develop and implement a local acute stroke clinical pathway that includes a standardised emergency triage tool
- Revision of local stroke protocols, processes and workflows to include telestroke
- Education and training of clinical staff on telestroke clinical processes
- Engage local stroke coordinators to champion telestroke and support the coordination and ongoing care of the stroke patient
- Establish capability for acute stroke image acquisition including: equipment; 24/7 access to radiography services; training for radiographers in acute stroke imaging acquisition
- Enhance or enable workstations on wheels with the NSW Health supported universal conference and collaboration platform to allow for virtual telestroke consults

Telestroke principles

Local governance and leadership

Patients receive high-quality care, underpinned by sound governance structures and clinical leadership

Standardised elements	Telestroke referring site (TRS)	Host site/NSW Telestroke Service
Formal governance arrangements are documented and in place		●
The telestroke model has local executive sponsorship and oversight, and local implementation support	●	●
The NSW Telestroke Service has a dedicated Medical Director to provide management of the medical workforce, clinical leadership and strategic service planning		●
A dedicated Operations Manager to provide organisational, divisional, and contractual governance.		●
A dedicated administrative and data support to undertake administrative tasks, data collection and analysis for the service.		
Dedicated information technology and telehealth support to provide training, education and business continuity processes for the service.		
Clinical roles and responsibilities are clearly defined and documented including scopes of practice and interdependencies for NSW Ambulance; telestroke referring site (emergency department, radiology, acute stroke unit or networked unit); NSW Telestroke Service; and ECR centre.	●	●
There are local, documented and implemented processes including: Patient eligibility criteria; ED triage using the statewide Acute Stroke Assessment Protocol; clinical pathways and workflows including feedback mechanisms; standardised documentation in use of the telestroke consultation tool; decision-making processes for patients who require transfer/retrieval for escalation of care; and formal and documented arrangements between the NSW Telestroke Service and the telestroke referring site.	●	●
Roles and responsibilities are clearly defined for the various steering and operational committees and groups, management, clinicians and the workforce.	●	●
Care delivery is regularly reviewed against clinical pathways/protocols.	●	●

Access

Timely provision of access to hyperacute stroke care coordinated across pre-hospital, emergency and specialist services

Standardised elements	Telestroke referring site (TRS)	Host site/NSW Telestroke Service
NSW Telestroke Service ensures rapid access to a stroke physician 24/7.		●
Documented agreement between local sites and NSW Ambulance on the pre-notification processes and inclusion of telestroke referring sites in local hospital bypass.	●	
NSW Ambulance triage protocol, prehospital notification and handover (FAST+ and Hunter 8) support early access to the NSW Telestroke Service.	●	●
Local "Code Stroke" protocols /procedures/pathways in place at telestroke referring sites to enable early notification, and appropriate referral to NSW Telestroke Service	●	●
A standardised telestroke triage tool is used in telestroke referring site emergency departments.	●	●
There are documented and agreed standardised criteria for assessment and referral to the NSW Telestroke Service.	●	●
The telestroke referring site has protocols/procedures/pathways in place to enable rapid access to telestroke for people experiencing stroke within the hospital.	●	
The NSW Telestroke Service is accessed via a dedicated 24/7 phone number (1300 878 887) to contact a specialist virtual stroke physician which has in place call routing flows for business continuity.	●	●
Telestroke referring sites include how to access the NSW Telestroke Service in local code stroke protocols/procedures/pathways to ensure access for appropriate patients.	●	
Local protocols/procedures/pathways enable immediate image acquisition including: notification of radiology; transport to CT; access (e.g. IV); patient readiness; acute stroke imaging protocol/procedure (multimodal CT); and monitoring of the hyperacute stroke patient.	●	
IT services allow for standardised virtual access, conference and collaboration between the telestroke referring sites, the NSW Telestroke Service and ECR centres.	●	●
Telestroke referring sites have standardised protocols/procedures/pathways to allow early/immediate access to thrombolysis and post-thrombolysis care including: storage of Recombinant tissue plasminogen activator (rTPA); staff roles and responsibilities; process for administration and care during thrombolysis; high level care post-thrombolysis (in the emergency department or transfer to ICU/CCU/ASU); transfer for stroke unit care; and retrieval for ECR.	●	
Clear patient retrieval pathways between local emergency department and the ECR Centre ensure timely access to clot retrieval services.	●	●

Protocols and procedures

Patients receive timely care from clinicians who are supported by standardised protocols and procedures

Standardised elements	Telestroke referring site (TRS)	Host site/NSW Telestroke Service (TSS)
Standardised tools are used for the identification, triage and assessment of potential stroke patients.	●	●
Telestroke referring sites have local code stroke protocols that include referral to the NSW Telestroke Service.	●	
Standardised clinical protocols/procedures/pathways are in place for referral to the NSW Telestroke Service (inclusion and exclusion criteria); and assessment by the virtual telestroke team.	●	●
Local protocols/procedures/pathways are in place for urgent access to image acquisition for stroke including a standardised acute stroke imaging protocol.	●	●
A standardised documentation protocol is in place for telestroke referring sites and NSW Telestroke Service outlining: responsibilities for documenting telestroke consultation in local electronic medical record including assessment, diagnosis and management plan; timelines for documentation in electronic medical record; ISBAR format to capture the consultation information; and responsibilities for noting any changes to the patient management plan.	●	●
Local protocols/procedures/pathways are in place for provision of thrombolysis including: inclusion and exclusion criteria; patient consent; storage and replacement of TPA; monitoring of the patient; staff roles, responsibilities and accreditation requirements for the administration of TPA.	●	
Local protocols/procedures/pathways are in place for care post thrombolysis including: observation and monitoring requirements; clinical area thrombolysis can be administered (e.g. in emergency department or transfer to ICU/COU/ASU); transfer for stroke unit care or retrieval for ECR.	●	
Local protocols/procedures are in place to support care of the deteriorating patient.	●	

Local data

High quality data are routinely collected and used to ensure patient safety and quality improvement

Standardised elements	Telestroke referring site (TRS)	Host site/NSW Telestroke Service (TSS)
A common dataset/metrics will be used to measure and evaluate patient and service outcomes. Datasets include indicators and criteria of success. Metrics include: process measures; outcome measures; patient reported outcome measures; measures of patient and provider experience; and adverse events.	●	●
Quantitative metrics are collected on service activity, volume and clinical consults.		●
Regular morbidity and mortality (M&M) meetings support case reviews and discuss adverse events both at a local and state service level.	●	●
Regular operational meeting review adherence to protocols and service planning and management.	●	●
Patient safety, process, outcome and experience metrics are reported via local operational meetings for telestroke, as well as in incident and risk management governance committees.	●	●
Systemic issues are reported through to statewide governance groups for monitoring and management.	●	●

Workforce, education and training

Patients receive access to high quality hyperacute stroke care delivered by a team of local and specialist practitioners that are trained in the delivery of telestroke care

Standardised elements	Telestroke referring site (TRS)	Host site/ NSW Telestroke Service (TSS)
Local workforce needs are identified, and roles and responsibilities defined and documented.	●	●
Availability of specialist stroke physician 24/7.		●
Each telestroke referring site is supported by a Stroke Coordinator role.	●	
NSW Telestroke Service stroke physicians are credentialed to deliver high quality stroke care.	●	●
There is a Telestroke Service Operational Manager to oversee the day-to-day business and operational aspects of the service. This role provides organisational, divisional, contractual and governance support so the TSS delivers a high level of service and meets expected targets and outcomes.		●
Staff are trained and in the use of telestroke equipment, documentation requirements and the stroke pathway including telestroke component.	●	●
All clinicians are trained in the standardised acute stroke assessment protocol and standardised assessment of stroke and its severity, e.g. National Institutes of Health Stroke Scale (NIHSS).	●	●
Staffing mix and ratios at the telestroke referring sites are appropriate for the administration of thrombolysis and monitoring the patients during and immediately after administration.	●	
Appropriate staffing ratios are in place for post thrombolysis care onsite, or transfer protocols with a networked stroke service are in place.	●	
Radiographers skilled in acute stroke image acquisition are available 24/7.	●	

Information technology

Time-critical specialist stroke assessment and care is enabled by information technology and telestroke consultations

Standardised elements	Standards	Telestroke referring site (TRS)	NSW Telestroke Service (TSS)	eHealth
Telestroke referring sites have access to high speed wide area networking, local area networking and wireless networking	HWAN & statewide wireless core	●		●
Telestroke referring sites have access to the Telestroke Service via a single 1800 phone number.	Statewide unified communications platform	●	●	●
Telestroke referring sites, users and departments have unified communications capabilities. This should include the ability to use: presence, video conferencing, telephony, voice conferencing, instant messaging, screen sharing, remote control of screens, file transfer and integration with active directory and Outlook Exchange address book.	Statewide unified communications platform	●	●	●
Telestroke referring sites have workstations on wheels enabled with unified communications capabilities to support consultations with TSS stroke clinicians.	Statewide unified communications platform	●	●	
TSS stroke physicians have laptops enabled with unified communication capabilities to connect to hospitals using the Telestroke Service.	Statewide unified communications platform		●	
The Telestroke Service and participating hospitals have support agreements in place to cover all aspects of the technology used for patient care. This should also include standard procedures (business continuity plan) in case of technology failure.	Statewide unified communications platform	●	●	●
Telestroke clinicians have access to patient imaging (including perfusion post processed scans) and medical records systems at hospitals using the Telestroke Service.*	Standard build for perfusion post processing Statewide unified communications platform	●	●	
Telestroke referring sites have access to stroke decision support tools.	Standardised telestroke triage tool	●	●	
Telestroke Service physicians use standardised assessment and documentation tools.	Standardised telestroke triage tool	●	●	

* NB: Work is underway to implement a statewide Radiology information systems including picture archiving and communication systems (RIS-PACS) and enterprise imaging repository (EIR) to provide access to imaging centrally.

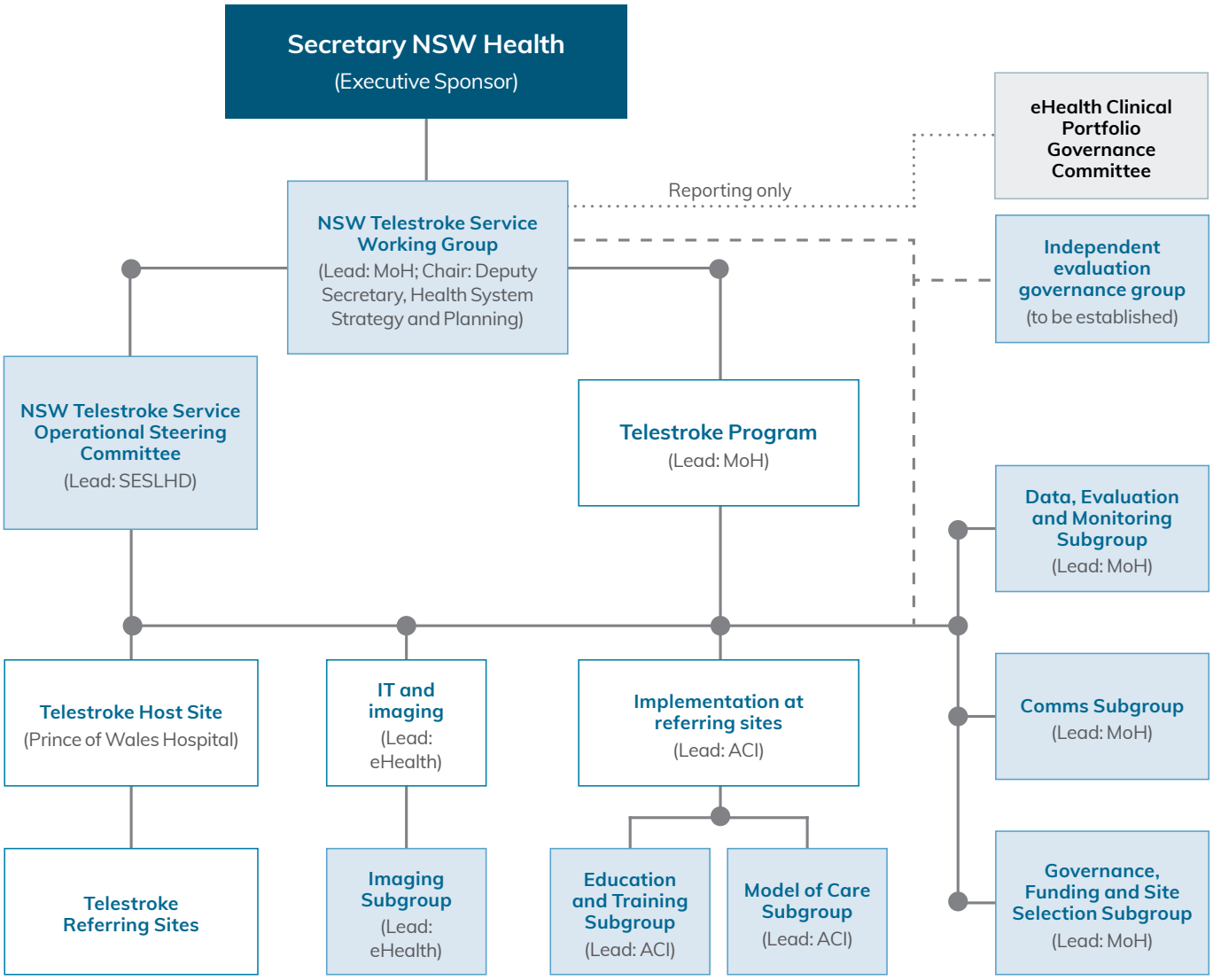
Statewide standardised elements

NSW Telestroke Service Governance

The *NSW Telestroke Service Governance Framework* outlines the clinical and governance arrangements for the service. The host site is responsible for clinical governance arrangements, with support as required from the NSW Telestroke Service Working Group. The NSW Telestroke Service Working Group and the host site are responsible for establishing the operational governance arrangements for the service.

- The *NSW Telestroke Service Governance Framework* outlines the clinical and operational governance arrangements for the service.
- The below diagram outlines the program governance for the NSW Telestroke Service.

Refer to the telestroke governance framework.



LEGEND

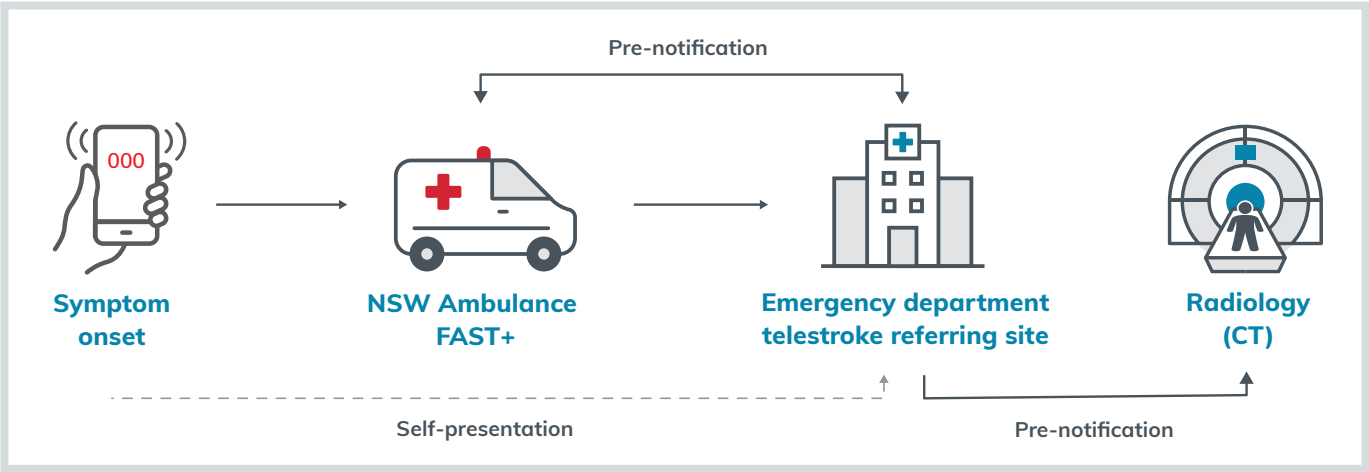
Governance/working group NSW Telestroke Service element

Access

1. NSW Ambulance

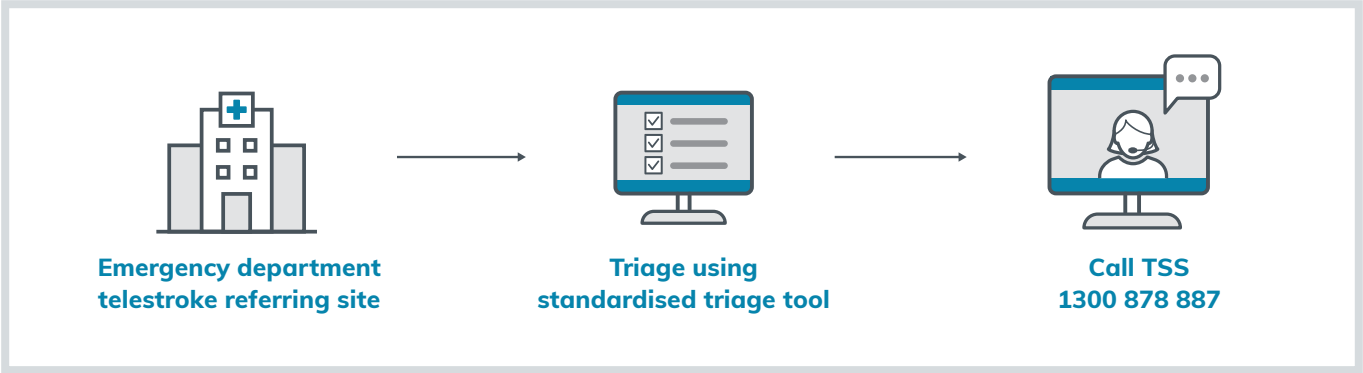
The first part of the access pathway is facilitated by NSW Ambulance, who notifies a local telestroke-enabled emergency department that a patient with suspected stroke (FAST+) is in transit, and provides a Hunter 8 score.

The emergency department team prepares for rapid triage, and in particular ensures radiology is ready to scan the potential stroke patient immediately following triage.



2. Triage at the TRS

On arrival TRS staff assess the patient using a standardised triage tool. The tool guides medical staff through a rapid assessment of the patient and provides recommended actions. When an appropriate patient is identified, the medical officer responsible for the care (e.g. Basic Physician Trainee (BPT) or emergency department registrar) contacts the TSS via the single statewide phone number and notifies them of the patient's arrival, prior to the patient being sent to radiology. When ready, the patient then goes to radiology and the TSS physician prepares for the consult.

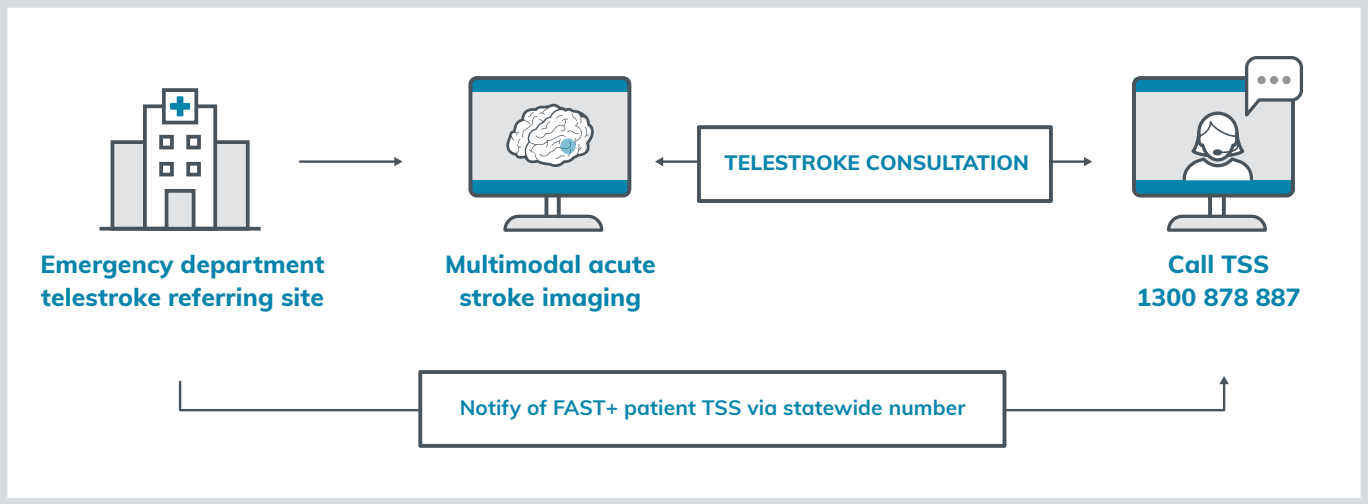


3. Radiology and the NSW Telestroke Service

Rapid access to radiology for acute stroke imaging is essential for effective telestroke implementation. Screen sharing technology and remote control between the NSW telestroke services allows the stroke physician to interact with the local team during and/or after image acquisition.

The stroke physician at the NSW telestroke service also requires the ability to manipulate images independently to generate a provisional diagnosis. Following image acquisition and review, the patient is transferred back to high acuity area where an audiovisual consultation can be conducted over the statewide unified communications platform. A full neurological assessment can be performed via video conference, and a proposed management plan can be discussed with patient and family and consent for procedures obtained.

At any point, consultation can occur between the interventional neuroradiologist and the virtual stroke team regarding ECR referrals.



4. Communication between team members, diagnosis and treatment plan

The telestroke model of care is enabled by leveraging and enhancing existing technology. This allows rapid communication between local emergency department staff, specialist stroke physicians, patients and carers and ECR centres.

It utilises the NSW Health statewide unified communications platform to support real-time sharing of the electronic medical records and multimodal imaging to inform and guide diagnosis and treatment.

Protocols and procedures

The telestroke model is a combination of statewide standardised elements and elements that can be adapted to align with the local needs or context. These are illustrated in Figure 1 – standardised elements are red and locally adaptable elements are in blue. All components of the model are required to be in place.

The NSW Telestroke Service will establish statewide referral criteria to the service (inclusions and exclusions) and provide a standard triage tool to support referral. The current proof of concept uses an acute stroke assessment protocol that has been embedded in the triage process within the referring site's emergency department to support patient selection for telestroke involvement.

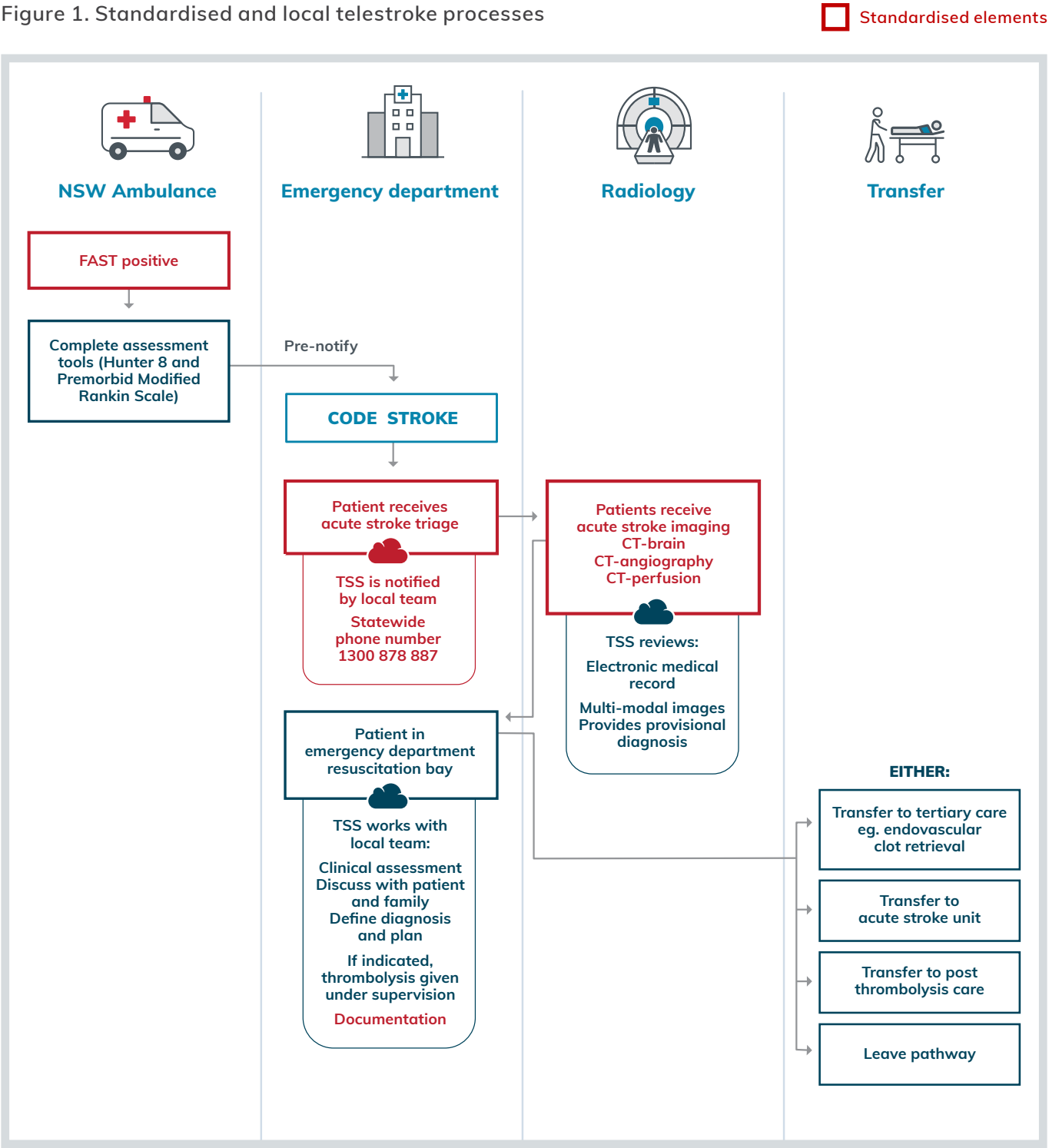
The NSW Telestroke Service will establish a standardised assessment and documentation process to support the virtual telestroke team. This will include standardised documentation of the consultation, assessment, diagnosis and treatment plan that is subsequently recorded in the EMR at the referring site.

If EMR is unavailable at the referring site, the consultation documentation should be sent by the NSW Telestroke Service via the unified communication platform and entered into the medical record by the local treating doctor. A telestroke consultation tool has been used in the proof of concept to standardise this process, allow for rapid transfer of clinical information to the referring site and provide data back to the host site to inform service management and quality improvements.

The documentation can then be countersigned by the responsible medical officer at the telestroke referring site.

It is recognised that access to imaging may vary, however a standardised acute stroke imaging protocol will be required to support the Telestroke Service to ensure expedient image acquisition and processing.

Figure 1. Standardised and local telestroke processes



Measurement and data

Collection of data for measurement and evaluation, is important to determine:

- Implementation progress and readiness for go-live
- Determine effectiveness and impact on patient outcomes

Measurement, monitoring and evaluation occurs across different timeframes:

- Short-term: focus on implementation/ operational and process monitoring
- Medium-term: focus on monitoring of outputs, early impact and outcomes and formative evaluation
- Longer-term: focus on outcomes monitoring and a summative evaluation.

Measures should be evidence based and could include the following for telestroke:

- time to treat measures (eg door to needle)
- process measures (eg protocol adherence rates)
- functional outcomes (eg disability measures)
- clinical outcome measures (eg complications and mortality)
- patient and provider reported measures (eg quality of life, experience of care)
- effectiveness and efficiency measures (eg service utilisation, appropriateness, resourcing and sustainability)

Measurement of the telestroke model will be undertaken within the broader context of overall stroke care. It will occur at different levels including patient outcomes, operational, LHD and system levels.

Defining measures and then collecting data from the beginning and as the model is implemented will build a data collection that can also be used for evaluation in the longer-term. Refer to the Monitoring and Evaluation Plan for more information.

Consistent with value based health care (VBHC) measurement will occur across the dimensions of:

- outcomes (clinical and patient reported)
- experience (patient, carer and clinician)
- effectiveness and efficiency. This includes considerations of appropriateness, impact, sustainability, access and reach and quality and safety.

The measurement approach aims to decrease the data collection burden and support the efficient collation of data and information and is guided by the following principles:

- measure what should be measured, not just what can be measured
- collect data once, use for multiple purposes
- join up data and house in one place
- fill the gaps along the way
- one set of aligned, consistent measures
- use to support priorities and inform decisions
- make data accessible and useable.

Workforce education and training

Teams using telestroke will need to complete training to ensure there is consistency in the knowlege base and expectation of practice. Training will be required for all staff involved in the delivery of a telestroke consultation. This will include the virtual clinicians providing the service as well as the local teams at the referring sites. Certain parts of the process are standardised, training will reflect this. Training requirements are outlined below.

In addition, there will be specific training for different disciplines including the virtual stroke clinicians providing the service, emergency department clinicians and triage nurses, radiology departments and stroke coordinators.

- What is the NSW Telestroke Service?
- The telestroke process and number
- How to identify patients with ischaemic stroke and who to refer to the Telestroke Service
- Imaging requirements for acute stroke
- How to do a telestroke consultation
- Expectations for clinical documentation and process
- Use of imaging platform
- Thrombolysis storage, provision and post administration care
- Core values for receiving a call and expectations from the telestroke referring site
- Business continuity changes
- Use of technology
- Core values and expectations for making and receiving telestroke calls
- Effective communication via telehealth.

Information technology

The telestroke model of care uses the NSW Health standardised statewide unified communications platform to allow the virtual team of stroke physicians to quickly provide specialist assessment, diagnosis and treatment planning remotely. Screen sharing and collaboration allows for remote viewing of electronic medical records, real-time scanning review of images and the live patient assessment. It facilitates the ability to quickly include additional clinicians from ECR centres into the consultation and decision-making processes.

While technology is central to the success of this telestroke, it is an enabler of the project, not the primary objective or outcome. Clinical teams will require training to use the equipment efficiently. The information technology is only effective when it is used within the context of clinical protocols/ procedures and pathways.

A central partner in the telestroke model of care is eHealth. eHealth is responsible for embedding new technologies in care to improve outcomes for patients. eHealth will be working together with teams to deliver training, troubleshoot and problem solve, review and refine processes as the Telestroke program is implemented.

Australia has state and federal laws, guidelines and best practices regarding the protection of an individual's privacy, management of information and operation of IT systems.

eHealth advises that the statewide unified communications platform meets all the privacy and security requirements for Australia and has been implemented using rigorous design and security processes.

Implementing the model of care

Implementation of the NSW telestroke model of care aims to:

- improve equitable access for NSW residents to time-critical hyperacute stroke services by providing access to specialist stroke diagnosis and treatment, closer to home
- increase access to reperfusion therapies and increase rates of reperfusion therapy provision for NSW patients
- provide access to evidence-based, high quality clinical care including assessment, diagnosis and treatment for patients presenting with stroke symptoms
- improve stroke outcomes and experiences of care
- support practitioners across NSW to deliver evidence-based care for hyperacute stroke
- to improve the value of stroke care delivery in NSW Health.

The primary objective of implementing the model of care is to establish world-class stroke care in NSW, which includes the assessment, treatment and management of a patient with a suspected stroke, irrespective of their location.

Successful establishment of the model will be demonstrated within 12 months of implementation at each site by:

- decreased time to specialist assessment and treatment
- increased thrombolysis rates within 4.5 hours of symptom onset
- increased referrals for endovascular clot retrieval and subsequent completion rates
- improved stroke patient outcomes and experience of care (patient reported outome measures and patient reported experience measures).

The expected outcomes is further detailed in a separate **NSW telestroke monitoring and evaluation plan**.

The implementation of the NSW telestroke model of care will be supported by the host site, the ACI and eHealth and overseen by the NSW Telestroke Working Group.

Sites across NSW will differ in terms of the volume of stroke patient presentations, existing stroke care resources and infrastructure, and the demographic profile of the local population. Referring sites implementing telestroke will therefore require a localised implementation plan. The implementation of telestroke at referring sites involves a redesign of stroke patient journey to incorporate the statewide service. Sites will work closely with the host site, the ACI and eHealth to facilitate the best possible outcomes of the service.

In the initial implementation, sites will be supported with training opportunities, capability events, site visits and sharing of implementation experiences from other sites. At the conclusion of the initial implementation period, support for implementation can be accessed through the host site.

Resources for implementation of models of care and clinical redesign can be found on the ACI website. See **www.aci.health.nsw.gov.au**

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Glossary

Acute stroke unit (ASU)	An organised in-hospital facility that is entirely (or almost entirely) devoted to care for patients with stroke. It is staffed by a multidisciplinary team with special knowledge in stroke care.
Close observation unit (COU)	A specially staffed and equipped area of a hospital providing a level of care between intensive care and a general adult ward. The COU may be established in a hospital with no intensive care service (i.e. a Level 3 COU) or in a hospital with a Level 4, 5 or 6 intensive care service (i.e. a Level 4 COU). These units may have historically been referred to as high dependency units or coronary care units, depending on the scope of services delivered.
Endovascular clot retrieval (ECR)	Removal of a clot by a retractable mechanical device. A large clot blocking a vessel is removed via an artery (intra-arterial approach). ECR requires highly specialised teams and is restricted to major metropolitan hospitals.
Endovascular clot retrieval centre	A comprehensive stroke centre that provides access to endovascular clot retrieval (ECR) for acute ischaemic stroke patients.
FAST +	An acronym for stroke symptoms: Face, Arm, Speech, Time.
Host site	Hospital that is the NSW Telestroke Service host. This site is selected to provide the central administrative functions of the NSW Telestroke Service including rostering and human resources. The host site will be a NSW hospital selected through a documented and transparent process. Prince of Wales Hospital is the NSW Telestroke Service host. This site has been selected to provide the central administrative functions of the NSW Telestroke Service including rostering and human resources. The site was selected through a documented and transparent process.
Hyperacute stroke management	Care that is delivered in the first 24 hours after the onset of stroke symptoms. It involves rapid assessment, diagnosis and management, provided by a well-coordinated multidisciplinary team, to deliver high impact, time sensitive interventions.

Intensive care unit (ICU)	A specially staffed and equipped, separate and self-contained area of a hospital dedicated to the management of patients with life-threatening illnesses, injuries and complications, and the monitoring of potentially life-threatening conditions. The intensive care unit (ICU) provide special expertise and facilities for support of vital functions, and use the skill of medical, nursing and other experienced staff in the management of these conditions. An ICU may be a Level 4, 5 or 6, depending on the scope of services, therapies and care delivered.
NSW Telestroke Service (TSS)	A state service consisting of a single virtual service 'hosted' by a facility and serviced by a roster of specialist stroke physicians who provide remote specialist assessment, diagnosis and treatment planning of patients with a suspected stroke.
Recombinant tissue plasminogen activator (rTPA)	Tissue plasminogen activator is a protein involved in the breakdown of blood clots. It is a serine protease found on endothelial cells, the cells that line the blood vessels. As an enzyme, it catalyzes the conversion of plasminogen to plasmin, the major enzyme responsible for clot breakdown.
Telestroke referring site (TRS)	The patient's local, telestroke-enabled hospital. A hospital in regional or rural NSW that refers in to the NSW Telestroke Service. Not all local hospitals will have the equipment or staffing to provide telestroke. TRSs must meet a list of criteria including access to appropriate imaging, technology and staffing.
Thrombolysis	Administering a drug that can break down and disperse a clot that is blocking a blood vessel and preventing blood from reaching the brain.[2] Thrombolysis must be administered within the first 4.5 hours of stroke symptoms occurring.
Unified communication platform	An integrated single platform for unified communications. Unified communications s a business and marketing concept describing the integration of enterprise communication services such as instant messaging (chat), presence information, voice (including IP telephony), mobility features (including extension mobility and single number reach), audio, web and video.
Virtual telestroke team	Virtual team of stroke physicians recruited to support the 24/7 roster and provide clinical advice supported by a Medical Director, Operations Manager and clerical support and form the service provider

Acknowledgements

The ACI would like to acknowledge Hannah Halloran – Healthy Partnerships who supported the development of this content.

The ACI would also like to acknowledge to all the clinicians and staff involved in the establishment of the Hunter New England telestroke pilot and Northern NSW Telestroke proof of concept. The programs have been the foundation for the telestroke model of care.

We would also like to thank eHealth Conference and Collaboration team for their support in the proof of concept and contribution to the document.

Consultation

The ACI is grateful to the local health districts and the many members of the Stroke Network who provided feedback during the consultation that has assisted in informing the telestroke model of care.

The ACI also wishes to thank its consumer representatives for their valuable feedback during the consultation.

Development

The ACI would like to acknowledge the contribution of the working group members, who were involved in the review of this document.

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We bring consumers, clinicians and healthcare managers together to support the design, assessment and implementation of clinical innovations across the NSW public health system to change the way that care is delivered.

The ACI's clinical networks, institutes and taskforces are chaired by senior clinicians and consumers who have a keen interest and track record in innovative clinical care.

We also work closely with the Ministry of Health and the four other pillars of NSW Health to pilot, scale and spread solutions to healthcare system-wide challenges. We seek to improve the care and outcomes for patients by re-designing and transforming the NSW public health system.

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