# Table of Contents

PART A: Executive Summary with Recommendations ..................................................6

Executive summary ...........................................................................................................6

Recommendations.............................................................................................................7

PART B: Background & Detailed Recommendations ...................................................12

1. Introduction and background ..................................................................................12
   Development of the Model of Stroke Care for WA 2012 .............................................12
   Guiding principles ........................................................................................................13
   Objectives: ..................................................................................................................13
   Principles ....................................................................................................................13
   Expected achievements ..............................................................................................13
   Developments since 2006 ..........................................................................................14

2. Overview of stroke ....................................................................................................14
   Stroke and TIA in WA .................................................................................................14
   Definition .....................................................................................................................14
   Symptoms ....................................................................................................................15
   Diagnosis .....................................................................................................................15
   Treatment.....................................................................................................................15

Stroke Care Pathways ....................................................................................................17

3. Prevention and early intervention ...........................................................................19
   Prevention and early detection .................................................................................19
   Early intervention: reducing treatment delays for stroke ........................................21

4. Atrial Fibrillation ......................................................................................................22

5. Acute stroke care ......................................................................................................24
   Pre-hospital emergency services ..............................................................................24
   Triage and emergency department care ....................................................................26
   Transfer of care ...........................................................................................................27
   Tissue Plasminogen Activator (tPA) administration ..................................................27
   Transient Ischaemic Attack (TIA) management .........................................................28

6. Organisation of stroke care services .......................................................................31
   Stroke care across WA ...............................................................................................31
   Stroke unit care ...........................................................................................................32
   Stroke services in rural WA .......................................................................................34
   Stroke services for Aboriginal people .......................................................................35

7. Rehabilitation ............................................................................................................37
   Stroke rehabilitation - inpatient .................................................................................38
   Ongoing inpatient rehabilitation ...............................................................................38

8. Palliation .....................................................................................................................40
9. Discharge planning................................................................................................................................. 41
   Discharge planning - inpatient acute and rehabilitation care............................................................... 41
10. Stroke rehabilitation outpatient ........................................................................................................... 42
11. Secondary prevention ............................................................................................................................ 44
12. Long term care ........................................................................................................................................ 46
13. Workforce ............................................................................................................................................... 47
14. Education and training ............................................................................................................................ 48
15. Research and monitoring ......................................................................................................................... 49

Appendices .................................................................................................................................................. 51
   Appendix 1: Achievements from Model of Stroke Care 2006\(^3\) ......................................................... 51
   Appendix 2: Stroke Epidemiology ............................................................................................................ 53
   Appendix 3: Evidence for treatment of stroke ......................................................................................... 57
   Appendix 4: Acute Stroke Bypass Guideline 2011 .................................................................................. 60
   Appendix 5: Current stroke services in WA ............................................................................................ 61
   Appendix 6: Proposed Stroke Care Pathway for Rural ............................................................................ 63
   Appendix 7: Components of Early Supported Discharge ....................................................................... 64
   Appendix 8: Areas of Focus for Workforce Development ........................................................................ 66
   Appendix 9: Measuring Clinical Care ....................................................................................................... 69

Acknowledgements ....................................................................................................................................... 70

Acronyms ...................................................................................................................................................... 73

Reference list .................................................................................................................................................. 75
Index of tables

Table 1: Risk factors associated with stroke .................................................................................................19
Table 2: Summary of the effectiveness of drug therapies for the primary prevention of first-ever stroke in a population of one million people...............................................................20
Table 3: CHADS2 .............................................................................................................................................22
Table 4: Stroke risk and the CHADS2 score ....................................................................................................22
Table 5: Anticoagulation based on the CHADS2 score ..................................................................................23
Table 6: The ABCD2 Score ............................................................................................................................29
Table 7: The ABCD2 Score to Identify Patients at High Risk of Stroke Within the First 2 Days........................29
Table 8: Recommended stroke services and clinical profile ...........................................................................33
Table 9: Summary of the effectiveness of interventions for the (secondary) prevention of recurrent stroke among 10,000 prevalent and 2,000 incident stroke and transient ischaemic attack survivors in a population of one million people ......44
Table 10: Summary of the effectiveness of treating 2,000 ischaemic stroke patients each year in a population of one million people .................................................................59

Index of figures

Figure 1: Stroke care pathway metropolitan WA ..............................................................................................17
Figure 2: Stroke care pathway rural and remote WA .........................................................................................18
Figure 3: Recommended stroke protocols for ambulance services .................................................................25
Figure 4: Map of WA stroke services .............................................................................................................32
Figure 5: Data sets available to monitor stroke clinical care .............................................................................49
Figure 6: Prevalence of stroke for adults in Western Australia 2008/09 .........................................................53
Figure 7: Hospitalisations for stroke and TIA ................................................................................................54
PART A: Executive Summary with Recommendations

Executive summary

Stroke is a neurological condition characterised by a disrupted or ceased flow of blood to the brain. It is a major cause of mortality and disability in Australia. In 2010, there were an estimated 60,000 new and recurrent strokes in Australia. Although the incidence of stroke is falling with changes in community vascular risk factors and with the greater ageing population, it is estimated that this number will rise to 74,000 by the year 2017. To deliver efficient, safe and high quality care to stroke survivors across the health system requires the development of a coordinated and integrated health service delivery model for stroke.

The Neurosciences and the Senses Health Network, which was established as part of the WA Health reform in 2004, developed a Model of Stroke Care for Western Australia (WA) 2006 (MSC2006). This Model was reviewed and updated in 2012 to reflect changes in current evidence for best practice and changes in the WA health care environment. This document reflects the principles of health reform identified by WA Health.

The Model of Stroke Care for WA 2012 (MSC 2012) includes increased detail and provides a comprehensive picture of stroke services across the State. It reflects the advances made since the MSC 2006 was first endorsed. The MSC 2012 has been expanded to include information on stroke services at Western Australian country hospitals and health facilities. The revision is based on the most recent data and projections of future service needs.

The MSC 2012 also takes into account government policy decisions made since the publication of the previous Model of Stroke Care for WA 2006. These include the development of a range of new Models of Care and Guidelines by Health Networks such as Models of Care for Heart Failure and Acute Coronary Syndromes and the Protocol for Administering Alteplase in Acute Ischaemic Stroke. As well as the publication of the WA Health Clinical Services Framework 2010-2020, the WA Health Strategic Intent 2010-2015, Revitalising WA Country Health Service 2009 - 2012, WA Sub Acute Plan 2009-2013, National Stroke Foundation (NSF) Acute Services Framework 2011 and the NSF Clinical Guidelines for Stroke Management 2010. Consideration has also been given to the Clinically Co-ordinated Patient Transfer Model of Service Delivery currently being developed for WA.

WA will continue to expand its Activity Based Funding (ABF) of health service providers, where funding is provided on the basis of activity. High quality safe health care is less expensive and provides better patient outcomes. The MSC 2012 reflects the shift towards ABF and Activity Based Management by focussing on the patient experience, improved efficiency and high quality safe care.

The Neurosciences and the Senses Network recognises the need to maintain the momentum of health reform by building on existing achievements to provide ‘healthier, longer and better quality lives for all Western Australians’. Within a constantly evolving health care environment, the MSC 2012 provides an opportunity to build on successes and to identify strategies to address new challenges. Sixteen recommendations have been identified across the patient pathway for stroke, with specific strategies aligning to each recommendation detailed through Part B of this document.
Recommendations

There are 16 recommendations arising under the MSC 2012. This section provides a summary of the recommendations with further detail on each of these areas provided under key headings later in the document. Implementation of these recommendations across area health services must be considered in the context of operational factors at a local level and implementation of Activity Based Funding within WA Health.

1. **Target risk factors for stroke and cardiovascular disease through the establishment of a comprehensive approach to primary prevention and early detection.**

A comprehensive approach will include:

- supporting primary prevention strategies to promote healthy behaviours and environments in the general community;
- raising public awareness of stroke risk factors and warning signs and identifying those at risk of stroke;
- providing high quality and standardised assessment of individual stroke risk by general practitioners; and
- providing quality-assured lifestyle and medical interventions to reduce individual risk of vascular disease and stroke; in primary care.

2. **Apply CHADS2 score in all patients with non-rheumatic atrial fibrillation to estimate stroke risk and to guide the administration of antithrombotic therapy.**

Atrial Fibrillation (AF) is associated with preventable stroke. It is estimated that AF is associated with a 5-fold increased risk of stroke. The AF Reference Guide 2011 identifies the importance of the timely diagnosis of the condition and assists practitioners in the management of AF to reduce stroke and other complications.

By using the CHADS2 score, the estimated risk of stroke in patients with non-rheumatic AF can be determined and standardised recommendations for the use of antithrombotic therapy can be considered. Other risk calculators such as CHADSVASC and HAS-BLED risk stratification scores will also be used more in the future to assist in decisions regarding antithrombotic therapy.

3. **Reduce delays in the treatment of acute stroke by establishing protocols for early intervention.**

Strategies for the rapid identification, accurate triage and expedient transportation of acute stroke patients to the appropriate facilities are vital in the early intervention phase of stroke. This involves public education regarding the recognition of stroke symptoms (see recommendation one above), training and organisation of the ambulance service, and a streamlined approach to emergency assessment and treatment of stroke patients in the hospital setting.

Protocols should be well established for:

- The appropriate management and possible transfer of patients taking into consideration logistics of regional and rural areas and the use of telehealth.
- Ambulance services including pre-notification systems and triaging of patients to the most appropriate emergency department to provide the stroke assessment.
4. **Immediately assess all patients with suspected stroke and transfer to a stroke unit where possible.**

Emergency Department (ED) staff should use a validated stroke screening tool to assist in the rapid assessment of people with stroke. The NSF Clinical Guidelines recommend that all patients with suspected stroke should have an urgent brain scan which may comprise Computed Axial Tomography (CT) or Magnetic Resonance Imaging (MRI) evaluation. Urgent is defined as ‘immediately’ where facilities are available but should occur within 24 hours. Patients who are candidates for thrombolysis should undergo brain imaging immediately.

There is overwhelming evidence that stroke unit care significantly reduces death and disability after stroke, compared with conventional care in general wards for all people with stroke. Stroke patients should be admitted to the stroke unit from the ED ideally within 3 hours to facilitate clinical care. Ideally all patients with stroke should be cared for within a geographically discrete stroke unit setting, with medical, nursing and allied health expertise in stroke care.

Where possible and with consideration of cultural and geographical issues, country patients with a stroke should be transferred to either a regional primary stroke centre (currently planned for Bunbury, Albany, Kalgoorlie and Geraldton to a metropolitan Comprehensive Stroke Centre and/or receive outreach specialist input from a metropolitan comprehensive stroke centre via telehealth to facilitate their care.

All emergency departments must have protocols for triage, assessment and management and transfer of patients experiencing acute stroke, including those eligible for thrombolysis and other hyperacute therapies.

Transfer from basic hospitals or rural primary stroke centres to tertiary hospital comprehensive stroke centres at SCGH or the new Fiona Stanley Hospital should be considered for patients who may need neurosurgical intervention such as large posterior fossa strokes or hemispheric strokes where craniectomy for decompression may be considered.

5. **Give intravenous tissue plasminogen activator (alteplase) to appropriate patients with confirmed acute ischaemic stroke within 4.5 hours of onset of stroke symptoms.**

Alteplase should be administered in ischaemic stroke, where appropriate, by approved Stroke Physicians or Neurologists in accordance with the Protocol for Administering Alteplase in Acute Ischaemic Stroke. This recommendation, and the Protocol will be continually reviewed by stroke experts as data from new trials becomes available.

6. **Ensure patients with Transient Ischaemic Attack (TIA), undergo specialist assessment within 48 hours of presentation.**

The risk of stroke after TIA is high immediately after an event; up to 5% in the first 2 days and 10% within the first week. In view of this, urgent evaluation and commencement of evidence based therapies which have been shown to lower stroke risk is required.

A coordinated, managed, synchronised pathway for patients presenting with a TIA needs to be established, ensuring that appropriate investigations and treatments are facilitated to allow an early accurate diagnosis as to whether it is a confirmed TIA and the aetiology to ensure that appropriate therapy is given. The need for hospitalisation will depend on the clinical setting and the availability and efficiency of outpatient TIA management services including investigations with MRI, carotid dopplers and echocardiography in ischaemic
strokes. Case management is required for all patients as either an inpatient by the neurology or stroke team, or as an outpatient by a Stroke Case Manager to ensure that the urgency of the assessment is respected. Aboriginal Health Workers should assist in ensuring discharge summaries of Aboriginal patients reach appropriate health professionals and that follow-up appointments are facilitated.

7. **Initiate standardised and evidenced based acute therapies and stroke unit care by a multidisciplinary team.**

Treatment should be initiated according to NSF Clinical Guidelines 2010\(^{12}\), in consultation with the patients and carer/s(A further definition of carer/s is on page 74). Standardised resources and care pathways including common assessment tools/outcome measures can be used in all stroke units, early supported discharge programs and outpatient rehabilitation units.

The central aspect of stroke recovery is the provision of a coordinated program by a specialised, multidisciplinary team (MDT) of health professionals. This MDT, includes medical, nursing and allied health staff, together with social, educational and vocational services, to provide individual assessment, treatment, regular review, discharge planning and follow-up. A stroke specialist, dedicated MDT is the foundation to best practice stroke care. The make up of the MDT should be consistent with NSF Clinical Guidelines 2010\(^{12}\).

Stroke services should be based on the Acute Stroke Services Framework 2011\(^{18}\) which provides a comprehensive outline to assist health services to structure acute stroke services by outlining recommended structures, networks, settings and criteria for monitoring performance and outcomes. It also outlines seven key areas for regional responsibility (For more information see page 34).

8. **Commence rehabilitation, based on standardised protocols for timing and intensity on day one following a stroke.**

Rehabilitation services need to be streamlined to improve equity of access, service content and timing. There needs to be standardised protocols for access to rehabilitation services, timing for transition or triage between services as well as planning and service specifications. Hospitals and health care services should ensure that there are clear referral protocols and processes to effectively link acute and rehabilitation services so that rehabilitation is commenced as soon as possible and continues in an appropriate setting and adequate intensity.

WA should have in place an adequate mix of rehabilitation options to ensure that the variable rehabilitation needs of all stroke survivors are able to be addressed. This will include specialised stroke inpatient rehabilitation, Early Supported Discharge (ESD), Rehabilitation in the Home (RITH) outpatient and community based services. In line with the NSF Clinical Guidelines 2010\(^{12}\) all patients, who are not receiving palliative care, including those with severe stroke should be assessed by a specialist rehabilitation team, prior to discharge from hospital regarding their suitability for ongoing rehabilitation. An increase in the number of rehabilitation physicians is required to enable provision of assessments prior to discharge. Stroke specific ESD or RITH services should be further developed and must be able to provide an appropriate range and intensity of therapy for the patient’s clinical requirements.
9. Develop a pathway for palliative care to support stroke patients and their families/carers and improved care for people dying after stroke.

Fourteen per cent of acute stroke patients admitted to hospital die in hospital (9% within seven days)\textsuperscript{19} and approximately 20% die as a result of the stroke in the first 30 days\textsuperscript{20}. An appropriate pathway should recognise the specialist palliative care needs of stroke patients and should be developed in accordance with the WA Palliative Care Model of Care\textsuperscript{21}.

10. Develop consistent and coordinated discharge care planning and follow-up.

An actively case managed pathway is necessary for all stroke patients from the time of their admission to guide them through the acute and rehabilitation phases of their stroke care (See stroke care pathways on page 17 and 18). This may require transfer between hospitals if rehabilitation is to be provided in a specialist hospital, or between the rehabilitation hospital phase and rehabilitation in the community by RITH or ESD. The post-discharge care plan should be documented in a consistent format and include all relevant information as outlined in the NSF Clinical Guidelines 2010\textsuperscript{12}. Ideally, an inpatient stroke care coordinator or equivalent should coordinate services and assist in discharge planning.

After discharge the level of follow up by members of the MDT will depend on the clinical requirements of the stroke patient and the availability of community based services. Vascular risk factors in most cases should be managed by the general practitioner, however unusual causes for stroke or difficult to manage vascular risk factors may require ongoing clinical review by stroke specialists or vascular surgeons.

11. Increase planning and investment in outpatient and community based rehabilitation services for stroke in WA.

Hospitals with a stroke unit should provide comprehensive, experienced multidisciplinary community rehabilitation from appropriately experienced health practitioners and adequately resourced support services for stroke survivors and their families/carers across WA. If services such as the multidisciplinary community rehabilitation services and carer support services are available, then ESD or RITH should be offered for all stroke patients with mild to moderate disability. Rehabilitation delivered in the home setting should be offered to all suitable stroke survivors as needed and where cost effective. Where home rehabilitation is unavailable or inappropriate, patients requiring rehabilitation should receive care within a rehabilitation centre.

12. Initiate secondary prevention in hospital and specialist settings and establish thorough systems for transfer and follow-up.

Secondary prevention relates to survivors of both stroke and TIA. A person with stroke has an accumulated risk of 43% of subsequent stroke over 10 years with an annual rate of approximately 4%\textsuperscript{22}. The rate of stroke after TIA is significantly higher (up to 10% after three months) suggesting greater opportunities to prevent stroke after TIA\textsuperscript{23}.

Long term management of lifestyle risk factors and adherence to recommended medications, particularly in relation to the management of hypertension, cholesterol and diabetes, carotid surgery and antiplatelet therapies are all important components for effective secondary stroke prevention. Secondary prevention should be initiated in hospital and specialist settings and should then be managed predominately in primary care.
13. Stroke service models with clearly articulated processes of care are to be established for long term care of survivors of stroke. These should be established in partnership with community services, to ensure continuity of care and availability of appropriate service options to meet the individual needs of stroke survivors.

Service models, with clearly articulated processes of care, which support stroke survivors following hospital discharge, need to be established in partnership with community services and primary health care across WA. Models should address referral to community services and follow-up of discharged patients, with a strong emphasis on involvement by the primary care physician. The focus should include continuity of care, increased availability and access to appropriate community services and increased availability of appropriate long term care for all types of stroke patients.


There is a need for better planning of future stroke care workforce requirements; including medical, nursing and allied health to provide sustainable stroke services across WA. Workforce levels should be guided by the national benchmarks being established by the NSF. A model of stroke care coordination should be considered where inpatient stroke care coordinators are used to coordinate services and to assist in discharge planning.

15. Develop a WA stroke specific education and training framework.

Stroke specific expertise and continuing education for stroke clinicians is one of the four key components of stroke unit care. Stroke clinicians need access to ongoing education to develop and maintain specialist skills. Stroke specific professional development, education and training programs must be made available to health professionals and should be based on the Australian Stroke Specific Education Framework (ASSEF).

16. Develop and maintain a statewide stroke data collection and quality improvement system, in line and consistent with the national framework for data collection and quality improvement.

In order to monitor and improve the quality of care for stroke patients in WA there is a need to develop and maintain a statewide stroke data collection and quality improvement system.

The system will be based on the national framework and as a minimum will include:

- participation in the national stroke registry (Australian Stroke Clinical Registry - AuSCR);
- continued participation in the national stroke audit program; and
- involvement in site specific and health service quality improvement processes/programs.

Collaborative approaches to stroke research, including the validation of new service delivery models are a key component of ensuring quality and evidence based improvements in stroke care.
PART B: Background & Detailed Recommendations

1. Introduction and background

Development of the Model of Stroke Care for WA 2012

The development of the MSC 2012 was overseen by a Stroke Care Review Committee. A range of targeted consultations were held in 2011 with clinical and community stakeholders building on the extensive consultation process undertaken in 2005. A number of rural clinicians continued to be engaged to improve stroke care in rural and remote WA, coordinated by WA Country Health Service (WACHS).

The MSC 2012 is guided and informed by the following best practice guidelines, models of care and programs:

- Clinical Guidelines for Stroke Management 2010 (NSF Clinical Guidelines 2010)\textsuperscript{12};
- National Stroke Audit Acute Services Clinical Audit Report\textsuperscript{26};
- Protocol for Administering Alteplase in Acute Ischaemic Stroke 2011\textsuperscript{16};
- Aboriginal Stroke Program 2003\textsuperscript{27};
- Acute Services Framework 2011\textsuperscript{18};
- Models of Care for Heart Failure\textsuperscript{4} and Acute Coronary Syndromes\textsuperscript{5}; and
- Atrial Fibrillation Reference Guide\textsuperscript{14}.

The MSC 2012 is a comprehensive document that covers the journey of the stroke survivor beginning at the initial recognition of stroke symptoms, right through to discharge from the hospital into the community, and ongoing management as required. It includes specifics of how and where this should be done both now and in the future (See Patient Pathways on pages 17-18). Consideration has been given to the role of the carer, that is the unpaid family or friends who provide support and care to the patient (Further definition of carer/s is on page 70). Considerable time was invested in planning the location, nature, and function of new stroke units around the Perth metropolitan area and how the various units will interface (See Organisation of Stroke Care Services on page 30). The basic framework is built around existing stroke units, with greater utilisation of the general and specialist hospitals that will continue to grow or change function over the next decade.

The opening of the Fiona Stanley Hospital (FSH) campus and reorganisation of stroke services throughout the South Metropolitan Area Health Service (SMAHS) will see major changes in the make up of tertiary hospitals, specialist hospitals and general hospitals in that sector.

WA faces unique challenges in designing a workable Model of Stroke Care, with difficulties related to the extensive geography and variable demographics across the state. This paper highlights some of these difficulties and in particular, the need for continuing to aim towards optimal stroke care in rural and remote regions. The revised MSC 2012 provides a greater focus on the needs of country regions with a vision of creating an integrated plan for stroke services for WA, affording all Western Australians the opportunity of accessing evidence based, organised, safe and effective stroke care.
Guiding principles

Objectives:
The objectives of this model include:
1. To articulate the Model of Care;
2. To provide the evidence for the adoption of the Model of Care;
3. To discuss future workforce requirements for stroke care;
4. To provide information to be taken into account in future clinical services planning; and
5. To detail rural area health needs as coordinated by the WACHS and increased focus on the needs of Aboriginal stroke care.

Principles
Principles underpinning the model are:
- Evidence-based, coordinated, best quality stroke care services;
- Improved equity of care;
- Geographically defined services to maximise access for patients, carers and family;
- Specialised multidisciplinary stroke care to ensure quality patient outcomes;
- Coordination and provision of stroke services across the continuum of care, from acute hospital to rehabilitation to community care and secondary stroke prevention at the primary health care level;
- Early stroke intervention and reduced acute length of stay;
- Integrated partnerships across sector and stakeholder groups;
- A consistent statewide approach to evidence-based policies, frameworks and guidelines in stroke care; and
- Attention to cultural needs of patients and their families.

Expected achievements
Implementation of the MSC 2012 will achieve the following benefits in stroke care in the medium to longer term:
- Improved transition of stroke patients through a state-wide stroke pathway;
- Increased care of the patient closer to home and equity of care;
- Decreased stroke related morbidity in WA;
- Reduced length of stay at tertiary and general hospitals;
- Reduced long term placement;
- Improved access to appropriate rehabilitation services;
- Early identification of stroke;
- Early intervention for stroke survivors;
- Reduced disability of stroke survivors;
- Better identification of patients suitable for management in a designated general or specialist hospital setting; and
- Improved access to community services and improved coordination of post discharge needs.

The Model of Stroke Care 2012 aims to ensure patients receive the right care, at the right time, by the right team and in the right place.
Developments since 2006

Since the development of the MSC 2006\(^3\) there have been a number of achievements nationally to improve stroke care. Important resources and policies to support best practice stroke care have been developed including the update and release of the NSF Clinical Guidelines 2010\(^{12}\). There has been significant planning for national health reform across all areas of health. The state stroke clinical networks have a clear focus on improved coordination of care. Additionally in July 2010 clinical representatives in WA were involved in the national review of the NSF Acute Stroke Services Framework\(^{11}\).

The MSC 2006\(^3\) presented five recommendations for clinical policy as well as considerations for the implementation of the Model. There has been significant progress towards the achievement of these recommendations and considerations. Detail of these achievements can be found in Appendix 1. The MSC 2012 builds upon these key areas as well as identifying new areas for focus over the next five years.

2. Overview of stroke

Stroke and TIA in WA

Stroke is a major cause of mortality and disability in Western Australia. In 2009, 37,035 adults in WA reported ever being diagnosed by a doctor as having a stroke\(^28\). In 2009/2010 there were 3,403 hospital admissions for stroke in WA and 1,266 hospital admissions for TIA\(^29\). It is likely that figures for TIA are underestimated as many cases do not present to hospital or present with no admission required. In addition, over a third of those admitted to hospital for stroke, will require rehabilitation services\(^12\). (More detail on stroke and TIA in WA can be found in Appendix 2)

Definition

A stroke is the sudden death of cells in a limited part of the brain caused by a reduced flow of blood to the brain. A stroke can be caused by a ruptured blood vessel in the brain (intra-cerebral haemorrhage) or blockage of the vessel by narrowing or blood clot (ischaemic stroke)\(^30\). The effects of a stroke depend on the part of the brain affected. A stroke may cause paralysis in varying degrees, difficulty with speech, loss of memory or reasoning ability, coma or death.

Cerebral thrombosis occurs when a blood clot forms inside the brain artery, stopping the flow of blood to or from the brain. The medical term for blood clot is thrombosis. The most common cause for the formation of a blood clot is the hardening of the arteries, or atherosclerosis.

A cerebral thrombosis may be preceded by a TIA. A TIA may act as a warning sign that a stroke is more likely to occur (For more information on TIA see page 28). Cerebral embolism is a clot that lodges in the cerebral tissue. The clot forms elsewhere in the body, typically in the heart or large arteries, then travels through the bloodstream to the brain. Once in the brain, it produces effects like those of cerebral thrombosis.

Sub-arachnoid haemorrhage and intra-cerebral haemorrhage are caused when blood vessels in the brain rupture. An intra-cerebral haemorrhage takes place inside the brain. A sub-arachnoid haemorrhage occurs on the surface of the brain within the sub-arachnoid space.
Symptoms

The symptoms of a stroke caused by an embolism usually appear suddenly and are most intense right after the stroke occurs. With a thrombosis, the stroke comes on more slowly. In either case, symptoms can include blurred vision, severe headache, weakness, numbness or paralysis of the face, arm, or leg, slurred speech or speech loss, dizziness or loss of balance or coordination, communication difficulties and cognition issues.

Diagnosis

Rapid diagnosis is essential in the successful treatment of stroke. If stroke is suspected, a Computed Axial Tomography (CT) scan will generally confirm the type of stroke and rule out a cerebral haemorrhage. The presence of a normal CT brain scan in the early stages after stroke does not rule out ischaemic stroke. A Magnetic Resonance Imaging (MRI) scan is more sensitive and specific in the diagnosis of acute stroke, however access to MRIs is more limited than CTs. In most cases, treatment for stroke should not be instituted without prior CT or MRI. Carotid Doppler, echocardiography, an Electrocardiogram (ECG) or 24 hour Holter monitor are all useful diagnostic tests to determine the cause of stroke. Blood tests to evaluate stroke risk factors include serum lipids and glucose, haemoglobin and renal function. Other specialised immunologic and haematologic tests should be reserved for patients with unexplained stroke or the younger patient with stroke.

Treatment

Stroke treatment usually occurs in two phases. The first phase involves basic resuscitation and maintenance of an airway. Once this is achieved there may be the possibility in ischaemic stroke of removing the thrombus blocking the blood vessel (so called reperfusion therapy). The treatment options include thrombolytic therapy with tissue Plasminogen Activator (tPA) (For more information on tPA see page 27), and mechanical extraction of the thrombus by endovascular techniques, by interventional neuroradiologists. Thrombolytic therapy should only be administered by experts in accordance with the WA Protocol. As explained in recommendation 5, there may be ongoing revisions of the role of thrombolytic therapy as new data from clinical trials emerges. A small number of patients may be suitable for endovascular stroke treatments to remove the clot (embolectomy) currently performed at Sir Charles Gairdner Hospital (SCGH) and Royal Perth Hospital (RPH), however as with all new stroke treatments, they should be evidence based and subject to the usual evaluation.

For ischaemic stroke, antiplatelet agents such as aspirin, aspirin/dipyridamole or clopidogrel may be safely started after a CT scan has excluded haemorrhage. Aspirin/dipyridamole and clopidogrel have evidence of superiority over aspirin monotherapy, although this benefit is small. (Further detail on recommendations for stroke treatment can be found in Appendix 3). Early carotid artery imaging (usually duplex ultrasound scan) should be performed. If a patient has a >70% carotid artery stenosis on the appropriate side, they should be referred to the Vascular Surgeons for consideration of a carotid endarterectomy as an effective means of secondary prevention.

Treatments for intracerebral haemorrhage remain limited, but stroke unit care remains vital for these patients. The role of surgery can be considered in select patients with lobar haemorrhage after consultation with the Neurosurgeons.
The most applicable and important treatment for all types of stroke is organised care in a designated stroke unit. A stroke unit is typically in a geographically defined area of the hospital, staffed by medical, nursing and allied health with knowledge and expertise in all aspects of the stroke care. Where stroke unit care is not available, stroke services should adhere as closely as possible to the criteria for stroke unit care (For more information about stroke units see page 31).

On day one or once a patient's medical condition has been stabilised, rehabilitation can begin. Rehabilitation refers to a variety of methods for helping a patient recover pre-morbid function to the maximum extent possible. The patient may also need to learn how to use existing functions, to take the place of those lost as a result of the stroke. (More information on rehabilitation can be found on page 37). The following stroke care pathways articulate the optimal pathway for patient care in metropolitan and rural and remote WA.
Stroke Care Pathways

Figure 1: The Stroke Care Pathway in Metropolitan WA

000 Call

Validated Pre-hospital Assessment by Paramedics

Patient Presents at Hospital with Stroke Symptoms

Advising Stroke Team

Patient Admitted to Hospital

Neuroimaging Performed

Where Carotid Stenosis >70% Refer for Opinion about a Carotid Endarterectomy

Initiate Acute Therapies:
Implement treatment according to NSE Best Practice Guidelines in consultation with patient and family

Transfer to Stroke Unit

End of Life Management

Post Acute Management

Rehabilitation, secondary prevention and palliation
Initiate post acute management and discharge planning for presentation
Coordinated Care

1. Multidisciplinary Assessment
2. Early Identification
3. Rehabilitation starting day one (or on medical stability)
4. Address secondary prevention
5. Team based discharge
6. Patient and carers education
7. Consultation with GP

Discharge
Specialised rehabilitation
Rehabilitation, 24 hour rehabilitation
Day stay
Community based services

Referral Services
Consult GP for secondary prevention and management

Support
Stroke Coordinator ensures access to Community based services

Community Based Rehabilitation and Care

Inpatient Specialised Rehabilitation

Long-term Care and Palliation
A detailed proposed Stroke Care Pathway for the four rural ‘Primary Stroke Centres’ including links with a stroke specialist MDT in metropolitan Comprehensive Stroke Centre/s is in Appendix 6.
3. Prevention and early intervention

**Recommendation 1: Target risk factors for stroke and cardiovascular disease through the establishment of a comprehensive approach to primary prevention and early detection.**

**Prevention and early detection**

A comprehensive approach to the prevention and management of stroke requires effective action across the continuum of care. Within each phase in the course of the development and progression of stroke there are important opportunities for prevention and health gain. There are a common set of risk factors which have a causal relationship to the development of stroke and which may contribute to future episodes and complications that arise as part of the stroke. These risk factors also increase the likelihood of heart disease and peripheral vascular disease. A number of these risk factors are amenable to prevention and early intervention and can be targeted across the different stages of disease. Risk factors may be related to behaviours or biomedical factors and can act independently or in combination. The compound effect of several risk factors can be more harmful than being exposed to individual factors.

**Table 1: Risk factors associated with stroke**

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Link to Stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>High blood pressure</td>
<td>Causes damage to blood vessels walls eventually leading to stroke</td>
</tr>
<tr>
<td>Smoking</td>
<td>Causes damage to blood vessels walls eventually leading to stroke. Increases blood pressure and reduces oxygen in the blood</td>
</tr>
<tr>
<td>High blood cholesterol</td>
<td>Causes damage to blood vessels walls eventually leading to stroke. Contributes to blood vessel disease often leading to stroke</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Can cause damage to the circulatory system and can increase risk of stroke</td>
</tr>
<tr>
<td>Poor diet, inactivity or overweight</td>
<td>Can lead to high blood pressure and cholesterol</td>
</tr>
<tr>
<td>Excessive alcohol</td>
<td>Can raise blood pressure, and make atrial fibrillation more likely.</td>
</tr>
<tr>
<td>Atrial Fibrillation</td>
<td>Higher risk of stroke if there is an irregular pulse due to atrial fibrillation (for more information on AF see page 22)</td>
</tr>
</tbody>
</table>

A comprehensive approach to prevention and early detection will include:

- supporting primary prevention strategies to promote healthy behaviours and environments in the general community;
- raising community awareness and identifying those at risk of stroke;
- providing high quality and standardised assessment of individual stroke and chronic disease risk by general practitioners; and
- providing quality-assured lifestyle and medical interventions to reduce individual risk of vascular disease and stroke; in primary care.
Stroke risk detection, assessment and management can be undertaken by general practitioners (GPs). There are several programs in operation in community and primary care settings in WA to detect vascular and related disease risk, and in some instances to improve management of this risk. There needs to be a focus on further education for GPs in the recognition of stroke, an improved uptake of these risk assessment tools, improved management of risk factors, together with a more integrated approach towards prevention and early intervention across WA. This applies particularly to Aboriginal patients and those patients who are rarely seen by a GP.

Early detection allows early treatment which can help to avoid unnecessary hospital admissions and the high cost of complex treatment. Effective medical approaches to stroke prevention, which can be prescribed by a GP should take an absolute risk approach to risk reduction. The importance of each risk factor should be considered, and need for treatment in the context of absolute risk. Absolute risk assessment guidelines, with management guidelines are being finalised and endorsed by NHMRC. Risk factors feeding into this might include:

1. Antihypertensives to reduce blood pressure;
2. Programmes to stop smoking;
3. Treatment of high cholesterol;
4. Optimising management and control of diabetes;
5. Antiplatelet agents to prevent the formation of abnormal clots eg: aspirin, dipyridamole, or clopidogrel; and
6. Anticoagulants to prevent blood clots from forming or growing eg: warfarin and in the future dabigatran, apixaban or rivaroxaban.

Table 2 below summarises the effectiveness of drug therapies for the primary prevention of first-ever stroke. (For more information on treatment see Appendix 3).

Table 2: Summary of the effectiveness of drug therapies for the primary prevention of first-ever stroke in a population of one million people

<table>
<thead>
<tr>
<th>Strategy/Intervention</th>
<th>Target population (% of general population)</th>
<th>Relative risk (95% CI)</th>
<th>Stroke risk per year</th>
<th>Relative risk reduction (RRR) (95% CI)</th>
<th>Absolute risk reduction (ARR)</th>
<th>No. of strokes avoided per year among target population</th>
<th>% of 1,400 first-ever ischaemic strokes avoided each year in a population of one million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil</td>
<td>0.00</td>
<td>1.0</td>
<td>0.14</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Blood pressure lowering (5 mm Hg)</td>
<td>179,600 (11.7%)</td>
<td>3.6 (2.2-5.0)</td>
<td>0.51</td>
<td>0.28</td>
<td>46% (35-55%)</td>
<td>0.23%</td>
<td>266</td>
</tr>
<tr>
<td>LDL-cholesterol lowering (1.0 mmol)</td>
<td>179,600 (20%)</td>
<td>1.4</td>
<td>0.19</td>
<td>0.14</td>
<td>36% (22-48%)</td>
<td>0.05%</td>
<td>99</td>
</tr>
<tr>
<td>Anticoagulation for atrial fibrillation</td>
<td>179,600 (50%) of individuals aged &gt;40 with AF</td>
<td>5.0</td>
<td>0.70</td>
<td>0.25</td>
<td>64% (49-74%)</td>
<td>0.35%</td>
<td>22</td>
</tr>
<tr>
<td>Cigarette smoking cessation</td>
<td>181.792 (18.4%)</td>
<td>1.9 (1.6-2.2)</td>
<td>0.27</td>
<td>0.14</td>
<td>47% (45-50%)</td>
<td>0.13%</td>
<td>236</td>
</tr>
<tr>
<td>Nicotine replacement therapy</td>
<td>5,454 (3% of 181,792)</td>
<td>1.9 (1.6-2.2)</td>
<td>0.27</td>
<td>0.14</td>
<td>47% (45-50%)</td>
<td>0.13%</td>
<td>7</td>
</tr>
<tr>
<td>HbA1c-lowering</td>
<td>42,484 (4.3%)</td>
<td>3.8 (1.8-8.2)</td>
<td>0.53</td>
<td>0.49</td>
<td>7% (6-19%)</td>
<td>0.04%</td>
<td>17</td>
</tr>
</tbody>
</table>
Early intervention: reducing treatment delays for stroke

Strategies for the rapid identification, accurate triage and the expedient transportation of acute stroke patients to the appropriate facilities are vital in the early intervention phase of stroke. This involves public education regarding the recognition of stroke symptoms, training and organisation of the ambulance service, a streamlined approach to emergency assessment and treatment of stroke patients in hospital.

It is critical that stroke is diagnosed and treated quickly as the effectiveness of many treatments is dependent upon the time between the onset of symptoms and intervention to minimise brain damage. Failure to immediately call an ambulance when stroke symptoms occur is the leading cause of treatment delay. Many individuals hope symptoms will alleviate, or will elect to speak to friends, family or their GP rather than call an ambulance straight away. It is therefore important to have continued education to the general public regarding the recognition of stroke and the importance of urgent access to medical assessment.

Currently in Australia, one in five people cannot recognise any signs of stroke and only a third of people can recognise three or more signs. Half of the people who experience stroke symptoms delay calling an ambulance and only 39% of patients present at hospital within time for potentially life-saving treatment.

There is substantial international evidence that social marketing campaigns can significantly improve public recognition of stroke warning signs and, when implemented alongside improvements to stroke-related health services, this can be associated with improvements in treatment access.

The NSF public education campaign promotes the use of the acronym “FAST” (face, arm, speech, time) which has been adopted throughout Australia. The campaign educates the community on the way to recognise a stroke event and the importance of early presentation to hospital. FAST campaigns have demonstrated that a high level of sustained social marketing activity is associated with improved stroke awareness, greater numbers of hospital presentations for stroke and reduction in delay between stroke onset and hospital presentation.

<table>
<thead>
<tr>
<th>Strategies:</th>
</tr>
</thead>
<tbody>
<tr>
<td>That a review of stroke detection, assessment and management in the WA community is conducted to identify opportunities for improvement in primary prevention of stroke and other chronic diseases.</td>
</tr>
<tr>
<td>Develop a comprehensive approach to primary prevention and early detection with links to WA’s current activities in preventive health and primary care strategies. The approach should consider Aboriginal populations and culture of special needs groups.</td>
</tr>
<tr>
<td>Funding of social marketing to increase awareness of stroke warning signs alongside service improvements to reduce treatment delay and strengthen tertiary prevention of stroke.</td>
</tr>
</tbody>
</table>
4. Atrial Fibrillation

**Recommendation 2:** Apply CHADS$_2$ score in all patients with non-rheumatic atrial fibrillation to estimate stroke risk and to guide the administration of antithrombotic therapy.

Atrial Fibrillation (AF) is associated with preventable stroke. It is estimated that AF is associated with a 5-fold increased risk of stroke$^{14}$. In 2009/2010 there were 411 hospitalisations for stroke with AF or atrial flutter in WA$^{45}$. Over the last 10 years, the rate of stroke with AF has decreased however it is predicted that with the emerging AF epidemic, the incidence of cardioembolic stroke will increase$^{46}$.

For stroke prevention, the AF Reference Guide (2011)$^{14}$ recommends the consideration of antithrombotic therapy to reduce the risk of systemic thromboembolism that could lead to stroke and death.

The CHADS$_2$ score is a clinical prediction rule for estimating the risk of stroke in patients with non-rheumatic AF. A high CHADS$_2$ score corresponds to a greater risk of stroke, while a low CHADS$_2$ score corresponds to a lower risk of stroke.

Table 3: CHADS$_2$$^{15}$

<table>
<thead>
<tr>
<th>Condition</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>C Congestive heart failure</td>
<td>1</td>
</tr>
<tr>
<td>H Hypertension: blood pressure consistently above 140/90 mmHg (or treated hypertension on medication)</td>
<td>1</td>
</tr>
<tr>
<td>A Age ≥75 years</td>
<td>1</td>
</tr>
<tr>
<td>D Diabetes Mellitus</td>
<td>1</td>
</tr>
<tr>
<td>S$_2$ Prior Stroke or TIA</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 4: Stroke risk and the CHADS$_2$ score$^{47}$

<table>
<thead>
<tr>
<th>CHADS$_2$ Score</th>
<th>Stroke Risk %</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.9</td>
<td>1.2–3.0</td>
</tr>
<tr>
<td>1</td>
<td>2.8</td>
<td>2.0–3.8</td>
</tr>
<tr>
<td>2</td>
<td>4.0</td>
<td>3.1–5.1</td>
</tr>
<tr>
<td>3</td>
<td>5.9</td>
<td>4.6–7.3</td>
</tr>
<tr>
<td>4</td>
<td>8.5</td>
<td>6.3–11.1</td>
</tr>
<tr>
<td>5</td>
<td>12.5</td>
<td>8.2–17.5</td>
</tr>
<tr>
<td>6</td>
<td>18.2</td>
<td>10.5–27.4</td>
</tr>
</tbody>
</table>

By using the CHADS$_2$ score, the estimated risk of stroke in patients with non-rheumatic AF can be determined. Standardised recommendations for the use of antithrombotic therapy can then also be applied in accordance with Table 5 below.
In all cases the patient should be counselled as to the options available for treating non-rheumatic valvular atrial fibrillation. In particular, age should not necessarily be a negative discriminator. Strategies need to be developed to increase awareness and use of CHADS2 and compliance with resulting recommendations, particularly in primary care.

The use of other risk calculation tools for stroke such as CHADSVASC and HAS-BLED are likely to become increasingly important. Several recent clinical trials have provided information on the safety and efficacy of new anti-thrombotic medications, which may provide an alternative to aspirin and warfarin\(^{48,49}\). The precise role of these medications in clinical practice will be determined in the near future.

Table 5: Anticoagulation based on the CHADS\(_2\) score\(^{15,47}\)

<table>
<thead>
<tr>
<th>Score</th>
<th>Risk</th>
<th>Anticoagulation Therapy</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Low</td>
<td>Aspirin</td>
<td>Aspirin daily</td>
</tr>
<tr>
<td>1</td>
<td>Moderate</td>
<td>Aspirin or Warfarin</td>
<td>Aspirin daily or raise INR to 2.0-3.0, depending on factors such as patient preference</td>
</tr>
<tr>
<td>2 or greater</td>
<td>Moderate or High</td>
<td>Warfarin</td>
<td>Raise INR to 2.0-3.0 unless contraindicated (e.g. clinically significant GI bleeding, inability to obtain regular INR screening)</td>
</tr>
</tbody>
</table>
5. Acute stroke care

**Recommendation 3:** Reduce delays in the treatment of acute stroke by establishing protocols for early intervention.

**Pre-hospital emergency services**

The timing and method by which people are transferred to hospital is critical to ensuring optimal outcomes for stroke patients\(^{50, 51}\).

In this phase of care the emergency services St Johns Ambulance (SJA) and Royal Flying Doctor Service (RFDS), have a central coordinating role. Acute stroke patients should receive a high triage priority comparable to other similarly lethal or disabling medical emergencies. Additionally the emergency services should facilitate early notification of the receiving hospital and ensure that a hospital with a stroke unit is selected where such hospitals exist\(^ {12}\).

In WA in 2009, 73% of people presented to hospital by ambulance as an emergency from the community, however only 29% presented within 3 hours and 33% within 4.5 hours of onset of symptoms\(^ {26}\). As acute treatments such as thrombolysis are time critical, a multifaceted strategy that includes high priority assignment by ambulance services and early notification to hospital EDs is essential to improve acute stroke management\(^ {52-55}\).
Figure 3: Recommended stroke protocols for ambulance services

Time of symptom onset: Critical to the initial assessment is knowledge of the time of onset. Where possible, witnesses should be interviewed to help with this. It would be helpful if witnesses, relatives, friends, carers or the patient’s next of kin could be encouraged to travel to the hospital to further assist with history ascertainment. Common difficulties in establishing the time of onset includes patients that are found collapsed at an uncertain time, those who wake up with a stroke and patients with dysphasia. Patients with symptom duration of less than 90 minutes are Priority One transport candidates.

Examination of patients in the field: It is proposed that programs be undertaken to improve the accuracy of ambulance officer field assessments of stroke patients. This could be modelled upon a program that has been used in Victoria that has been shown to improve ambulance officer diagnosis of stroke. Key symptoms include hemiparesis, hemisensory symptoms, language disturbance, vertigo and headache. It should be noted that one of the hallmarks of stroke symptoms, is sudden onset.

Blood sugar testing: The performance of Dextrostix testing in the field would be useful, because hypoglycaemia can cause focal neurological symptoms and hyperglycaemia (greater than 22 m.mol/L) is a relative contra-indication to thrombolytic therapy.

Priority transportation: If the assessment suggests stroke and the time of onset is less than 90 minutes then Priority One transportation to Sir Charles Gairdner Hospital (SCGH), Royal Perth Hospital (RPH), Fremantle Hospital (FH) or Swan District Hospital (SDH) is proposed. It should be noted that the NSF Clinical Guidelines 2010 for the treatment of acute stroke patients recommend preferential transportation of patients to hospitals with stroke units. Currently, in Perth, this means the above hospitals. Resource limitations mean that NOT ALL stroke patients could be taken to these institutions, however, the a scientific position statement from NSF on the use of Tissue Plasminogen Activator (tPA), suggest that only these hospitals are in a position to administer the drug strictly according to these guidelines.

It should be noted that in some leading North American stroke centres it has long been the practice to preferentially transport acute stroke patients to the major centres capable of interventional therapy, even if this means bypassing a closer facility.

Hospital pre-notification: It is proposed that when acute stroke patients are assessed as Priority One transport candidates that the receiving hospital is notified as soon as possible prior to the arrival of the patient at the emergency department, in order to assemble the acute stroke team and/or other clinicians involved.

Hospital handover: It is proposed that the ambulance officer give direct handover to the receiving triage nurse and stroke team emphasising time of onset of symptoms, nature of symptoms, finger-prick blood sugar level, and location of witnesses, relatives, friends, carers or next of kin.

Ambulance services should work closely with their local clinical networks, including general practitioners, to establish pre-notification strategies for stroke. The Stroke Units and EDs of RPH, SDH, SCGH and FH have implemented a guideline for the management of acute stroke patients that are transported by ambulance in Perth with a view to improving patient outcome (See Appendix 4). Patients that meet this guideline are to be taken to the nearest RPH, SDH, SCGH or FH ED (even if a smaller general hospital is closer). The objective is to deliver acute stroke patients to the tertiary hospital with stroke units as soon as possible after the onset of symptoms to allow consideration of acute therapies.
In regional areas rapid assessment and intervention is restricted due to reduced access to GPs and specialist paramedic services. Primary Stroke Centres are currently planned to be established in Albany, Bunbury, Geraldton and Kalgoorlie. These centres would link to metropolitan comprehensive stroke units, for Stroke Neurologist input and guidance when required. A more formal network needs to be established between the regional and metropolitan hospitals to enable support for equitable stroke care of the patient closer to home with the option of transfer to metropolitan hospitals when appropriate.

In the north west Kimberley and Pilbara regions, there may need to be a different structure to support improvements in stroke care due to the remote nature of the population and the greater number of aboriginal stroke patients to ensure culturally appropriate care in the community.

The state-wide Clinically Coordinated Patient Transfer Model of Service Delivery, which is currently being developed, will provide detailed appropriate referral and transfer pathways across the State. The Transfer Model will include consideration of the specific requirements for regional areas.

<table>
<thead>
<tr>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health and ambulance services should develop and use prenotification systems for stroke.</td>
</tr>
<tr>
<td>Ambulance services should preferentially transfer suspected stroke patients to a hospital with a designated stroke unit.</td>
</tr>
<tr>
<td>Protocols should be in place for transfer of patients between hospitals. These protocols should take into consideration the logistics of rural and regional road and air transport. Arrangements with other emergency transport providers such as RFDS should also be included.</td>
</tr>
<tr>
<td>Protocols for ambulance stroke care should include:</td>
</tr>
<tr>
<td>— Rapid efficient assessment with a validated pre-hospital stroke screening tool;</td>
</tr>
<tr>
<td>— Pre-hospital communication with ED staff;</td>
</tr>
<tr>
<td>— Medical stabilization enroute to hospital; and</td>
</tr>
<tr>
<td>— Rapid communication between ambulance and ED staff.</td>
</tr>
</tbody>
</table>

**Recommendation 4:** Immediately assess all patients with suspected stroke and transfer to a stroke unit where possible.

**Triage and emergency department care**

The management of stroke patients in the ED includes appropriate diagnosis of stroke and immediate referral to a stroke team. The advances in acute stroke treatment other than thrombolysis are centred around good quality nursing, medical and allied health care. This early management of stroke is vital to minimise the risk of complications in the early stages of stroke. ED protocols should reflect evidence-based best practice, to ensure stroke episodes are triaged and responded to in an appropriate manner.

The management of stroke in ED is the first component of a multi-disciplinary clinical pathway for stroke management. It is imperative that once a patient reaches a hospital that there is an organised plan for rapid and efficient assessment and treatment. Clinical pathways for the assessment of acute stroke patients have been introduced into RPH and SCGH and SDH. Excellent communication between medical and nursing staff, ED and
stroke unit staff, as well as with the laboratories and radiology services is essential. Ideally, an experienced consultant stroke physician should be accessible for advice on a 24-hour basis.

The NSF guidelines recommend that all patients with suspected stroke should have an urgent brain CT or MRI. Urgent is defined as immediately where facilities are available but within 24 hours. Patients who are candidates for thrombolysis should undergo brain imaging immediately. In WA in 2009, 93% of stroke patients received imaging within 24 hours of their admission and 100% received brain imaging at some time during their hospital stay. To meet these guidelines, improved access to scanning equipment and radiology services across general hospitals and in regional centres is necessary.

**Transfer of care**

There is overwhelming evidence that stroke unit care significantly reduces death and disability after stroke compared with conventional care in general wards for all people with stroke. Therefore, stroke patients should be transferred immediately to a stroke unit from the ED, this transfer should occur within 3 hours. In situations where the nearest hospital does not have a stroke unit the situation is more complex. Several non-randomised studies found significantly improved outcomes when patients were admitted directly to a stroke unit rather than assessed at a non-stroke unit centre and subsequently transferred. Rural transfer protocols between WACHS and Comprehensive Stroke Units in the metropolitan area are currently under development as part of the Clinically Coordinated Patient Transfer Model of Service Delivery.

**Strategies**

<table>
<thead>
<tr>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standardised ED protocols are to be established to transfer stroke patients from the ED to the stroke unit immediately or at least within 3 hours.</td>
</tr>
<tr>
<td>Hospitals are to have established documented bed management practices.</td>
</tr>
<tr>
<td>If people with suspected stroke present to non-stroke unit hospitals, standardised transfer protocols should be developed and used to guide urgent transfers to the nearest stroke unit hospital.</td>
</tr>
<tr>
<td>Smaller hospitals should consider stroke services that adhere as closely as possible to the criteria for stroke unit care. Where possible, patients should receive care on geographically discrete units.</td>
</tr>
<tr>
<td>Improve access to scanning equipment and radiology services across general hospitals and in regional centres.</td>
</tr>
</tbody>
</table>

**Recommendation 5:** Give intravenous tissue plasminogen activator (alteplase) to appropriate patients with confirmed acute ischaemic stroke within 4.5 hours of onset of stroke symptoms.

**Tissue Plasminogen Activator (tPA) administration**

There remain some points of debate about the benefits of thrombolytic therapy with tPA, among emergency physicians, although the procedure is generally accepted as beneficial in selected cases by Stroke Physicians and Neurologists. Despite these reservations, the time-critical systems that are required for the delivery of tPA will also be required for any future ischaemic or haemorrhagic stroke therapy.
Currently four hospitals within WA have the capability to administer tPA. Each of these hospitals have different models of care with their emergency departments related to tPA administration. The WA Department of Health has recently developed the Protocol for Administering Alteplase in Acute Ischaemic Stroke\textsuperscript{6} which provides overarching guidelines for the administration of tPA. As data from new stroke trials emerges, the protocol may require further revisions. The results of a major study of stroke thrombolysis (IST 3)\textsuperscript{61}, will be announced in May 2012, and this will provide further important data concerning the use of tPA. It is recognised that larger hospitals within the WACHS have upgraded CT imaging equipment, but have limited capacity to support safe and effective administration of tPA and the required after care.

In order to be effective, tPA must be given as soon as possible (up to a maximum of four and half hours) after stroke onset. This medication should only be given after a CT of the brain has excluded haemorrhage and should only be given by a credentialed medical practitioner, in a recognised stroke unit\textsuperscript{6}.

Many patients cannot be given tPA if they do not meet the current internationally endorsed selection criteria. For example, logistical reasons such as late presentation or lack of credentialed medical staff means that many patients do not receive this therapy.

<table>
<thead>
<tr>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>All EDs must have protocols for triage, assessment and management of acute stroke, including those eligible for thrombolysis and other future hyper acute therapies.</td>
</tr>
</tbody>
</table>

**Recommendation 6:** Ensure patients with TIA, undergo specialist assessment within 48 hours of presentation.

**Transient Ischaemic Attack (TIA) management**

A TIA may act as a warning sign that a full stroke may occur. The causes and symptoms of a TIA are similar to those of a stroke, however if the signs of stroke resolve within 24 hours, the term TIA is used. TIA is traditionally defined as a sudden focal neurologic deficit lasting for less than 24 hours, of presumed vascular origin, and confined to an area of the brain or eye (causing amaurosis fugax) perfused by a specific artery. The risk of stroke post TIA is high immediately after an event; up to 5% in the first 2 days and 10% within the first week. In view of this, urgency is required in evaluation and commencement of evidence based therapies which have been shown to lower stroke risk.

TIA is a clinical diagnosis and may be a precursor to subsequent stroke. A systematic response to TIA diagnosis and treatment is therefore crucial. There are three main models suggested for organising services for those with TIA:

- Admission to hospital;
- Rapid access TIA clinic; and
- Management by primary care.

Those at high risk can be discriminated from those at low risk by means of clinical assessment (the ABCD2 score) and the use of brain and carotid artery imaging (ABCD3I score)\textsuperscript{62, 63}. The ABCD2 scale is a 7-point scale based on clinical data available before neuroimaging, which can be used to estimate the risk of stroke after TIA\textsuperscript{62}.  

**Obsolete - for reference use only**
Table 6: The ABCD2 Score\textsuperscript{62}

<table>
<thead>
<tr>
<th></th>
<th>HR (95%CI)</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>≥ 60 years</td>
<td>2.6 (0.7 to 8.8)</td>
</tr>
<tr>
<td>Blood pressure</td>
<td>SBP &gt; 140 systolic and/or DBP&gt;90</td>
<td>9.6 (2.2 to 42)</td>
</tr>
<tr>
<td>Clinical features</td>
<td>Unilateral weakness Speech disturbance</td>
<td>6.6 (1.5 to 28)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.6 (0.5 to 14)</td>
</tr>
<tr>
<td>Duration of symptoms</td>
<td>&gt; 60 mins</td>
<td>6.2 (1.4 to 27)</td>
</tr>
<tr>
<td></td>
<td>&gt; 10-59 mins</td>
<td>3.1 (0.6 to 15)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Present</td>
<td></td>
</tr>
</tbody>
</table>

Table 7: The ABCD2 Score to Identify Patients at High Risk of Stroke Within the First 2 Days\textsuperscript{62}

<table>
<thead>
<tr>
<th>Score</th>
<th>Patients (%)</th>
<th>% Risk (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>34</td>
<td>1.0</td>
</tr>
<tr>
<td>4-5</td>
<td>45</td>
<td>4.1</td>
</tr>
<tr>
<td>6-7</td>
<td>21</td>
<td>8.1</td>
</tr>
</tbody>
</table>

Patients with an ABCD2 score of 0 to 3 are eligible to be discharged directly from the ED for outpatient investigation and assessment in the TIA clinic within 48 hours. For patients with an ABCD2 score of 4 or greater, carotid artery imaging (carotid duplex or CTA) should be obtained in the ED. If a significant carotid artery stenosis is identified, then hospital admission is recommended. The relevant hospital stroke team will then be contacted. If vessel imaging does not reveal a significant lesion, then referral to the TIA clinic with further outpatient investigation as above can be arranged with the TIA community nurse.

The success of any patient pathway is based on accurate diagnosis, rapid and thorough assessment and initiation of effective treatment (See optimal patient pathways detailed on page17 and 18). Overall, cohort studies report the lowest risk of subsequent stroke in services that provide emergency intervention in specialised stroke centres\textsuperscript{23}. Due to limited resources, access to services may need to be determined on the basis of predicted risk of stroke. The ABCD2 score has modest but clinically useful predictive ability\textsuperscript{64} but may miss 20–30% of cases. Other important indications of risk, particularly the presence of AF or carotid disease, should be considered to determine high and low-risk and where necessary the patient should undergo a neurological review. Whichever model is used it should focus on rapid assessment and early initiation of proven therapies (e.g. antiplatelet therapy, blood pressure lowering and cholesterol lowering) and be based on local resources and needs.

A detailed audit of the availability of the resources required to make an accurate diagnosis and assessment is needed to better understand the best pathways required to meet the needs of all Western Australians including those in regional and rural areas. Planning for TIA services should be taken into account when planning hospital based stroke services, outpatient clinics and links to primary care. Some clarity around the appropriate referral pathway for TIA is required prior to the development of clinical pathways for TIA assessment, treatment and follow-up.
The pathway can be guided by the National Institute of Clinical Studies’ Emergency Department Stroke and TIA care bundle, that focuses on implementation of key components for the assessment and management of stroke and TIA.

Patients with suspected TIA should be assessed urgently (i.e. the same day) by the stroke registrar. Admission may not be required if the diagnosis of TIA, its cause and appropriate management can be established in ED. This may require same-day blood tests, ECG, cranial imaging and some form of carotid imaging. Patients may be admitted to an ED ward whilst awaiting same day investigations, pending discharge, with the stroke team managing the discharge summary and follow up process. If investigations will be delayed beyond 24 hours, then formal admission should be considered. Patients with a carotid stenosis > 70% should be referred for an opinion about carotid endarterectomy.

Options for outpatient based management with liaison with a general practitioner should be investigated. Aboriginal Health Workers should assist in ensuring discharge summaries of Aboriginal patients reach appropriate health professionals and facilitate follow-up appointments. It is acknowledged that due to the current limited access to imaging and resources, regional areas and general hospitals will require the development of alternative pathways.

Further details on the management of TIA can be found in the NSE’s Clinical Guidelines for Stroke and TIA Management: A Quick Guide for General Practice (2010).

### Strategies

<table>
<thead>
<tr>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undertake a detailed audit of resources available to accurately diagnose, assess and treat TIA.</td>
</tr>
<tr>
<td>Outline preferred models and develop pathways for TIA management for both metropolitan and rural WA.</td>
</tr>
<tr>
<td>Identify resource requirements to implement proposed pathways.</td>
</tr>
</tbody>
</table>

Obsolete - for reference use only
6. Organisation of stroke care services

Recommendation 7: Initiate standardised and evidence based acute therapies and stroke unit care by a multidisciplinary team.

Stroke care across WA

It is recognised that there are significant benefits of stroke unit care as opposed to general ward care in terms of reduced morbidity and mortality through better care and reduced complications\(^\text{12}\). The MSC 2012 has facilitated the leadership, development and planning of the following stroke services in WA:

- Acute Stroke Units at Royal Perth Hospital (RPH), Sir Charles Gairdner Hospital (SCGH) and Fiona Stanley Hospital (FSH) from 2014;
- Comprehensive Stroke Centres at Swan District Hospital (SDH) or Midland Health Campus (MHC) (from 2015) and Rockingham General Hospital (RGH) (from 2011). It is anticipated that a comprehensive centre may also be required at Armadale Kelmscott Memorial Hospital (AKMH) in 2014 following the opening of FSH and the decline in bed numbers at RPH and FH. This would be achieved by adding an acute stroke unit component to the COAG funded rehabilitation service;
- One statewide Neuro-rehabilitation Unit at Shenton Park Centre (SPC) and in the future at FSH;
- Two Neuro-rehabilitation Units, geographically linked to aged care units at Osborne Park Hospital (OPH) and Bentley Hospital (BH) and in the future at Fremantle Hospital (FH); and
- Rural ‘Primary Stroke Centre’ are being planned for Geraldton, Albany, Bunbury and Kalgoorlie. Community rehabilitation options are currently under consideration for regional areas.
- Linkages with ESD/RITH programs are planned for all of these units. Links with RPH, FSH, RGH, BH to SMAHS RITH; SCGH, SDH, OPH with North Metropolitan Area Health Service (NMAHS) RITH/ESD.

Future Planning:

- Acute stroke unit care in the NMAHS is currently available at SCGH and SDH, with future potential for Joondalup Health Campus to develop a stroke unit.
- The plans of SMAHS are in transition with changes in the size and level of care provided at RPH, FH and the general hospitals with the opening of FSH in 2014.
- From 2014, acute stroke care is planned to be provided at RPH, FSH, RGH and AKMH hospital. Rehabilitation care will be provided through the State Rehabilitation centre at FSH for under 65 year olds, and at the comprehensive stroke units at RGH and AKMH. Rehabilitation care alone will be provided at FH and BH. As RPH will have a short stay inpatient service, stroke patients will be triaged away from that ED.
Figure 4: Map of WA stroke services

More detail on these services can be found in Appendix 5.

Stroke unit care

The organisation of hospital services to provide stroke unit care is the single most important recommendation for improving stroke management\textsuperscript{12}. Stroke unit care significantly reduces death and disability after stroke compared with conventional care in general wards for all people with stroke\textsuperscript{16}. It has been estimated that stroke unit care reduces death and disability by 20\%\textsuperscript{26}. While numbers of stroke units and stroke unit beds in WA have increased to 73 since 2007, only 50\% of stroke patients receive stroke unit care\textsuperscript{26}.

In some areas of WA, the number of people with stroke requiring care is not high enough to support the need for a dedicated stroke unit and maintain staff expertise. Rural residents, and particularly Aboriginal populations do not have universally adequate access to a stroke unit, which can result in suboptimal outcomes\textsuperscript{67}. To ensure equitable and timely service for all stroke survivors, support for non specialist sites in both metropolitan and regional areas may be facilitated via formal or informal networks and appropriate resourcing needs to be provided based on patient demand. Access to more specialised medical or allied health services may also be facilitated through the use of telemedicine\textsuperscript{12}.

Standard resources and care pathways across stroke units and ESD programs can be developed and used, including common assessment tools and outcome measures. Additionally acute care facility medical diagnostic investigations should be readily accessible for patients/medical staff at this point of assessment. This can be enhanced by anticipating demand and pre-booking services.
The Acute Stroke Services Framework 2011\textsuperscript{18} provides a comprehensive outline to assist health services to structure acute stroke services by outlining recommended structures, networks, settings and criteria for monitoring. See Table 8 below for more details.

Predicting future requirements for bed numbers is complex and was previously modelled in the MSC 2006 based on stroke episodes in WA public hospitals and average length of stay. The WA Health Clinical Services Framework 2010-2020\textsuperscript{7} provides some guidance for future service planning and bed number modelling. Implementation of the MSC 2012 will require more detailed analysis of demands for acute and rehabilitative beds across WA to provide recommendations for stroke specific service planning.

<table>
<thead>
<tr>
<th>Table 8: Recommended stroke services and clinical profile (based on Acute Stroke Services Framework 2011)\textsuperscript{18,18}</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Component of care</strong></td>
</tr>
<tr>
<td>Stroke unit</td>
</tr>
<tr>
<td>Onsite CT brain (24/7)</td>
</tr>
<tr>
<td>Carotid artery imaging</td>
</tr>
<tr>
<td>Advanced imaging capability (e.g. MRI, advanced CT, catheter angiography)</td>
</tr>
<tr>
<td>Neuro-interventional services (e.g. for use in intra-arterial or mechanical thrombolysis)</td>
</tr>
<tr>
<td>Neurosurgical services (e.g. for hemicraniectomy due to large middle cerebral artery infarcts)</td>
</tr>
<tr>
<td>Delivery of intravenous tissue plasminogen activator (tPA)</td>
</tr>
<tr>
<td>Ability to provide acute monitoring (telemetry and other physiological monitoring) for up to 72 hours</td>
</tr>
<tr>
<td>Dedicated stroke coordinator position</td>
</tr>
<tr>
<td>Dedicated medical lead</td>
</tr>
<tr>
<td>Access to High Dependency Unit (HDU), Intensive Care Unit (ICU) (for complex patients)</td>
</tr>
<tr>
<td>Rapid (within 48 hours) Transient Ischaemic Attack (TIA) assessment clinics/services</td>
</tr>
<tr>
<td>Vascular Surgery Service for Carotid Artery Intervention</td>
</tr>
<tr>
<td>Focus on early rehabilitation, including strong integration and access to specialist rehabilitation services (e.g. inpatient rehabilitation or supported discharge services)</td>
</tr>
<tr>
<td>Routine involvement of carers in the rehabilitation process</td>
</tr>
<tr>
<td>Routine use of guidelines, care plans and protocols</td>
</tr>
<tr>
<td>Regular audit and stroke specific quality improvement activities</td>
</tr>
<tr>
<td>Access and collaboration with other specialist services (cardiology, palliative care, vascular)</td>
</tr>
<tr>
<td>Regional responsibility</td>
</tr>
</tbody>
</table>

\# If tPA not currently provided, services should have plan to develop or systems in place to transfer appropriate patients to service that offers tPA

\¥ Or clear transfer arrangements to centres with this service

\* Regional responsibility

\^ Dedicated medical lead who has primary focus on stroke (stroke centre director)
Further evidence on treatment options for stroke can be found in Appendix 3.

**Stroke services in rural WA**

The provision of equitable service across WA is particularly challenging in regional and remote areas where resources, particularly human resources, may be limited. Local solutions need to be developed to ensure optimal practice and quality outcomes that are based on the best evidence using the available resources. Current planning for stroke unit care in rural regions includes a focus on providing access to ‘Primary Stroke Centre’ level of care closer to home, with formal links to ‘Comprehensive Stroke Units’ in the Metropolitan area. In regions, a mix of day sub acute care level rehabilitation including day therapy units, outpatient clinics, and community health services provide significant care of stroke patients. Community rehabilitation options are currently under consideration in regional areas.

The Acute Stroke Services Framework 2011\(^{18}\) outlines the following areas for regional stroke responsibility:

- Responsibility for regional stroke planning and local stroke network;
- Extra capacity for specialist clinical support (outreach or via telemedicine);
- Extra capacity for educational outreach (including medical, nursing [educator or consultant], allied health and research);
- Extra capacity to respond to/accept additional transfers;
- Dedicated stroke coordinator position to coordinate care between sites;
- Regional coordination of hyperacute therapy; and
- Use of telemedicine links to comprehensive stroke centres (for primary stroke centres).

Consideration also needs to be given to ensuring that there is localised input into the way stroke services are delivered, the provision of training for regional and remote staff and capacity building for Aboriginal families. Education and support for patients and their families need to be delivered in a culturally secure way.

**Access to specialist stroke care**

Guidelines for the appropriate management and possible transfer of patients presenting to rural hospitals with Primary Stroke Centres need to be established with Metropolitan Comprehensive Stroke Centres. A patient care pathway should be established to guide referral of the state’s entire population (See Appendix 6 for the proposed stroke care pathway for rural WA). In rural and remote regions patients should receive initial diagnosis and then be referred or ‘link in’ with a stroke centre. Telehealth consultations could provide specialist support when required. High quality suitable care should be provided locally where possible. Smaller and more remote sites need to be adequately networked to larger, experienced and better resourced stroke centres.

Access to more specialised medical or allied health expertise may be facilitated through the use of telemedicine or ‘telestroke’ as it is known when applied to stroke care\(^ {68}\). Telestroke has been used widely internationally and in a limited manner within Australia for both acute and rehabilitation stroke care.
The application of telestroke for thrombolysis, when used as part of an organised system of care linked with stroke experts or units, has been found to be capable of improving thrombolysis rates without increasing complication rates\textsuperscript{68, 69}. This does however depend on all protocols and procedures being in place for after care. In addition to improved access to thrombolysis and the subsequent (net) improved patient outcomes, the application of telemedicine for stroke care and the networked stroke services may reduce length of stay, improve decisions regarding patient transfers for other urgent investigations or interventions (e.g. surgery) and lead to improvement of stroke care in non-specialist hospitals\textsuperscript{70}.

The extension of telestroke services to rural, remote and outer metropolitan areas has the potential to significantly improve stroke outcomes across the Australian community. The NSF Clinical Guidelines 2010\textsuperscript{12} make the following recommendations in relation to the use of telemedicine and networks for stroke care:

\begin{itemize}
    \item[a)] All health services which include regional or rural centres caring for stroke patients should use networks which link large stroke specialist centres with smaller regional and rural centres\textsuperscript{68, 69}.
    \item[b)] These networks should be used to help establish appropriate stroke services along with protocols governing rapid assessment, telestroke services and rapid transfers\textsuperscript{68, 69, 71}.
    \item[c)] Where no onsite stroke medical specialists are available, telestroke consultation should be used to assess eligibility for acute stroke therapies and/or transfer to specialist stroke centres\textsuperscript{68, 69, 72}.
    \item[d)] Telestroke can be used to improve assessment and management of rehabilitation where there is limited access to on-site stroke rehabilitation expertise\textsuperscript{68, 69}.
\end{itemize}

\textbf{Stroke services for Aboriginal people}

The burden of stroke in the Aboriginal population is substantially higher than in non-Aboriginal Western Australians, with a younger age distribution among Aboriginal cases and higher fatality\textsuperscript{73}. There is therefore a need for increased focus on reducing Aboriginal stroke incidence and improving stroke outcomes in metropolitan and regional areas\textsuperscript{73}. Screening for and management of risk factors need to be initiated at younger ages than in the non-Aboriginal population. Consideration should be given to undertaking opportunistic screening for stroke and other vascular risk factors in all adult Aboriginal patients.

The particular needs of Aboriginal people demand special attention and resources\textsuperscript{74}. In March 2010, the NSF surveyed a number of Aboriginal and Torres Strait Islander (ATSI) and non-ATSI health professionals and researchers concerning stroke care for ATSI people. The survey results reinforced stroke-specific and whole health system issues previously identified and outlined in the Aboriginal Stroke Project Report (2003)\textsuperscript{27}.

Whole health system issues include access to and equity of appropriate services (including transportation), cultural safety (see page 74 for a definition), workforce development (Aboriginal health workers and training for non-Aboriginal health workers) and improving communication and knowledge. These issues are consistent with current national policy and program initiatives including the National Strategic Framework for Aboriginal and Torres Strait Islander Health\textsuperscript{75}.

Stroke-specific service issues confirmed by survey respondents included the need for increased availability of stroke unit care in larger regional centres in order to increase service access for ATSI people and reduce the need for transfer, often over large distances, away from family and community.
There was the overwhelming view that ATSI people are less likely to want to participate in rehabilitation away from family and community. Thus it was suggested that networks and processes be improved so that stroke specialist centres support non-specialist staff at smaller regional and rural centres\textsuperscript{12}.

<table>
<thead>
<tr>
<th>Strategies</th>
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<tbody>
<tr>
<td>All hospitals that admit over 100 stroke patients each year should have organised stroke unit care with appropriate specialised stroke staff and facilities.</td>
</tr>
<tr>
<td>All people with stroke should be assessed at a hospital and be provided with stroke unit care by a multidisciplinary team, as per NSF minimum criteria. This may also include ESD where appropriate. Aboriginal health workers should be part of stroke hospital and outreach teams.</td>
</tr>
<tr>
<td>All people with stroke should be admitted directly to a stroke unit (preferably within 3 hours of stroke onset). Smaller hospitals should consider stroke services that adhere as closely as possible to the criteria for stroke unit care and therefore need to be appropriately resourced. Where possible, patients should receive care on geographically discrete units.</td>
</tr>
<tr>
<td>If people with suspected stroke present to non-stroke unit hospitals, transfer protocols should be developed and used to guide urgent and appropriate transfer to the nearest stroke unit hospital.</td>
</tr>
<tr>
<td>WA should have in place an adequate mix of comprehensive and primary stroke centres appropriate to its population and geography. Service planning should also include regional factors and transfer patterns.</td>
</tr>
<tr>
<td>Service planning for improving stroke services for rural and remote populations needs to be undertaken by the WACHS in collaboration with metropolitan area health services to support implementation of recommendations in the NSF Acute Services Framework 2011 \textsuperscript{18} and the evidence based clinical guidelines\textsuperscript{3}.</td>
</tr>
<tr>
<td>WACHS is planning for primary stroke centres in the Midwest, South West, Great Southern and Goldfields regions to support the projected increase in stroke patients in future years.</td>
</tr>
<tr>
<td>Extension of ‘telestroke’ services should be planned in line with the NSF Clinical Guidelines 2010\textsuperscript{12} and the Clinical Services Framework\textsuperscript{7}.</td>
</tr>
<tr>
<td>Work in partnership with local Aboriginal Community Controlled Organisations to enhance knowledge of improvements in metropolitan and regional stroke services, referral pathways, discharge planning and support available for stroke survivors.</td>
</tr>
<tr>
<td>Cultural safety training and an ongoing commitment to cultural learning should be available for health professionals working in stroke units and other stroke services in both metropolitan and regional areas.</td>
</tr>
</tbody>
</table>
7. Rehabilitation

**Recommendation 8: Commence rehabilitation, based on standardised protocols for timing and intensity on day one following a stroke.**

There is increasing evidence to support rehabilitation as a major contributor to positive outcomes for stroke survivors and their families\(^26, 76-78\). There is also evidence concerning the amount and timing of rehabilitation that shows that the earlier rehabilitation is commenced the better the outcome for the stroke survivor\(^12\).

The evidence base shows that patient outcomes are better where rehabilitation is provided in a dedicated Stroke Rehabilitation Unit (SRU), than in a generic ward\(^72, 76\). Like Acute Stroke Units, these utilise geographically defined beds, and a multidisciplinary team with an interest and experience in stroke. Studies show that compared with ‘generic’ rehabilitation, an SRU leads to a 34%-40% reduction in death, 30% reduction in death or disability, or 32% reduction in death or dependency\(^76, 79\).

Rehabilitation’s aim is to improve function and/or prevent deterioration of function, and to bring about the highest possible level of independence, physically, psychologically, socially and financially. Rehabilitation is concerned not only with physical recovery but also with reintegration of the person into the community and therefore the transition between hospital and community care (including primary care) and supporting services is vitally important.

Rehabilitation services need to be streamlined to improve equality of access, service intensity and timing. There needs to be standardised protocols around access to rehabilitation services, timing for transition or triage between services as well as planning and service specifications.

The NSF Clinical Guidelines 2010\(^12\) recommends that all patients including those with severe stroke, who are not receiving palliative care, be assessed by a specialist rehabilitation team prior to discharge from hospital regarding their suitability for ongoing rehabilitation. There is also a need for future follow-up assessment and/or revaluation for patients discharged into long term care, to identify opportunities to access public rehabilitation services where appropriate.

The recommended requirements for stroke rehabilitation services in WA by 2014 include:

- Quaternary level rehabilitation to be provided by the State Rehabilitation Centre (SRC) on the new FSH campus at Murdoch by 2014. This statewide rehabilitation services will include, but will not be limited to, younger stroke patients (under 65 years of age) and will be based on clinical need.
- In addition to the Comprehensive Stroke Units (CSU) at SDH and RGH, CSUs may be developed at Joondalup Hospital and AKMH to provide both acute and rehabilitative stroke care for patients throughout their illness, and to link with both the quaternary and secondary level units to provide access for all patients to optimal care.
- Secondary level rehabilitation to be provided in a small number of specialised rehabilitation units at OPH and BH and, if required, at SDH.
- Area wide ESD programs to provide home based stroke specific rehabilitation programs particularly for mild-moderate severity strokes. A consistent model across the metropolitan area with equity of access from all acute and rehabilitation inpatient facilities.
- Expansion of the current stroke specialist outpatient rehabilitation services to include a ‘community rehabilitation’ stream to deliver home and community rehabilitation when this is deemed to be more beneficial than the traditional clinic setting.
- Primary Stroke Centres to be in place at major regional/rural country centres currently planned at Albany, Geraldton, Kalgoorlie and Bunbury.

**Strategies**

All patients, including those with severe stroke, who are not receiving palliative care, are in a coma or are actively refusing rehabilitation, should be assessed by the specialist rehabilitation team prior to discharge from hospital regarding their suitability for ongoing rehabilitation. This assessment should occur in acute hospital settings, comply with nationally recommended benchmarks and consider all rehabilitation options.

WA should have in place an adequate mix of rehabilitation options to ensure the rehabilitation needs of all stroke survivors are able to be addressed. This will include specialist stroke inpatient rehabilitation services, ESD, outpatient and community based options. Culturally secure practices for Aboriginal patients are to be incorporated.

**Stroke rehabilitation - inpatient**

**Ongoing inpatient rehabilitation**

Organised stroke unit care is most effective when a number of weeks of rehabilitation are offered. Specialist stroke rehabilitation units were found to reduce rates of death or dependency compared to mixed rehabilitation units, even though there was no difference in length of stay (LOS). If the acute stroke services are unable to provide the necessary ongoing rehabilitation by a specialised multidisciplinary team then alternative rehabilitation services, ideally on a stroke rehabilitation unit, need to be considered and organised.

Hospitals and healthcare services should ensure that there are clear referral protocols and processes to effectively link acute and rehabilitation services so that rehabilitation is commenced as soon as possible and continues in an appropriate setting and intensity.

ESD continues inpatient rehabilitation levels of care in a home based setting. The patient is not discharged from hospital until the "outreach" program is terminated and the patient is suitable for a range of alternative therapy options including outpatient clinic, day therapy unit and community physiotherapy.

Inpatient rehabilitation needs to cater for the full range of stroke deficits including the physical, sensory, cognitive, perceptual, speech and functional elements. Twenty percent of stroke patients have little or no physical disability from their stroke but it is imperative that they have the same access to inpatient rehabilitation services as those with physical disabilities, to improve their function and ability to return to premorbid activities. The role of Orthotists and orthotist services, including orthotic management for survivors with a hemiplegic gait pattern secondary to a stroke, are important considerations as part of the inpatient and outpatient treatment plan.

There is increasing evidence of the importance of early mobilisation (within the first 24 hours) and early onset of rehabilitation in medically stable patients. Results from A Very Early Rehabilitation Trial for stroke (AVERT) Phase II indicate that very early mobilisation may fast-track return to unassisted walking and functional recovery. Other important aspects of inpatient rehabilitation which should be considered, as described in the NSF Clinical Guidelines 2010, include speech, cognition, perception, incontinence management and function for daily living.
The management of these secondary complications should include initial efforts in prevention and include strategies to reduce impairments. Areas such as nutrition and hydration and incontinence management should commence immediately in the acute phase and continue into the post-acute and long-term care phases.

Additionally, most people are able to tolerate an increase in rehabilitation intensity. There is evidence to suggest that greater intensity of treatment and therefore practice of necessary skills in the first six months post stroke is linked to better outcomes. For example, evidence indicates that daily aphasia therapy in very early stroke recovery can improve communication outcomes in stroke survivors with moderate to severe aphasia. Also early and more intensive rehabilitation has been shown to lead to improved functional outcomes in acute stroke patients, with severe stroke cases benefiting more than those with moderate deficits. Additional weekend therapy can result in significant improvements in Functional Independence Measure (FIM) efficiency as well as a reduction in LOS.

The timeliness of diagnostic investigations impacts on the length of stay in the tertiary facilities. There are perceived barriers in transitioning from tertiary care to general or specialist rehabilitation units or into the ESD / RITH services, in an appropriate timeframe. In addressing demand management for stroke and stroke rehabilitation into the future, targets for length of stay in each component across the care continuum needs to be determined and managed. Inclusion criteria need to be reviewed and standardised for specialist and generalist rehabilitation. This should include improved access for younger adults below 65 years to ESD programs. Care coordination at key transition points is critical to ensuring the right care is provided in the right place at the right time. Where appropriate, Aboriginal Health Workers should be engaged to support the care of Aboriginal stroke patients. Consideration also needs to be given to supporting survivors from cultural minority groups to access and adhere to rehabilitation and to support their carers throughout the pathway of care.

### Strategies

<table>
<thead>
<tr>
<th>In line with NSF Guidelines, WA should have in place adequately staffed, specialised inpatient stroke rehabilitation to meet the needs of the WA population, particularly those severely affected by stroke. Service planning should also include rural and regional factors and transfer patterns.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke specific ESD or RITH services should be further developed and must be able to provide similar range and intensity of therapy as inpatient models of care.</td>
</tr>
<tr>
<td>Staffing and models of services must take into account timing and intensity of therapy recommended to optimise patient outcomes.</td>
</tr>
</tbody>
</table>
8. Palliation

**Recommendation 9: Develop a pathway for palliative care to support stroke patients and their families/carers and improved care for people dying after stroke.**

Fourteen per cent of acute stroke patients admitted to hospital die in hospital (9% within seven days)\(^{26}\) and approximately 20% die as a result of the stroke in the first 30 days\(^ {20}\). The palliative care needs of stroke patients need to be assessed and individualised according to patient and family and carer needs. For example, health care workers can support family members to communicate with patients who are aphasic by providing aphasic resources and advice.

People with stroke who are dying and their families and carers, should receive care consistent with the principles and philosophies of palliative care in accordance with the WA Palliative Care Model of Care\(^ {21}\). This includes an integration of the physical, psychological, spiritual, cultural and social needs of all those involved. An accurate assessment of prognosis or imminent death should be made for patients with severe stroke or those who are deteriorating. Where death is imminent, the WA Liverpool Care Pathway for the Dying Patient (WA lcp)\(^ {87}\) should be used.

Practical end-of-life issues, such as the use of Advance Health Care Directives and Enduring Power of Guardianship, should be discussed. Organ donation may be sensitively raised if appropriate. Issues of bereavement should become part of the responsibility of the stroke team, with referral to the family’s GP and community based counselling services for ongoing support.

### Strategies

- **Stroke patients and their families/carers** should have access to specialist palliative care teams and services as required and receive care consistent with the principles and philosophies the WA Palliative Care Model of Care\(^ {21}\).
- **Develop a pathway for stroke palliative care to support stroke patients and their families/carers and improve care for people dying after stroke.** The pathway should consider the specific cultural needs of cultural minority groups and Aboriginal patients and their families.
- **Improve care for people dying after stroke through use of the WA lcp\(^{87}\).**
- **Relevant staff need to be provided with education and training on the provision of best practice end of life care, including the use of the WA lcp\(^ {87}\).**
9. Discharge planning

Recommendation 10: Develop consistent and coordinated discharge care planning and follow-up.

Discharge planning - inpatient acute and rehabilitation care

Good discharge planning is crucial for successful reintegration into the community and effective and efficient use of limited health sector resources. Discharge planning relies on effective communication between team members, stroke survivors, families/carers, and community service providers, including general practitioners. Discharge planning may be coordinated by one member of the team (e.g. inpatient care coordinator) or it may be undertaken by someone who coordinates discharges for multiple teams or the whole hospital. Aboriginal health workers and Aboriginal liaison officers should be an integral part of the discharge planning process for Aboriginal patients.

Local Aged Care Assessment Teams (ACAT) should be notified of the need for an assessment at the time that the patient is medically stable and their in-patient rehabilitation has been completed. The role of ACAT is important in relation to obtaining approval for Commonwealth funded aged care services such as: community aged care packages, flexible care (including extended aged care at home and transition care), permanent residential aged care and residential respite opportunities.

A post-discharge care plan is normally completed prior to discharge and identifies appropriate management strategies to guide care after the stroke survivor returns to the community. Care plans are based on the needs and goals identified in the pre-discharge assessment, and may be useful in building self-management strategies for the stroke survivor. The timely and appropriate provision of assistive technology, particularly custom deives needs to be considered to facilitate safe and early discharge from hospital into the community. An electronic Care Management Plan (CMP) is already used in SMAHS, This type of record could be considered for use in stroke care across WA.

<table>
<thead>
<tr>
<th>Strategies</th>
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<tbody>
<tr>
<td>A documented post-discharge care plan should be in a consistent format and able to include all relevant information as outlined in the NSF Clinical Guidelines 2010. Ideally electronic discharge plans based on consistent guidelines and informed by an MDT should be developed.</td>
</tr>
<tr>
<td>An inpatient stroke care coordinator should be used to coordinate discharge plans and assist in discharge planning, including liaison with community organisations and supports.</td>
</tr>
<tr>
<td>Continual monitoring of discharge planning should be included in routine data collection.</td>
</tr>
<tr>
<td>Primary health care through the general practitioner in most cases remains the central focus in medical management after discharge with specialist medical review when required. Develop standardised guidelines for GPs to coordinate community based care. Systems should be in place to enable stroke survivors to have regular and ongoing review by a member of a stroke team if required.</td>
</tr>
<tr>
<td>Stroke survivors and their carers/families should be aware of the importance of their primary health care provider as part of the stroke team. They should also be provided with contact information for the specialist stroke service and a contact person (in the hospital or community) for any post-discharge queries. Aboriginal health workers should be an integral part of the discharge planning process for Aboriginal patients, and for their longer term care and follow up.</td>
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10. Stroke rehabilitation outpatient

**Recommendation 11:** Increase planning and investment in outpatient and community based rehabilitation services for stroke in WA.

Rehabilitation will often need to continue after discharge either as part of an ESD program (including RITH) or general community rehabilitation. It can be undertaken in various settings depending on the availability of transport, the requirements of the stroke survivor, the family/carer and local resources. Where possible outpatient services should be stroke specialised with early outpatients appointments prioritised. The setting of goals for discharge timeframes can have positive implications for reducing length of stay.

Generally there are two models for rehabilitation in the community:
- Centre-based therapy provided in the hospital or in a community facility, including rehabilitation for those attending on a full-day basis or as an out-patient; and
- Home-based or domiciliary rehabilitation provided within the home or residential facility.

There needs to be increased planning and investment in outpatient and community based rehabilitation services, including a cost utility analysis, within WA for stroke. An articulated standardised pathway is necessary for planning the discharge strategy from soon after admission, to allow for earlier transfer of patients. For WA to meet benchmarks and discharge targets established by the Australian Rehabilitation Outcomes Centre (AROC), it will require increased investment in home based rehabilitation and outpatient programs. Processes are needed to ensure that early assessment of suitability for ESD and RITH occurs (where these services are available) in order to ensure that these options are considered, where appropriate (More details on ESD and RITH are in Appendix 7).

Comprehensive community services for rehabilitation and carer support services and complementary community programs need to be developed and utilised with consideration given to improving access. The expansion for community-based services will have a significant impact on workforce (See Appendix 8 for more information on workforce development). Links can be made with specialist services such as Neurological Council of WA (NCWA) neurological nurses. Aboriginal Health Workers should be an integral part of the rehabilitation team. Opportunities for the delivery of less complex services by non-specialist MDT providers should also be considered. Where appropriate, return to work and driving programs should be included as part of the programs.

Many stroke survivors who complete inpatient rehabilitation have restricted access to outpatient rehabilitation services, especially those who reside in rural locations. Tele-rehabilitation has the potential to provide timely and efficient post acute care for stroke patients beyond the hospital and into an individual’s home. It enables clinicians to monitor the patient’s health status and to identify conditions that need improvement before complications or adverse complications ensue, optimally improving patient function while reducing long term disability and costs.

The use of telemedicine for allied health assessments has been reported to be feasible and valid in several trials and is also feasible and useful for providing therapy. Videoconferencing applications have also been found to be feasible in community-based stroke rehabilitation and for delivering in-home rehabilitation interventions for adults living in the community. However, home based Telehealth is likely to be more useful for maintenance than hands on inpatient (or ESD/ RITH) therapy.
**Strategies**

Health services with a stroke unit should provide comprehensive, experienced multidisciplinary community rehabilitation and adequately resourced support services for stroke survivors and their families/carers. If services such as the multidisciplinary community rehabilitation services and carer support services are available, then early supported discharge should be offered for all stroke patients with mild to moderate disability.

Rehabilitation delivered in a safe home setting should be offered to all stroke survivors as needed. Where home rehabilitation services are unavailable, patients requiring rehabilitation should receive centre-based care. A combination of home and centre-based outpatient therapy should also be considered based on patients needs.
Secondary prevention

**Recommendation 12:** Initiate secondary prevention in hospital and specialist settings and establish thorough systems for transfer and follow-up.

A person with stroke has an accumulated risk of subsequent stroke of 43% over 10 years with an annual rate of approximately 4%\(^{22}\). The risk of myocardial infarction or peripheral vascular disease is similar. The rate of strokes after TIA is significantly higher (up to 10% after three months) suggesting greater opportunities to prevent stroke after TIA\(^{23}\).

Secondary prevention therefore relates to both stroke and TIA. Long term management of lifestyle risk factors and adherence to recommended medications (particularly in relation to the management of hypertension, cholesterol and diabetes), carotid artery surgery, and antiplatelet therapies are essential for effective secondary stroke prevention. The effectiveness of secondary prevention initiatives is summarised in the Table below.

<table>
<thead>
<tr>
<th>Table 9: Summary of the effectiveness of interventions for the (secondary) prevention of recurrent stroke among 10,000 prevalent and 2,000 incident stroke and transient ischaemic attack survivors in a population of one million people(^{46})</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategy/intervention</strong></td>
</tr>
<tr>
<td>Nil</td>
</tr>
<tr>
<td>Carotid revascularisation</td>
</tr>
<tr>
<td>Aspirin</td>
</tr>
<tr>
<td>Aspirin &amp; ER dipyridamole</td>
</tr>
<tr>
<td>Clopidogrel</td>
</tr>
<tr>
<td>Anticoagulants (by 10 mm Hg diastolic)</td>
</tr>
<tr>
<td>Blood pressure lowering (by 10 mm Hg diastolic)</td>
</tr>
<tr>
<td>LDL-cholesterol-lowering (by 10 mg/L LDL)</td>
</tr>
<tr>
<td>LDL-cholesterol lowering (by 0.9%)</td>
</tr>
<tr>
<td>Cessation of cigarette smoking</td>
</tr>
</tbody>
</table>

Initial secondary prevention, including both lifestyle advice and medication provision should be commenced whilst an inpatient, after the acute management phase, and continued into the community by the GP. Comprehensive hospital based inpatient and outpatient services are required to address the issue of adherence to secondary prevention advice and treatments.
Community based stroke liaison nurses or other appropriately trained staff could be utilised to facilitate this role through visiting patients in the community. These programs should then continue into the primary care setting and primarily into the GP environment. As secondary prevention is a key role of community based GPs, good communication mechanisms must be established between the inpatient and outpatient hospital settings primary carers to ensure advice on treatments are consistent and reinforced\(^\text{12}\) and to disseminate updated guidelines.

Secondary prevention programs may include cardiac rehabilitation, effective blood pressure, diabetic and cholesterol control, exercise, lifestyle coaching, support groups and self management programs to support people to manage their existing conditions. Additionally in a minority of cases surgery, in the form of carotid endarterectomy, can be undertaken to removing the fatty deposits that are clogging the artery. The result is improved blood flow to the brain and a lower risk of blood clots or blockages in blood flow\(^\text{31}\).

There is a need for better prevention of adverse events or complications that affect length of inpatient stay for stroke patients. A greater emphasis needs to be given to the uptake of evidence based strategies to prevent secondary complications such as shoulder subluxation, loss of cardio-respiratory fitness and preventable adverse events such as deep vein thrombosis or falls\(^\text{12}\). The NSF audits identify adverse events and complication post stroke for both acute and rehabilitation care. All facilities treating stroke patients should participate in these audits with the aim of identifying areas for improvement.

<table>
<thead>
<tr>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop hospital initiated but community based programs aimed at addressing secondary prevention. Ensure formal mechanisms are established between hospital based secondary prevention services and primary care providers to ensure consistent information and advice are being given.</td>
</tr>
<tr>
<td>Establish mechanism for the regular provision of updated information and education to GPs on secondary prevention for stroke.</td>
</tr>
</tbody>
</table>
12. Long term care

**Recommendation 13:** Stroke service models with clearly articulated processes of care are to be established for long term care for survivors of stroke. These should be established in partnership with community services, to ensure continuity of care and availability of appropriate service options to meet the individual needs of stroke survivors.

Stroke service models with clearly articulated processes of care, which support stroke survivors following hospital discharge, need to be established in partnership with community services and primary health care across WA. Models should address referral to community services and follow-up of discharged patients. The focus should be on ensuring continuity of care and increased availability and access to appropriate community services and long term care for all types of patients. Respite and support for carers also needs to be addressed.

The National Stroke Support Strategy outlined a model of care to comprehensively respond to the needs of stroke survivors in the community to reduce the burden of disease at an individual and societal level. The Strategy identified improvements needed to address:

- discharge planning;
- greater access to stroke specific services;
- comprehensive information about stroke and support services; and
- the capacity of generic services to respond to the needs of stroke survivors and carers.

A core component of this strategy outlines the need for a comprehensive follow up and navigation service which aims to ensure timely intervention and link survivors and carers to services. The NSF also coordinates a number of stroke support groups in metropolitan and some country areas for survivors and carers.

A review of the Stroke Liaison Worker Model found that follow up by a stroke liaison worker for survivors with mild to moderate disability resulted in a significant reduction in death and dependence. For every 100 survivors with mild to moderate disability who were seen by a stroke liaison worker, 11 fewer patients were dead or dependent. A trial of this approach could be considered in WA, at the very least in high risk groups such as the Aboriginal patient. In addition formalised links can be consider with the NCWA, to provide specialist support to stroke victims and carers from hospital discharge into the community.

More long term accommodation options are needed in WA for stroke patients under the age of 65 who are currently being located in residential aged care facilities if they are unable to go home from hospital. In addition, increased access for young disabled stroke patients in a long term program is required in WA, to avoid these patients remaining in inpatient rehabilitation for unnecessarily long periods.

<table>
<thead>
<tr>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge planning protocols to include systems for clinical review and follow-up and mechanisms for providing information on community services for patients and carers.</td>
</tr>
<tr>
<td>Staged implementation and evaluation of the stroke liaison worker model and establishing formal links with specialist neurological community based care with the NCWA.</td>
</tr>
<tr>
<td>Provide increased residential and long-term care accommodation options for the ‘young disabled’ stroke patients.</td>
</tr>
</tbody>
</table>
13. Workforce

**Recommendation 14: Increase investment in workforce planning.**

The central aspect of stroke recovery is the provision of a coordinated program by a specialised MDT of health professionals, including Aboriginal Health Workers and Therapy Assistants. This team involves integrated use of medical, nursing and allied health skills, along with social, educational and vocational services, to provide individual assessment, treatment, regular review, discharge planning and follow-up. Specialist, dedicated, MDTs are vital for best practice stroke care^12^.

There is a need for better planning of future stroke care workforce requirements, including medical, nursing and allied health to provide sustainable stroke service across WA. There is a clear need for data collection about the current staffing of stroke services (including levels of experience and qualification) as well as the varying needs of different types of stroke services and for research to inform staffing levels for best practice rehabilitation.

Staffing levels are expected to vary depending on local considerations such as hospital service and clinical profile. It is important to note that other essential considerations in determining the most appropriate stroke unit staffing levels include skill mix, capacity within stroke unit and cross-cover with other non-stroke services, weekend cover, and additional time allocated to professional development, research and quality improvement activities. Staffing for ESD/outpatients and the long term care of stroke patients is a key area of focus, as this is where the patient should be spending most of their time.

The use of an inpatient stroke care coordinator is one of a number of strategies to facilitate a coordinated approach to care. The coordinator is generally a member of the stroke team and the role is often performed in addition to other clinical or management responsibilities. Exponents of this model suggest that a stroke care coordinator is particularly useful for coordinating services and facilitating the involvement of the person with stroke and the family/carer in care planning, including planning for discharge or transfer of care. This type of model has demonstrated a reduction in patient LOS (11 vs 14 days), and therefore lower costs, as well as a reduction in return presentations to ED^50^.

Currently national staffing benchmarks for rehabilitation are being reviewed by the Australasian Faculty of Rehabilitation Medicine and acute staffing levels are being reviewed by the NSF. National and international staffing reviews and tools such as SIGN^92^ and NICE^93^ should be considered when undertaking WA benchmarking and ensuring they are in line with industry standards.

Workforce analyses should be undertaken to inform future resource allocations across country areas in WA. Rural and remote areas already suffer from significant workforce shortages, ie adequate numbers of permanent highly skilled and senior/experienced staff cannot support any new junior or new staff across the stroke continuum, including weekend cover. Recruitment and retention of allied health professionals with specialist skills in rural and remote centres continues to influence the level of care able to be provided on a daily basis. Often there are insufficient episodes of stroke within an area to justify additional recruitment of stroke specialists. Therefore, increasing collaboration with GPs and nurse practitioners in rural communities is fundamental to enabling supportive care pathways for local stroke patients. While telehealth is a tool for bridging the gap by enabling access to specialised stroke clinicians, it is important that there are sufficient health care providers available at remote sites to work with these clinicians.
Current workforce planning in the WACHS with metropolitan and country links, includes training and exchange of staff. Additionally, there is planning to combine broader subacute and rehabilitation expertise and personnel with stroke specific services to maintain a critical mass of regional expertise and workforce.

**Strategies**

- Workforce planning is to be based on national benchmarks, currently being developed.
- Increasing the use of inpatient stroke care coordinators to coordinate services and assist in discharge planning.

### 14. Education and training

**Recommendation 15: Develop a WA stroke specific education and training framework.**

Stroke specific expertise and continuing education for stroke clinicians is one of the four key components of stroke unit care\(^2^4\). Stroke clinicians need access to ongoing education to develop and maintain specialist skills. Best practice stroke services require care from staff that have specialist knowledge, training and skills.

A greater investment in ongoing staff training and retention is needed in WA, with increased availability of site-appropriate training and education, and improved access to clinical leadership and support. There should also be strategies to attract medical and allied health graduates into working in stroke related fields. The development of the WA Framework and associated programs will be based on the Australian Stroke Coalition (ASC) Stroke Specific Education Framework\(^2^5\).

Seven areas to be addressed under the education and training framework include:

1. Training programs for non-stroke specific services;
2. National stroke specific training program;
3. Formal post graduate training in stroke care;
4. Building and retaining stroke expertise;
5. Increasing professional education on stroke;
6. Increasing public awareness; and
7. Culturally appropriate education for stroke survivors and carers.

More detail on these areas can be found in Appendix 8.

**Strategies**

- Increase availability of stroke specific professional development, education and training programs for health professionals.
- Development of education and training programs and a framework, based on the Australian Stroke Specific Education Framework.
15. Research and monitoring

**Recommendation 16:** Develop and maintain a state-wide stroke data collection and quality improvement system, in line and consistent with the national framework for data collection and quality improvement.

In order to monitor and improve the quality of care for stroke patients in WA there is a need to develop and maintain a state-wide stroke data collection and encourage participation in quality improvement systems at all health care settings.

Monitoring of stroke clinical care in WA will allow for:
- National and international benchmarking;
- Identification of gaps in service delivery and healthcare management;
- Implementation of improved services to meet changing needs of stroke survivors; and
- Improved stroke services throughout WA.

In WA, all stroke services will be monitored using the Australian Stroke Clinical Registry (AuSCR), the framework from the NSF’s clinical audit and the National Performance Indicator Set (NPIS). Designated rehabilitation services will be monitored using the Australasian Rehabilitation Outcomes Centre (AROC). AuSCR and the NPIS are designed to monitor acute stroke services. In order to monitor stroke services across the stroke care continuum from acute hospital admission to reintegration into the community, four rehabilitation indicators have been added to the NPIS data set. The data points are outlined in Figure 5. (Further details on these data sets can be found in Appendix 9).

**Figure 5:** Data sets available to monitor stroke clinical care

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*Obsoleted - for reference use only*
The four additional rehabilitation data points to be included in the NPIS data set are:

1. Rehabilitation goals set at each phase of recovery for the stroke survivor
2. Multidisciplinary team to meet with patient/family/carer to discuss rehabilitation plan/goals
3. Carer training provided before discharge into the community
4. Patient offered RITH including ESD.

Further to collecting data, there is recognition of the importance of WA being involved in quality improvement processes and programs based on data captured in these systems. AROC incorporates a national benchmarking system to improve clinical rehabilitation outcomes and provides feedback on the efficacy of rehabilitation interventions. From 2012, it will be a requirement that designated rehabilitation units become active participants in AROC for ABF and national benchmarking to improve clinical outcomes in rehabilitation.

**Strategies**

Develop and maintain a state-wide stroke data collection and quality improvement system. The system will be inline and consistent with the national framework for data collection and quality improvement.

This will include:

- participation in the national stroke registry;
- continued participation in the national stroke audit program; and
- involvement in quality improvement processes and programs.

All services that manage stroke should be involved in data collection and quality improvement activities to ensure services meet an adequate standard.

**Stroke research**

Collaborative approaches to stroke research, including the validation of new service delivery models are a key component of ensuring quality and evidence based improvements. Basic science and clinical research into stroke requires support. At present, there are numerous research groups across WA working on the full range of stroke related research fields, including basic science, epidemiology, and clinical aspects, including acute and rehabilitation therapies. There is a strong need to improve support for this research. The creation of clinical or research stroke fellowships attached to the major stroke units would greatly enhance research activity, and the provision of more research assistants would also be extremely valuable.

A collaborative approach to clinical trials should be encouraged through the Australian Stroke Trialists Network (ASTN) and promotion of stroke research through collaborations with local and national universities.

**Strategies**

Implement strategies to improve the support for stroke research in WA.
Appendices

Appendix 1: Achievements from Model of Stroke Care 2006

Recommendation 1: That the State Health Executive Forum (SHEF) endorses the comprehensive stroke service model for WA to facilitate the organisation of care for stroke patients across the state.

Achievement:
- The MSC 2006 was endorsed by SHEF in 2006.

Recommendation 2: That SHEF endorses the development of guidelines and protocols for the appropriate management of stroke including:
- Transfer protocols for patients presenting to hospitals without stroke units;
- State-wide referral pathways; and
- Continuation of the Towards a Safer Culture (TASC) project in developing and monitoring clinical pathways for assessment of acute stroke.

Achievement:
- Transfer protocols for patients presenting to hospitals without stroke units are in development;
- The TASC project has been completed; an “in-hospital” pathway was created out of the TASC project, and is still in use at SCGH.

Recommendation 3: That SHEF endorse the development of TIME-CRITICAL RESPONSE protocols including:
- Ambulance service symptom assessment
- Priority transportation
- Hospital pre-notification
- Treatment window.

Achievement:
- These have all been achieved.

Recommendation 4: That SHEF endorse the development of a Rehabilitation In The Home (RITH) service for stroke aligned with the Ambulatory Care Framework.

Achievements:
- RITH, an early supported discharge program, is operational as an area wide service across the whole of SMAHS, accepting referrals from all SMAHS hospitals and cross referrals from the NMAHS ‘Homelink’ program.
- RITH has grown considerably over the past 5 years and in 2010 the SMAHS program managed approximately 400 stroke patients.
- Within NMAHS ‘RITH’ operates from the secondary stroke unit at OPH for patients >65yrs.
- Recently Commonwealth subacute care funds have further supported the RITH and Homelink programs to increase the ESD model of care delivery in the metropolitan area.
- Community rehabilitation options are currently under consideration for regional areas.
Recommendation 5: That SHEF endorse the development of a detailed workforce plan that incorporates:

- The recommended stroke staffing numbers across all disciplines (current and projected needs).
- Consideration of career structure for allied health disciplines that encourage staff to continue in the neurological specialty and to be involved in ongoing professional development.
- Strategies for recruitment and retention of staff. This may include a structured graduate program, improvements in career structure and development of quality programs in undergraduate teaching.

Achievements

- Improved contemporary guidelines became available in 2011 for clinical resource requirements for Stroke from the ASC and NSF.
- The past 5 years has seen more first patient contact for specific allied health practitioners and higher output of College Trainees/Higher Degree Graduates that will make a contribution to improved patient access to services and better outcomes.
- There is an evolution towards more appropriate ‘seven day’ services and patients being transferred to a site relative to their recovery stage.
Appendix 2: Stroke Epidemiology

Stroke is a major cause of mortality and disability in Australia. In 2010, there were an estimated 60,000 new and recurrent strokes in Australia\(^1\). With the ageing population, it is estimated that this number will rise to 74,000 by the year 2017 unless there is a strong focus on reducing the incidence rate\(^2\).

Disease burden

In WA in 2006, stroke was identified as the 6th leading cause of disease burden for both males and females\(^94\). For Aboriginal women, stroke was the 6\(^{th}\) leading cause of disease burden and 10\(^{th}\) for Aboriginal males\(^94\). In 2009, 37,035 adults in WA reported being ever-diagnosed by a doctor as having a stroke\(^28\). Stroke prevalence has remained fairly consistent over the past eight years and does not appear to be influenced by whether people live in country or metropolitan areas\(^28\).

A statewide study of the incidence of stroke in 2000 using linked data highlighted that stroke incidence increased with age, with male rates being higher than female rates in the 55-84 year age group\(^73\). Statewide trends in first-ever hospitalisations for stroke using linked data showed a statistically significant age-adjusted per annum decrease of 2.9 for males and 2.3% for females over the period 1994 to 2002\(^95\). However, female rates increased significantly in the 15-54 year age group. The Perth Community Stroke Study has shown consistent declines of about one quarter in population-based stroke incidence rates from 1989 to 1990 to 1995 to 1996, and again to 2000 to 2001, to produce an overall 43% (95%CI 31% to 53%) fall in stroke incidence in parts of the northern metropolitan area over 11 years\(^96\).

Age

Adults aged 65 years and over are significantly more likely to have suffered a stroke than adults aged 25-64 years. In 2009, 8.2% of people aged 65+ years in WA had ever been diagnosed by a doctor with stroke\(^28\).

Figure 6: Prevalence of stroke for adults in Western Australia 2008/09\(^28\)

Hospitalisations

Of the 60,000 Australians that experience a stroke each year, approximately 89% will be admitted to hospital\(^26\). Approximately one in five who have a first ever stroke will die within a month and one in three will die in the first 12 months\(^12\). Over a third of those admitted to hospital will require rehabilitation services\(^12\). Stroke is the third largest impairment category for rehabilitation accounting for almost one of every ten rehabilitation episodes\(^97\).
In WA, there were 3,403 hospital admissions for stroke in 2009/10. Of these, 83% were people being hospitalised once in that year for stroke and 17% were people being hospitalised for stroke more than once that year. Over the last 10 years (1999/00-2009/10) there has been a small but significant decrease in the age standardised rate of hospitalisations for stroke (on average 2.25% per year) with no significant change for TIA.

Figure 7: Hospitalisations for stroke and TIA

Patients treated for stroke in the metropolitan area spent an average of 9 days in hospital for an episode of stroke which equated to 25,853 bed days in 2009/2010. The average length of stay and total number of bed days in metropolitan hospitals has decreased over the last 10 years from an average of 14 days and 47,961 bed days in 1999/2000.

In WA country hospitals, patients spent an average of 7 days for an episode of stroke with a total of 3,707 bed days in 2009/2010. The average length of stay and number of bed days has also decreased from 11 and 5,892 in 1999/2000.

These decreases reflect current reform policy which aims to improve quality of care and reduce unnecessary bed days.

It is estimated that 30% of strokes occur where an individual has had a previous TIA or stroke. Additionally over 50% of strokes occur in individuals that have had a previous vascular event. Recurrent strokes are more severe than first episodes of stroke. This data illustrates the importance of initiating urgent secondary prevention approaches. Over a third of those admitted to hospital for stroke will require rehabilitation services.

Aboriginal population

Across Australia, there is an unacceptable gap between Aboriginal and non-Aboriginal health outcomes and life expectancy. The incidence of stroke hospitalisations in the Aboriginal population is 2.7 times higher compared to the non-Aboriginal population. Between 2005/06 and 2009/10, 16,271 non-Aboriginal and 621 Aboriginal people were hospitalised for stroke.

A recent study highlighted the very high burden of disease for stroke in Aboriginal compared to non-Aboriginal Western Australians. The most substantial inequalities were noted from the 15-64 year old age group where age-adjusted rates were 5.1 times higher in the Aboriginal population. The findings highlight the need for increased focus on reducing Aboriginal stroke incidence and improving stroke outcomes.
Metropolitan and rural comparisons

While Western Australians generally enjoy very good health, country residents have been shown to experience poorer health than those living in metropolitan area\textsuperscript{101}. In terms of stroke, the estimated prevalence of stroke in adults 25+ years in 2009 was 2.3\% in country areas and 2.5\% in the metropolitan area\textsuperscript{98}. When the incidence of stroke in non-Aboriginal Western Australians (1997-2002) was estimated using linked data, males 15-64 years living in outer regional (rate ratio 1.27) had higher rates than those in metropolitan areas. The same study found that this was true for females living in outer regional (rate ratio 1.28) and remote (rate ratio 1.49) areas.

Besides the differentials in incidence, there are unique implications for country residents in terms of the need to travel to other country centres or the metropolitan areas for investigations, diagnosis, treatment and outpatient follow-up care.

In 2009/10, there were 529 episodes of hospitalisation for stroke in country areas in WA\textsuperscript{98}. This figure has remained relatively constant over the past ten years.

As would be expected, bed days and average length of stay data for country hospitals varies a great deal between hospital sites. This is dependent largely on whether hospitals have facilities to deal with complex cases of stroke and the need for patient transfers to other regional or metropolitan stroke units as well as population size. In 2009/10, the south west and midwest had the highest numbers of hospitalisations for stroke in the country (219, 84) and the south west and great southern had the highest average bed days (1651, 787) and length of stay (10, 8)\textsuperscript{98}.

Socio-economic differentials

The incidence of stroke is significantly higher in socially disadvantaged areas of WA, with the differentials being highest in the 15-64 year age group. A decreasing gradient in incidence was evident with increasing socio-economic status\textsuperscript{95}.

Cost

The cost of stroke in Australia is estimated to be over $2.14 billion per year\textsuperscript{1}. In WA, the costs of hospitalisations for stroke alone were approximately $48.3 million in 2009/10. This is an approximate cost of $13,283 per hospitalisation. Adjusting for inflation, this is an increase of 15\% per hospitalisation over the past 10 years\textsuperscript{98}.

Early supported discharge (ESD)

In 2009, 15\% of SMAHS stroke patients were referred to RITH. In 2010 the SMAHS RITH program provided an ESD service for approximately 400 stroke patients, 41\% under the age of 65 years. The average functional level of stroke patients was a Modified Barthel Index (MBI) score of 80-90. This is a higher level of function than similar programs used in the UK & Scandinavia where the MBI score is 50-60 \textsuperscript{102} suggesting a conservative approach. The average occasion of service (OOS) for stroke in RITH is approximately 16 visits, LOS of approximately 20 days at an average cost per patient of approximately $3000. ‘Gold standard’ ESD programs internationally report an average of 35 OOS, LOS approx 3 months – this supports the more dependent discharge functional level and longer time periods offered in these programs\textsuperscript{103}(More information on ESD can be found in Appendix 7).

Disability

Stroke also contributes considerably to the disability burden in WA for males and females (12th and 11th respectively)\textsuperscript{94}. About 88\% of stroke survivors live at home and most have a disability\textsuperscript{94}. This highlights the importance of ongoing rehabilitative support following discharge.
TIA

In WA, there were 1,266 hospital admissions for TIA in 2009/10. Patients treated for TIA in the metropolitan area spent an average of 3 days in hospital for an episode of TIA which equated to 3,006 bed days in 2009/2010. The average length of stay and total number of bed days in metropolitan hospitals has decreased over the past 11 years from an average of 5 days, and 3,119 bed days in 1999/2000.

In WA country hospitals, patients spent an average of 3 days for an episode of stroke with a total of 1,056 bed days in 2009/2010. The average length of stay has also decreased from 3.5 and and number of bed days increased from 996 in 1999/2000.

The average cost of a hospital admitted TIA episode in 2009/10 was $4,438 with a total cost of hospitalisations for TIAs is estimated to be $5,618,431 in 2009/10.

Atrial Fibrillation (AF)

Almost 25% of first ever strokes will be specifically caused by AF. At least half of the strokes in people with undiagnosed or diagnosed but untreated AF could be avoided with the use of effective stroke prevention medicines.

Projections

A study projecting the burden of stroke in WA from 2000 to 2016 predicted reductions in incidence rates at ages 55 and over. At younger ages, an increase in the number of younger non-fatal cases is anticipated, mainly due to constant or increasing incidence in the context of population growth. Additionally, the number of non-fatal first-ever males 75 years and over and females 85 years and older is predicted to increase, both of the latter being due to population ageing. Stroke fatality is predicted to remain constant at younger ages, reducing in older ages, with male trends being more favourable. In the context of constant or decreasing stroke fatality and increasing life-expectancy, durations for both sexes and all ages were predicted to increase. Thus, not only can more non-fatal cases be expected in the future, but survival will also increase.

The study predicted a substantial increase of between 30% and 40% in age-standardised total stroke burden per capita between 2000 and 2016. Despite the substantial decrease in burden per capita, the crude burden for 2016 is expected to be similar to those of 2000 because of the increase in population size, especially in the proportion of cases in the older age groups where rates are the highest. In addition, projections showed a shift of about 10% of total stroke burden from mortality burden to disability burden. This projected shift to disability burden has implications for both the quantity and quality of services offered for stroke in WA. Various studies show the dramatic effect of demographic changes on the number of stroke cases, highlighting the substantial reductions in incidence required to counteract these changes. These conclusions underscore the importance of reductions in stroke incidence through primary prevention, while at the same time continuing efforts at secondary prevention and rehabilitation to improve stroke outcomes.
Appendix 3: Evidence for treatment of stroke

Due to the high risk of early stroke recurrence following TIA or stroke, secondary prevention approaches should be initiated with some urgency. For ischaemic stroke, antiplatelet agents such as aspirin, aspirin/dipyridamole or clopidogrel may be safely started after a CT scan has excluded haemorrhage. Aspirin/dipyridamole and clopidogrel have evidence of superiority over aspirin monotherapy, although this benefit is small.

Evidence for specific treatment approaches are detailed below.

**Blood pressure lowering in acute stroke**

*Evidence*

A systematic review of interventions to alter blood pressure within one week of acute ischaemic or haemorrhagic stroke, which included 11 randomised trials and 7000 patients, concluded that pharmacologically lowering blood pressure does not have an overall beneficial effect on functional outcome (risk ratio 1.04, 95% CI 0.97–1.12; p=0.30; I²=28%)\(^{105}\). Two large trials of blood pressure (BP) lowering in acute stroke are ongoing (ENOS and INTERACT2).

**Recommendations**

1. Ischaemic stroke eligible for thrombolytic therapy:
   Very high BP (>185/110mmHg) should be treated concurrently in patients receiving thrombolytic therapy for acute ischaemic stroke in order to reduce the risk of secondary intracranial hemorrhage. [Evidence Level B].

2. Ischaemic stroke patients not eligible for thrombolytic therapy:
   Treatment of hypertension in the setting of acute ischaemic stroke should not be routinely undertaken [Evidence Level C].

   Extreme blood pressure elevation (e.g. systolic > 220 or diastolic > 120mmHg) may be treated to reduce the blood pressure by ~15 percent, and not more than 25%, over the first 24h with gradual reduction thereafter [Evidence Level C].

   Avoid excessive lowering of BP as this may exacerbate existing ischemia or may induce ischemia, particularly in the setting of intracranial arterial occlusion or extracranial carotid or vertebral artery occlusion [Evidence Level C].

3. Haemorrhagic stroke patients:
   “Until ongoing clinical trials of BP intervention for Intracranial Haemorrhage (ICH) are completed, physicians must manage BP on the basis of the present incomplete efficacy evidence. (Class IIb; Level of Evidence: C)”\(^{(p2010)}^{106}\).

   In patients those presenting with a systolic BP of 150 to 220 mm Hg, acute lowering of systolic BP to 140 mm Hg is probably safe [Class IIa; Level of Evidence: B].

**Lowering blood cholesterol**

*Evidence*

A meta-analysis of 4 Randomised Controlled Trials (RCT) of statins in patients with a history of stroke or TIA shows that random assignment to a statin is associated with a reduction in low density lipoprotein (LDL) concentration by about 1mmol/l and a reduction in the relative risk of recurrent stroke by about 12% (95% CI: 1 to 21%), compared with control.
Recommendations

- Patients with ischaemic stroke or TIA should be managed with lifestyle modification and dietary guidelines as part of a comprehensive approach to achieve LDL cholesterol of < 2 mmol/L [Evidence Level A]. Other parameters may be considered including a 50% reduction in LDL concentration or apolipidprotein B level of <0.80 g/L [Evidence Level B]107.

- Statin agents should be prescribed for most patients who have had an ischaemic stroke or transient ischaemic attack to achieve current recommended lipid levels [Evidence Level A]107.

Venous thromboembolism prophylaxis

Evidence

Graduated compression stockings:
A systematic review identified four RCTs of physical methods to reduce the risk of deep vein thrombosis (DVT) and pulmonary embolism (PE), by means of graduated compression stockings (GCS) or intermittent pneumatic compression (IPC) applied to the legs, within seven days of the onset of stroke. Overall, among the “two trials of GCS that included 2615 patients, and two small studies of IPC that included 177 patients, physical methods were not associated with a significant reduction in DVTs during the treatment period (odds ratio (OR) 0.85, 95% confidence interval (CI) 0.70 to 1.04) or deaths (OR 1.12, 95% CI 0.87 to 1.45). Use of GCS was not associated with any significant reduction in risk of DVT (OR 0.88, 95% CI 0.72 to 1.08) or death (OR 1.13, 95% CI 0.87 to 1.47) at the end of follow up. IPC was associated with a non-significant trend towards a lower risk of DVTs (OR 0.45, 95% CI 0.19 to 1.10) with no evidence of an effect on deaths (OR 1.04, 95% CI 0.37 to 2.89). This data does not support the routine use of GCS to reduce the risk of DVT after acute stroke. There is insufficient evidence to support the routine use of IPC to reduce the risk of DVT in acute stroke and further larger randomised studies of IPC are needed to reliably assess the balance of risks and benefits of this intervention” (p1-2)108.

Heparin:
Nine randomised trials were undertaken comparing heparinoids or low-molecular-weight heparins with standard unfractionated heparin, started within 14 days of stroke onset, in 3137 people with acute ischaemic stroke. The results revealed that “allocation to low-molecular-weight heparin or heparinoid was associated with a significant reduction in the odds of deep vein thrombosis compared with standard unfractionated heparin (odds ratio (OR) 0.55, 95% confidence interval (CI) 0.44 to 0.70). However, the number of more major events (pulmonary embolism, death, intracranial or extracranial haemorrhage) was too small to provide a reliable estimate of the benefits and risks of low-molecular-weight heparins or heparinoids compared with standard unfractionated heparin for these, arguably more important, outcomes. Insufficient information was available to assess effects on recurrent stroke or functional outcome” (p1-2)109. There is insufficient evidence on the safety and efficacy of anticoagulant deep vein thrombosis prophylaxis after intracerebral haemorrhage [Evidence Level C].
Recommendations:

- All stroke patients should be assessed for their risk of DVT and PE.
- “Patients at high risk include those who are unable to move one or both lower limbs and those who are unable to mobilise independently; a previous history of venous thromboembolism; dehydration; and comorbidities such as malignant disease.
- Patients at high risk of venous thromboembolism should be started on venous thromboembolism prophylaxis immediately [Evidence Level B].
- Early mobilisation and adequate hydration should be encouraged for all acute stroke patients to help prevent venous thromboembolism [Evidence Level C].
- Low molecular weight heparin should be considered for patients with acute ischaemic stroke at high risk of venous thromboembolism; or unfractionated heparin for patients with renal failure [Evidence Level B].
- The use of anti-embolism stockings for post-stroke venous thromboembolism prophylaxis alone is not recommended [Evidence Level A].
- Antithrombotics and anticoagulants should be avoided for at least 48 hours after onset of intracerebral hemorrhage [Evidence Level C]”(p1)110.

DVT prevention should be instituted early with a heparin based therapy instead of compression stocking therapy, once haemorrhage has been excluded.

The primary treatment for brain haemorrhages is treatment according to stroke unit principles, although correction of bleeding disorders (reversal of anticoagulant therapy and management of hypertension are also important. Optimal, blood pressure parameters following haemorrhagic stroke are currently not well defined, although they may become clearer with the release of the INTERACT 2 trial. Surgery may be indicated in selected cases. Prothrombotic factors such as recombinant factor VII have been shown to be hazardous and should be avoided.

**Surgery**

Treatments for intracerebral hemorrhage remain limited, but stroke unit care remains vital for these patients. The role of surgery can be considered in select patients with lobar haemorrhage after consultation with the Neurosurgeons. A protocol for decompressive surgery for malignant middle cerebral infarction has been developed by the WA Neurosciences Advisory Group.

### Table 10: Summary of the effectiveness of treating 2,000 ischaemic stroke patients each year in a population of one million people

<table>
<thead>
<tr>
<th>Strategy/intervention</th>
<th>Target population (% of all ischaemic stroke patients)</th>
<th>Death or dependency</th>
<th>Absolute risk reduction (ARR)</th>
<th>No. of dead and dependent stroke survivors avoided per year in a population of one million</th>
<th>% of 1,300 dead and dependent stroke survivors avoided per year in a population of one million</th>
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<tr>
<td>Nil</td>
<td>2,000 (0.2% of pop of 1 million)</td>
<td>65.0%</td>
<td>N/A</td>
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<td>Thrombolysis</td>
<td>200 (10%)</td>
<td>53.0%</td>
<td>47.1%</td>
<td>5.9%</td>
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<tr>
<td>Aspirin</td>
<td>1,900 (95%)</td>
<td>46.2%</td>
<td>45.0%</td>
<td>1.2%</td>
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<tr>
<td>Stroke unit</td>
<td>1,600 (80%)</td>
<td>58.7%</td>
<td>54.4%</td>
<td>4.3%</td>
<td>69</td>
</tr>
<tr>
<td>Decompressive surgery</td>
<td>40 (2%)</td>
<td>76.5%</td>
<td>60.2%</td>
<td>16.3%</td>
<td>7</td>
</tr>
</tbody>
</table>

Obsolete - for reference use only
Appendix 4: Acute Stroke Bypass Guideline 2011

1. Patients with acute stroke symptoms, onset < 1 hour to calling for ambulance.
2. Age < 80 years.
3. Obvious stroke (at least 2/3 FAST score).
5. If above criteria met the patient is taken to nearest of RPH, SCGH, SDH, or Fremantle Hospitals (even if smaller peripheral hospital is nearer).
6. Relatives/witnesses are encouraged to accompany patient.
7. Receiving hospital is PRENOTIFIED via the usual "patch" phone number, with an estimated time of arrival.
8. It is important to strictly adhere to this protocol as stroke mimics have the potential to overwhelm EDs with patients ineligible for acute stroke care.

Contraindications:

- Stroke patients experiencing seizure activity are excluded from the acute stroke guideline as tPA therapy is not appropriate.
- Where there is concern about a compromised airway the acute stroke bypass guideline should be ignored and the patient taken to the nearest appropriate hospital.

(Note: there is potential for changes to future Bypass Guidelines based on new evidence around thrombolysis)
Appendix 5: Current stroke services in WA

When MSC 2006 was developed, government policy included the closure of RPH and the relocation of services to other facilities. Under the Clinical Service Framework 2010-2020, RPH will remain open and will sit within SMAHS in terms of policy, planning and operations.

Acute Tertiary Stroke Units

RPH, SCGH and FH provide tertiary stroke unit services with variations on admission and management in accordance with local hospital issues. Based upon previous NSF audits, a major concern of WA stroke management has been access to a stroke unit for patients with stroke.

In 2010, RPH introduced an open-ended stroke unit. In this unit, patients requiring stroke care on a stroke unit were admitted and the issue of exit of the patients to the most appropriate site or method of rehabilitation was considered the priority issue rather than entry restrictions due to insufficient beds. All patients presenting to RPH with stroke are currently assessed for stroke unit admission (either to the stroke unit, or to geriatric medicine on the basis of comorbidities primarily by an ED assessment).

An acute stroke unit is planned at FSH from 2014, at which time the acute stroke units at RPH and FH will close, although RPH with its ED facilities will provide an acute admission service with stroke unit standard care, before transfer when medically stable.

To maintain stroke unit beds in SMAHS, an acute stroke unit is also planned at AKMH to complement the rehabilitation stroke unit and to provide local care to patients with acute stroke. Additional acute beds may be required at RGH, SDH and into the northern sector depending on planning studies. Stroke patients will be triaged away from the RPH emergency department to other acute stroke units.

Comprehensive Stroke Units

SDH has a comprehensive stroke unit providing acute and rehabilitation care. The Unit services approximately 300 patients per year including thrombolysis management. A comprehensive stroke unit is now under consideration for AKMH, based on the success of the SDH stroke unit, and demographic needs. This will require the addition of an acute service to the current rehabilitation stroke plans.

Comprehensive Stroke Units are planned for MHC (from 2015) and RGH (from 2011); There are future plans for the establishment of a comprehensive stroke unit at Joondalup Health Campus.

Statewide Neuro-Rehabilitation Centre

The Tertiary State-wide Neuro-rehabilitation Unit sets standards for neurorehabilitation services that are evidence-based and benchmarked to comparable units in Australia and worldwide. Other roles of this unit include setting standards for the rehabilitation referral group, training of doctors, nurses and allied health staff for the state neuro-rehabilitation network; and initiating and overseeing clinical research for neuro-rehabilitation.

From 2014 rehabilitation care will be provided through the State Rehabilitation centre at FSH for under 65 year olds, and at the comprehensive stroke units at RGH and AKMH hospital with rehabilitation care alone being provided at FH and BH.
Stroke-Rehabilitation

The stroke-rehabilitation units, are included within the CSUs at SDH and the soon to be opened RGH stroke unit and geographically linked to aged care units at OPH and BH. Further rehabilitation stroke units are planned for AKMH (to be expanded to a CSU) and for FH (when the tertiary SU is reduced to a rehabilitation SU) after the opening of FSH.

The OPH model of rehabilitation stroke care with a strong emphasis on their early supported discharge programme, and the BH rehabilitation stroke unit with a strong emphasis on their RITH programme are models of care that emphasise the importance of early discharge from hospital and community based care. Similar models should be incorporated into all stroke units both current and future planned.

ESD

Early Supported Discharge programs offer intensive rehabilitation at home as an alternative to inpatient care. Early means that these programs have the potential to reduce hospital LOS by 8 days. These are offered in the Perth metropolitan area. Staff have specialist skills and knowledge in the management of stroke patients and expertise in community based rehabilitation and services. These programs may be run as a specialised, stroke-specific arm of well established HITH (NMAHS) or RITH (SMAHS) services, concentrating on facilitating early discharge as above. Alternatively, the ESD service can be embedded within the stroke rehabilitation service, as at OPH.

In 2010 Commonwealth SAC funding has allowed the implementation of RITH programs in Geraldton and Bunbury Regional Resource Centres within WACHS. These programs are being developed utilising a very flexible model as a component of the rehabilitation and aged care stream of services in these local areas.

(More detail on these programs can be found in Appendix 7).

Rural Regional Hub Centres

Since the last MSC 2006, there have been a number of key developments which have occurred with respect to improving stroke care. Bunbury, Kalgoorlie, Geraldton and Albany have been identified as major regional centres which would benefit from the development of Primary Stroke Centres, based on the number of patients treated, the population served, and distances to the Perth metropolitan area. These units would be managed by local physicians with special interest in stroke as part of multidisciplinary stroke care teams, and supported with a specialist stroke service via telehealth to metropolitan hospitals with the intention of more rural stroke survivors to be cared for closer to home. Stroke care in these regional resource centres is being integrated and supported within the WA Subacute Care Plan.
Appendix 6: Proposed Stroke Care Pathway for Rural
Appendix 7: Components of Early Supported Discharge

Following on from stroke unit care, early supported discharge (ESD) models of practice provide the second most important aspect of stroke care for mild to moderate severity strokes to achieve the best possible outcomes for patients. These services are designed to reduce the length of inpatient acute and rehabilitation phases providing stroke patient care in the patient’s own home and community environment. It improves the transition of hospital to community care and studies report improved functional levels for patients who are offered this service. ESD programs originate from Scandinavian countries and the UK and have been adopted in Perth, WA over the past 5 years. There are several programs providing ESD for stroke patients. These are:

- SMAHS Rehabilitation in the Home (RITH);
- NMAHS Home Link (RITH);
- NMAHS OPH Stroke ESD program; and
- Community rehabilitation options are currently under consideration for regional areas.

Early Supported Discharge

ESD is a hospital substitution model that provides rehabilitation in a patient’s home with the aim of reducing LOS. ESD services should be considered an extension of stroke unit care rather than an alternative. It has been found that ESD services reduce inpatient LOS and adverse events (e.g. readmission rates) while increasing the likelihood of being independent and living at home, particularly those with mild to moderate disability 79. Stroke survivors have also reported greater satisfaction following ESD than conventional care. Stroke unit care combined with early supported discharge improves 5-year outcome: a randomized controlled trial111 112. In Western Australia, ESD services are currently provided by RITH SMAHS (since 2006), NMAHS Home Link RITH (2009) and Osborne Park Hospital for NMAHS (November 2010). The SMAHS & NMAHS RITH program links into all hospitals within the metro area accepting stroke referrals from all hospitals and across the continuum of care such as ED, acute stroke unit or medical ward, inpatient rehabilitation or community referral. Program entry is based on clinical assessment of the patient and the suitability of the home environment.

Key components of an ESD service include that it is:

1. Early: on average, patients discharged to ESD in the trials are able to leave hospital 8 days earlier than those offered non-ESD rehabilitation programs112.
2. Supported: average therapy intensity is 3-6 days per week for up to 12 weeks. The ESD approach must be multidisciplinary.
3. Seamless: integration of the ESD service with the inpatient and outpatient services allows a seamless transition of rehabilitation, and avoids duplication of assessments. This also facilitates early discharge (on average 10 days earlier) than where an external ESD service provides ‘in-reach’ services.
4. Stroke specific: It is well demonstrated in all phases of stroke care - acute assessment, acute stroke unit care, CSU care, inpatient stroke rehabilitation unit care - are superior to ‘generic’ rehabilitation. Whilst less certain in the ESD literature, it is implied that this specificity also translates to improved outcomes.

The greatest benefits in ESD are seen in patients with mild to moderate strokes who are offered a coordinated team approach to their home based rehabilitation.
The literature on ESD shows cost neutrality or savings, with equivalent or even superior functional outcomes. Patient and carer satisfaction surveys are extremely supportive of the suggestion that for suitable patients this option is preferable to inpatient therapy. Local data from OPH, NMAHS RITH and SMAHS RITH strongly confirms this.

**WA programs**

RITH, an early supported discharge program, is operational as an area wide service across the whole of the metro area. SMAHS and NMAHS RITH, accept referrals from all SMAHS and NMAHS hospitals and cross refer depending on patient residential suburbs. RITH has grown considerably over the past 5 years and in 2010 the SMAHS and NMAHS RITH programs managed approximately 400 and 122 stroke patients respectively.

Within NMAHS another stroke specific ESD program also operates from the secondary stroke unit at OPH for patients >65yrs.

Recently Commonwealth sub-acute care funds have further supported the SMAHS RITH and NMAHS Home Link programs to increase the ESD model of care delivery in the metro area. Community rehabilitation options are currently under consideration for regional areas. Service planning in WACHS supports the incorporation of these programs into the aged care, rehabilitation and sub acute services.
Appendix 8: Areas of Focus for Workforce Development

1. Training programs for non-stroke specific services

- There is increasing evidence and support for the development of generalist roles across all aspects of long term care or even rehabilitation depending on the level of functional disability of stroke patients. A focus on a generalist training approach has significant benefits for training a diverse section of the workforce with competencies in stroke care and management. It also allows for earlier discharge from specialist units. Stroke medicine should also continue to be incorporated into the training of local general physicians and GPs.

- There is a need to provide more education to general medical wards for care of acute stroke patient where patients are not being cared for in a stroke unit for reasons of co-morbidities.

- The workforce, training and professional development group of the ASC met with members of the Royal Australian College of Physicians to discuss stroke specific education programs (who oversee Neurology, Geriatric, rehabilitation and general physician training programs). Partnerships with this group should be established to address the training needs of those in various fellowship training programs.

- Due to the constant rotation of staff, there is a need for ongoing education and structured training programs regarding essential acute management of TIA and stroke in ED (as per recommendation 3.2 in NSF Clinical Guidelines for Stroke Management 2010). The National Institute of Clinical Studies has published an ED Stroke and TIA ‘care bundle’ that could underpin such educational packages. The University of Western Australia (UWA) E-Ageing Stroke Module provides an interactive case study including diagnosis, treatment and rehabilitation of a patient who has experienced an acute stroke.

- Links should be facilitated with the WA Subacute Care Training and Development Unit and WACHS Regional Resource Training Centres as per Subacute Care Plan WA 2009-2013. This will provide mechanisms to share clinical skills and knowledge across hospital sites with specialist staff educating and upskilling staff by conducting site visits or by telehealth. This is of particular benefit where staff attrition rates are high, such as in rural and remote sites.

2. National stroke specific training program

- The ASC Executive has approved a plan to create a National Stroke Specific Education Framework (SSEF) as an overarching guide for stroke curriculum development. There is a need for a focus on continued education for health professionals already involved in stroke care, colleagues not directly involved in stroke care, as well as the general public.

- Provision of structured training programs regarding TIA management and tPA delivery will greatly facilitate standardised and best practice care.

- The Victorian Stroke Care Education Group is leading a project to develop an online educational resource. 12 modules out of 14 have been developed. These cover different aspects of stroke care.

- Specialist staff and generalist staff in rural health settings in allied health disciplines to be provided with the ongoing clinical training, across campuses, to initially up-skill and to maintain skill levels at optimum and up to date levels.

3. Formal post graduate training in stroke care

- Very few post graduate programs that provide stroke specific training exist in Australia. Two exceptions are the Graduate Diploma of Neurological Rehabilitation at the UWA which is a program available only to qualified physiotherapists (www.cms.uwa.edu.au)
and the Stroke Management Specialisation stream of the Master of Health Science at the University of Newcastle (www.GradSchool.com.au). The latter inter-professional program comprises a number of online modules which address stroke epidemiology, acute management and rehabilitation. SCGH also provides a state postgraduate neuroscience (neurology/stroke, neurosurgery and neuro-ICU) nursing program. Consideration should also be given to the availability of training programs for non-specialists with a focus on practical skill development.

- WACHS is working towards ongoing provision of the Stroke Clinical Leadership Program as the minimum standard of stroke education.
- Clearly undertaking stroke specific education will enhance staff skill and knowledge levels, encourage retention within the specialty, and indirectly improve the quality of care provided. In order to encourage uptake of specialised post graduate training, particularly for allied health staff, access to financial assistance and other study support (for instance leave allowances, and opportunity for ongoing clinical experience in the area) is required. There is currently considerable inequity between facilitators to engage in formal post graduate study offered to medical and nursing staff compared to allied health professionals (eg funding support, leave, career pathways etc).

4. Building and retaining stroke expertise

- An improved career structure will enable more teaching time and a higher level of specialised training to be available to all levels of staff in the services. The provision of standardised, discipline-specific programs in ‘basic stroke care’ and ongoing professional development will attract more staff to the area, encourage building of expertise and attainment of higher positions in specialty areas.
- Continuing development of nursing and allied health clinical specialist roles is required for developing stroke units. Staffing models should include rotation of staff between acute and rehabilitation services, (and possibly country and metro services) to encourage broad experience to be gained and retention of upskilled staff within stroke services. Rotation of staff into areas of desired specialisation, and the ability to remain for adequate lengths of time in these areas, would enable and encourage specialisation and retention of staff.
- A coordinated effort is required to train and retain specialised staff progressively as the new units are opened.
- The problems of staff injury and burnout in physiotherapy, occupational therapy and nursing are factors that also influence staff retention levels. High quality education including manual handling skills and quality practice may ameliorate these factors.

5. Increasing engagement with stroke

- The workforce, training and professional development group of the ASC have committed to developing an undergraduate stroke package and letter outlining contents for distribution. The group are compiling a simple pack of information with a supporting letter which will be mailed out to relevant health related courses. The aim is to develop an information pack of resources.
- Education that identifies stroke as a specialist area and offers training at all levels (undergraduate and postgraduate) needs to be coordinated through the Universities, Professional Associations and the tertiary facilities.
- It may be possible to influence curriculum in undergraduate programs across generalist, nursing and allied health to increase exposure to stroke patients. The move towards evidence based interdisciplinary education programs occurring within some educational institutions in WA will facilitate this.
Improved levels and quality of teaching for undergraduate students in the non-tertiary units will attract graduates to the specialty. Undergraduates should be exposed to specialised neuro-rehabilitation during their neurology placements wherever possible.

More experienced clinicians should be encouraged and given the capacity to embrace teaching and mentoring roles to ensure that WA expand the breadth of stroke knowledge in the workforce. Additionally they can aid in promoting stroke as a specialty with undergraduates and support the maintenance of effective skills.

6. Increasing public awareness

Close liaison is needed with the NSF’s public education campaigns to ensure that consistent messages about stroke management and prevention are conveyed. This includes the FAST campaign which aim to educates the community on the way to recognise a stroke event and the importance of early presentation to hospital, and ‘Know your numbers’ a preventative initiative to encourage members of the public to be more aware of the impact of hypertension.

7. Culturally appropriate education for stroke survivors and carers

It is necessary to continue to explore different models of patient and family/ carer education and training across the spectrum of care.

Close liaison and development of stronger partnerships with the NSF consumer liaison service, NCWA and other consumer community organisations is needed to better support and educate both stroke survivors and carers.
Appendix 9: Measuring Clinical Care

Measuring clinical care: Data collection, audits and quality control

In order to measure and improve the quality of care for stroke survivors in WA, stroke services will be monitored using the Australian Stroke Clinical Registry (AuSCR), the framework from the NSF’s clinical audit, the National Performance Indicator Set (NPIS) and Australasian Rehabilitation Outcomes Centre (AROC).

An electronic data collection tool has been developed to collect stroke specific data. This data collection tool will use existing hospital information systems and add manually entered data points to allow for bulk exporting of data to AuSCR and the NSF for registry, audit and other quality improvement programs.

The WA Department of Health (DoH) is the data custodian and data will be extracted from the DoH central data store and exported to AuSCR and the NSF acute and subacute audits as required.

The Australian Stroke Clinical Registry

The AuSCR is a database that will be used to significantly improve the quality of hospital care in Australia for all patients admitted with stroke or TIAs. The information recorded in the AuSCR database will allow individual hospitals to monitor the care they provide to patients. National and state-based comparisons of the quality and outcomes of care are also possible. The goal of the AuSCR database is to obtain the most accurate picture about stroke, the care received everyday by patients who have had a stroke, and whether or not the best-quality interventions are being provided to all stroke patients. Collecting the data is not, in itself, sufficient to improve quality of care. Systems are in place within AuSCR to ensure that data is analysed in a timely manner with clinical interpretation on findings, and then fed back to appropriate personnel/bodies to ensure that appropriate action occurs.

The National Performance Indicator Set

A National Audit program was initiated by the NSF in 2007 under the guidance of a panel of experts representing each member of the stroke team (National Advisory Committee). This program was used to measure adherence to the Clinical Guidelines for Acute Stroke Management across the nation, and also to determine whether equitable care was being accessed regardless of geographical location. The full complement of indicators measured in the National Stroke Audit- Acute Stroke Management 2007 had been derived from the evidence-based Clinical Guidelines for Acute Stroke Management 2003. The audit program will be conducted biennially to track data longitudinally within the same health care organisations. The data will be used to understand whether key processes of care are stable.
## Acknowledgements

The Neurosciences and Senses Health Network, Stroke Review Committee and key contributors have developed the Model of Care for Stroke.

<table>
<thead>
<tr>
<th>Aboriginal Health Division Department of Health WA</th>
<th>Activity Based Funding Team Quality Improvement Directorate, Performance Activity and Quality Division, Department of Health WA</th>
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<tbody>
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<td>Professor Garry Allison * Dean, Research and Graduate Studies, Faculty of Health Sciences, Curtin Health Innovation Research Institute Curtin University</td>
<td>Dr Tony Alvaro Consultant Neurologist Fremantle Hospital</td>
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<td><strong>Neurological rehabilitation Unit</strong></td>
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| **Ms Katie Kyle  
A/Program Manager, Homelink** | **Dr Amanda Ling *  
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<th><strong>National Stroke Foundation</strong></th>
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<td>Ms Rebecca Naylor, Divisional Director Stroke Support</td>
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<th><strong>Mr Chris Price, * Divisional Director, Stroke Services</strong></th>
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<td>Aged and Continuing Care Directorate</td>
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| **Ms Sue Shannon  
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Staff from the Health Networks Branch at the Department of Health WA are acknowledged for their contributions to developing this Model of Care, including Joanne Cronin, Senior Development Officer at Health Networks Branch, Office of the Chief Medical Officer.

We would also like to acknowledge South Australia’s Stroke Services Plan 2009-2016. SA Department of Health. Statewide Service Strategy Direction which provided direction for the development of this document.
Acronyms

ABF  Activity Based Funding
ACAT  Local Aged Care Assessment Teams
AF  Atrial Fibrillation
AKMH  Armadale Kelmscott Memorial Hospital
AROC  Australian Rehabilitation Outcomes Centre
ASTN  Australian Stroke Trialists Network
ASC  Australian Stroke Coalition
ASSEF  Australian Stroke Specific Education Framework
ATSI  Aboriginal and Torres Straight Islander
AuSCAR  Australian Stroke Clinical Registry
AVERT  A Very Early Rehabilitation Trial
BH  Bentley Hospital
BP  Blood Pressure
CI  Confidence Interval
CMP  Care Management Plan
CSU  Comprehensive Stroke Unit
CT  Computed Axial Tomography
DVT  Deep Vein Thrombosis
ECG  Electrocardiogram
ED  Emergency Department
ESD  Early Supported Discharge
FH  Fremantle Hospital
FIM  Functional Movement
FSH  Fiona Stanley Hospital
GCS  Graduated Compression Stockings
GP  General Practitioner
HDU  High Dependency Unit
Hg  Haemoglobin
ICU  Intensive Care Unit
ICH  Intra-cranial Haemorrhage
IPC  Intermittent Pneumatic Compression
LDL  Low Density Lipoprotein
LOS  Length of Stay
MBI  Modified Barthel Index
MDT  Multidisciplinary Team
MHC  Midland Health Campus
MRI  Magnetic Resonance Imaging
MSC  Model of Stroke Care for WA
NCWA  Neurological Council of WA
NMAHS  North Metropolitan Area Health Service
NPIS  National Performance Indicator Set
Glossary

**Carer:** Any person who (without being paid) provides ongoing support or assistance to a person with a disability, chronic illness, mental illness or who is frail.

**Cultural safety:** This is defined as an outcome of health practice and education that enables safe service to be defined by those who receive the service. An environment that is safe for people: where there is no assault, challenge or denial of their identity, or who they are and what they need. It is about shared respect, shared meaning, shared knowledge and experience, of learning, living and working together with dignity and truly listening.
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