New Zealand Clinical Guidelines for
Stroke Management
2010

Disclaimer

This document is a general guide to appropriate practice, to be followed subject to the clinician's judgment and the patient's preference in each individual case. The guideline is designed to provide information to assist decision-making and is based on the best evidence available at the time of development. Copies of the document can be downloaded through the Stroke Foundation of New Zealand website: www.stroke.org.nz.

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About the Stroke Foundation of New Zealand

Established in 1981, the Stroke Foundation of New Zealand is a not-for-profit organisation working to reduce the incidence of stroke and improve outcomes after stroke.

The Foundation's primary purposes are to:

- save lives
- improve outcomes
- enhance life after stroke for the community affected by stroke.

The Foundation seeks to achieve these by:

- educating the public about risk factors and signs of stroke, and promoting healthy lifestyles
- working with health service providers to improve access to, and delivery of, the highest-quality stroke services
- providing community-based support and information services.

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Key messages

Need for organised stroke services

Much has happened since the publication of the last New Zealand stroke guideline in 2003, 'Life after stroke' (Baskett & McNaughton, 2003) and after seven years, revision of the guideline is considered overdue.

However, the two most important recommendations in this guideline have not changed since 2003, and the critical areas of stroke management where a change in practice would make an important difference to outcomes for people with stroke remain.

1.   All District Health Boards (DHBs) should provide organised stroke services.

2.   All people admitted to hospital with stroke should expect to be managed in a stroke unit by a team of health practitioners with expertise in stroke and rehabilitation.

Implementation of the evidence-based practice described in this guideline is critically dependent on provision of these services by DHBs.

Frameworks for provision of organised stroke services in DHBs of all sizes in New Zealand have been updated since 2003 to explicitly include acute stroke thrombolysis, pathways for management of transient ischaemic attack (TIA) and community stroke teams, and are detailed in the chapter 'Stroke service provision in New Zealand'.

The 2003 definition of a 'stroke unit' has been retained.

A 'stroke unit':

-   is a geographically-located area where people with stroke are managed

-   has staff organised into a coordinated interdisciplinary team

-   has staff who are knowledgeable and enthusiastic about the management of stroke

-   provides ongoing education about stroke for staff, people with stroke and caregivers

-   has written protocols for the assessment and management of common problems related to stroke.

Since 2003 there has been a significant increase in availability of organised stroke services and stroke unit care across New Zealand; however, many gaps still remain. A national audit of acute stroke services was performed in 2009 (SFNZ, 2010). Only 39% of stroke patients in New Zealand are admitted to a stroke unit. While more than 80% of the New Zealand population now lives in a DHB which provides an acute stroke thrombolysis service, last year only 3% of patients admitted to hospital with stroke received this treatment (SFNZ, 2010).

Data from the Auckland Regional Community Stroke studies spanning more than three decades has described trends in stroke incidence in New Zealand and enabled projections for the future (ARCOS Study Group, 2009). Striking ethnic differences have emerged. While there has been a significant fall in stroke incidence among the New Zealand European population between 1981–1982 and 2002–2003 there has been no fall in stroke incidence among Māori over the same period and stroke incidence among Pacific peoples appears to have increased. The mean age of first stroke is 61 years in Māori and 65 years in Pacific people, compared with 76 years in the New Zealand European population (Carter et al, 2006).

Organised stroke services should be available to, accessible to and effective for all New Zealanders, irrespective of where they live, their age, gender or ethnicity. The inclusion of specific chapters addressing Māori and Pacific peoples' perspectives on stroke management recognises the importance of cultural competency in stroke care in New Zealand.

Highlighted stroke service recommendations

Recommendations	Grade
All District Health Boards (DHBs) should provide organised stroke services.	✔
All people admitted to hospital with stroke should expect to be managed in a stroke unit by a team of health practitioners with expertise in stroke and rehabilitation.	✔
Large and medium-sized DHBs should provide an acute stroke thrombolysis service for their populations.	✔
All DHBs should provide a transient ischaemic attack (TIA) service in accordance with the NZ TIA Guideline (2008).	✔
Large DHBs can provide organised stroke-specific community teams.	✔
Māori and Pacific participation in decision-making, planning, development and delivery of stroke services should be supported. Stroke services should work, where possible, with Māori and Pacific providers.	✔
Community services should be equally accessible for stroke patients under 65 years as those 65 years and over. Community services for stroke patients under 65 years should be responsive to the needs of Māori and Pacific peoples.	✔
Health practitioners and others providing stroke care should receive training and support in delivering culturally-competent, patient-centred care; including understanding the impact of culture on illness and rehabilitation.	✔

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✔ Consensus-based recommendations (GPP)

Highlighted new stroke management recommendations

Recommendations	
Stroke recognition	**Grade**
The general public should receive ongoing education emphasising how to recognise the symptoms of stroke and the importance of early medical assistance (Jones et al, 2010; Muller-Nordhorn et al, 2009) – see part 3, section 2.1.	**B**
The FAST (face, arm, speech, time) message is appropriate for public awareness campaigns about both TIA and stroke – see part 3, section 2.1.	✔
The delivery of public awareness programmes should be tailored to specific target audiences, such as Māori and Pacific people – see part 3, section 2.1.	✔
Thrombolysis and pre-hospital care	**Grade**
Intravenous tPA should be given as early as possible in carefully selected patients with acute ischaemic stroke as the effect size of thrombolysis is time-dependent. Where possible intervention should commence in the first few hours but may be used up to 4.5 hours after stroke onset (Wardlaw et al, 2009; Lansberg, 2009b) – see part 3, section 4.1.	**A**
Stroke patients should be given a high priority designation by ambulance services (Quain et al, 2008; Mosely et al, 2007; Lindsberg et al, 2006; Bray et al, 2005b; Belvis et al, 2005) – see part 3, section 2.2.	**C**
Ambulance services should use a validated rapid pre-hospital stroke-screening tool and incorporate such tools into pre-hospital assessment of people with suspected stroke (Bray et al, 2005a; Nor et al, 2004; Kidwell et al, 2000; Kothari et al, 1999) – see part 3, section 2.2.	**B**
Secondary prevention	**Grade**
Low dose aspirin and modified release dipyridamole or clopidogrel alone should be prescribed to all people with ischaemic stroke or TIA taking into consideration patient comorbidities (Sacco et al, 2008) – see part 3, section 5.4.	**B**
Aspirin alone can also be used, particularly in patients who do not tolerate aspirin plus dipyridamole or clopidogrel (Antithrombotic Trialists, 2002) – see part 3, section 5.4.	**A**
Eligible, stable patients should undergo carotid endarterectomy as soon as possible after the stroke event (ideally within two weeks) (Rothwell et al, 2004) – see part 3, section 5.7.	**A**
Rehabilitation and recovery	**Grade**
Rehabilitation should be structured to provide as much practice as possible within the first six months after stroke (Kwakkel et al, 2004) – see part 3, section 6.1.	**A**
Managing secondary complications	**Grade**
All patients, particularly those with swallowing difficulties, should have assistance and or education to maintain good oral and dental hygiene (including dentures) – see part 3, section 7.2.	✔
Low molecular weight heparin or heparin in prophylactic doses can be used with caution for selected people with acute ischaemic stroke at high risk of DVT/PE. If low molecular weight heparin is contraindicated or not available, use unfractionated heparin (Sandercock et al, 2008c; Shorr et al, 2008) – see part 3, section 7.12.	**B**
Thigh-length antithrombotic stockings are NOT recommended for the prevention of DVT/PE post stroke (Clots Trials Collaboration, 2009) – see part 3, section 7.12.	**B**

Grade description

A   Body of evidence can be trusted to guide practice

B   Body of evidence can be trusted to guide practice in most situations

C   Body of evidence provides some support for recommendation(s) but care should be taken in its application

D   Body of evidence is weak and recommendation must be applied with caution

✔   Consensus-based recommendations (GPP)

Summary of recommendations

This section lists the recommendations presented in the guidelines along with the relevant section where the supporting evidence is discussed. Each recommendation is given an overall grading based on Australian National Health and Medical Research Council (NHMRC) levels of evidence and grades of recommendation (2008–2010). Where no robust Level I, II, III or IV evidence was available but there was sufficient consensus within the New Zealand Reference Group, good practice points have been provided.

In general, where the evidence is clear and trusted, or where there is consensus on the basis of clinical experience and expert opinion (good practice point), the word 'should' has been used to indicate that the intervention should be routinely carried out. Where the evidence is less clear or where there was significant variation in opinion in the literature, the word 'can' has been used. Individual patient factors should always be taken into account when considering different intervention options.

Grading of recommendations (NHMRC 2008–2010)

Grade of recommendation	Description
A	Body of evidence can be trusted to guide practice
B	Body of evidence can be trusted to guide practice in most situations
C	Body of evidence provides some support for recommendation(s) but care should be taken in its application
D	Body of evidence is weak and recommendation must be applied with caution

Good practice point (✓)	Recommended best practice based on clinical experience and expert opinion

Part 2: Stroke in New Zealand

Māori and stroke

Recommendations	

Policy	Grade
Stroke services, including funding and planning agencies, should work with iwi, hapū, whānau and Māori communities to develop strategies for Māori health gain and to reduce inequalities.	✔

Data	Grade
Ethnicity data is collected using the New Zealand Census question.	✔
Stroke services should provide training on 'ethnicity data collection' to appropriate staff.	✔

Workforce	Grade
A benchmark audit of the stroke workforce including ethnicity should be undertaken.	✔
A plan and appropriate budget should be developed to recruit, train and retain a Māori stroke workforce.	✔
Māori health worker capability in stroke should be supported. Māori health workers should receive training and education about stroke and local stroke protocols.	✔
All stroke workers should receive appropriate training and support in cultural safety and cultural competency.	✔

Organised stroke services	Grade
Māori participation in decision-making, planning, development and delivery of stroke services should be supported. Stroke services should work, where possible, with Māori providers.	✔
Audits in stroke care should identify, and modify, differential stroke service provision by ethnicity.	✔
Outcomes specific to Māori with stroke should be developed.	✔
Provide an appropriate resource package, such as the 'Life After Stroke: four inspirational stories from Māori and Pacific people with stroke' DVD to person and their whānau within three months of stroke; ensure timely follow-up with a provider (GP, Stroke Foundation Officer or other) for clarification or reinforcement of the information provided and assistance with goal setting.	✔
Develop culturally-appropriate services, information and resources for Māori with stroke and their whānau.	✔

Whānau ora	Grade
'Whānau' is defined by the person with stroke.	✔
Goal-setting exercises should also consider the wellbeing of whānau; their physical, emotional, cultural, and social needs should be identified and addressed.	✔

Cultural	Grade
Providers should consider the cultural beliefs and practices of the person with stroke and respond appropriately to the person's preferences.	✔
Providers should facilitate access to cultural expertise for Māori with stroke including traditional healing (karakia, rongoa, mirimiri), te reo me nga tikanga Māori.	✔
Providers should seek Māori cultural input at times of assessment, goal setting and discharge planning when appropriate.	✔
Research	**Grade**
Stroke services should develop a research programme that provides evidence on access to, quality of care through and outcomes of stroke care for Māori. Interventions should be developed specifically for Māori with stroke, and their effectiveness measured.	✔
Kaupapa Māori research methodologies, including equal explanatory power, should be utilised in stroke research.	✔

Pacific people and stroke

Recommendations

Quality of health care	Grade
For Pacific people, a programme to reduce the incidence of stroke should have health promotion and prevention as its primary focus. Health promotion materials and mechanisms should reflect the needs of the communities they serve, and be delivered in an appropriate manner.	✔
Health systems planners need to ensure that information about stroke, support services and related health-promotion materials reflect the needs of the communities they serve, and are delivered in an appropriate manner.	✔
The establishment of Pacific community support networks specific to stroke in appropriate geographical locations should be facilitated.	✔
Service providers should support improvements in culturally-competent, patient-centred care by collecting accurate ethnicity data, monitoring the effectiveness of care, and reviewing patient experiences.	✔
Research that provides further quantitative information, and includes qualitative research capturing the experiences of Pacific people with stroke, should be developed. Capability development needs to be a key part of a research programme.	✔
Research needs to reflect the ethnic diversity of the Pacific community and ensure that the findings are shared with the community from which they were generated.	✔
Health provider organisations and practitioners should be aware that they are required to meet quality of service obligations under the New Zealand Health and Disability Code of Rights.	✔

Valuing family	Grade
The role of the family, extended family and community should be acknowledged and empowered by identifying attitudes and beliefs that the individual and family have towards stroke.	✔
Sufficient time should be set aside for communication and this process should be facilitated early in post-acute care by a culturally-competent health practitioner, and in an appropriate environment. This is especially important for Pacific people who have limited English (eg, older Pacific people and recent migrants).	✔
Health practitioners should ascertain: • the person with stroke's attitudes and beliefs concerning their illness, their sense of personal responsibility for recovery/regaining function, their expectations about their family's role in caring for them and their beliefs regarding traditional healing practices • the person with stroke's willingness to implement change based on these beliefs and expectations • the family and extended family's beliefs about stroke causation, expectations of post-stroke function and beliefs about post-stroke care • the consequent barriers to change for that individual. Health practitioners, or a culturally-competent facilitator, should then negotiate the changes that are possible, realistic, culturally acceptable and affordable.	✔
Respecting Pacific culture	Grade
Health practitioners and others providing stroke care should receive training and support in delivering culturally-competent, patient-centred care; including understanding the impact of culture on illness, rehabilitation and recovery.	✔
Health practitioners should recognise that the term 'Pacific' represents diverse ethnic groups, and increasingly includes multi-ethnic and New Zealand-born Pacific people.	✔
Health practitioners should consider the impact of cultural and spiritual beliefs and respond to the preferences of the patient in order to enhance the therapeutic relationship.	✔
Workforce development should target the training of more Pacific stroke care providers and researchers to increase the capacity and capability of Pacific health workforce.	✔
Pacific people with stroke may prefer to see Pacific providers. Pacific providers in the area are a valuable resource, and should be consulted for advice on approaches or made available to the patient during management of stroke in Pacific peoples.	✔

Working together	Grade
For Pacific people with stroke, a culturally-competent health care worker should be involved from early in the post-acute phase of care, to support the person with stroke and their family in the following areas: • planning of care and the provision of information to the patient and their family • setting recovery goals collaboratively with the patient and their family • developing a comprehensive discharge programme and ensuring safe transfer of care • facilitating contact with community health workers who support the person with stroke and their family post discharge.	✔
Health practitioners and others providing stroke care should ascertain a person's specific needs related to communication of information, including an interpreter where necessary, and ensure that these are met.	✔
Health practitioners and others providing stroke care should be aware that socioeconomic circumstances will impact on the care of the Pacific person with stroke. There may be financial obligations (to the family and church), which may take priority over personal and health needs.	✔

Younger adults and stroke

Recommendations

Younger adults and stroke	Grade
Community services should be equally accessible for people with stroke aged under 65 years as for those aged 65 years and over.	✔
Community services for people with stroke aged under 65 years should be responsive to the needs of Māori and Pacific peoples.	✔
People with stroke who wish to work should be offered assessment (ie, to establish their cognitive, language and physical abilities relative to their work demands) and assistance to resume or take up work or referral to a supported employment service.	✔
Research on New Zealand stroke rehabilitation and community support services for people with stroke aged under 65 years should be a priority area.	✔

Stroke services

Recommendations	
Stroke service provision	**Grade**
All District Health Boards (DHBs) should provide organised stroke services.	✔
All people admitted to hospital with stroke should expect to be managed in a stroke unit by a team of health practitioners with expertise in stroke and rehabilitation.	✔
Large and medium-sized DHBs should provide an acute stroke thrombolysis service for their populations.	✔
All DHBs should provide a TIA service in accordance with the NZ TIA Guideline (2008).	✔
Large DHBs can provide organised stroke-specific community teams.	✔
Māori and Pacific participation in decision-making, planning, development and delivery of stroke services should be supported. Stroke services should work, where possible, with Māori and Pacific providers.	✔

Stroke prevention

Recommendations	
Stroke prevention	**Grade**
New stroke prevention strategies are required to address ethnic inequalities in stroke incidence in New Zealand.	✔
Stroke prevention strategies should also be targeted to people with socioeconomic disadvantage.	✔
Stroke prevention strategies should be implemented as a part of a broader cardiovascular disease and diabetes prevention programme.	✔

Part 3: Review of Evidence and Evidence-based Recommendations

1.   Organisation of services

Recommendations	
1.1 Hyper-acute care recommendations	**Grade**
Local protocols developed jointly by staff from pre-hospital emergency services, the hospital emergency department and the acute stroke team should be used for all people with suspected stroke. Such protocols should include systems to receive early notification by paramedic staff, high priority transportation and triage, rapid referrals from ED staff to stroke specialists and rapid access to imaging (Kwan et al, 2004b; Bray et al, 2005a; Belvis et al, 2005; Lindsberg et al, 2006; de Luca et al, 2009; Quain et al, 2008; Hamidon & Dewey, 2007).	C
1.2 Hospital care	**Grade**
1.2.1 Stroke unit care	
All people with stroke should be admitted to hospital and be treated in a stroke unit with an interdisciplinary team (SUTC, 2007).	A
All people with stroke should be admitted directly to a stroke unit (preferably within three hours from stroke onset) (Silvestrelli et al, 2006).	C
Small and medium-sized District Health Boards (DHBs) should consider models of stroke care that adhere as closely as possible to the criteria for stroke unit care. Where possible, patients should receive care in geographically-discrete units (SUTC, 2007; Langhorne et al, 2005).	B
If people with suspected stroke present to non-stroke unit hospitals, transfer protocols should be developed and used to guide urgent transfers to the nearest stroke unit hospital (de la Ossa et al, 2008; Muller et al, 2007).	C
1.2.2 Ongoing inpatient rehabilitation	
To ensure all stroke patients receive early, active rehabilitation by a dedicated stroke team, DHBs should have comprehensive services, which include and link the fundamentals of acute and rehabilitation care (Foley et al, 2007; SUTC, 2007).	B
Patients should be transferred to a stroke rehabilitation unit (where available) if ongoing inpatient rehabilitation is required (Foley et al, 2007; SUTC 2007).	B
If a stroke rehabilitation unit is not available then those with stroke who require ongoing inpatient rehabilitation should be transferred to a mixed rehabilitation unit (Foley et al, 2007).	B
All patients with severe stroke, who are not receiving palliative care, should be assessed by the specialist rehabilitation team regarding their suitability for ongoing rehabilitation prior to discharge from hospital.	✓
1.2.3 Care pathways	
All stroke patients admitted to hospital can be managed using an acute care pathway (Kwan & Sandercock, 2004).	C

1.2.4 Inpatient stroke care coordinator	
A stroke care coordinator can be used to foster coordination of services and assist in discharge planning.	✔
1.2.5 Telemedicine and networks	
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 (Schwamm, 2009a; Audebert & Schwamm, 2009).	**C**
These networks can assist to establish appropriate stroke units along with protocols governing rapid assessment, 'telestroke' services and rapid transfers (Schwamm 2009a, Audebert & Schwamm, 2009; Price et al, 2009a).	**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 stroke specialist centres (Meyer et al, 2008; Schwamm, 2009a; Audebert & Schwamm, 2009).	**B**
Telestroke can be used to improve assessment and management of rehabilitation where there is limited access to onsite stroke rehabilitation expertise (Schwamm, 2009a; Audebert & Schwamm, 2009).	**C**
1.3 Discharge planning and transfer of care	**Grade**
1.3.1 Safe transfer of care from hospital to community	
Prior to hospital discharge, all patients should be assessed to determine the need for a home visit, which may be carried out to minimise safety risks and facilitate provision of appropriate aids, support and community services (Barras, 2005).	**C**
To optimise safety at discharge, hospital services should ensure the following are completed as early as possible and definitely prior to discharge:	
• patients and families/carer have the opportunity to identify and discuss their post-discharge needs (eg, physical, emotional, social, recreational, financial and community support needs) with relevant members of the interdisciplinary team	✔
• general practitioners, primary health care teams and community services are all informed before or at the time of discharge	✔
• all medications, equipment and support services necessary for a safe discharge are organised	✔
• any continuing specialist treatment required is organised	✔
• a documented post-discharge care plan is developed in partnership with the patient and family/carer and a copy provided to them. This may include relevant community services, self-management strategies (eg, including medications information and compliance advice, goals and therapy to continue at home), stroke support services (eg, Stroke Foundation, marae-based services), any further rehabilitation or outpatient appointments, and an appropriate contact number for any queries.	✔
A locally developed protocol may assist in implementation of a safe discharge process.	✔
A discharge planner can be used to coordinate a comprehensive discharge programme for people with acute stroke (Schedlbauer et al, 2004).	**D**

1.3.2 Carer training	
Relevant members of the interdisciplinary team should provide specific and tailored training for carers/family before the person with stroke is discharged home. This should include training, as necessary, in: • personal care techniques • communication strategies • physical handling techniques • ongoing prevention and other specific stroke-related problems • safe swallowing and appropriate dietary modifications • management of behaviours and psychosocial issues (Kalra et al, 2004).	**B**
1.4 Care after hospital discharge	**Grade**
1.4.1 Community rehabilitation services and follow-up	
Interdisciplinary community rehabilitation services and support services should be made available whenever possible to enable early supported discharge to be offered to all people with stroke who have mild to moderate disability (Larsen et al, 2006; ESD Trialists, 2005).	**A**
Health services with organised inpatient stroke services should provide comprehensive, experienced interdisciplinary community rehabilitation and adequately-resourced support services for people with stroke and their family/carers (Larsen et al, 2006; ESD Trialists, 2005).	**A**
Rehabilitation services after hospital discharge should be offered to all stroke patients as needed and where available, delivered in the home setting (Hillier & Gakeemah, 2010).	**B**
Contact with and education by trained staff should be offered to all people with stroke and family/carers after discharge (Middleton et al, 2005; Boter, 2004).	**C**
People with stroke can be managed using a case management model after discharge. If used, service providers should incorporate education of the recognition and management of depression, screening and assistance to coordinate appropriate interventions via a medical practitioner (Joubert et al, 2006; Allen et al, 2009).	**C**
People with stroke and their carers/families should be provided with the contact information for the specialist stroke service and a contact person (in the hospital or community) for any post-discharge queries for at least the first year following discharge.	✔

1.4.2 Long-term rehabilitation services	
The duration of the formal rehabilitation phase of care should be tailored to the individual patient based on their response to interventions, not on an arbitrary time limit.	✔
People with stroke who have residual impairment at the end of the formal rehabilitation phase of care should be reviewed regularly (ie, at least annually) usually by the general practitioner to consider whether access to further interventions are needed. This includes consideration of whether the person's physical or social environment has changed.	✔
People with stroke with residual impairment identified as having further rehabilitation needs should receive therapy services to set new goals and improve task-orientated activity (OST 2002; Legg et al, 2007).	B
People with stroke with confirmed difficulties in performance of personal tasks, instrumental activities, vocational activities or leisure activities should have a documented management plan updated and initiated to address these issues.	✔
People with stroke should be encouraged to participate long term in appropriate exercise programmes (Langhammer et al, 2007).	C
1.5 Services for transient ischaemic attack	**Grade**
All patients with suspected TIA should be managed in services that allow rapid assessment and early treatment to be undertaken within 24 hours of symptom onset.	
• Those identified at high risk (ABCD^2 score 4–7 or those with any one of the following: atrial fibrillation, tight carotid stenosis, or crescendo TIA) should be transferred urgently to hospital (preferably admitted to a stroke unit or where available referred to a specialist TIA clinic if the person can be assessed within 24 hours) to facilitate rapid assessment and treatment (Rothwell et al, 2007; Lavelle et al, 2007; Giles & Rothwell, 2007; Giles & Rothwell, 2010; Kehdi & Cordato, 2008; Wu et al, 2009).	C
• Those identified at lower risk (ABCD^2 score 0–3 or late presentations, ie, after a week) can be managed in the community by a general practitioner, private specialist or where possible referred to a specialist stroke/TIA clinic and seen within seven days. Note: a low ABCD^2 score does not obviate the need for urgent carotid ultrasound to exclude carotid stenosis and an ECG/history to exclude AF, with appropriate urgent actions (surgery, anticoagulation) to be considered if these are present.	✔
1.6 Standardised assessment	**Grade**
Clinicians should use validated and reliable assessment tools or measures that meet the needs of the patient to guide clinical decision-making.	✔
1.7 Goal setting	**Grade**
Every person with stroke and their family/carer involved in the recovery process should have their wishes and expectations established and acknowledged.	✔
Every person with stroke and their family/carer should be provided with the opportunity to participate in the process of setting goals unless they choose not to or are unable to participate (SUTC, 2007).	B
Health practitioners should collaboratively set goals with the patient for rehabilitation. Goals should be prescribed, specific and challenging. They should be recorded, reviewed and updated regularly (Levack et al, 2006).	C
People with stroke should be offered training in self-management skills, which include active problem-solving and individual goal setting.	✔

1.8	Team meetings	Grade
The interdisciplinary stroke team should meet regularly (at least weekly) to discuss assessment of new patients, review patient management and goals, and plan for discharge (Langhorne & Pollock, 2002).		C

1.9	Patient and carer/family support	Grade
1.9.1 Information and education		
All people with stroke and their families/carers should be offered information that is tailored to meet their needs and provided using relevant language and communication formats (Smith et al, 2008).		A
Information should be provided at different stages in the recovery process (Smith et al, 2008).		B
Routine, follow-up opportunities should be provided to people with stroke and their families/carers with opportunities for clarification or reinforcement of the information provided (Smith et al, 2008).		B
1.9.2 Family meetings		
The stroke team should meet regularly with the person with stroke and their family/carer to involve them in management, goal setting and planning for discharge (Langhorne 2002).		C
1.9.3 Counselling		
Counselling services should be available to all people with stroke and their families/carers during rehabilitation and community reintegration and can take the form of:		
• an active educational counselling approach (Bhogal, 2003a)		B
• information supplemented by family counselling (Clark et al, 2003)		C
• a problem-solving counselling approach (Evans et al, 1988).		C
1.9.4 Respite care		
People with stroke and their carers/families should have access to respite care options. The respite care may be provided in their own home or an institution.		✔

1.10	Palliative care	Grade
An accurate assessment of prognostic risk factors or imminent death should be made for patients with severe stroke or those who are deteriorating.		✔
People with stroke and their family/carers should have access to specialist palliative care teams as needed and have care that is consistent with the principles and philosophies of palliative care (Gade et al, 2008).		B
A pathway for stroke palliative care can be used to support people with stroke and their families/carers and improve palliation for people dying after stroke (Jack et al, 2004).		D

1.11 Stroke service improvement	Grade
All stroke services should be involved in quality improvement activities that include regular audit and feedback ('regular' is considered at least every two years) (Jamtvedt et al, 2006).	B
Indicators based on nationally agreed standards of care should be used when undertaking any audit.	✓
General practitioners should classify stroke patients within current practice datasets to enable audit and review of relevant stroke and TIA management (Wright et al, 2007).	B

2.   Stroke recognition and pre-hospital care

Recommendations

2.1 Stroke recognition	Grade
The general public should receive ongoing education emphasising how to recognise the symptoms of stroke and the importance of early medical assistance (Jones et al, 2010; Muller-Nordhorn et al, 2009).	B
The FAST (face, arm, speech, time) message is appropriate for public awareness campaigns about both TIA and stroke.	✓
The delivery of public awareness programmes should be tailored to specific target audiences, such as Māori and Pacific people.	✓
2.2 Pre-hospital care	**Grade**
Stroke patients should be given a high priority designation by ambulance services (Quain et al, 2008; Mosely et al, 2007; Lindsberg et al, 2006; Bray et al, 2005b; Belvis et al, 2005).	C
Ambulance services should use a validated rapid pre-hospital stroke-screening tool and incorporate such tools into pre-hospital assessment of people with suspected stroke (Bray et al, 2005a; Nor et al, 2004; Kidwell et al, 2000; Kothari et al, 1999).	B
Health and ambulance services should develop and use pre-notification systems for stroke (de Luca et al, 2009; Quain et al, 2008; Mosley et al, 2007).	C
Ambulance services should preferentially transfer suspected stroke patients to a hospital with stroke unit care (de Luca et al, 2009; Quain et al, 2008; Silverman et al, 2005; Kwan et al, 2004c; Rymer et al, 2003).	C

3.   Early assessment and diagnosis

Recommendations

3.1 Assessment of transient ischaemic attack	Grade
All patients with suspected TIA should have a full assessment that includes thorough history and clinical, prognostic (eg, ABCD^2 score) and investigative tests (eg, blood tests, brain and carotid imaging and ECG) at the initial point of health care contact whether first seen in primary or secondary care (Rothwell et al, 2007; Lavelle et al, 2007; Giles & Rothwell, 2010).	B
The following investigations should be undertaken routinely for all patients with suspected TIA: full blood count, electrolytes, erythrocyte sedimentation rate (ESR), renal function tests, lipid profile, glucose level, and ECG.	✔
Patients classified as high risk (ABCD^2 4–7 or those with any one of the following: AF, tight carotid stenosis, or crescendo TIA) should have urgent brain imaging (preferably MRI); ('urgent' is immediately where available, but within 24 hours). Carotid imaging should also be undertaken urgently (within 24 hours) in patients with carotid territory symptoms who would potentially be candidates for carotid re-vascularisation. In settings with limited access to these investigations referral within 24 hours should be made to the nearest centre where such tests can be quickly conducted (Giles & Rothwell, 2010; Redgrave et al, 2007; Douglas et al, 2003; Wardlaw et al, 2006; Wardlaw 2009b).	B
Patients classified as low risk (ABCD^2 0–3 or late presentations, ie, after a week) should have brain and carotid imaging (where indicated) within seven days (Giles & Rothwell, 2010, Wardlaw et al, 2004; Wardlaw et al, 2006; Wardlaw 2009b).	B
3.2 Rapid assessment in the emergency department	**Grade**
Diagnosis should be reviewed by a clinician experienced in the evaluation of stroke (Martin et al, 1997; Morgenstern et al, 2004; Hand et al, 2006).	C
Local protocols developed jointly by staff from pre-hospital emergency services, the hospital emergency department and the acute stroke team should be used for all people with suspected stroke. Such protocols should include systems to receive early notification by paramedic staff, high priority transportation and triage, rapid referrals from ED staff to stroke specialists and rapid access to imaging (Kwan et al, 2004b; Bray et al, 2005a; Belvis et al, 2005; Lindsberg et al, 2006; de Luca et al 2009; Quain et al, 2008; Hamidon & Dewey, 2007).	C
Emergency department staff should use a validated stroke screen tool to assist in rapid accurate assessment for all people with stroke (Nor et al 2005; Jackson et al, 2008).	C
Stroke severity should be assessed and recorded on admission by a trained clinician using a validated tool (eg, National Institutes of Health Stroke Scale or Scandanavian Stroke Scale) (Muir et al, 1996; Weimar et al, 2004; Christensen et al, 2005a).	C

3.3 Imaging	Grade
All patients with suspected stroke should have an urgent brain CT or MRI ('urgent' is immediately where available, but within 24 hours). Patients who are candidates for thrombolysis should undergo brain imaging immediately (Brazzelli et al, 2009; Wardlaw et al, 2004).	**A**
When a patient's condition deteriorates acute medical review and a repeat brain CT or MRI should be considered urgently.	✔
All patients with carotid territory symptoms who would potentially be candidates for carotid re-vascularisation should have urgent carotid imaging (Wardlaw et al, 2006; Debrey et al, 2008; Chappell et al, 2009).	**B**
Further brain, cardiac or carotid imaging should be undertaken in selected cases including: • patients where initial assessment has not confirmed the likely source of the ischaemic event • patients with a history of more than one TIA • patients likely to undergo carotid surgery (Wardlaw et al, 2006; Wardlaw, 2009b).	**B**
3.4 Investigations	**Grade**
The following investigations should be obtained routinely for all patients with suspected stroke: full blood count, electrocardiogram, electrolytes, renal function tests, fasting lipids, erythrocyte sedimentation rate and/or C-reactive protein, and glucose.	✔
Selected patients may require the following additional investigations: angiography, chest x-ray, syphilis serology, vasculitis screen, prothrombotic screen and Holter monitor. These tests should be performed as soon as possible after stroke onset, and in selected patients, some of these tests may need to be performed as an emergency procedure.	✔

4. Acute medical and surgical management

Recommendations	

4.1 Thrombolysis	Grade
Intravenous tPA in acute ischaemic stroke should only be undertaken in patients satisfying specific inclusion and exclusion criteria (Wardlaw et al, 2009a).	A
Intravenous tPA should be given as early as possible in carefully selected patients with acute ischaemic stroke as the effect size of thrombolysis is time-dependent. Where possible, intervention should commence in the first few hours but may be used up to 4.5 hours after stroke onset (Wardlaw et al; 2009a; Lansberg et al, 2009b).	A
Intravenous tPA should be given under the authority of a physician trained and experienced in acute stroke management (Wardlaw et al, 2009a).	B
Thrombolysis should only be undertaken in a hospital setting with appropriate infrastructure, facilities and network support. This includes:	
• an interdisciplinary acute care team with expert knowledge of stroke management who are trained in delivery and monitoring of patients treated with thrombolysis	✔
• pathways and protocols used to guide medical, nursing and allied health acute phase management. Pathways or protocols must include guidance in acute blood pressure management (Graham, 2003; Ahmed et al, 2009; Butcher et al, 2010)	C
• immediate access to imaging facilities and staff trained to interpret the images.	✔
A minimum set of de-identified data from all patients treated with thrombolysis should be recorded in a central register to allow monitoring, review, comparison and benchmarking of key outcomes measures over time (Wahlgren et al, 2007).	C
The commencement of aspirin for patients who have received thrombolysis should be delayed for 24 hours (usually after a follow-up scan to exclude significant bleeding).	✔

4.2 Neurointervention	Grade
Intra-arterial thrombolysis within six hours can be used in carefully selected patients (Wardlaw et al, 2009a).	B
Each major centre should consider establishing facilities and systems for IA thrombolysis.	✔
Currently there is insufficient evidence for the use of mechanical clot retrieval in routine clinical practice. Consideration should be given to enrolling patients in a suitable clinical trial evaluating this intervention.	✔

4.3 Antithrombotic therapy	Grade
Aspirin orally (or via nasogastric tube or as a suppository for those with dysphagia) should be given as soon as possible after the onset of stroke symptoms if CT/MRI scanning excludes haemorrhage. The first dose should be at least 150 to 300 mg. Dosage thereafter can be reduced (eg, 100 mg daily) in the following few weeks (Sandercock et al, 2008c).	A
The routine use of early anticoagulation in unselected patients following ischaemic stroke/TIA is NOT recommended (Sandercock et al, 2008a).	A

4.4 Acute blood pressure lowering therapy	Grade
If blood pressure is extremely high (eg, for ischaemic stroke BP >220/120, for intracerebral haemorrhage >180/100 mm Hg) antihypertensive therapy can be started or increased, but blood pressure should be cautiously reduced (eg, by no more than 10–20%) and the patient monitored for signs of neurological deterioration.	✔
In acute primary intracerebral haemorrhage, medication (that could include intravenous treatment) can be used to maintain a blood pressure below 180 mm Hg systolic (mean arterial pressure of 130 mm Hg) if severe hypertension is observed over several repeated measures within the first 24 to 48 hours of stroke onset.	✔
Pre-existing antihypertensive therapy can be continued (orally or via nasogastric tube) provided there is no symptomatic hypotension or other reason to withhold treatment.	✔
4.5 Surgery for ischaemic stroke and management of cerebral oedema	**Grade**
Selected patients (eg, 18–60 years where surgery can occur within 48 hours of symptom onset) with significant middle cerebral artery infarction should be urgently referred to a neurosurgeon for consideration of hemicraniectomy (Vahedi et al, 2007).	A
Corticosteroids are NOT recommended for management of patients with brain oedema and raised intracranial pressure (Qizilbash et al, 2002).	A
Osmotherapy and hyperventilation can be trialled while a neurosurgical consultation is undertaken. (Righetti et al, 2004 for potential short term benefit of glycerol, Hofmeijer et al, 2003 for hyperventilation.)	C
There is currently insufficient evidence to make recommendations about the use of intracranial endovascular intervention (Cruz-Flores & Diamond, 2006).	D
4.6 Intracerebral haemorrhage	**Grade**
The use of haemostatic drug treatment with recombinant activated factor VII (rFVIIa) is currently considered experimental and is NOT recommended for use outside a clinical trial (You & Al-Shahi, 2006).	B
If patients with ICH were receiving anticoagulation prior to the stroke (and have elevated INR), therapy to reverse the anticoagulation therapy should be initiated immediately, eg, using a combination of prothrombin complex concentrate, vitamin K and fresh frozen plasma (Aguilar et al, 2007; Steiner et al, 2006).	D
Corticosteroids should NOT be used routinely for patients with ICH, but could be considered for patients with suspected underlying neoplasm (Feigin et al, 2005).	C
Osmotic diuretics including glycerol and mannitol are NOT recommended for patients with primary ICH (Righetti et al, 2004; Misra et al 2005; Bereczki et al, 2007).	C
For most patients with ICH, the usefulness of surgery is uncertain. Surgery for supratentorial ICH can be considered in carefully selected patients. For patients presenting with lobar clots >30 ml and within 1 cm of the surface, evacuation of supratentorial ICH by standard craniotomy might be considered (Morgenstern et al, 2010).	C
Patients with supratentorial ICH should be referred for neurosurgical review if they have hydrocephalus.	✔
Patients with cerebellar haemorrhage who are deteriorating neurologically or who have brainstem compression and/or hydrocephalus from ventricular obstruction should be considered for surgical removal of the haemorrhage as soon as possible.	✔

4.7	Physiological monitoring	Grade
Patients should have their neurological status (eg, Glasgow Coma Scale) and vital signs including pulse, blood pressure, temperature, oxygen saturation, glucose, and respiratory pattern monitored and documented regularly during the acute phase, the frequency of such observations being determined by the patient's status (Sulter et al, 2003; Silva et al, 2005; Cavallini et al, 2003; Roquer et al, 2008).		C

4.8	Oxygen therapy	Grade
Patients who are hypoxic (ie, <95% O_2 saturation) should be given oxygen supplementation.		✔
The routine use of supplemental oxygen is NOT recommended in people with acute stroke who are not hypoxic (Ronning & Guldvog, 1999).		C

4.9	Glycaemic control	Grade
Intensive, early maintenance of euglycaemia is currently NOT recommended (Gray et al, 2007).		B
On admission, all patients should have their blood glucose level monitored and appropriate glycaemic therapy instituted to ensure euglycaemia, especially if the patient is diabetic.		✔

4.10	Neuroprotection	Grade
The use of putative neuroprotectant therapies (including hypothermic cooling) should only be used if part of a randomised controlled trial (den Hertog et al, 2009a; Diener et al, 2008; Doesborgh et al, 2004; Rose et al, 2002; Bath, 2004).		A
People with acute ischaemic stroke who were receiving statins prior to admission can continue statin treatment (Blanco et al, 2007).		B

4.11	Pyrexia management	Grade
For acute stroke, antipyretic therapy comprising regular paracetamol and/or physical cooling measures, should be used routinely where fever occurs (Mayer et al, 2004; den Hertog et al, 2009a).		C

4.12	Seizure management	Grade
Anticonvulsant medication should be used for people with recurrent seizures after stroke.		✔

4.13	Complementary and alternative therapy	Grade
The routine use of the following complementary and alternative therapies is NOT recommended:		
• acupuncture (Zhang et al, 2005)		B
• traditional Chinese herbal medicines (Li et al, 2009; Yan & Hui-Chan, 2008; Cao et al, 2008; Tan et al, 2008; Zeng et al, 2005; Wu et al, 2007b; Chen et al, 2008; Zhuo et al, 2008).		B
Health practitioners should be aware of different forms of complementary and alternative therapies and be available to discuss these with people with stroke and their families.		✔

5. Secondary prevention

Recommendations	

5.1 Lifestyle modifications	**Grade**
Every person with stroke should be assessed and informed of their risk factors for a further stroke and possible strategies to modify identified risk factors. The risk factors and interventions include:	
• smoking cessation: nicotine replacement therapy, bupropion or nortriptyline therapy, nicotine receptor partial agonist therapy and/or behavioural therapy should be considered (Silagy et al, 2004; Hughes et al, 2007; Cahill et al, 2007, Stead & Lancaster, 2005; Sinclair et al, 2004; Rice & Stead, 2004; Lancaster & Stead, 2005; Stead et al, 2006)	**A**
• improving diet: a diet that is low in fat (especially saturated fat) and sodium, but high in fruit and vegetables should be consumed (He et al, 2006; Dauchet et al, 2005; He & MacGregor, 2004; Hooper et al, 2004; Sacks et al, 2001; Appel et al, 1997; Barzi et al, 2003; de Lorgeril et al, 1999)	**A**
• increasing regular exercise (Lee et al, 2003; Wendel-Vos et al, 2004)	**B**
• avoidance of excessive alcohol (ie, no more than two standard drinks per day) (Reynolds et al, 2003; NHMRC, 2003; NHMRC, 2009).	**C**
Interventions should be individualised and delivered using behavioural techniques (such as educational or motivational counselling) (Rubak et al, 2005; Lancaster & Stead, 2005; Stead & Lancaster, 2005; Stead et al, 2006; Sinclair et al, 2004).	**A**
For Māori and Pacific people, involvement of whānau and culturally-appropriate service providers is advised, where these are available.	✓
5.2 Adherence to pharmacotherapy	**Grade**
Effective interventions to promote adherence with medication regimes are often complex and should include combinations of the following:	
• reminders, self-monitoring, reinforcement, counselling, family therapy, telephone follow-up, supportive care, or dose administration aids (Haynes et al, 2008; Heneghan et al, 2006)	**B**
• information and education while in hospital and/or in the community (Haynes et al, 2008; Chiu et al, 2008).	**B**
5.3 Blood pressure lowering recommendations	**Grade**
All patients after stroke or TIA, whether normotensive or hypertensive, should receive blood pressure lowering therapy for secondary prevention, unless contraindicated by symptomatic hypotension (Lakhan & Sapko, 2009).	**A**
New blood pressure lowering therapy should commence prior to discharge for those with stroke or TIA or soon after TIA if the patient is not admitted (Nazir et al, 2004; Nazir et al, 2005).	**B**
Cautious introduction of BP lowering medication may be required in older people with frailty due to risk of complications such as symptomatic hypotension.	✓

5.4 Antiplatelet therapy	Grade
Long-term antiplatelet therapy should be prescribed to all people with ischaemic stroke or TIA who are not prescribed anticoagulation therapy (Antithrombotic Trialists, 2002).	A
Low dose aspirin and modified release dipyridamole or clopidogrel alone should be prescribed to all people with ischaemic stroke or TIA taking into consideration patient comorbidities (Sacco et al, 2008).	B
Aspirin alone can also be used, particularly in patients who do not tolerate aspirin plus dipyridamole or clopidogrel (Antithrombotic Trialists, 2002).	A
The combination of aspirin plus clopidogrel is NOT recommended for the secondary prevention of cerebrovascular disease in patients who do not have acute coronary disease or recent coronary stent (Diener et al, 2004; Bhatt et al, 2006).	A
5.5 Anticoagulation therapy	**Grade**
5.5.1 Anticoagulation therapy after ischaemic stroke	
Anticoagulation therapy for secondary prevention for those people with ischaemic stroke or TIA from presumed arterial origin should NOT be routinely used as there is no evidence of additional benefits over antiplatelet therapy (Sandercock et al, 2009).	A
Anticoagulation therapy for long-term secondary prevention should be used in all people with ischaemic stroke or TIA who have atrial fibrillation or cardioembolic stroke and no contraindication (Saxena & Koudstaal, 2004a; Saxena & Koudstaal, 2004b).	A
In acute ischaemic stroke, the decision to commence anticoagulation therapy can be delayed for up to two weeks but should be made prior to discharge (Ovbiagele et al, 2004).	C
In patients with TIA, commencement of anticoagulation therapy should occur once CT or MRI has excluded intracranial haemorrhage as the cause of the current event.	✔
5.5.2 Anticoagulation after intracerebral haemorrhage	
There is insufficient evidence to allow firm recommendations regarding the use of anticoagulant or antiplatelet therapy in patients with ICH who are considered to be at high risk of future thromboembolic events.	D
All patients with ICH should have their individual risk of future thromboembolic events and their risk of recurrent ICH assessed, taking into account patient specific factors. The risk of recurrent ICH is thought to be greatest in those with lobar and previous ICH and less with deep 'hypertensive ICH' when blood-pressure control can be optimised. In general, thromboembolism risk is highest in patients with mechanical heart valves (particularly mitral valves), and is high in those with atrial fibrillation and patients with previous ischaemic events.	✔
Expert advice should be sought and the potential benefits and risks of anticoagulant and antiplatelet therapy after ICH discussed with patients and their families, and documented.	✔
5.5.3 Self-monitoring of oral anticoagulation	
Home monitoring using a point-of-care INR testing device can be offered to selected patients (Khan et al, 2004; Völler et al, 2005).	B
Patients need to be trained and reassessed periodically for safe self-monitoring.	✔

5.6	Cholesterol lowering	Grade
Therapy with a statin should be considered for all patients with ischaemic stroke or TIA (Amarenco & Labreuche, 2009; Manktelow & Potter, 2009).		A
Statins should NOT be used routinely for patients with intracerebral haemorrhage (Amarenco & Labreuche, 2009; Manktelow & Potter, 2009).		B
5.7	**Carotid surgery**	**Grade**
Carotid endarterectomy should be undertaken in patients with non-disabling carotid artery territory ischaemic stroke or TIA with ipsilateral carotid stenosis measured at 70–99% (NASCET criteria) only if it can be performed by a specialist surgeon with low rates (<6%) of peri-operative mortality/morbidity (Cina et al, 1999; Rothwell et al, 2003; Ederle et al, 2007).		A
Carotid endarterectomy can be undertaken in highly selected ischaemic stroke or TIA patients (considering age, gender and comorbidities) with symptomatic carotid stenosis of 50–69% (NASCET criteria) or asymptomatic carotid stenosis >60% (NASCET criteria) only if it can be performed by a specialist surgeon with very low rates (<3%) of peri-operative mortality/morbidity (Chambers & Donnan, 2005; Cina et al, 1999; Ederle et al; 2007).		A
Eligible stable patients should undergo carotid endarterectomy as soon as possible after stroke event (ideally within two weeks) (Rothwell et al, 2004).		A
Carotid endarterectomy should only be performed by a specialist surgeon in centres where outcomes of carotid surgery are routinely audited (Rothwell et al, 1996; Cina et al, 1999).		B
Carotid endarterectomy is NOT recommended for those with symptomatic stenosis <50% (NASCET criteria) or asymptomatic stenosis < 60% (NASCET criteria) (Cina et al, 1999; Chambers & Donnan, 2005).		A
Carotid stenting should NOT routinely be considered for patients with carotid stenosis (Ederle et al, 2007; Eckstein et al, 2008).		A
5.8	**Diabetes management**	**Grade**
Patients with glucose intolerance or diabetes should be managed in line with appropriate guidelines for diabetes (see SIGN 116 Management of Diabetes 2010).		✔
5.9	**Patent forament ovale management**	**Grade**
All patients with an ischaemic stroke or TIA and a patent foramen ovale should receive antiplatelet therapy as first choice (Homma et al, 2002).		C
Anticoagulation can also be considered for those with ischaemic stroke or TIA and a patent foramen ovale, taking into account other risk factors and the increased risk of harm (Homma et al, 2002).		C
Currently there is insufficient evidence to recommend closure for patent foramen ovale.		✔
5.10	**Hormone replacement therapy**	**Grade**
Use of hormone replacement therapy (HRT) at the time of stroke should be stopped. The decision whether to start or continue HRT in patients with previous stroke or TIA should be discussed with the individual patient and based on an overall assessment of risk and benefit (Sare et al, 2008; Magliano et al, 2006; Gabriel Sanchez et al, 2005; Bath & Gray, 2005).		B

5.11 Oral contraception	Grade
The decision whether to start or continue oral contraception in women with stroke in the childbearing years should be discussed with the individual patient and based on an overall assessment of risk and benefit. Non-hormonal methods of contraception should be considered (Chakhtoura et al, 2009; Baillargeon et al, 2005; Chan et al, 2004).	C

6.   Rehabilitation and recovery

Recommendations

6.1 Amount, intensity and timing of rehabilitation	Grade
6.1.1 Amount and intensity of rehabilitation	
Rehabilitation should be structured to provide as much practice as possible within the first six months after stroke (Kwakkel et al, 2004).	A
For patients undergoing active rehabilitation, physical therapy (physiotherapy and occupational therapy) should be provided as much as possible but should be a minimum of one hour active practice per day (at least five days a week).	✔
Task-specific circuit class training or video self-modelling should be used to increase the amount of practice in rehabilitation (Wevers et al, 2009; McClellan & Ada, 2004).	B
For patients undergoing active rehabilitation, therapy for dysphagia or communication difficulties should be provided as much as tolerated (Bhogal et al, 2003b; Bakheit et al, 2007; Godecke, 2009; Carnaby et al, 2006).	C
Patients should be encouraged by staff members, with the help of their family and/or friends if appropriate, to continue to practise skills they learn in therapy sessions throughout the remainder of the day.	✔
6.1.2 Timing of rehabilitation	
Patients should be mobilised as early and as frequently as possible (Bernhardt et al, 2009).	B
Treatment for aphasia should be offered as early as tolerated (Godecke, 2009).	B
Upper limb training using constraint-induced movement therapy (CIMT) can commence within the first week of stroke for highly-selected patients, however, early high-intensity CIMT may be harmful (Dromerick et al, 2009).	C

6.2	Sensorimotor impairments	Grade
6.2.1 Dysphagia		
All stroke patients should have their swallowing screened as soon as possible, but at least within 24 hours of admission.		✔
The gag reflex is not a valid screen for dysphagia and should NOT be used as a screening tool (Martino et al, 2000; Perry & Love, 2001).		B
Patients should be screened for swallowing deficits before being given food, drink or oral medications. Personnel specifically trained in swallowing screening should undertake screening using a validated tool (Westergren, 2006; Ramsay et al, 2003).		B
Patients who fail the swallowing screening should be referred to a speech-language therapist for a comprehensive assessment. This may include instrumental examination, eg, videofluoroscopic modified barium swallow [VMBS] and/or fibreoptic endoscopic evaluation of swallowing [FEES]. Special consideration should be given to assessing and managing appropriate hydration. These assessments can also be used for monitoring during rehabilitation.		✔
Compensatory strategies such as positioning, therapeutic manoeuvres or modification of food and fluids to facilitate safe swallowing should be provided for people with dysphagia based on specific impairments identified during comprehensive swallow assessment (Carnaby et al, 2006).		B
One or more of the following methods can be provided to facilitate resolution of dysphagia:		C
• therapy targeting specific muscle groups (eg, 'Shaker' therapy) (Shaker et al, 2002; Logemann, 2009)		
• thermo-tactile stimulation (Rosenbek et al, 1998; Leelamanit et al, 2002; Lim et al, 2009).		
Dysphagic patients on modified diets should have their intake and tolerance to diet monitored. The need for continued modified diet should be regularly reviewed.		✔
Patients with persistent weight loss and recurrent chest infections should be urgently reviewed.		✔
All staff and carers involved in feeding patients should receive appropriate training in feeding and swallowing techniques.		✔
6.2.2 Weakness		
One or more of the following interventions should be used for people who have reduced strength:		
• progressive resistance exercises (Ada et al, 2006; Pak & Pattern, 2008; Harris & Eng, 2010)		B
• electromyographic biofeedback in conjunction with conventional therapy (Ada 2006)		C
• electrical stimulation (Glinsky et al, 2007; Ada et al, 2006).		B

6.2.3 Loss of sensation	
People with stroke should be assessed by an appropriate health practitioner for loss of or reduction or alteration of sensation, including hypersensitivity. This information should be shared with the person, their family/carers and the interdisciplinary team in order to implement specific strategies for optimising function and safety.	✔
Sensory-specific training can be provided to people with stroke who have sensory loss (Carey et al, 1993; Yekutiel & Guttman, 1993; Byl et al, 2003; Hillier & Dunsford, 2006).	**C**
Sensory training designed to facilitate transfer can also be provided to people with stroke who have sensory loss (Carey & Matyas, 2005).	**C**
6.2.4 Visual impairment	
People with stroke who report or appear to have difficulties with vision and/or perception should be screened using specific assessment instruments, and if a deficit is found, referred on for comprehensive assessment by relevant health practitioners.	✔
15-diopter Fresnel prism glasses can be used to improve visual function in people with homonymous hemianopia but there is no evidence of benefit in activities of daily living (Rossi et al, 1990).	**C**
Computer-based visual restitution training can be used to improve visual function in people with visual field deficits (Kasten et al, 1998).	**C**
6.3 Physical activity	**Grade**
6.3.1 Sitting	
Sitting practice with supervision/assistance should be provided for people who have difficulty sitting (Dean et al, 2007; Dean & Shepherd, 1997).	**B**
6.3.2 Standing up	
Practising standing up should be undertaken for people who have difficulty in standing up from a chair (Langhorne et al, 2009; French et al, 2007).	**A**
6.3.3 Walking	
After thorough assessment and goal setting by a trained clinician, all people with difficulty walking should be given the opportunity to undertake tailored, repetitive practice of walking (or components of walking) as much as possible (French et al, 2007).	**A**
One or more of the following interventions can be used in addition to conventional walking therapy:	
• cueing of cadence (Langhorne et al, 2009)	**B**
• mechanically assisted gait (via treadmill, automated mechanical or robotic device) (Mehrholz et al, 2007)	**B**
• joint position biofeedback (Langhorne et al, 2009)	**C**
• virtual reality training (You et al, 2005; Mirelman et al, 2009; Kim et al, 2009; Yang et al, 2008; Jaffe et al, 2004).	**C**
Ankle-foot orthoses can be used for people with persistent drop foot. If used, the ankle-foot orthosis should be individually fitted (Leung & Moseley, 2003; Bleyenheuft et al, 2008; de Wit et al, 2004; Pohl & Mehrholz, 2006; Sheffler et al, 2006; Wang et al, 2005; Wang et al, 2007; Tyson & Rogerson, 2009; Chen et al, 1999).	**C**

6.3.4 Upper limb activity	
For people with difficulty using their upper limb one or more of the following interventions should be given in order to encourage using their upper limb as much as possible:	
• constraint-induced movement therapy (Langhorne et al, 2009; Sirtori et al, 2009)	**B**
• mechanical assisted training (Mehrholz et al, 2008)	**B**
• repetitive task-specific training (French et al, 2007).	**C**
One or more of the following interventions can be used in addition to interventions listed above:	
• mental practice (Langhorne et al, 2009)	**B**
• mirror therapy (Yavuzer et al, 2008; Dohle et al, 2009)	**C**
• EMG biofeedback in conjunction with conventional therapy (Langhorne et al, 2009; Meilink et al, 2008)	**C**
• electrical stimulation (Langhorne et al, 2009)	**C**
• bilateral training (Stewart et al, 2006).	**C**
6.4 Activities of daily living	**Grade**
Patients with difficulties in performance of daily activities should be assessed by a trained clinician (Legg et al, 2006; OST, 2003).	**A**
Patients with confirmed difficulties in personal or extended activities of daily living should have specific therapy (eg, task-specific practice and trained use of appropriate aids) to address these issues (Legg et al, 2006; Walker et al, 2004).	**B**
Other staff members, the person with stroke and carer/family should be advised regarding techniques and equipment to maximise outcomes relating to performance of daily activities and life roles, and to optimise sensorimotor, perceptual and cognitive capacities.	✔
People with difficulties in community transport and mobility should set individualised goals and undertake tailored strategies such as multiple escorted outdoor journeys (ie, up to seven) which may include practice crossing roads, visits to local shops, bus or train travel, help to resume driving, aids and equipment, and written information about local transport options/alternatives (Logan et al, 2004).	**B**
Administration of amphetamines to improve activities of daily living is NOT currently recommended (Martinsson et al, 2007; Sprigg & Bath, 2009).	**B**
The routine use of acupuncture alone or in combination with traditional herbal medicines is NOT currently recommended in stroke rehabilitation (Wu et al, 2006; Zhang et al, 2005; Junhua et al, 2009).	**B**

6.5 Communication	Grade
6.5.1 Aphasia	
All patients should be screened for communication deficits using a screening tool that is valid and reliable (Salter et al, 2006).	**C**
Those patients with suspected communication difficulties should receive formal, comprehensive assessment by a specialist clinician.	✔
Where a patient is found to have aphasia, the clinician should:	
• document the provisional diagnosis	✔
• explain and discuss the nature of the impairment with the patient, family/carers and treating team and discuss/teach which strategies or techniques may enhance communication	✔
• in collaboration with the patient and family/carer, identify goals for therapy and develop and initiate a tailored intervention plan. The goals and plans should be reassessed at appropriate intervals over time	✔
• ensure all members of the interdisciplinary team are aware of and proficient in appropriate strategies for assessing impairment, activity and participation in the presence of aphasia; and are aware of how aphasia may impact on the way all rehabilitation interventions from the interdisciplinary team are best provided.	✔
All written information on health, aphasia, social and community supports should be available in an aphasia-friendly format (Brennan et al, 2005; Rose et al, 2003).	**D**
Alternative means of communication (such as gesture, drawing, writing, use of augmentative and alternative communication devices) should be facilitated as appropriate.	✔
Interventions should be individually tailored but can include:	
• treatment of aspects of language (including phonological and semantic deficits, sentence-level processing, reading and writing) following models derived from cognitive neuropsychology (Doesborgh et al, 2004)	**C**
• constraint-induced language therapy (Cherney et al, 2008)	**B**
• the use of gesture (Rose et al, 2002)	**D**
• supported conversation techniques (Wertz et al, 1986; Kagan et al, 2001)	**C**
• delivery of therapy programmes via computer (Katz & Wertz, 1997).	**C**
Until clinical safety is proven and any benefits clearly outweigh any harms, the routine use of the following interventions are NOT recommended:	
• piracetam (Greener et al, 2001)	**B**
• other pharmacological interventions.	✔
Group therapy and conversation groups can be used for people with aphasia, and should be available in the longer term for those with chronic and persisting aphasia (Elman 1999).	**C**
People with chronic and persisting aphasia should have their mood monitored.	✔
Environmental barriers facing people with aphasia should be addressed, such as through training communication partners, raising awareness of and educating about aphasia in order to reduce negative attitudes, and promoting access and inclusion by providing aphasia-friendly formats or other environmental adaptations. People with aphasia from culturally and linguistically diverse backgrounds may need special attention, for example, from trained health care interpreters.	✔
The impact of aphasia on functional activities, participation and quality of life, including the impact upon relationships, vocation and leisure, should be assessed and addressed as appropriate from early post-onset and over time for those chronically affected.	✔

6.5.2 Dyspraxia of speech recommendations	
Patients with suspected motor speech difficulties should receive comprehensive assessment.	✓
Interventions for motor speech skills should be individually tailored and can target articulatory placement and transitioning, speech rate and rhythm, increasing length and complexity of words and sentences, prosody including lexical, phrasal, and contrastive stress production. In addition therapy can incorporate:	
• integral stimulation approach with modelling, visual cueing, and articulatory placement cueing (Wambaugh et al, 2006)	**D**
• principles of motor learning to structure practice sessions (eg, order in which motor skills are practiced during a session, degree of variation and complexity of behaviours practised, intensity of practice sessions and delivery of feedback on performance and accuracy (Maas & Robin, 2008; Austermann Hula et al, 2008; Ballard et al, 2007)	**D**
• PROMPT therapy (Wambaugh et al, 2006).	**D**
The use of augmentative and alternative communication modalities such as gesture or speech generating devices is recommended in functional activities (Wambaugh et al, 2006).	**D**
6.5.3 Dysarthria	
Patients with unclear or unintelligible speech should be assessed to determine the nature and cause of the speech impairment.	✓
Interventions for the treatment of dysarthria can include:	
• biofeedback or a voice amplifier to change intensity and increase loudness (Simpson et al, 1988; Cariski & Rosenbek, 1999)	**D**
• intensive therapy aiming to increase loudness (eg, Lee Silverman Voice Treatment) (Wenke et al, 2008)	**D**
• the use of strategies such as decreased rate, over-articulation or gesture.	✓
People with severe dysarthria can benefit from augmentative and alternative communication devices for use in everyday activities.	✓
6.5.4 Cognitive-communication deficits	
Stroke patients with cognitive involvement who have difficulties in communication should have a comprehensive assessment undertaken and a management plan developed, and family education, support and counselling as required.	✓
6.6 Cognition	**Grade**
6.6.1 Assessment of cognition	
All patients should be screened for cognitive and perceptual deficits using validated and reliable screening tools.	✓
Patients identified with cognitive or perceptual deficits during screening should be referred for comprehensive domain specific assessment by a clinical neuropsychologist or other appropriately-trained health practitioner.	✓
6.6.2 Attention and concentration	
Cognitive rehabilitation can be used in people with stroke with attention and concentration deficits (Lincoln et al, 2000, Barker-Collo et al, 2009).	**C**

6.6.3 Memory	
Any patient found to have memory impairment causing difficulties in rehabilitation or activities/participation should:	
• be referred for a more comprehensive assessment of their impaired and preserved memory abilities	✓
• have their nursing and therapy sessions tailored to use techniques which capitalise on preserved memory abilities	✓
• be assessed to see if compensatory techniques to reduce their disabilities, such as using notebooks, diaries, audiotapes, electronic organisers and audio alarms, are useful (Wilson et al, 2001)	**D**
• be taught approaches aimed at directly improving their memory	✓
• have therapy delivered in an environment that is as like the usual environment for that patient as possible to encourage generalisation.	✓
6.6.4 Executive functions	
Patients considered to have problems associated with executive functioning deficits should be formally assessed using reliable and valid tools including measures of behavioural symptoms.	✓
External cues, such as a pager, can be used to initiate everyday activities in people with impaired executive functioning (Wilson et al, 2001).	**C**
Information should be provided to individuals with impaired executive functioning in an appropriate way that supports their learning (Boyd & Winstein, 2006).	**C**
6.6.5 Apraxia	
People with suspected difficulties executing tasks but who have adequate limb function should be screened for apraxia and if indicated complete a comprehensive assessment.	✓
For people with confirmed apraxia, tailored interventions (eg, strategy training) can be used to improve activities of daily living (Donkervoort et al, 2001; Smania et al, 2006).	**C**
6.6.6 Agnosia	
The presence of agnosia and implications on function and safety should be assessed by an appropriate health practitioner.	✓
Information from assessment should be shared with the person with agnosia, their family/carers and the interdisciplinary team. Specific strategies for optimising function and safety should be implemented.	✓
6.6.7 Neglect	
Any patient with suspected or actual impairment of spatial awareness eg, hemi-inattention or neglect should have a full assessment with appropriate tests (Bowen & Lincoln, 2007; Jehkonen et al, 2006).	**C**
Patients with unilateral neglect can be trialled with one or more of the following interventions:	
• simple cues to draw attention to the affected side	✓
• visual scanning training in addition to sensory stimulation (Luaute et al, 2006; Polanowska et al, 2009)	**C**
• mental imagery training or structured feedback (Luaute et al, 2006)	**D**
• half-field eye patching (Luaute et al, 2006; Tsang 2009).	**C**

7. Managing secondary complications

Recommendations	
7.1 Nutrition and hydration	**Grade**
All stroke patients should have their hydration status assessed, monitored and managed as required. Appropriate fluid supplementation should be used to treat or prevent dehydration (Bhalla et al, 2000; Kelly et al, 2004; Whelan, 2001; Hodgkinson et al, 2003; Challiner et al, 1994).	**B**
All patients with acute stroke should be screened for malnutrition (Martineau et al, 2005; FOOD Trial, 2005a).	**B**
All patients with acute stroke who are at risk of malnutrition, including those with dysphagia, should be referred to a dietitian for assessment and ongoing management.	✔
Screening and assessment of nutritional status should include the use of validated nutritional assessment tools or measures.	✔
Nutritional supplementation should be offered to people with stroke whose nutritional status is poor or deteriorating (Milne et al, 2006).	**A**
Nasogastric feeding is the preferred method during the first month post stroke for people who do not recover a functional swallow (FOOD Trial, 2005b).	**B**
Food intake and weight should be monitored for all people with acute stroke.	✔
7.2 Oral hygiene	**Grade**
All patients, particularly those with swallowing difficulties, should have assistance and/or education to maintain good oral and dental hygiene (including dentures).	✔
Staff or carers responsible for the care of patients disabled by stroke (in hospital, in residential care and in home care settings) can be trained in assessment and management of oral hygiene (Brady et al, 2006).	**C**
7.3 Spasticity	**Grade**
In addition to general therapy (eg, task specific practice) other interventions to decrease spasticity should NOT be routinely provided for people with stroke who have mild to moderate spasticity (ie, spasticity that does not interfere with their activity or personal care).	✔
In people with stroke who have persistent, moderate to severe spasticity (ie, spasticity that interferes with their activity or personal care):	
• botulinum toxin A should be trialled in conjunction with rehabilitation therapy which includes setting clear goals (Rosales & Chua-Yap, 2008; Elia et al, 2009; Garces et al, 2006)	**B**
• electrical stimulation in combination with EMG biofeedback may be used (Bakhtiary & Fatemy, 2008; Yan & Hui-Chan, 2009).	**C**

7.4 Contracture	Grade
For people at risk of developing contractures undergoing active rehabilitation, the addition of prolonged positioning of muscles in a lengthened position to maintain range of motion is NOT recommended (Turton & Britton, 2005; Gustafsson & McKenna, 2006).	**B**
Overhead pulley exercise should NOT be used to maintain range of motion of the shoulder (Kumar et al, 1990).	**C**
For people who have contracture, management can include the following interventions to increase range of motion:	
• electrical stimulation (Pandyan et al, 1997)	**C**
• casting/serial casting (Mortenson & Eng, 2003).	**C**
7.5 Subluxation	**Grade**
For people with severe weakness who are at risk of developing a subluxed shoulder, management should include one or both of the following interventions to minimise subluxation:	
• electrical stimulation (Ada & Foongchomcheay, 2002)	**B**
• firm support devices.	✓
For people who have developed a subluxed shoulder, management can include firm support devices (eg, lap trays, arm troughs and triangular slings) to prevent further subluxation (Ada et al, 2005).	**C**
People with stroke, carers and staff should receive appropriate training in the care of the shoulder and use of support devices to prevent/minimise subluxation.	✓
7.6 Pain	**Grade**
7.6.1 Shoulder pain	
For people with severe weakness who are at risk of developing shoulder pain, management can include:	
• shoulder strapping (Ada et al, 2005; Griffith & Bernhardt, 2006)	**B**
• interventions to educate staff, carers and people with stroke to prevent trauma to the shoulder.	✓
For people with severe weakness who are at risk of developing shoulder pain or who have already developed shoulder pain, the following interventions are NOT recommended:	
• ultrasound (Inaba & Piorkowski, 1972).	**C**
As there is no clear evidence for effective interventions once shoulder pain is already present in people with stroke, management should be based on other guidelines for acute musculoskeletal pain (eg, AAMPGG, 2003).	

7.6.2 Central post-stroke pain	
People with stroke found to have unresolved central post stroke pain should receive a trial of:	
• tricyclic antidepressants (eg, trial amitriptyline first followed by other tricyclic agents or venlafaxine) (Saarto & Wiffen, 2007)	**B**
• anticonvulsants (eg, carbamazepine) (Wiffen et al, 2005).	**C**
Any patient whose central post stroke pain is not controlled within a few weeks should be referred to a specialist pain management team.	✔
Other muscular skeletal conditions should be considered as a cause for the patient's pain.	✔
7.7 Swelling of the extremities	**Grade**
For people who are immobile, management can include the following interventions to prevent swelling in the hand and foot:	
• dynamic pressure garments for the upper limb (Gracies et al, 2000)	**C**
• electrical stimulation (Faghri & Rodgers, 1997)	**C**
• elevation of the limb when resting.	✔
For people who have swollen extremities, management can include the following interventions to reduce swelling of the hand and foot:	
• dynamic pressure garments for the upper limb (Gracies et al, 2000)	**C**
• electrical stimulation (Faghri & Rodgers, 1997)	**C**
• continuous passive motion with elevation (Giudice, 1990)	**D**
• elevation of the limb when resting.	✔
7.8 Loss of cardiorespiratory fitness	**Grade**
Rehabilitation should include interventions to increase cardiorespiratory fitness once the person with stroke has sufficient strength in the large lower limb muscle groups (Sanders et al, 2009; Pang et al, 2006).	**A**
People with stroke should be encouraged to undertake regular, ongoing fitness training.	✔
7.9 Fatigue	**Grade**
Therapy sessions should be scheduled and paced to coincide with periods of the day when the person with stroke is most alert and least likely to be physically or cognitively fatigued.	✔
People with stroke and their families/carers should be provided with information and education about fatigue including potential management strategies.	✔

7.10 Incontinence	Grade
7.10.1 Urinary incontinence	35
All people with stroke with suspected continence difficulties should be assessed by trained personnel using a structured functional assessment (Thomas et al, 2008; Martin et al, 2006).	**B**
A portable bladder ultrasound scan can be used to assist in diagnosis and management of urinary incontinence (Martin et al, 2006).	**B**
People with stroke who have confirmed continence difficulties should have a continence management plan formulated and documented, implemented and monitored (Thomas et al, 2008).	**C**
The use of indwelling catheters should be avoided as an initial management strategy except in acute urinary retention.	✔
A post-discharge continence management plan should be developed with the person with stroke and family/carer prior to discharge and should include how to access continence resources and appropriate review in the community.	✔
If incontinence persists the person with stroke should be re-assessed.	✔
For people with urge incontinence:	
• a prompted or scheduled voiding regime programme/bladder retraining can be trialled	✔
• anticholinergic drugs can also be trialled (Wallace et al, 2004; Nabi et al, 2006)	**B**
• if continence is unachievable, containment aids can assist with social continence.	✔
For people with urinary retention:	
• the routine use of indwelling catheters is NOT recommended. However, if urinary retention is severe, then intermittent catheterisation should be used to assist bladder emptying during hospitalisation. If retention continues, intermittent catheterisation is preferable to indwelling catheterisation	✔
• if using intermittent catheterisation, then a sterile catheterisation technique should be used in hospital (Quigley & Riggin, 1993)	**C**
• where management of chronic retention requires catheterisation and intermittent catheterisation is not feasible, consideration should be given to choice of appropriate route, whether urethral or suprapubic	✔
• any patient discharged with either intermittent or indwelling catheterisation will require education of patient/carer for management, where to access supplies and a contact point in case of problems.	✔
For people with functional incontinence, a whole-team approach is recommended	✔
• strategies to improve mobility (and reduce delirium) can also assist management of functional incontinence.	✔

7.10.2 Faecal incontinence	
All people with stroke who have suspected continence difficulties should be assessed by trained personnel using a structured functional assessment (Harari et al, 2004).	**B**
For those with constipation or bowel incontinence, a full assessment (including a rectal examination) should be carried out and an appropriate management plan of constipation, faecal overflow or bowel incontinence should be established, and targeted education should be provided (Harari et al, 2004).	**B**
Bowel habit retraining using diet, regular dietary habits and exploiting the gastro-colic reflex can be used for people who have bowel dysfunction (Venn et al, 1992).	**C**
If continence is unachievable, containment aids can assist with social continence.	✔
Education and careful discharge planning and preparation are required for any patient being discharged with bowel incontinence.	✔
7.11 Management of mood	**Grade**
7.11.1 Identification	
All people with stroke should be screened for depression using a validated tool, preferably one that has been designed for use in a medically ill population.	✔
Screening for depression should be introduced in a way that is culturally appropriate.	✔
Patients with suspected altered mood (eg, depression, anxiety, emotional lability) should be assessed by trained personnel using a standardised and validated scale (Benaim et al, 2004; Aben et al, 2002; Bennett et al, 2006).	**B**
7.11.2 Prevention	
Psychological strategies (eg, problem solving, motivational interviewing) can be used to prevent depression after stroke (Hackett et al, 2008a).	**B**
Routine use of antidepressants to prevent post-stroke depression is NOT currently recommended (Hackett et al, 2008a).	**B**
7.11.3 Intervention	
Antidepressants can be used for people with stroke who are depressed (following due consideration of the benefit and risk profile for the individual) and for those who have emotional lability (Hackett et al, 2008b).	**B**
Psychological (cognitive and behavioural) intervention can be used for people with stroke who are depressed (Hackett et al, 2008b).	**B**

7.12 Deep venous thrombosis/pulmonary embolism	Grade
Early mobilisation and adequate hydration should be encouraged for all acute stroke patients to help prevent deep venous thrombosis (DVT) and pulmonary embolism (PE).	✔
Antiplatelet therapy should be used for people with ischaemic stroke to assist in preventing DVT/PE (Sandercock et al, 2008c).	A
Low molecular weight heparin or heparin in prophylactic doses can be used with caution for selected people with acute ischaemic stroke at high risk of DVT/PE. If low molecular weight heparin is contraindicated or not available, unfractionated heparin can be used (Sandercock et al, 2008c; Shorr et al, 2008).	B
Antithrombotic therapy is NOT recommended for the prevention of DVT/PE in patients with intracerebral haemorrhage.	✔
Thigh-length antithrombotic stockings are NOT recommended for the prevention of DVT/PE post stroke (Clots Trials Collaboration, 2009).	B
7.13 Pressure ulcers	**Grade**
All people with stroke with reduced mobility should have a pressure care risk assessment and regular evaluation completed by trained personnel.	✔
All people with stroke assessed as high risk for developing pressure ulcers should be provided with appropriate pressure-relieving aids and strategies, including a pressure-relieving mattress as an alternative to a standard hospital mattress (McInnes et al, 2008).	B
7.14 Falls	**Grade**
Falls risk assessment should be undertaken using a valid tool on admission to hospital. A management plan should be initiated for all those identified as at risk of falls.	✔
Multifactorial interventions in the community, including an individually prescribed exercise programme, should be provided for people who are at risk of falling (Gillespie et al, 2009).	B
7.15 Sleep apnoea	**Grade**
For people with sleep apnoea after stroke, continuous positive airway pressure (CPAP) or oral devices should be used (Giles et al, 2006; Lim et al, 2006).	B

8. Community participation and long-term recovery

Recommendations	
8.1 Self-management	**Grade**
People with stroke who are cognitively able should be made aware of the availability of generic (chronic disease) self-management programmes before discharge from hospital and be supported to access such programmes once they have returned to the community (Kendall et al, 2007; Lorig et al, 2001).	**C**
Stroke-specific programmes for self-management should be provided to people who require more specialised programmes.	✔
A collaboratively developed self-management care plan can be used to harness and optimise self-management skills.	✔
Community-based rehabilitation programmes can use self-management approaches to optimise recovery and social reintegration.	✔
8.2 Driving	**Grade**
All patients admitted to hospital should be asked if they intend to drive again.	✔
Any patient who does wish to drive should be given information about driving after stroke and be assessed for fitness to return to driving using the NZ Transport Agency Medical aspects of fitness to drive guideline.	✔
Patients with stroke or TIA should NOT return to driving for a minimum of one-month post event (refer to Medical aspects of fitness to drive guideline). A follow-up assessment (normally undertaken by a GP or specialist) should be conducted prior to driving.	✔
If a person is deemed medically fit but is required to undertake further testing, they should be referred for an occupational therapy driving assessment. Relevant health practitioners should discuss the results of the test and provide a written record of the decision to the patient as well as informing the GP.	✔
8.3 Leisure	**Grade**
Targeted occupational therapy programmes can be used to increase participation in leisure activities (Walker et al, 2004).	**A**
8.4 Return to work	**Grade**
People with stroke who wish to work should be offered assessment (ie, to establish their cognitive, language and physical abilities relative to their work demands) and assistance to resume or take up work or referral to a supported employment service.	✔
Psychological wellbeing should be a focus for intervention in working-age stroke patients as it is a predictor of return to work.	✔
8.5 Intimacy and sexuality	**Grade**
People with stroke and their partner should be offered:	
• the opportunity to discuss issues relating to sexuality with an appropriate health practitioner	✔
• written information addressing issues relating to sexuality post stroke	✔
Any interventions relating to sexuality should address psychosocial aspects as well as physical function.	✔

8.7 Peer support	Grade
People with stroke and family/carers should be provided with information about the availability and potential benefits of a local stroke support group and/or other sources of peer support prior to discharge from the hospital or in the community.	✔

8.8 Carer support	Grade
Carers should be provided with tailored information and support during all stages of the recovery process. This includes (but is not limited to) information provision and opportunities to talk with relevant health practitioners about the stroke, stroke team members and roles, test or assessment results, intervention plans, discharge planning, community services and appropriate contact details (Brereton et al, 2007; Smith et al, 2008).	C
Where it is the wish of the person with stroke (and their family/carer), carers should be actively involved in the recovery process by assisting with goal setting, therapy sessions, discharge planning, and long-term activities.	✔
Carers of people with stroke should be provided with information about the availability and potential benefits of local stroke support groups and services, at or before the person's return to the community (Brereton et al, 2007; Lee et al, 2007; Eldred & Sykes, 2008; Visser-Meily et al, 2005).	C
Carers of people with stroke should be offered services to support them after the person's return to the community. Such services can use a problem-solving or educational-counselling approach (Lee et al, 2007; Eldred & Sykes, 2008; Lui et al, 2005; Bhogal et al, 2003a).	C
Assistance should be provided for family/carers to manage people with stroke who have behavioural problems.	✔
Advice about the financial support available should be provided for family/carers of people with stroke prior to discharge and as needs emerge and circumstances change.	✔

8.9 Access to resources	Grade
Efforts to reduce the effects of socioeconomic disadvantage on stroke should be aimed at the pre-hospital stage in primary and secondary prevention, and in rehabilitation services post discharge (Wong et al, 2006; Putman et al, 2007).	C
A comprehensive assessment of the individual and their family/whānau's needs should be undertaken to facilitate access to appropriate secondary prevention and rehabilitation resources after stroke, including identification of any enablers and barriers.	✔

Part 2:
Stroke in New Zealand

Part 2 summarises evidence based on research questions that are specific to New Zealand. It has been developed to meet the specific needs of the New Zealand population.

Introduction to the guidelines

Burden of stroke in New Zealand

Stroke is the second most common cause of death worldwide and a common cause of disability in adults in developed countries (Johnston et al, 2009; Rothwell, 2001). Stroke is a major public health challenge in New Zealand (MOH, 2000). It is the third greatest cause of death in New Zealand, after all cancers combined and heart disease (MOH, 2009), and has an enormous physical, psychological and financial impact on patients, families, the health care system and society (Strong et al, 2007; Caro et al, 2000). A systematic review of 56 stroke incidence studies (Feigin et al, 2009) showed that the age-adjusted stroke incidence rate in New Zealand is high compared with other developed countries. Approximately 6000 New Zealanders suffer from a stroke every year (Brown, 2009; Tobias et al, 2007) and approximately 2000 deaths each year are attributable to stroke.

Most strokes are not fatal and, by contrast with coronary heart disease and cancer, the major burden of stroke is chronic disability rather than death (Wolfe, 2000). There are approximately 32,000 people living with a stroke in New Zealand, with only 30% independent in activities of daily living (Bonita, 1997a). A recent population-based, five-year follow-up of people with stroke in the Auckland region in 2002 to 2003, showed that a significant proportion had ongoing functional impairments over a wide range of domains (22.5% dementia, 20% recurrent stroke, 15% institutionalised, 30% depression, 33% bladder control problems or falls) (Feigin et al, in press; Barker-Collo et al, in press).

Although there has been a decrease in the overall incidence and mortality due to stroke in New Zealand in recent decades, favourable downward trends in some vascular risk factors, such as cigarette smoking, have been counterbalanced by observed increases in body mass index and frequency of diabetes, in patients with stroke (Anderson et al, 2005). Though there has been a significant decrease seen in stroke incidence among the New Zealand European population between 1981–1982 and 2002–2003, there has been no decrease in stroke incidence observed among Māori over the same period and stroke incidence among Pacific peoples appears to have increased (Carter et al, 2006).

The decline in overall age-standardised mortality rate for stroke in New Zealand over the last 20 years has been almost exactly balanced by the ageing of the population in general, resulting in almost no change at all in the number of stroke deaths per 100,000 population over this time (MOH, 2009). The increasing number of elderly people in New Zealand and the increased number of people with stroke being discharged from hospital, often with serious levels of disability, has resulted in an increase, rather than a decrease in the burden of stroke both on the health system and on families (Brown, 2009).

Lifetime costs per stroke patient in New Zealand are estimated at $73,600 per person, with a total cost to the country of over $450 million annually (Brown, 2009). If current trends in incidence and mortality continue (Anderson et al, 2005; Carter et al, 2007; Tobias et al, 2007), the number of people living with stroke will reach 50,000 by 2015, with overall annual costs of more than $700 million. Reducing stroke burden is key to improving independence within the community and for health service planning (Feigin & Howard, 2008).

Effective early intervention aims to promote maximum recovery and prevent costly complications and subsequent strokes. These guidelines have been developed in response to the burden of stroke on individuals and the community as a whole, and to incorporate new evidence related to the care of people with stroke or transient ischaemic attack (TIA).

About the guidelines

Purpose of the guidelines

The *New Zealand Clinical Guidelines for Stroke Management 2010*, referred to throughout this document as 'the guidelines', provides a series of evidence-based recommendations related to recovery from stroke and TIA to assist decision-making, and is based on the best evidence available at the time of development. The guidelines provide guidance on appropriate, evidence-based practice, to support clinical judgment that takes into account the preferences of the person with stroke and their family/whānau.

Scope of the guidelines

These guidelines cover aspects of stroke care across the continuum of care, including pre-hospital, acute, post-acute and community care. The guidelines cover secondary prevention of stroke and also cover management of TIA. The updated guidelines cover the most important topics pertaining to effective stroke care, of relevance to the New Zealand context.

It should be noted that these guidelines do not cover:

- subarachnoid haemorrhage
- stroke in infants, children and youth (ie, <18 years old)
- primary prevention of stroke – see *New Zealand Cardiovascular Guidelines Handbook* (2009). This can be accessed at: www.nzgg.org.nz.

Target audience

These guidelines are intended for use by health practitioners, administrators, funders and policy makers who plan, organise or deliver care for people with stroke during any phase of recovery from stroke or TIA.

Development of the guidelines

This guideline was developed in collaboration with the Australian National Stroke Foundation (NSF) Australian stroke guidelines update. In revising a guideline, the greatest requirement is a robust scientific evidence review process and the subsequent writing of evidence-based recommendations. The Stroke Foundation of New Zealand (SFNZ) recognised that collaboration with the NSF provided important economies of scale and avoided unnecessary duplication of process. New Zealand stroke experts have been involved in all aspects of the guidelines development process, and work on specific New Zealand aspects of the guidelines has been completed in collaboration with the New Zealand Guidelines Group (NZGG). The Australian stroke guidelines 2010 revision is the first time that a comprehensive stroke guideline incorporating both acute stroke management and stroke rehabilitation has been produced in Australia; this format has been used in New Zealand since 1996. It is hoped that the timetable for future revisions of the New Zealand guideline will also be synchronised with the Australian NSF programme.

The guidelines have been developed according to processes prescribed by the NHMRC and NZGG under the direction of an interdisciplinary working group – see Appendix 1. Details about the development methodology and consultation process are outlined in Appendix 2.

Importantly, the process of developing the guidelines has included input and advice from people with stroke and their families/carers. Their first-hand experience of stroke and stroke care has contributed a great deal, highlighting the importance of particular aspects of care, including those such as discharge planning, for which there is currently a limited evidence base.

While science and the fundamentals of evidence-based practice do not differ between Australia and New Zealand, this guideline has been prepared to specifically meet the needs of New Zealand and New Zealanders. The New Zealand Guideline Reference Group was given an important mandate to address areas of inequality in stroke care in this country. Comprehensive chapters focusing on Māori and Pacific peoples' stroke care are therefore included, as well as other sections addressing stroke care and stroke service provision issues which are unique to New Zealand.

Revision of the guidelines

SFNZ aims to review and update the guidelines every three to five years.

Using the guidelines

The primary goal in developing guidelines is to help health practitioners improve the quality and effectiveness of the care they provide.

Guidelines are different to clinical or care pathways (also referred to as critical pathways, care paths, integrated care pathways, case management plans, clinical care pathways or care maps). Guidelines are an overview of the current best evidence translated into clinically relevant statements. Care pathways are based on best practice guidelines but provide a local link between the guidelines and their use (Campbell, 1998).

In considering implementation of these guidelines at a local level, health practitioners are encouraged to identify the barriers and facilitators to evidence-based care within their environment to determine the best strategy for local needs (Shaw, 2005). Where change is required, initial and ongoing education is essential and is relevant for all recommendations in this guideline. Further information regarding implementation is discussed in Appendix 2.

Continuity, coordination and access

Continuum of stroke care

Acute care is characterised by a focus on rapid, thorough assessment and early management. Evidence continues to evolve and highlights the fact that the principles of rehabilitation should be similarly applied in the acute and post-acute setting (SUTC, 2007). Rehabilitation is a proactive, person-centred and goal-oriented process that should begin the first day after stroke. Its 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 an individual's improvements at an impairment level, but also with facilitating the resumption or development of meaningful life roles and reintegration into their community. These issues are considered by people with stroke to be vital to their 'recovery'. Therefore the importance of the transition between hospital and community care (including primary care) and supporting services is also vital.

Interdisciplinary team approach

The central aspect of stroke recovery is the provision of a coordinated programme by a specialised, interdisciplinary team of health practitioners. This rehabilitation team involves combined and coordinated 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. The person with stroke and their family/carer should also be recognised as important team members.

Perspectives of people with stroke

'The team should be like a wagon wheel with the patient being the hub and the various disciplines on the rim of the wheel and feeding into the hub via the spokes.'

While the interdisciplinary team recognises the specialist contribution of each discipline, generally no mention has been made of their specific roles throughout the document. The following is provided as a summary of the main roles of members of the team:

- **Doctors** coordinate comprehensive medical care (including consulting other medical specialists as needed), assist people with stroke and their family/carers in making informed choices and re-adjustments, and prevent complications and recurrent stroke. The doctor is often responsible for making sure the best available resources and services are offered to those affected by stroke. An inpatient medical team (commonly a specialist [eg, in neurology, rehabilitation or geriatric medicine], registrar and junior medical officers) work in conjunction with general practitioners to provide care in hospital and subsequently in the community.

- **Nurses** perform comprehensive nursing assessments and help manage aspects of patient care including observations, swallowing, mobility, continence, skin integrity, pain control and prevention of complications. Nurses also provide 24-hour inpatient-centred care and assist coordination of care, discharge planning, support and education. Nurses can provide specialist stroke care in the acute, rehabilitation and community context, as well as deliver palliative and terminal nursing care.

- **Physiotherapists** address recovery of sensorimotor function in the upper and lower limb, and work with people with stroke and their family/carers to aid recovery of functional ability (including walking and arm functions) in both hospital and community environments. They also assist in the treatment of musculoskeletal problems or complications (eg, shoulder pain) and respiratory problems.

- **Occupational therapists** work with people with stroke and their family/carers to enable participation in meaningful occupation. Meaningful occupation has been described as everything that people do to occupy themselves, including looking after themselves (self-care), enjoying life (leisure), and contributing to the social and economic fabric of their communities (productivity) (Townsend & Polatakjko, 2007). This may be achieved by either working directly to address recovery of function (including motor, cognitive or perceptual function), or by adapting the task or the environment.

- **Speech-language therapists** work with people with stroke who have difficulties with communication, cognition or swallowing, and also train family/carers to facilitate activity and participation.

- **Dietitians** work with people with stroke who need medical nutrition therapy (including texture modified diets and enteral [tube] feeding) and their family/carers, as well as those at risk of or with malnutrition. They also provide education and counselling for risk factor modification and management of comorbidities.

- **Social workers** provide support, counselling and information to people with stroke and their family/carers regarding options to optimise physical, emotional, social and spiritual wellbeing. They also assist in organising community resources and appropriate transfer to low level or high level care (eg, nursing homes).

- **Psychologists** work with people with stroke who have intellectual/cognitive impairment, emotional problems, or difficulties in behaviour, daily functioning or interpersonal relationships. They also work with family/carers to assist adjustment to and understanding of the cognitive deficits experienced by their relatives.

- **Pharmacists** assist in providing guidance and advice on the optimal use of pharmacotherapy and liaise with other health practitioners to discuss treatment options, provide therapeutic drug monitoring and assist in therapeutic decision-making. They also educate and counsel people with stroke and their family/carers about medicines.

Perspectives of people with stroke

'Family or whānau should also be part of the team.'

The team may be expanded to include psychiatrists, ophthalmologists, orthoptists, podiatrists, orthotists, recreation therapists and therapy assistants, as well as general ward staff.

Implications for service equity

Access to services is one of the major barriers to equitable services and is influenced by geography (including availability of transport), culture and spiritual beliefs. Particular challenges are noted for the provision of rural and remote services where resources, particularly human resources, may be limited. While it is recognised that residents in rural and remote areas may have difficulty accessing health care as readily as their urban counterparts, the aim in all settings is to develop local solutions that ensure optimal practice and quality outcomes that are based on the best available evidence using available resources. In New Zealand, the specific issues that are unique to Māori and Pacific peoples deserve special attention and are the subject of separate sections in the guidelines. Service equity issues relating to stroke in younger people are also addressed in a separate section.

Perspectives of people with stroke

In collaboration with the Stroke Foundation of New Zealand (SFNZ), the New Zealand Guidelines Group (NZGG) coordinated and facilitated a consumer forum which was held on 24 June 2010 in Auckland. The aim of this forum was to provide consumer feedback to the New Zealand Guideline Reference Group on the consultation draft of the guidelines. The focus of the forum was on 'Rehabilitation and life after hospital discharge'. Key content derived from the consumer forum is included in this section. For more details of the consumer forum and the process of consumer involvement in the development of the guidelines see Appendix 2.

Consumer priorities for a stroke service

Consumers participating in the forum were invited to list the 10 most important things they would like a stroke service to help them achieve, and to bring this list along to the consumer forum to share with other participants. The following is the agreed summary of forum contributions and discussion.

The 10 most important things consumers at the forum would like a stroke service to help them achieve were:

- optimum recovery through **ongoing** rehabilitation
- maximum independence (return home, resolve family/whānau issues)
- participation in leisure activity
- return to work (including understanding/empathy from employers)
- ability to drive again
- community support (support groups)
- support for spouses/caregivers (psychosocial and financial)
- ready access to information about stroke 'in plain language' and 'at a level for consumers'
- overcoming language/communication barriers (especially where English is a second language)
- achievement of goals and aspirations.

Improving the experience of health care for people with stroke

Some issues highlighted by consumers at the forum as areas where the experience of people with stroke could be improved included:

- psychosocial support during the early post-stroke period when difficulty coping with the unknown was a common experience

- availability of a key worker in the health care team who can provide consistent support

- consistency of messages between different members of the rehabilitation team

- empathy for simple needs, such as pain relief and need for sleep

- a patient-centred approach, tailored to the individual

- continuity of care in the long-term recovery process, including care in the process of transition between services, avoidance of unnecessary duplication of assessments and avoidance of premature discharge from rehabilitation services

- recognition that recovery from stroke is not 'time-limited' and recognition of the need for support to assist and encourage recovery in the long term.

Rehabilitation and recovery

Consumers at the forum expressed the view that in some situations the term 'rehabilitation' felt somewhat perjorative. Younger members of the group in particular commented that in popular culture the term rehabilitation is now commonly associated with rehabilitation from addiction or criminal behaviour. The perception of the group was that many New Zealanders viewed 'rehab' in this way.

Consumers at the forum also expressed the view that the term 'recovery' felt more appropriate to describe their overall experience and challenges after stroke. The following quote was written with respect to another health care setting but articulates this same consumer viewpoint:

> 'Persons are not passive recipients of rehabilitation services. Rather, they experience themselves as recovering a new sense of self and of purpose within and beyond the limits of the disability .... Rehabilitation refers to the services and technologies that are made available to disabled persons so that they may learn to adapt to their world. Recovery refers to the lived or real life experience of persons as they accept and overcome the challenge of the disability' (Deegan, 1988).

Māori and stroke

Key messages

- Significant disparities exist between Māori and non-Māori in the prevalence of stroke risk factors, stroke incidence and mortality rates, access to stroke care and stroke outcomes.

- Māori are also younger on average at first stroke onset than New Zealand Europeans (mean age 61 years compared with 76 years).

- Strategies to reduce inequalities in health, including stroke, must include the application of evidence-based guidelines to clinical decision-making.

- The recommendations made here aim to improve Māori health gain in stroke, reduce inequalities and support whānau. Importantly, Māori experience stroke, on average, 15 years earlier than New Zealand Europeans, and readers should also review the chapter 'Younger adults and stroke' in order to address the considerable issues for young Māori with stroke.

- Significant gains can be made for all New Zealanders when Māori cardiovascular health is improved.

Recommendations

Recommendations	
Policy	**Grade**
Stroke services, including funding and planning agencies, should work with iwi, hapū, whānau and Māori communities to develop strategies for Māori health gain and to reduce inequalities.	✔
Data	**Grade**
Ethnicity data is collected using the New Zealand Census question.	✔
Stroke services should provide training on 'ethnicity data collection' to appropriate staff.	✔
Workforce	**Grade**
A benchmark audit of the stroke workforce including ethnicity should be undertaken.	✔
A plan and appropriate budget should be developed to recruit, train and retain a Māori stroke workforce.	✔
Māori health worker capability in stroke should be supported. Māori health workers should receive training and education about stroke and local stroke protocols.	✔
All stroke workers should receive appropriate training and support in cultural safety and cultural competency.	✔

Recommendations continued ...	

Organised stroke services	Grade
Māori participation in decision-making, planning, development and delivery of stroke services should be supported. Stroke services should work, where possible, with Māori providers.	✔
Audits in stroke care should identify, and modify, differential stroke service provision by ethnicity.	✔
Outcomes specific to Māori with stroke should be developed.	✔
Provide an appropriate resource package, such as the 'Life After Stroke: four inspirational stories from Māori and Pacific people with stroke' DVD to person and their whānau within three months of stroke; ensure timely follow-up with a provider (GP, Stroke Foundation Officer or other) for clarification or reinforcement of the information provided and assistance with goal setting.	✔
Develop culturally-appropriate services, information and resources for Māori with stroke and their whānau.	✔

Whānau ora	Grade
'Whānau' is defined by the person with stroke.	✔
Goal-setting exercises should also consider the wellbeing of whānau; their physical, emotional, cultural, and social needs should be identified and addressed.	✔

Cultural	Grade
Providers should consider the cultural beliefs and practices of the person with stroke and respond appropriately to the person's preferences.	✔
Providers should facilitate access to cultural expertise for Māori with stroke including traditional healing (karakia, rongoa, mirimiri), te reo me nga tikanga Māori.	✔
Providers should seek Māori cultural input at times of assessment, goal setting and discharge planning when appropriate.	✔

Research	Grade
Stroke services should develop a research programme that provides evidence on access to, quality of care through and outcomes of stroke care for Māori. Interventions should be developed specifically for Māori with stroke, and their effectiveness measured.	✔
Kaupapa Māori research methodologies, including equal explanatory power, should be utilised in stroke research.	✔

Grade description

A   Body of evidence can be trusted to guide practice
B   Body of evidence can be trusted to guide practice in most situations
C   Body of evidence provides some support for recommendation(s) but care should be taken in its application
D   Body of evidence is weak and recommendation must be applied with caution
✔   Consensus-based recommendations (GPP)

Background

The Māori Advisory Rōpu in Stroke was established for the purpose of participating in the development of the 2010 New Zealand stroke guidelines. The group co-authored this chapter and contributed to the full guideline document. This chapter not only presents recommendations that are specific to Māori with stroke, but also directs the reader to relevant recommendations in other sections of the guidelines.

Māori indigenous rights in New Zealand are first and foremost recognised in the Treaty of Waitangi. Its intention is to ensure the wellbeing of all New Zealand residents, with Article Three in particular guaranteeing that Māori share equally in the benefits of modern society, including health care and health status (Waitangi Tribunal, 2001).

Health disparities between Māori and non-Māori are the most compelling and consistent in health in New Zealand (MOH & UoO, 2006). This is unacceptable. Strategies to reduce inequalities in health, including stroke, must include the application of evidence-based guidelines to clinical decision-making (Riddell, 2003). Significant gains can be made for all New Zealanders when Māori cardiovascular health is improved (Riddell, 2003).

Stroke and its impact for Māori

Māori are at increased risk for having a stroke and dying from stroke compared with non-Māori, non-Pacific peoples living in Aotearoa (Robson & Harris, 2007). Māori are also younger on average at first time of stroke than New Zealand Europeans (mean age 61 years compared with 76 years) (Carter et al, 2006). The age difference reflects the younger age of the Māori population as a whole (compared to the New Zealand European population), but stroke at a young age is associated with significant additional issues. These include loss of employment and income, increased strain on whānau and caregivers, and reduced social support (Daniel et al, 2009). Māori with stroke and their whānau also seek assistance for young people with stroke who are not able to drive and who have limited access to or opportunities for retraining. In addition, funding for and access to rehabilitation services is more restricted for people aged under 65 years (Fink, 2006), thereby limiting the rehabilitation options for the majority of Māori with stroke.

Disparities between Māori and non-Māori in the prevalence of stroke risk factors, access to stroke care and stroke outcomes have been well documented (Carter et al, 2006; McNaughton et al, 2002a; McNaughton et al, 2002b; Robson & Harris 2007; Feigin et al, 2007). A call to address ethnic disparities in stroke burden has been made in previous New Zealand stroke guidelines, published literature and national strategies and plans (Bramley et al, 2004; Robson & Harris, 2007; SFNZ & NZGG, 2003).

Māori health frameworks and stroke

Māori are not a homogenous population (Durie, 2001), but there are aspects that are more common to Māori than non-Māori. Components of a Māori health framework include:

- a holistic view of health that may feature physical, mental, spiritual, whānau, social or environmental wellbeing

- access to aspects of Te Ao Māori including te reo Māori (language) and whānau, hapū, iwi, marae and their specific customs or practices (tikanga)

- access to kaupapa Māori services including health and social services

- Māori aspirations for health and disability support, and a commitment to reducing the inequalities that exist between Māori and other New Zealanders (MOH, 2002).

Māori health frameworks considered for these guidelines:

- He Korowai Oranga, the Māori Health Stratgey for the Ministry of Health in New Zealand; translated as 'the cloak of wellness', its overall aim, *whānau ora*, is that Māori families are supported to achieve their maximum health and wellbeing (MOH, 2002)

- the Māori Cardiovascular Action Plan developed to improve the responsiveness of the health sector to Māori in cardiovascular health, including stroke (Bramely et al, 2004)

- the Whānau Ora Taskforce Report (Whānau Ora Taskforce, 2010), which sets out options for improving support services for families across New Zealand.

Policy

Given the significant disparities between Māori and non-Māori for stroke, policies for stroke in New Zealand must prioritise Māori health gain (Bramley et al, 2004). A revision of policies that may have negative impacts for Māori with stroke and their whānau (such as rehabilitation funding for under-65-year-olds) is also recommended.

Data

Data issues continue to undermine planning for Māori and stroke services. Immediate steps should be taken to collect accurate data by ethnicity, and by health and disability need so that a clear picture of the state of Māori and stroke is obtained (Robson & Harris, 2007).

Workforce

A critical shortage of Māori health and disability workers exists. Despite comprising 15% of the total population of New Zealand, fewer than 4% of doctors, 7% of nurses and 3% of therapists are Māori (MOH, 2007). Priority areas for the Māori stroke workforce are the recruitment, training and retention of doctors, nurses, therapists, researchers (Bramely et al, 2004) and stroke field officers.

Most of the Māori health workforce is made up of community health workers. Their knowledge and understanding of Māori language, culture and connections within Māori communities is significant. They therefore play an important role in facilitating access to and navigating through care pathways for Māori.

A culturally-safe and competent stroke workforce understands that quality and effective stroke care integrates cultural practices, values and concepts into the service delivery model. Such a workforce provides information in the person's first language, encourages whānau participation in decision-making, understands that people have different world views and values, and works alongside traditional healers (Tapsell, 2009).

Organised stroke services for Māori

Prevention

The assessment and modification of lifestyle and medical risk factors is essential given the higher incidence of stroke amongst Māori compared with non-Māori (Carter et al, 2006; Feigin et al, 2007). However, a total population approach to lifestyle and behavioural risk factors, such as smoking may have the potential to increase ethnic inequalities (Jarvis & Wardle, 1999) and may not therefore be effective for Māori. Interventions should be tailored to the individual; this may include risk assessment and modification for the whole whānau and involvement of culturally-appropriate services (such as auahi kore – smoking cessation). For further information see part 3, section 5.1 (Secondary prevention – Lifestyle modifications).

Assessment

A delay in access to stroke assessment for Māori can occur when frontline services or the individuals and their whānau do not recognise the symptoms/signs of stroke or the need for urgent medical attention (Harwood, 2005). For recommendations to improve early recognition and response to stroke see part 3, chapter 2 'Stroke recognition and pre-hospital care'; educational resources on these topics should be developed for Māori.

Organised stroke care

Organised stroke care, preferably in a stroke unit, is associated with improved stroke outcomes. It is also preferred by Māori and their whānau (Harwood, 2005). Access to stroke rehabilitation in particular is not universally available in New Zealand; people aged under 65 years and those living in rural areas have reduced access (Gommans et al, 2003). Given the younger age and the rural location of many Māori, inequalities in stroke care and outcomes are likely. Māori participation in all aspects of stroke services should be supported. Of note, indicators for quality of stroke services should include 'equity' and outcomes specific to Māori with stroke – see also part 3, section 1.11 (Stroke service improvement).

Information

Good quality 'information about stroke' is a significant issue for Māori with stroke and their whānau. Current information provision for Māori has been described as uncoordinated, difficult to understand and delivered by people with dissimilar backgrounds (Harwood, 2005). Oral information was preferred over written information. Importantly, the 2006 Adult Literacy and Life Skills report found that Māori had poorer health literacy skills compared with non-Māori (MOH, 2010), which limits the ability to understand and manage health conditions.

A DVD produced for Māori and Pacific people with stroke and their whānau aimed to address these issues. The DVD is called 'Life After Stroke: four inspirational stories from Māori and Pacific people with stroke'. The effectiveness of the DVD (to improve stroke recovery for Māori with stroke) was tested in a randomised controlled trial. The study showed that the DVD along with a 'goal setting exercise' led to improved physical summary scores on the SF36 and improved 'whānau ora' scores on the Hua Oranga measure (in press, 2010). The Stroke Foundation of New Zealand has copies of the DVD. Māori who have had a stroke reported preferring to watch the DVD with whānau and within 12 weeks of stroke. Further resources should be identified or developed for Māori and across 'age bands'. For more information about best practice in stroke information, see part 3, section 1.9.1 (Information and education).

Goal setting

Goal setting was identified by Māori with stroke as an area for concern; goals were said to be set by stroke workers, were limited by low expectations made by workers of Māori with stroke and did not always include whānau (Harwood, 2005). Goal setting should always take place with the person with stroke and whānau; appropriate outcome measures should be identified and used. Further information on goal setting is provided in part 3, section 1.7 (Goal setting).

Discharge planning

Māori with stroke are more likely to be discharged from hospital to live with others/whānau than to live on their own with support services or to live in a rest home/private hospital (McNaughton, 2002a). Evidence shows that young Māori experience more difficulties returning to work than non-Māori, particularly in the presence of an untreated psychiatric comorbidity (Glozier et al, 2008). Rural location, reduced access to transport and insecure tenure also create barriers in access to outpatient clinics and social and whānau activities. These issues should be considered when planning discharge – see part 3, sections 1.4 (Care after hospital discharge), 1.9.2 (Family meetings), 7.11 (Management of mood), 8.4 (Return to work) and 8.9 (Access to resources).

Māori participation in decision-making, planning, development and delivery of stroke services should be supported. Stroke services should work, where possible, with Māori providers.

Whānau ora

Whānau is defined as families within Māori communities. It may include traditional Māori definitions (such as extended family) or more contemporary models (groupings around similar interests such as social activities, work, health need or disability). Whānau ora is about families being supported to achieve wellbeing as a 'collective' (MOH, 2002).

Whānau ora outcomes have been defined:

- that whānau experience physical, spiritual, mental and emotional health and have control over their own destinies

- that whānau members live longer and enjoy a better quality of life (than they currently do)

- that whānau members, including those with disabilities, participate in Te Ao Māori (Māori society) and wider New Zealand society (MOH, 2002).

Māori are more likely to be discharged into the care of whānau after hospitalisation for stroke (McNaughton et al, 2002a); therefore more whānau take on caregiving tasks. International evidence that caregiving for a person with stroke is associated with adverse effects (Young & Forster, 2007) is supported by qualitative interviews with Māori who have had a stroke and their whānau (Moewaka Barnes & Tunks, 1996; Harwood, 2005). The reported negative impacts on emotional health, social activities, family relationships and finances, may outweigh the privilege of caring. For relevant recommendations on carer/whānau support see part 3, sections 8.7 (Peer support) and 8.8 (Carer support).

Health determinants such as social, economic, environmental and political factors have important roles in health outcomes. The profile for Māori in education, employment, income, housing, income support, justice, health literacy and deprivation is very different to that of non-Māori (Ministry of Social Development, 2006) and health disparities between Māori and non-Māori are a direct consequence of inequalities in the distribution of these health determinants (Robson, 2004; King & Gracey, 2009).

Whānau Ora policy recognises the differential distribution of determinants for poor, and good, health between Māori and non-Māori. It also requires sectors such as housing, education, social welfare, along with the whole government sector, to work together and address this issue. Stroke providers should work with people in their social contexts, not just with their physical symptoms (MOH, 2002); an example is the provision of information about available financial support, as recommended in part 3, section 8.8 (Carer Support).

Cultural

While Māori and non-Māori may have some stroke care needs in common, there are also differences. *He Anga Whakamana: A Framework for the Delivery of Disability Support Services for Māori* identified a preference from Māori with disabilities for Māori specific assessment criteria, access to cultural expertise and input to assessments Ratima et al, 1995). Lack of 'cultural fit' has been identified by Māori as a barrier to accessing health and disability services (Jansen et al, 2009).

Research

The evidence base for Māori and stroke is limited; both quantitative and qualitative research pertaining to access and equity of stroke care for Māori is needed (Bramely et al, 2004). Kaupapa Māori research should be given precedence as it prioritises Māori, is focused on reducing inequalities, and is by Māori and for Māori (Smith, 1999).

Pacific people and stroke

The priority outcomes and actions for Pacific health for 2010 to 2014 are outlined in the Ministry of Health document *'Ala Mo'ui* (MOH, 2010). *'Ala Mo'ui* reinforces the importance of a holistic approach to Pacific health and wellbeing, and healthy, strong families and communities, and rests key priorities within four guiding principles:

- quality health care
- valuing family
- respecting Pacific culture
- working together.

These guiding principles have been used to group the following key messages and recommendations for Pacific people with stroke.

Key messages

- **Quality health care:** A programme to reduce the incidence of stroke in Pacific people should have health promotion and prevention as its primary focus.

- **Valuing family:** Pacific peoples have a holistic perspective of health and, within this perspective, family and cultural beliefs play important roles in influencing their health care preferences. Involving the family in the care process is important for most Pacific people.

- **Respecting Pacific culture:** A culturally-competent health care worker should be involved early in the post-acute phase to support the person with stroke and their family. Care is culturally-competent when it integrates cultural practices, values, and concepts into the service delivery model and this is vital to Pacific people receiving high-quality and effective health care.

- **Working together:** Given the multiplicity of barriers (ie, cultural, financial and communication barriers) to care access, a multidimensional approach to addressing disparities in care access is advocated for Pacific peoples with stroke.

  Networks that support Pacific families through the stroke care process are necessary to assist carers and their families with accessing the relevant benefits and entitlements.

Recommendations

Recommendations	
Quality of health care	**Grade**
For Pacific people, a programme to reduce the incidence of stroke should have health promotion and prevention as its primary focus. Health promotion materials and mechanisms should reflect the needs of the communities they serve, and be delivered in an appropriate manner.	✔
Health systems planners need to ensure that information about stroke, support services and related health-promotion materials reflect the needs of the communities they serve, and are delivered in an appropriate manner.	✔
The establishment of Pacific community support networks specific to stroke in appropriate geographical locations should be facilitated.	✔
Service providers should support improvements in culturally-competent, patient-centred care by collecting accurate ethnicity data, monitoring the effectiveness of care, and reviewing patient experiences.	✔
Research that provides further quantitative information, and includes qualitative research capturing the experiences of Pacific people with stroke, should be developed. Capability development needs to be a key part of a research programme.	✔
Research needs to reflect the ethnic diversity of the Pacific community and ensure that the findings are shared with the community from which they were generated.	✔
Health provider organisations and practitioners should be aware that they are required to meet quality of service obligations under the New Zealand Health and Disability Code of Rights.	✔
Valuing family	**Grade**
The role of the family, extended family and community should be acknowledged and empowered by identifying attitudes and beliefs that the individual and family have towards stroke.	✔
Sufficient time should be set aside for communication and this process should be facilitated early in post-acute care by a culturally-competent health practitioner, and in an appropriate environment. This is especially important for Pacific people who have limited English (eg, older Pacific people and recent migrants).	✔
Health practitioners should ascertain: • the person with stroke's attitudes and beliefs concerning their illness, their sense of personal responsibility for recovery/regaining function, their expectations about their family's role in caring for them and their beliefs regarding traditional healing practices • the person with stroke's willingness to implement change based on these beliefs and expectations • the family and extended family's beliefs about stroke causation, expectations of post-stroke function and beliefs about post-stroke care • the consequent barriers to change for that individual. Health practitioners, or a culturally-competent facilitator, should then negotiate the changes that are possible, realistic, culturally acceptable and affordable.	✔

Recommendations continued ...	

Respecting Pacific culture	Grade
Health practitioners and others providing stroke care should receive training and support in delivering culturally-competent, patient-centred care; including understanding the impact of culture on illness, rehabilitation and recovery.	✓
Health practitioners should recognise that the term 'Pacific' represents diverse ethnic groups, and increasingly includes multi-ethnic and New Zealand-born Pacific people.	✓
Health practitioners should consider the impact of cultural and spiritual beliefs and respond to the preferences of the patient in order to enhance the therapeutic relationship.	✓
Workforce development should target the training of more Pacific stroke care providers and researchers to increase the capacity and capability of Pacific health workforce.	✓
Pacific people with stroke may prefer to see Pacific providers. Pacific providers in the area are a valuable resource, and should be consulted for advice on approaches or made available to the patient during management of stroke in Pacific peoples.	✓

Working together	Grade
For Pacific people with stroke, a culturally-competent health care worker should be involved from early in the post-acute phase of care, to support the person with stroke and their family in the following areas: • planning of care and the provision of information to the patient and their family • setting recovery goals collaboratively with the patient and their family • developing a comprehensive discharge programme and ensuring safe transfer of care • facilitating contact with community health workers who support the person with stroke and their family post discharge.	✓
Health practitioners and others providing stroke care should ascertain a person's specific needs related to communication of information, including an interpreter where necessary, and ensure that these are met.	✓
Health practitioners and others providing stroke care should be aware that socioeconomic circumstances will impact on the care of the Pacific person with stroke. There may be financial obligations (to the family and church), which may take priority over personal and health needs.	✓

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✓ Consensus-based recommendations (GPP)

Stroke in Pacific peoples

Pacific peoples, along with Māori, experience strokes at high rates compared with other New Zealanders, with research indicating that the Pacific stroke mortality rate for 2001 to 2004 was over two times the mortality rate of European/Other New Zealanders for the same period (Blakely et al, 2007). In 2001 to 2004, age-standardised stroke mortality rates were 27.3 per 100,000 for Pacific males and 19.9 per 100,000 for Pacific females. There was no significant difference in these stroke mortality rates between males and females (Blakely et al, 2007).

Studies on the incidence of stroke show onset occurring at younger ages among Pacific people (Anderson et al, 2005; Bonita et al, 1997b; Carter et al, 2006; Feigin et al, 2007; Fink, 2006) and on average, 10 to 15 years earlier compared with New Zealand Europeans (Carter et al, 2006). This higher incidence of stroke among Pacific people is associated with the presence of more risk factors for stroke including diabetes, obesity, smoking and hypertension (Carter et al, 2006; Fink, 2006; Feigin et al, 2006), and may also reflect lower use of primary and secondary preventive care (eg, lower use of cholesterol-lowering and blood pressure control medications) (Fink, 2006). In addition Pacific peoples, along with Māori and Asian/Other New Zealanders, experience more severe strokes than New Zealand Europeans (CTRU, 2010).

One recent study estimates Pacific stroke incidence has increased by approximately 66% (95% CI 11–225%) and diverged from the (decreasing) trend seen in New Zealand Europeans from 1981 to 2003 (Carter et al, 2006). Some of this observed increase in stroke incidence could be due to increased immigration (Fink, 2006), and this explanation is supported by the disproportionately larger number of Island-born stroke patients in the Pacific cohort (Carter et al, 2006) of the study. Over the same period, there has been a reduction in stroke mortality among Pacific peoples, with a 50% to 60% decreasing trend in Pacific peoples' stroke mortality from 1981 to 2004, alongside a larger decline in European/Others (Blakely et al, 2007). This is likely to reflect a decline in stroke case fatality, with Pacific peoples experiencing the largest decline in 28-day case fatality rate from 1981 to 2003 among ethnic groups (Carter et al, 2006). This data shows that while Pacific peoples are benefiting from improvements in hospital stroke care since 1981, efforts to reduce disparities in stroke outcome for Pacific peoples must prioritise primary prevention and community rehabilitation/integration phases of stroke care.

For Pacific people, the importance of preventive care, aimed at pre-hospital stages, becomes apparent from the research literature. The Pacific cohort in the Auckland Regional Community Stroke (ARCOS) study (ARCOS Study Group, 2009) had significantly higher proportions of people with diabetes, smoking, obesity – all known risk factors for stroke onset; and this is mirrored internationally in ethnic minorities in the UK and USA (Carter et al, 2006; Fink, 2006; Feigin et al, 2006). Other New Zealand studies, on patients with diabetes and cardiovascular disease, report similar risk factor profiles among Pacific groups; and recognise the risk factors as key contributors to the poorer long-term health outcomes Pacific people with these chronic diseases experience (Kerr et al, unpublished; Robinson et al, 2006). Given the

increasing trend in Pacific stroke incidence (Carter et al, 2006), and international evidence that preventive measures can substantially reduce stroke incidence (Feigin et al, 2009), improving preventive care for Pacific peoples with known risk factors for stroke, warrants further attention.

Pacific peoples in New Zealand

Pacific peoples in New Zealand are a diverse population; their origins lie in more than 22 different Pacific nations, each with its own distinct culture, language and history, but with underlying commonalities (MOH, 2008a). In the 2006 New Zealand Census, there were 265,974 people self-identifying with Pacific ethnicity, representing almost 7% of the New Zealand population. Samoan was the largest Pacific group (131,103 people), making up almost half the Pacific population, followed by Cook Island Māori (58,011), Tongan (50,478), Niuean (22,476), Fijian (9,864), Tokelauan (6,822) and Tuvaluan (2,625) groups (SNZ, 2007). The Pacific population overall is very young and highly urbanised, with 38% of the population aged under 15 years in 2006, and 92% of the population living in areas with over 30,000 residents (SNZ, 2007; MSD, 2009). At least two-thirds of Pacific peoples reside in the Auckland region, with Manukau city having the highest Pacific population (MOH, 2008a).

The Pacific population is dynamic, and cultural beliefs and values within the population continue to evolve (Minister of Health & Minister of Pacific Island Affairs, 2010). Since immigration, the proportion of Pacific peoples born in New Zealand (New Zealand-born) has increased, with larger New Zealand-born groups among Niueans, Cook Island Māori and Tokelauans; and smaller New Zealand-born groups among Samoans, Tongans and Fijians. The number of Pacific children born with dual or multiple ethnic ancestries has also increased (Callister & Didham, 2008).

Subtle cultural differences have emerged between the Pacific groups. Smaller proportions of Niueans and Cook Island Māori, for example, speak their language and identify with a religion compared to Samoans and Tongans; and more ethnic intermarriage occurs among Niueans and Cook Island Māori (Blakely et al, 2009). There is also evidence that health outcomes, such as cardiovascular disease, vary between Pacific groups (Blakely et al, 2009).

All of these aspects of diversity – place of birth, multiple ethnicities and variation between groups – mean Pacific peoples' health beliefs, values, and care preferences, are also diverse.

Pacific peoples' health status

Pacific peoples experience poorer health outcomes than other New Zealanders across a number of indicators and have high rates of chronic diseases (MOH & MPIA, 2004). Although there have been some improvements, Pacific peoples are still worse off across a number of socioeconomic indicators known to influence health, including: employment, education and housing quality (Minister of Health & Minister of Pacific Island Affairs, 2010; Tait, 2008).

Amenable mortality, a subset of avoidable mortality which reflects deaths that should not occur given available health care technologies (including health prevention), is high for Pacific people (Tobias & Yeh, 2009). Pacific peoples' amenable mortality has decreased relatively little in recent years compared to other ethnic groups, indicating that health care has been less effective, and suggesting improvements are needed in the quality and cultural safety of care, for Pacific peoples (Tobias & Yeh, 2009).

Pacific concepts of health and illness

Although Pacific peoples are culturally diverse, two underlying commonalities are that the view of health is holistic, and that family is the basis of successful and healthy Pacific individuals and communities (Minister of Health and Minister of Pacific Island Affairs, 2010; Capstick et al, 2009). The holistic perspective has been described in various Pacific models of health as incorporating the physical, mental, spiritual and social connectedness of Pacific people in their communities (Minister of Health & Minister of Pacific Island Affairs, 2010). The role of the family is known to be central to Pacific health and wellbeing, and involving the family in the care process is important for Pacific peoples (National Advisory Committee on Health and Disability, 2007).

Pacific peoples' holistic health beliefs, and the cultural importance of the family and community, can impact on their health behaviours and choices (Minister of Health & Minister of Pacific Island Affairs, 2010). Sometimes heavy family commitments, including remittance payments to families in the Pacific Islands, take priority over health care (CBG Health Research, 2005) and traditional healing practices play an important role in the health care for some, particularly older Pacific people (MOH, 2008b).

For Pacific peoples, cultural competence is vital to receiving high-quality and effective health care (MOH, 2008a; 2008b). Care is culturally competent when it integrates cultural practices, values and concepts into the service delivery model. Achieving this may require: providing information in the patient's first language; using interpreters and translators to facilitate communication; allowing participation of family members as well as the person with stroke in decision-making about health care; understanding the family living situation and working alongside traditional healers (MOH, 2008b).

The Pacific health and disability workforce is particularly important for providing Pacific peoples with culturally-competent health care, but there continue to be shortages throughout the workforce (Minister of Health & Minister of Pacific Island Affairs, 2010). The Pacific health workforce is largely comprised of nurses and care and support workers (eg, community health workers, youth workers and aged care workers), the latter of which play important roles as coordinators of Pacific health care (Minister of Health & Minister of Pacific Island Affairs, 2010; Ulugia-Veukiso et al, 2009). Pacific doctors are under-represented compared to the proportion of Pacific peoples in New Zealand (MCNZ, 2008). Pacific health workers have a knowledge and understanding of the culture and language, and have connections with Pacific communities; all of which are important for facilitating communication, trust and comfort during the care process (NACHD, 2007). Involving workers from the same ethnic group as the patient into health care delivery can enhance access to, and improve their effectiveness, for ethnic minorities (Barwick, 2000).

Acute and post-acute stroke care for Pacific peoples

There is a limited evidence-base on stroke care for Pacific peoples. In particular, qualitative research describing Pacific peoples' experiences of stroke and stroke care is sparse, and the majority of the research does not investigate outcomes for specific Pacific groups. The literature reviewed for these guidelines was based on a broader search that included evidence on the care of Pacific people with chronic conditions.

There are general issues for Pacific peoples' access to health services that are applicable to stroke care. In particular, barriers to accessing health services and care are prominent among Pacific peoples. These barriers include: cost of services; lack of access to transport or after hours services; communication barriers and experiencing cultural discomfort when discussing health issues with non-Pacific practitioners (MOH, 2008b; CBG Health Research, 2005). Barriers to care access are implicated in the high rates of 'did not attends' observed, particularly for secondary care appointments, among Pacific peoples (MOH, 2008b). Attendance at post-discharge cardiac rehabilitation services, for example, has been shown to be lower for Pacific peoples (Kerr et al, unpublished). Negative inpatient experiences by stroke patients and their families may also contribute to post-discharge clinic non-attendance. Health care workers should be aware that open discussion about bodily functions and personal care may not always be appropriate and may create barriers. For Pacific stroke patients, the complex mix of their socioeconomic resources, their diverse cultural beliefs and the role that family plays in their lives, influences their expectations, and the outcomes, of rehabilitation services.

Evidence from international literature suggests an individual's access to socioeconomic resources has the most impact on their access to post-discharge stroke care, with studies showing little difference in in-hospital outcomes observed between patients from differing social deprivation areas (Wong et al, 2006), and incomes (Putman et al, 2007). For guidelines on the effect of access to resources (family and financial resources, access to transport, and social deprivation) – see part 3, section 8.9 (Access to resources).

Mental health disorders are common in people with stroke and should not be underestimated in Pacific people with stroke. Pacific people are less likely to report and receive care for mental health difficulties, and are more likely to be diagnosed with serious mental health disorders. It is important that culturally-appropriate mental health screening tools are used, particularly when patients and their families have English as a second language. For example, TaPasefika, a Pacific Primary Health Organisation, uses open questions about sleep, appetite and interests to lead into a mental health screening tool. Care with language is vital to support the destigmatisation of mental disorders and to improve access to culturally-appropriate talking therapy (Tiatia, 2008). For further guidance on the detection and treatment of mental health disorders, see part 3, section 7.11 (Management of mood).

The family is central to the care process for many Pacific peoples, and it is important to connect the family to the health worker treating the person to ensure the overall needs of the family are met (NACHD, 2007). Pacific families will, because of cultural expectations, often take up the role of informal carer of the member of their family with stroke. Case studies have shown that, in addition to providing practical support, Pacific family members took on roles as advocates, translators and 'errand runners' for the person with the chronic condition. This multiplicity of roles placed stress on the family caregiver but, because of cultural expectations on family members to care for their own, Pacific participants preferred not to use paid care services (NACHD, 2007).

Along with limited financial resources and lack of knowledge of the available support services, difficulties understanding the information provided by medical practitioners and poor housing, present significant challenges for the Pacific carer (NACHD, 2007; 2009). The complex tasks involved with post-discharge care, such as housing modifications, can place significant demands on the family member taking up the informal carer role. Networks that support Pacific families through the stroke care process are necessary to assist carers and their families with accessing the relevant benefits and entitlements. For guidelines on carer support – see part 3, section 8.8 (Carer support).

Given the mean age of Pacific stroke onset is within the working years (Carter et al, 2006), stroke will have a major impact on the Pacific family's finances, when the person with stroke is the main provider for the family. The combination of services necessary for meeting the needs of Pacific stroke patients of working age, and their families, will be different compared with those designed to meet the needs of a stroke patient of non-working age.

International evidence has demonstrated a higher number of unmet service needs in younger stroke patients, particularly in vocational rehabilitation (Daniel et al, 2009). In New Zealand, there is some evidence that being of Pacific, Māori and Asian ethnicity, or having untreated psychiatric comorbidity, is associated with being less likely to return to work post-stroke (Glozier et al, 2008). Although there is no specific evidence on Pacific peoples' vocational rehabilitation and use of services to support return to work, there is some suggestion (based on a combined Māori, Pacific and Asian, or, 'non-European' cohort) that longer hospital stays observed in non-European New Zealanders may reflect their lower access to inpatient rehabilitation services aimed at younger people, because most New Zealand inpatient stroke services are aimed at older stroke patients (McNaughton et al, 2002b).

There is evidence (based on a combined Māori, Pacific and Asian, or 'non-European' cohort) that non-European stroke survivors have lower physical functioning and remain more dependent after hospital discharge (McNaughton et al, 2002a). Although the exact reasons for the higher dependence among non-European stroke survivors is unclear, international literature on other ethnic minorities suggest the higher prevalence of comorbidities, and delay seeking care and rehabilitation may be responsible.

Reasons for delay in seeking care and rehabilitation are complex. In addition to negotiating socioeconomic and cultural barriers, accessing acute stroke care requires awareness of stroke symptoms at the initial care-seeking stage. Preliminary findings from interviews and focus groups with Pacific (and Māori) stroke patients in New Zealand revealed that many lacked knowledge about stroke (Medical Research Institute of New Zealand 2005–2009). International literature suggests an individual's knowledge of stroke can be improved through well-designed community-specific education programmes that are culturally- and age-appropriate (Williams & Noble, 2008), although, there is less evidence that increased knowledge translates into faster contact with medical services when symptoms are recognised (Moloczij et al, 2008). For guidelines on stroke education programmes – see part 3, section 2.1 (Stroke recognition).

For Pacific peoples, accessing post-acute stroke services requires having access to information and support services that are delivered in appropriate formats. Pacific peoples are often unaware of the support available to them from government agencies and health practitioners or services (MOH, 2008b). Internationally, the term 'health literacy' has been used to describe the capacity people have to obtain, process and understand the health information and services needed to make appropriate health decisions (Ratzan & Parker, 2000). A person's health literacy is mediated by their education, culture and language, and these interact to influence a person's health outcomes and their utilisation of available health services. A person's culture, for example, and differing education levels between providers and patients, as well as between creators of health information and users of the information, can influence health literacy in a particular setting (IOM, 2004). Health literacy, utilisation of services and associated health outcomes, tend to be poorer in ethnic minorities and people with English as a second language (Minister of Health & Minister of Pacific Island Affairs 2010; IOM, 2004).

Supporting Pacific people to be healthy, through improving health literacy, has also become an important point of focus in the New Zealand health sector (Minister of Health & Minister of Pacific Island Affairs, 2010). Systematic reviews of international evidence show that providing culturally-appropriate health education improves management and health outcomes for ethnic minorities with type 2 diabetes (Hawthorne et al, 2008). Examples include having community-based health advocates delivering health education in an appropriate language, and using teaching and learning methods that suit the cultural and community needs (Hawthorne et al, 2008). For Pacific peoples, this may mean ensuring that stroke care includes the provision of information on stroke and symptom recognition in an appropriate language and delivered in appropriate modes tailored to their needs.

Considerations when caring for Pacific peoples with acute and post-acute stroke

Based on the evidence reviewed and the expertise of the Pacific Peoples Sub-group, a number of considerations need to be taken into account when caring for Pacific peoples with acute and post-acute stroke. These considerations are:

- Pacific peoples have a holistic perspective of health and, within this perspective, family and cultural beliefs play important roles in influencing their health care preferences. Traditional healing practices are still important for the health care of some Pacific peoples.

- For Pacific peoples' stroke care, three levels, including primary prevention (pre-hospital), secondary care (rehabilitation) and home/community care, should be considered. At the primary prevention level, those designing and delivering education and public awareness programmes, should consider the appropriateness of the language and delivery methods (eg, Pacific radio) suitable for Pacific peoples. At the secondary care level, culturally-competent care, and providing appropriate information about available support for Pacific stroke patients and their families is important for reducing barriers to accessing rehabilitation. At the home/community level, ensuring that adequate support is available to the family of the Pacific person with stroke is important for facilitating their access to support entitlements and supporting the family carer's wellbeing.

- Given the multiplicity of barriers (ie, cultural, financial and communication barriers) to access care, service providers should apply a multidimensional approach to addressing disparities in care access and benefit entitlements, when caring for Pacific peoples with stroke. Multidimensional strategies include:
  - training for health practitioners in communication, cultural competency and the impact of culture on illness, rehabilitation and family roles
  - putting in place processes which support feedback from different cultural groups to improve service quality

- addressing additional financial barriers (eg, cost of transport to appointments, cost of GP visits and medications)
- addressing communication barriers and other barriers to care (eg, appointment flexibility).

- It is particularly important to consider the young age of Pacific stroke patients and the post-acute services needed to enhance their return to work. There will be a large financial impact on the family if the person with stroke was the main source of family income.

- The Pacific health workforce is valuable for providing culturally-competent care to Pacific stroke patients and their families, and improving the overall quality of care and support they receive. Training and support in the delivery of culturally-competent, patient-centred stroke care is important for all health practitioners.

- Careful monitoring and reviewing of patient experiences of stroke care can further improve quality of care. Establishing quality improvement processes to support feedback from people of different cultures is important.

Younger adults and stroke

Recommendations

Recommendations	
Younger adults and stroke	**Grade**
Community services should be equally accessible for people with stroke aged under 65 years as for those aged 65 years and over.	✔
Community services for people with stroke aged under 65 years should be responsive to the needs of Māori and Pacific peoples.	✔
People with stroke who wish to work should be offered assessment (ie, to establish their cognitive, language and physical abilities relative to their work demands) and assistance to resume or take up work or referral to a supported employment service.	✔
Research on New Zealand stroke rehabilitation and community support services for people with stroke aged under 65 years should be a priority area.	✔
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

Approximately one-quarter of all people with first stroke in New Zealand are aged under 65 years at stroke onset (Tobias et al, 2007). However, there is a striking disparity in age at stroke onset between ethnic groups in New Zealand. The mean age at first stroke onset is 76 years in the New Zealand European population, 65 years in Pacific peoples and 61 years in Māori (Carter et al, 2006). Much of the burden of stroke among Māori and Pacific peoples is therefore seen to fall in the 'younger' age group, aged under 65 years.

Return to work

In the 2002 to 2003 Auckland Regional Community Stroke (ARCOS) study, 20% of people with first-ever stroke reported being in paid employment before the index event (Glozier et al, 2008). The mean age of these people was 55 years and 75% of them had survived at six months post stroke. Of the working people who survived six months, 53% had returned to full-time work. New Zealand European ethnicity showed a significant association with return to paid employment, with 60% of New Zealand Europeans returning to work at six months compared with 40% among non-Europeans (p=0.05). Apart from non-European ethnicity, other factors associated with reduced probability of returning to work included stroke severity, prior part-time employment and psychiatric morbidity. Most (86%) previously working people who were still in hospital

at one month post stroke were unable to return to work (Glozier et al, 2008). Successful return to work is strongly associated with greater quality of life (Barker, 2006). A return to work recommendation has been included in this chapter, given the importance of this topic for young people with stroke. For further recommendations and additional information on return to work post stroke see part 3, section 8.4 (Return to work).

Other social consequences

Stroke in working-age adults has important social consequences. Family relationships can be affected. Issues may include marital problems, impaired sexual relationships, difficulty with childcare and the impact on children as caregivers; however, the reported frequency of these problems varies greatly between studies in different populations and using different methodologies (Daniel et al, 2009). The proportion of people with stroke who decrease involvement in leisure activities has been reported as from 15% to 79% (Daniel et al, 2009).

Unmet needs

As part of a longitudinal study of stroke in the Netherlands (van de Port et al, 2007), factors related to perceived unmet needs in people who had a stroke three years earlier were examined. People were interviewed in their homes about perceived problems, participation, needs and comorbidities, with only those who were capable of communicating in an interview included in the study. Low motor function (OR 5.05, 95% CI 1.94–13.15), presence of depression (OR 5.28, 95% CI 1.43–19.53) and fatigue (OR 3.80, 95% CI 1.49–9.71) were all independently associated with a higher likelihood of having perceived unmet needs. Being aged over 60 years was associated with lower unmet needs (OR 0.19, 95% CI 0.07–0.52). One-third of people with stroke had at least one unmet need, with work, leisure time and education-related unmet needs identified most frequently.

A UK survey of people with stroke aged under 65 years found that there were significantly more unmet needs among the youngest within this group, particularly younger people with poorer mobility and those unable to return to work (Kersten et al, 2002).

Stroke services for people aged under 65 years in New Zealand

There is limited access to rehabilitation services that are specialised in stroke rehabilitation for people aged under 65 years in New Zealand. A recent survey of stroke rehabilitation services in New Zealand excluded rehabilitation for people aged under 65 years from consideration (Gommans et al, 2008a). While funding of rehabilitation and community support services for people with stroke aged 65 years or older is the responsibility of District Health Boards (DHBs), funding of these services for people aged under 65 years is provided through Disability Support Services. A negative consequence of this division in funding streams is that people with stroke aged under 65 years, including the majority of Māori and Pacific people with stroke, are not able to access DHB-funded stroke-specific rehabilitation and community services that are developed in response to guidelines such as this one.

The process by which community rehabilitation services, including vocational (re)training, and community support are accessed after stroke is often complex for those aged under 65 years and there is a perception of significant unmet need (Fink, 2006). A large burden of stroke is borne by unpaid caregivers, most of whom are female and of working age; many of whom are the spouse of the person with stroke (Parag et al, 2008). Māori caregivers for family members with stroke have identified income-testing and asset-testing for access to residential care as an issue for Māori, due to concerns regarding the possibility of loss of Māori land secured through whakapapa (genealogy) (Dyall et al, 2008). Care for family members with stroke poses a substantial financial burden on caregivers and results in restriction in participation in other family and community activities and impaired emotional wellbeing among Māori (Dyall et al, 2008), as for the general population (Parag et al, 2008).

Stroke service provision in New Zealand

Recommendations

Recommendations	
Stroke service provision	**Grade**
All District Health Boards (DHBs) should provide organised stroke services.	✔
All people admitted to hospital with stroke should expect to be managed in a stroke unit by a team of health practitioners with expertise in stroke and rehabilitation.	✔
Large and medium-sized DHBs should provide an acute stroke thrombolysis service for their populations.	✔
All DHBs should provide a TIA service in accordance with the NZ TIA Guideline (2008).	✔
Large DHBs can provide organised stroke-specific community teams.	✔
Māori and Pacific participation in decision-making, planning, development and delivery of stroke services should be supported. Stroke services should work, where possible, with Māori and Pacific providers.	✔

Grade description
A   Body of evidence can be trusted to guide practice
B   Body of evidence can be trusted to guide practice in most situations
C   Body of evidence provides some support for recommendation(s) but care should be taken in its application
D   Body of evidence is weak and recommendation must be applied with caution
✔   Consensus-based recommendations (GPP)

The previous version of the New Zealand stroke guideline *Life After Stroke: New Zealand guideline for management of stroke* published in 2003 (Baskett & McNaughton, 2003) identified that the two critical areas of stroke management where a change in practice would make an important difference to outcomes for people with stroke were that:

1.   all DHBs should provide organised stroke services

2   all people admitted to hospital with stroke should expect to be managed in a stroke unit by a team of health practitioners with expertise in stroke and rehabilitation.

These same key messages were present in the first edition of the New Zealand stroke guidelines (Baskett, 1996), but were largely ignored at that time (Arden-Jones et al, 1999; Barber et al, 2002; Gommans et al, 2003).

Since 2003 there has been a significant increase in availability of organised stroke services and stroke unit care across New Zealand; however, many gaps still remain.

In 2007, a survey of acute stroke services in New Zealand was performed and results compared with a similar survey in 2001 (Barber et al, 2008). The number of hospitals with a designated lead stroke physician rose from five out of 41 hospitals surveyed in 2001, providing service to 26% of the New Zealand population, to 16 out of 46 hospitals surveyed in 2007, providing service to 88% of the population (Barber et al, 2008). A designated area for care of acute stroke patients was provided for 11% of the New Zealand population in 2001 and had increased to 48% of the population in 2007, with similar proportions reported for designated stroke rehabilitation areas. An acute stroke thrombolysis service was provided for only 9% of the New Zealand population in 2001 but had increased to 67% of the population in 2007.

In 2009, all 21 DHBs participated in a national acute stroke audit (SFNZ, 2010). At the time of the national audit, a stroke unit, defined as 'discrete wards or beds within a ward with a dedicated specialised multidisciplinary team' was provided by five out of seven large DHBs and three out of six medium DHBs. On the day of the stroke audit, 45% of stroke patients in large DHBs were in a stroke unit, and 39% of stroke patients in medium DHBs were in stroke units. In DHBs with stroke units, 36% of stroke patients on the audit day were not in the designated stroke unit. The proportion of stroke patients in New Zealand receiving stroke unit care remains low by international comparison: 74% in the UK (RCP, 2008), more than 80% in Scandinavian countries (Kaste et al, 2006). In the same audit as that carried out in New Zealand, 49% of Australian stroke patients were cared for in a stroke unit for some of their hospital stay (NSF, 2009a).

In the 2009 New Zealand acute stroke audit, a documented pathway for assessing people presenting with transient ischaemic attack (TIA) was used in 67% of DHBs. An outpatient TIA clinic was used in 43% of DHBs, with such clinics operating a median of two days per week (range 1–5 days). Stroke thrombolysis was offered in 14 of 21 DHBs, including the seven largest DHBs. Stroke thrombolysis was potentially available in DHBs caring for over 80% of New Zealand stroke patients. Since the 2009 audit, at least one additional DHB is known to have commenced a stroke thrombolysis service. However, of the patients audited, only 3% had actually received thrombolysis (SFNZ, 2010).

In a 2007 survey of stroke rehabilitation services, seven DHBs serving 49% of the New Zealand population provided a designated inpatient area for stroke rehabilitation in 2007 compared with one DHB serving 10% of the population in 2002 (Gommans et al, 2008a). In six DHBs (serving 37% of the NZ population), this designated area was within a general rehabilitation unit. Only one DHB (serving 12% of the New Zealand population) had a dedicated stroke rehabilitation unit (Gommans et al, 2008a). A national stroke rehabilitation audit has not yet been performed.

The fundamental recommendations for organisation of DHB stroke services prescribed in the 2003 New Zealand stroke guideline still remain relevant and important today (Box 1).

Box 1: Definition of organised stroke services

- All people with acute stroke are the responsibility of, and are managed by, services specialising in stroke and rehabilitation.

- The organisation has a 'lead clinician' for stroke services.

- Care is provided and coordinated by an interdisciplinary team skilled in stroke and rehabilitation.

- All people with stroke or transient ischaemic attack (TIA) have a comprehensive assessment and appropriate secondary prevention measures are provided.

- Systems exist to identify people with stroke and TIA not admitted to hospital and to ensure that they receive all necessary services, particularly prompt assessment, treatment and secondary prevention.

Provision of acute stroke thrombolysis

The evidence supporting both the efficacy and safety of acute stroke thrombolysis has continued to accumulate since publishing the 2003 guideline – see part 3, section 4.1 (Thrombolysis). New Zealand experience has also confirmed that acute stroke thrombolysis is feasible, particularly in large and medium-size DHBs, but also in some smaller DHBs (SFNZ, 2010). Organised stroke service provision in these DHBs must now also include an acute stroke thrombolysis service (Table 1). Small DHBs should consider providing acute stroke thrombolysis for their populations, where it is possible to do so safely.

Services for transient ischaemic attack

The New Zealand TIA guideline was published in 2008 (Gommans, 2008b). This guideline emphasised the need to manage TIA as a medical emergency and to provide rapid access to appropriate specialist assessment and investigations in order to reduce the risk of subsequent stroke effectively. A TIA service should be seen as an integral part of an organised stroke service – see part 3, section 1.5 (Services for transient ischaemic attack).

Community rehabilitation services and follow-up

Part 3, section 1.4.1 (Community rehabilitation services and follow-up) of these guidelines includes the following recommendation: 'Health services with organised inpatient stroke services should provide comprehensive, experienced interdisciplinary community rehabilitation and adequately-resourced support services for people with stroke and their family/carer (Larsen et al, 2006, ESD Trialists, 2005)'.

In New Zealand, larger DHBs should consider using a stroke-specialist community interdisciplinary team to optimally provide this service, rather than depend on generic community rehabilitation services. Community services should be responsive to the needs of all people with stroke, including people aged under 65 years, and Māori and Pacific people, who are disproportionately represented among people with stroke under 65 years – see also part 2, 'Māori and stroke', 'Pacific people and stroke' and 'Stroke in younger adults'.

The recommended framework for organised stroke services in New Zealand (Table 1) should be viewed as a **minimum** requirement for stroke services, as it is the foundation upon which delivery of care to patients with stroke can be made in accordance with the recommendations of this guideline.

Table 1: **Recommended minimum DHB stroke service provision to meet New Zealand stroke guidelines 2010**

DHB size	Description	Relevant DHBs	Recommended service provision
Large	Population catchment >200,000 Annual stroke admissions >300	Auckland DHB Bay of Plenty DHB Canterbury DHB Capital Coast DHB Counties Manukau DHB Waikato DHB Waitemata DHB	1. Stroke patients should be admitted to a stroke unit or specialised area within a general unit. The admitted patient will be under the care of a designated stroke clinician. 2. An acute stroke thrombolysis service should be provided. 3. Rehabilitation should occur in a dedicated area (ie, stroke unit) under the care of an interdisciplinary team (IDT) involving stroke clinicians. 4. If possible both acute and rehabilitation care should be delivered in the same area. 5. IDT will utilise current stroke protocols for stroke management and have ongoing education programmes for staff, patients and families. 6. An acute TIA service should be provided. 7. A stroke-specific community team may be used.
Medium	Population catchment 120,000–200,000 Annual stroke admissions 150–300	Hawkes Bay DHB Hutt DHB MidCentral DHB Nelson-Marlborough DHB Northland DHB Otago-Southland DHB (Otago)	1. Admit all patients to a defined area for acute management, in a separate area or a designated area within a general ward; all acute care occurs in consultation with designated stroke clinician(s). 2. An acute stroke thrombolysis service should be provided. 3. Rehabilitation should occur in a geographically-designated area (ie, stroke unit or rehab unit) under the coordinated care of the IDT. 4. IDT will utilise current stroke protocols for stroke management and have ongoing education programmes for staff, patients and families. 5. An acute TIA service should be provided.
Small	Population catchment <120,000 Annual stroke admissions <150	Lakes DHB Otago-Southland DHB (Southland) South Canterbury DHB Tairawhiti DHB Taranaki DHB Wairarapa DHB West Coast DHB Whanganui DHB	1. Acute care of all stroke patients occurs in consultation with hospital's designated stroke clinician(s). 2. An acute stroke thrombolysis service may be provided. 3. Ongoing rehabilitation occurs under care of coordinated IDT with people knowledgeable and enthusiastic about stroke. 4. IDT will utilise current stroke protocols for stroke management and have ongoing education programmes for staff, patients and families. 5. An acute TIA service should be provided.

TIA=transient ischaemic attack; IDT=interdisciplinary team; DHB=District Health Board.

Stroke prevention

<table>
<tr><th colspan="2">Recommendations</th></tr>
<tr><th>Stroke prevention</th><th>Grade</th></tr>
<tr><td>New stroke prevention strategies are required to address ethnic inequalities in stroke incidence in New Zealand.</td><td>✔</td></tr>
<tr><td>Stroke prevention strategies should also be targeted to people with socioeconomic disadvantage.</td><td>✔</td></tr>
<tr><td>Stroke prevention strategies should be implemented as a part of a broader cardiovascular disease and diabetes prevention programme.</td><td>✔</td></tr>
</table>

Grade description

A   Body of evidence can be trusted to guide practice

B   Body of evidence can be trusted to guide practice in most situations

C   Body of evidence provides some support for recommendation(s) but care should be taken in its application

D   Body of evidence is weak and recommendation must be applied with caution

✔   Consensus-based recommendations (GPP)

This *New Zealand Clinical Guidelines for Stroke Management 2010* covers the management of patients presenting with stroke or transient ischaemic attack (TIA), including secondary prevention strategies. These guidelines do not cover the primary prevention of stroke. However, as most of the ethnic inequality in stroke is due to increased age-adjusted incidence of stroke among Māori and Pacific peoples (Carter et al, 2006, Feigin et al, 2007), any strategy to reduce inequalities in stroke should address primary stroke prevention.

The reasons for the ethnic differences in stroke incidence have been defined in terms of differences in lifestyle, the limitations of health promotion programmes, and access to and delivery of health services for different ethnic populations (Feigin et al, 2007). These issues are discussed further in the chapters 'Māori and stroke' and 'Pacific people and stroke'. Analysis of ethnic disparities in the incidence of stroke subtypes suggested that the divergent trends in ethnic-specific stroke incidence/attack rates may be associated with ethnic differences in risk factor profiles and trends in prevalence of some common cardiovascular risk factors in these populations (Carter et al, 2006; Feigin et al, 2006; Feigin et al, 2007). Compared with the New Zealand European population, the Māori and Pacific populations with stroke have a higher prevalence of low socioeconomic status, hypertension, diabetes and obesity (Feigin et al, 2006). Current cigarette smoking was reported in 39% of Māori stroke patients, compared with 13% of Pacific people and 13% of New Zealand Europeans (Feigin et al, 2006). Socioeconomic disadvantage is known to be strongly associated with stroke incidence, cigarette smoking and hypertension, aside from ethnicity (Thrift et al, 2006). The risk factors for stroke are shared with other cardiovascular diseases and diabetes.

The trend in reduction in stroke incidence seen in the New Zealand European population since the 1980s has not been seen in Māori or Pacific populations (Carter et al, 2006). Evidence suggests the incidence of stroke is increasing among Pacific people (Carter et al, 2006) and the burden of stroke in both Māori and Pacific populations is anticipated to increase as both of these populations age (Feigin et al, 2007).

Prevention and management of cardiovascular diseases (including stroke) and diabetes are a priority area for the New Zealand Ministry of Health. The *New Zealand Cardiovascular Guidelines Handbook* (NZGG, 2009) which includes guidance on cardiovascular risk assessment and diabetes screening, and cardiovascular risk factor management, has recently been updated and can be accessed at www.nzgg.org.nz. While there has been a fall in overall stroke incidence and mortality over the last several decades, downward trends in some vascular risk factors, such as cigarette smoking have been counterbalanced by increasing age and body mass index, and increasing rates of diabetes, in patients with stroke (Anderson et al, 2005). Historical efforts in primary prevention for stroke appear not to have been successful for Māori and Pacific people. New public health strategies for prevention of cardiovascular disease and diabetes have been developed and implemented since the last ARCOS study between 2002 and 2003. Continuing monitoring of the success or otherwise of these measures and ongoing service development remain as major public health priorities for New Zealand, but are beyond the scope of this guideline.

Part 3:
Review of Evidence and
Evidence-based Recommendations

Part 3 reflects collaboration with Australia on the development of the 2010 stroke guidelines. The content here conforms very closely to the Australian guidelines, except where a decision has been taken by the New Zealand Reference Group to modify content to reflect the New Zealand setting.

Chapter 1: Organisation of services

1.1 Hyper-acute care

In New Zealand, 75% of patients arrive in emergency departments by ambulance. Only 38% of patients reached hospital within 4.5 hours of onset (SFNZ, 2010). Thrombolytic therapy with intravenous (IV) recombinant tissue plasminogen activator (tPA) is the most effective hyper-acute intervention proven to reduce the combined endpoint of death and disability for ischaemic stroke (Wardlaw et al, 2009a). However, in 2008 only 3% of all ischaemic stroke patients received intravenous tPA in New Zealand and only 7% of patients who arrived at hospital within three hours received tPA (SFNZ, 2010). Organisation of systems that incorporate the ambulance service, emergency department, radiology department and stroke teams is therefore paramount to improving access to thrombolytic therapy.

There are different models of care aimed at facilitating improved hyper-acute care. A systematic review of 54 observational studies (describing 59 services) found rates of thrombolysis varied with different models of care but regional collaborations resulted in higher rates than centres that worked in isolation (Price et al, 2009a). This data on rates of thrombolysis (tPA use) and associated safety estimates by service model is summarised in Table 2. Obviously, the decision as to which model to use will be determined by factors such as local resources and distance to the nearest stroke unit hospital.

Table 2: Summary of tPA use and safety estimates by service description category

Service description	Treatment rate (SD) per 100 ischaemic strokes	Treatment rate (SD) per 100 activations	Symptomatic haemorrhages (%) #	Protocol violations (%)
Local service	3.1 (2.1) n=31,411	NA	4.6 n=619	24.7 n=417
EMS redirection of thrombolysis-eligible patients	9.9 (0.9) n=491	NA	4.4 n=480	0.7 n=450
EMS redirection of all possible acute stroke patients	5.7 (2.1) n=3976	NA	5.1 n=273	13.0 n=69
Telemedicine – no redirection	5.8 (0.02) n=3995	15.3 (3.7) n=268	3.9 n=563	Not reported
Telemedicine – drip and ship	7.1 (0.3) n=4082	23.5 (N/A) n=255	4.4 n=273	20.7 n=117

SD=Standard deviation; #: As reported in study (no standard definition applied) weighted SD is only displayed when there is >1 contributing services description; n = pooled number of patients in contributing service descriptions; NA = not available; EMS = emergency medical services.

Source: Price CI, Clement F, et al. (2009) Systematic review of stroke thrombolysis service configuration. Expert Review of Neurotherapeutics 9(2):211–33.

Other studies (Quain et al, 2008; Mosely et al, 2007; de Luca et al, 2009) have demonstrated that well-organised systems of care can achieve greater thrombolysis rates and earlier access to stroke unit care.

The main barriers to early delivery of thrombolytic therapy include (Kwan et al, 2004a):

1. lack of patient or family recognition of stroke symptoms

2. delay in seeking appropriate emergency help

3. the general practitioner (rather than an ambulance) is called first

4. paramedics and emergency department staff triage stroke as non-urgent

5. delay in obtaining urgent brain imaging

6. delay in in-hospital evaluation and treatment

7. difficulties in obtaining consent for thrombolysis

8. physicians' uncertainty about administering thrombolysis.

A systematic approach to resolving the barriers that delay early stroke care and the implementation of geographically-appropriate models of hyper-acute care should assist to achieve greater thrombolysis rates and improved assess to stroke unit care throughout New Zealand.

Recommendations for elements considered important to deliver effective hyper-acute stroke care are found throughout these guidelines and include:

- effective public education systems for stroke recognition – see part 3, sections 2.1 (Stroke recognition) and 2.2 (Pre-hospital care)

- well-organised pre-hospital care systems – see part 3, section 2.2 (Pre-hospital care)

- specific services for rural and regional centres: telemedicine and networks – see part 3, sections 1.2.5 (Specific services for rural and regional centres) and 1.2.1 (Stroke unit care)

- rapid assessment in the emergency department (ED) – see part 3, section 3.2 (Rapid assessment in the emergency department)

- early imaging – see part 3, section 3.3 (Imaging)

- thrombolysis – see part 3, section 4.1 (Thrombolysis)

- early use of aspirin – see part 3, section 4.3 (Antithrombotic therapy)

- early stroke unit care – see part 3, section 1.2.1 (Stroke unit care)

- early rehabilitation – see part 3, section 6.1 (Amount, intensity and timing of rehabilitation)

Recommendations	
Hyper-acute care	**Grade**
Local protocols developed jointly by staff from pre-hospital emergency services, the hospital emergency department and the acute stroke team should be used for all people with suspected stroke. Such protocols should include systems to receive early notification by paramedic staff, high priority transportation and triage, rapid referrals from ED staff to stroke specialists and rapid access to imaging (Kwan et al, 2004b; Bray et al, 2005a; Belvis et al, 2005; Lindsberg et al, 2006; de Luca et al 2009; Quain et al, 2008; Hamidon & Dewey, 2007).	**C**
Grade description	
A Body of evidence can be trusted to guide practice	
B Body of evidence can be trusted to guide practice in most situations	
C Body of evidence provides some support for recommendation(s) but care should be taken in its application	
D Body of evidence is weak and recommendation must be applied with caution	
✓ Consensus-based recommendations (GPP)	

1.2 Hospital care

1.2.1 Stroke unit care

The organisation of hospital services to provide stroke unit care is the single most important recommendation for stroke management. While the number of stroke unit beds has increased since 2003, only 39% of stroke patients in New Zealand are admitted to stroke units (SFNZ, 2010). Hence, stroke unit care should be the highest priority for clinicians and administrators to consider.

There is overwhelming evidence (31 RCTs) that stroke unit care significantly reduces death and disability after stroke compared with conventional care in general wards for all people with stroke (odds ratio [OR] 0.82, 95% CI 0.73–0.92) (SUTC, 2007). There is also evidence that stroke unit care has reduced mortality through prevention and treatment of complication rates, especially infections and immobility-related complications (Govan et al, 2007). A systematic review of observational studies (18 studies) found similar outcomes for stroke units to those described in the trials, making a strong case for generalisability of stroke unit care (Seenan et al, 2007).

In situations where the nearest hospital does not have a stroke unit, the situation becomes 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 (Muller et al, 2007; de la Ossa et al, 2008). One cohort study found that, excluding the effects of tPA treatment, early admission (<3 hours after symptom onset) to a stroke unit resulted in significantly better recovery at three months compared to admission more than six hours after symptom onset (National Institutes of Health Stroke Scale: 34.6% vs 15.2%; modified Rankin Score: 32.9% vs 16.8%), without any significant difference in mortality (Silvestrelli et al, 2006). Evidence derived from other studies for pre-hospital and thrombolysis services also note improved processes of care ('door to brain imaging')

and access to proven interventions (tPA, stroke unit care) with direct access to stroke unit hospitals – see part 3, section 2.2 (Pre-hospital care) and 4.1 (Thrombolysis).

Models of stroke unit care described in the literature include:

- acute stroke ward: acute unit in a discrete ward

- comprehensive stroke unit care: combined acute and rehabilitation unit in a discrete ward

- stroke rehabilitation unit: a discrete rehabilitation unit for people with stroke, who are transferred from acute care 1 to 2 weeks post stroke

- mixed rehabilitation ward: rehabilitation provided on a ward managing a general caseload.

The evidence for stroke unit care is clearest for units that can provide several weeks of rehabilitation on a comprehensive stroke unit or stroke rehabilitation unit (SUTC, 2007; Foley et al, 2007). Different models of rehabilitation have slightly different effects (Table 3). Services that can provide combined, or highly integrated, acute and rehabilitation care appear to be the preferred model.

Table 3: Mortality and dependency rates for different models of stroke care

	Mortality OR (95% CI)	Death/dependency OR (95% CI)
Acute stroke care	0.80 (0.61–1.03)	0.50 (0.39–0.65)
Combined acute and rehabilitation	0.71 (0.54–0.94)	0.63 (0.48–0.83)
Post-acute rehabilitation	0.60 (0.44–0.81)	0.62 (0.53–0.71)
Overall	0.71 (0.60–0.83)	

OR = Odds ratio; CI = Confidence interval

Source: Foley N, Salter K, et al. (2007). Specialized stroke services: A meta-analysis comparing three models of care. Cerebrovascular Diseases, 23(2–3), 194–202.

In New Zealand, most stroke units have a primary focus on acute care and early aspects of rehabilitation, with varying degrees of intensity and follow-up. Currently there are nine stroke units managing acute stroke patients but only one dedicated stroke rehabilitation unit – see part 2, 'Stroke service recommendations' in this guideline).

The stroke units that have been shown to deliver highly-effective stroke care share a number of characteristics, including:

- location in a geographically-discrete unit

- comprehensive assessments

- a coordinated interdisciplinary team

- early mobilisation and avoidance of bed rest

- staff with a special interest in the management of stroke, and access to ongoing professional education and training

- clear communication, with regular team meetings to discuss management (including discharge planning) and other meetings as needed (eg, family conferences)

- active encouragement of people with stroke and their carers/family members to be involved in the rehabilitation process (SUTC, 2007; Langhorne et al, 2005).

A mobile stroke team has also been suggested as one strategy to improve processes of care for hospitals that do not currently have a dedicated stroke unit (van der Walt et al, 2005). One systematic review (six trials) found no clear benefit for mobile stroke teams. The only significant benefit related to a process outcome (documented occupational therapy [OT] assessment) with non-significant trends reported for improved patient outcomes (Langhorne et al, 2005). Mobile stroke teams are generally not more effective than care on a general ward and are inferior to care on a stroke unit (Langhorne et al, 2005). Therefore, based on best available data, mobile stroke teams are not the answer for regional hospitals or metropolitan hospitals without a stroke unit. In such situations, it is recommended that a small (2–4 bed) geographically-based stroke unit be established as part of a larger general ward. In larger hospitals, a comprehensive stroke unit is considered the best model for acute stroke patients (Foley et al, 2007). Mobile stroke teams should only be developed if part of a formal RCT to establish a New Zealand evidence base.

There is also evidence that all people with stroke should be admitted to a stroke unit in a hospital rather than avoid admission to hospital ('hospital at home'). Evidence from one systematic review (22 RCTs) found that hospital at home services had similar outcomes to general ward care but noted that general ward care is inferior to stroke unit care (Langhorne et al, 1999). A subsequent RCT confirmed that stroke unit care is indeed superior to general hospital ward care and hospital at home services provided by a specialist stroke team (Kalra, 2000). Currently hospital at home services are not a common model used in New Zealand and hence efforts should be focused on providing organised inpatient stroke unit care.

All hospital services should clearly review the existing stroke services in light of the recommendations below. For hospitals without existing stroke units, the framework described in the chapter 'Stroke service provision in New Zealand' should be used as a guide. For hospitals with existing stroke units, consideration should be given to reviewing the percentage of stroke patients actually admitted to the stroke unit to determine if there is adequate capacity (bed numbers). Clear hospital protocols for bed allocation are needed for all stroke unit hospitals.

Recommendations	
Stroke unit care	**Grade**
All people with stroke should be admitted to hospital and be treated in a stroke unit with an interdisciplinary team (SUTC, 2007).	**A**
All people with stroke should be admitted directly to a stroke unit (preferably within three hours from stroke onset) (Silvestrelli et al, 2006).	**C**
Small and medium-sized District Health Boards (DHBs) should consider models of stroke care that adhere as closely as possible to the criteria for stroke unit care. Where possible, patients should receive care in geographically-discrete units (SUTC, 2007; Langhorne et al, 2005).	**B**
If people with suspected stroke present to non-stroke unit hospitals, transfer protocols should be developed and used to guide urgent transfers to the nearest stroke unit hospital (de la Ossa et al, 2008; Muller et al, 2007).	**C**

Grade description

A   Body of evidence can be trusted to guide practice

B   Body of evidence can be trusted to guide practice in most situations

C   Body of evidence provides some support for recommendation(s) but care should be taken in its application

D   Body of evidence is weak and recommendation must be applied with caution

✓   Consensus-based recommendations (GPP)

1.2.2   Ongoing inpatient rehabilitation

The evidence (as noted previously) suggests that organised stroke unit care is most effective when a number of weeks of rehabilitation are offered (SUTC, 2007; Foley et al, 2007). While stroke unit care or mixed rehabilitation units have been reported to reduce death and disability compared to general ward care, specialist stroke rehabilitation units were found to reduce odds of death or dependency compared to mixed rehabilitation units; however, there was no difference in length of stay (SUTC, 2007; Foley et al, 2007). Furthermore, all people with stroke benefit from rehabilitation, probably more so those who are severely affected by stroke (SUTC, 2007). If the acute stroke services are unable to provide necessary ongoing rehabilitation by a specialised, interdisciplinary team then alternative rehabilitation services, ideally on a stroke rehabilitation unit, need to be considered and organised.

While prognostic studies have described different attributes that impact on rehabilitation and recent imaging can predict the amount of damage and areas where recovery may be possible, there are no generic criteria for selecting those who require ongoing, active rehabilitation. Hence, the decision as to who should be provided with continued inpatient or outpatient rehabilitation is a complex decision that requires input from the whole stroke team taking into consideration the needs and wishes of the person with stroke and their family/carer.

Hospitals and health care services should ensure 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 – see section 6.1 (Amount, intensity and timing of rehabilitation).

Recommendations	
Ongoing inpatient rehabilitation	**Grade**
To ensure all stroke patients receive early, active rehabilitation by a dedicated stroke team, DHBs should have comprehensive services, which include and link the fundamentals of acute and rehabilitation care (Foley et al, 2007; SUTC, 2007).	**B**
Patients should be transferred to a stroke rehabilitation unit (where available) if ongoing inpatient rehabilitation is required (Foley et al, 2007; SUTC 2007).	**B**
If a stroke rehabilitation unit is not available then those with stroke who require ongoing inpatient rehabilitation should be transferred to a mixed rehabilitation unit (Foley et al, 2007).	**B**
All patients with severe stroke, who are not receiving palliative care, should be assessed by the specialist rehabilitation team regarding their suitability for ongoing rehabilitation prior to discharge from hospital.	✔

Grade description

A   Body of evidence can be trusted to guide practice

B   Body of evidence can be trusted to guide practice in most situations

C   Body of evidence provides some support for recommendation(s) but care should be taken in its application

D   Body of evidence is weak and recommendation must be applied with caution

✔   Consensus-based recommendations (GPP)

1.2.3   Care pathways

Clinical pathways (also known as care pathways or critical pathways) are defined as a plan of care that aims to promote organised and efficient interdisciplinary stroke care based on the best available evidence and guidelines (Kwan & Sandercock, 2004). Care pathways are one way of promoting organised and efficient patient care and improving outcomes. The definition, structure and detail contained within the pathway may vary from setting to setting (Kwan, 2007).

A systematic review found both positive and negative effects, and concluded that there was insufficient evidence to justify routine use of care pathways (Kwan & Sandercock, 2004). However, of the three RCTs and twelve non-RCTs included, only one RCT and seven non-RCTs were initiated in the acute phase (three of the non-RCTs were initiated in the hyper-acute phase in the emergency department). When the acute trials were considered separately no negative effects were found while benefits for some patient outcomes including reduced length of stay, fewer readmissions and fewer urinary tract infections as well as improved process outcomes, such as access to neuroimaging, were found (Kwan & Sandercock, 2004). Of the other outcomes reported, a large proportion demonstrated non-significant trends in favour of care pathway intervention (Kwan & Sandercock, 2004). Further, a large cluster RCT found a

pre-hospital care pathway using validated tools, criteria, and education led to more patients transferred by pre-hospital services to a stroke unit (24.2% vs 13.1%) although this was not statistically significant (de Luca et al, 2009). Overall there is a small body of consistent evidence that suggests care pathways can improve the process of care in acute stroke management where a number of investigations are needed in a short period of time, particularly when thrombolysis is considered. In the clinical setting, care pathways can provide a useful resource to optimise early stroke care, especially in settings without organised stroke care or where hospital staff are frequently changing.

In contrast, the current evidence reveals little or no effect for the routine use of care pathways in rehabilitation and that their routine use in fact lowers patient satisfaction with hospital care (Kwan & Sandercock, 2004). The routine implementation of care pathways is not recommended where there is a dedicated interdisciplinary team in an established stroke unit or in situations where the patient has been undergoing rehabilitation for more than seven days. If used, care pathways should be flexible enough to meet the varying needs of people with stroke.

Recommendation	
Care pathway	**Grade**
All stroke patients admitted to hospital can be managed using an acute care pathway (Kwan & Sandercock, 2004).	**C**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

1.2.4 Inpatient stroke care coordinator

The use of an inpatient stroke care coordinator is one of a number of strategies used to facilitate a coordinated approach to care. The coordinator is generally a member of the 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 carer in care planning, including planning for discharge or transfer of care. A Cochrane review that included one RCT and two non-RCTs (Kwan & Sandercock, 2004) about a case managed care intervention in which one person coordinates inpatient acute stroke care reported a reduction in length of stay (11 vs 14 days) and therefore lower costs, as well as a reduction in returns to the emergency department. While a care coordinator was only one component of care (usually in combination to protocols or pathways) it is logical that such a position aids the organisation of services noted in stroke unit care settings.

Recommendation	
Inpatient stroke care coordinator	**Grade**
A stroke care coordinator can be used to foster coordination of services and assist in discharge planning.	✔
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

1.2.5 Specific services for rural and regional centres: telemedicine and networks

In some areas, the number of people with stroke requiring care is not high enough to support a dedicated stroke unit and maintain staff expertise. Access to more specialised expertise may be facilitated through the use of 'telemedicine' and 'networks'.

'Telemedicine' is broadly defined as the use of telecommunications technologies to provide medical information and services (Perednia & Allen, 1995). The application of telemedicine in stroke care is known as 'telestroke'. It is most commonly used to describe telemedicine in the form of video-teleconferencing (VTC) to support acute stroke intervention (ie, tPA); however, telephone and diagnosis through remote imaging are also used. Video-teleconferencing is characterised by the use of dedicated, high-quality, interactive, bidirectional audiovisual systems, coupled with the use of teleradiology for remote review of brain images. Telestroke via VTC has also been shown to be a feasible, reliable and valid method of assessing acute stroke patients (Schwamm et al, 2009a; Audebert & Schwamm, 2009). One RCT demonstrated that the accuracy of decision-making by a stroke neurologist via telestroke and assisted by the local referring physician was superior to decision-making via telephone when assessing suitability for treatment with thrombolytics (OR for correct intervention decision 10.9, 95% CI 2.7–44.6) (Meyer et al, 2008).

The application of telestroke for thrombolysis, when used as part of an organised system of care (ie, linked with stroke experts/units), has been found to be feasible, reliable and to improve thrombolysis rates, without increasing complication rates (Schwamm et al, 2009a; Audebert & Schwamm, 2009). One systematic review (54 observational studies) found services that use telemedicine increased thrombolysis by 4.4% when initiated by remote hospitals and subsequently transferred to a specialist stroke centre ('drip and ship' approach) and 1.9% with initiation but no redirection (Price et al, 2009a). The TEMPiS project, a notable example, established high-quality VTC telestroke services in a 'hub and spoke' network that linked 12 regional hospitals that had no stroke units to two comprehensive stroke centres. A high rate (38%) of telestroke consultations (Audebert et al, 2005) led to a significantly greater number of

patients treated with thrombolysis as well as improved outcomes (Audebert et al, 2006; Schwab et al, 2007). Patients in telestroke network hospitals had a 38% lower probability of a poor outcome, defined as severe disability, institutional care, or death at 3, 12 and 30 months (Audebert et al, 2006; Audebert & Schwamm, 2009). In addition to improved access to thrombolysis and related patient outcomes, the application of telemedicine for stroke care and networked stroke services may reduce length of stay, improve decisions regarding patient transfers for other urgent investigations or interventions (eg, surgery) and lead to general improvement in stroke care in non-specialist hospitals (Tatlisumak et al, 2009).

Telerehabilitation is defined as the ability to provide distance support, evaluation and intervention via telecommunication to persons who are disabled and is a subcategory of telemedicine (Lai et al, 2004). 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 (Audebert & Schwamm, 2009; Schwamm 2009a; Piron et al, 2009).

Telemedicine is not commonly part of stroke services in New Zealand. Along with the availability of acute and rehabilitation stroke specialists, infrastructure and training would need to be available to effectively use telestroke in New Zealand.

Recommendations	
Telemedicine and networks	**Grade**
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 (Schwamm, 2009a; Audebert & Schwamm, 2009).	**C**
These networks can assist to establish appropriate stroke units along with protocols governing rapid assessment, 'telestroke' services and rapid transfers (Schwamm 2009a; Audebert & Schwamm, 2009; Price et al, 2009a).	**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 stroke specialist centres (Meyer et al, 2008; Schwamm, 2009a; Audebert & Schwamm, 2009).	**B**
Telestroke can be used to improve assessment and management of rehabilitation where there is limited access to onsite stroke rehabilitation expertise (Schwamm, 2009a; Audebert & Schwamm, 2009).	**C**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

1.3   Discharge planning and transfer of care

Good discharge planning is crucial for successful reintegration into the community as well as effective and efficient use of limited hospital resources. People with stroke and carers/family alike report this phase of the recovery process to be a critical step and that insufficient attention and resources are often provided for this process (NSF, 2007a). One group that is of particular concern is younger people with stroke (ie, <65 years) who may require residential care post discharge. While the ideal discharge outcome may in fact be to an inpatient rehabilitation facility, this is not always feasible in all geographical locations. Careful consideration needs to be given to discharge destinations (other than a rehabilitation facility) to ensure the person with stroke is in appropriate accommodation and is able to receive necessary services (Winkler et al, 2006).

Discharge planning relies on effective communication between team members, people with stroke, family/carers, and community service providers, including general practitioners. Important aspects of care during this phase including team meetings, family meetings, information and education, and care after hospital discharge have been discussed in section 9.2 (Organisation of care) and should also be considered when planning discharge or transfer of care – see sections 1.4 (Care after hospital discharge), 1.8 (Team meetings), 1.9.1 (Information and education), and 1.9.2 (Family meetings).

1.3.1   Safe transfer of care from hospital to community

The safe transfer of a person with stroke from the hospital to the community is often a complex process and requires early planning, comprehensive assessment of the needs of the person with stroke, and effective communication.

Assessment of discharge needs should start as soon as possible after admission. A pre-discharge and/or post-discharge needs assessment examines, for example, the social, emotional, physical and financial needs of the person with stroke and their family/carer. Any cognitive or behavioural issues identified should be discussed and management incorporated into any discharge plan (eg, monitoring of mood).

The needs assessment should identify who requires a home visit. Factors to consider include the reported environmental barriers at home, functional abilities, specific physical, communication and/or cognitive impairments, risk of falls, and the needs and desires of the person with stroke and their family/carers. The need for home modifications or assistive equipment may also be determined, and appropriate modifications and/or assistive equipment recommended. There is no stroke-specific evidence regarding the effectiveness of home visits, and very little evidence in other populations. One systematic review of four RCTs evaluating the use of an OT home visit found no clear evidence on the effectiveness of pre-discharge home visits (Barras, 2005). A subsequent RCT (Grasel et al, 2006) considered an intervention of therapeutic weekend care, bedside teaching and structured information for relatives during rehabilitation. This study reported long-term benefits (reduced institutionalisation

and mortality) but numbers were small and a larger study is required. Home assessment and modification have not been found to affect the number of falls in elderly people in the community (Gillespie et al, 2009) but it is unclear if this is the same for people with stroke discharged from an acute hospital. Further studies are therefore required to determine which sub-groups benefit from home visits, since this is a time-consuming and costly intervention.

A post-discharge care plan is normally completed prior to discharge and identifies appropriate management strategies to guide care after the person with stroke 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 person with stroke. All team members, including the person with stroke, the family/carer, the general practitioner, and community-based service providers are ideally involved in developing and documenting an agreed plan that takes into account the complex adjustments needed, especially when changing settings or care. A formal family meeting or conference is often used to develop such a plan.

A systematic review of 18 studies (including both qualitative and quantitative studies) found it is uncertain whether interdisciplinary care involving GPs improves outcomes for people with stroke (Mitchell et al, 2008). Interpretation of the results is difficult, as results of the two largest studies appear contradictory, and analysis is complicated by the diversity of outcome measures.

Discharge planning may be coordinated by one member of the team (eg, inpatient care coordinator) or it may be undertaken by someone who coordinates discharges for multiple teams (or the whole hospital). Two relevant Cochrane reviews were identified related to discharge planning; however, neither review provided clear conclusions (Kwan and Sandercock, 2004; Shepperd et al, 2004). One subsequent systematic review (21 RCTs and four non-randomised trials) for interventions to improve discharge planning for elderly people (>65 years) reported improved patient satisfaction and quality of life early after discharge, along with possible reduced length of stay and lower readmission rates (Preyde et al, 2009). One lower level trial involving a comprehensive discharge planning programme for people with craniotomy or stroke, coordinated by a discharge planner, reduced length of stay and readmissions, but did not change function or patient satisfaction (Schedlbauer et al, 2004). Any person coordinating discharge should provide the person with stroke and their family/carer with appropriate information regarding the details of any community services, possible waiting times, costs and contact details prior to discharge.

Recommendations	
Safe transfer of care from hospital to community	**Grade**
Prior to hospital discharge, all patients should be assessed to determine the need for a home visit, which may be carried out to minimise safety risks and facilitate provision of appropriate aids, support and community services (Barras, 2005).	**C**
To optimise safety at discharge, hospital services should ensure the following are completed as early as possible and definitely prior to discharge:	
• patients and families/carer have the opportunity to identify and discuss their post-discharge needs (eg, physical, emotional, social, recreational, financial and community support needs) with relevant members of the interdisciplinary team	✔
• general practitioners, primary health care teams and community services are all informed before or at the time of discharge	✔
• all medications, equipment and support services necessary for a safe discharge are organised	✔
• any continuing specialist treatment required is organised	✔
• a documented post-discharge care plan is developed in partnership with the patient and family/carer and a copy provided to them. This may include relevant community services, self-management strategies (eg, including medications information and compliance advice, goals and therapy to continue at home), stroke support services (eg, Stroke Foundation, marae-based services), any further rehabilitation or outpatient appointments, and an appropriate contact number for any queries.	✔
A locally-developed protocol may assist in implementation of a safe discharge process.	✔
A discharge planner can be used to coordinate a comprehensive discharge programme for people with acute stroke (Schedlbauer et al, 2004).	**D**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

1.3.2 Carer training

Carers often report feeling inadequately trained, poorly informed and dissatisfied with the extent of support available after discharge (Greenwood et al, 2009). Evidence from a high-quality RCT (n=300) suggests that carers benefit from undertaking training prior to discharge in a range of activities related to care, including personal care techniques, communication, physical handling and transfers, ongoing prevention of functional decline and other specific stroke-related problems (Kalra et al, 2004). Another RCT (n=70) of an intervention of therapeutic weekend care, bedside teaching and structured information for relatives during rehabilitation reported long-term benefits (reduced institutionalisation and mortality) but numbers were small (Grasel et al, 2006). Ideally training should occur in both hospital and home environments.

Recommendations	
Carer training	**Grade**
Relevant members of the interdisciplinary team should provide specific and tailored training for carers/family before the person with stroke is discharged home. This should include training, as necessary, in: • personal care techniques • communication strategies • physical handling techniques • ongoing prevention and other specific stroke-related problems • safe swallowing and appropriate dietary modifications • management of behaviours and psychosocial issues (Kalra et al, 2004).	**B**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

1.4   Care after hospital discharge

1.4.1   Community rehabilitation services and follow-up

Often rehabilitation services will need to continue after discharge, either as part of an early supported discharge (ESD) programme or through general community rehabilitation services. Rehabilitation can be undertaken in various settings depending on availability of transport, the wishes of the person with stroke and family/carer, and local resources. Generally there are two models for rehabilitation services in the community:

• centre-based therapy, provided in the hospital or in a community facility such as a community centre, and including rehabilitation for those attending on a full-day basis or as an outpatient

• home-based or domiciliary rehabilitation provided within the home or residential facility.

Perspectives of people with stroke

'Post-hospital rehabilitation/recovery support of half an hour a week for three months is not enough.'

One Cochrane review (14 RCTs) found rehabilitation therapy services in the community (home or centre-based) within the first year after stroke reduced the odds of a poor outcome (OR 0.72, 95% CI 0.57–0.92) and improved personal activities of daily living (ADL) scores (SMD 0.14, 95% CI 0.02–0.25) (Outpatient Service Trialists, 2002). One systematic review (six RCTs and one non-randomised trial) found that home-based rehabilitation may be cheaper than centre-based therapy, but no difference in effectiveness was found (Britton & Andersson, 2000). A subsequent systematic review (11 RCTs) found home-based rehabilitation compared with centre-based rehabilitation significantly improved scores on functional measures within six months (MWD 3–6 months 4.07, 95% CI 0.81–7.34) although differences between settings were no longer significant at six months (MWD 0.65, 95% CI -0.50–1.81) (Hillier & Gakeemah, 2010). Home-based therapy may also increase satisfaction of carers. A subsequent Australian RCT of mixed populations (36% with stroke) found home-based rehabilitation had a lower risk of readmission (RR 2.1, 95% CI 1.2–3.9) and lower carer strain compared to centre-based rehabilitation (Crotty et al, 2008). Home-based rehabilitation is not a common model of care in New Zealand and access to such services is variable.

Early supported discharge (ESD) is a model that links inpatient care with community services with the aim of reducing length of stay. ESD services should be considered an extension of stroke unit care rather than an alternative to it. A key argument for ESD is that the home provides an optimum rehabilitation environment, since the goal of rehabilitation is to establish skills that are appropriate to the home setting. One Cochrane review (11 RCTs) and another systematic review (seven RCTs) found that ESD services reduce the inpatient LOS and adverse events (eg, readmission rates), while increasing the likelihood of being independent and living at home (Early Supported Discharge Trialists, 2005; Larsen 2006). Risks relating to carer strain might be expected with ESD, but there is too little evidence to demonstrate whether or not this is the case (ESD Trialists, 2005; Larsen 2006). ESD predominantly involves people with mild to moderate disability and thus this service should target this group of people with stroke (ESD Trialists, 2005; Larsen et al, 2006). People with stroke have reported greater satisfaction following ESD than conventional care. To work effectively, ESD services should have similar elements to those of organised stroke teams – see characteristics of stroke units in section 1.2.1 (Stroke unit care). The level of services available following discharge from hospital can be poor, and people with stroke and their families/carers often report being dissatisfied with the information, support services and therapy available (Tyson & Turner, 2000). Therefore, while there is great pressure to ensure early discharge from acute services, the evidence is based on early **supported** discharge, and it is vital to ensure that adequate community services for rehabilitation and carer support services, mirroring those used in the trials, are developed and utilised.

A number of other follow-up services after hospital discharge have been evaluated including:

- social work (Christie & Weigall, 1984; Towle et al, 1989)

- specialist nurse support (Boter, 2004; Burton & Gibbon, 2005; Larson et al, 2005; Nir & Weisel-Eichler, 2006; Middleton et al, 2005; Forster & Young, 1996)

- the Stroke Transition After Inpatient Care (STAIR) programme (Goldberg et al, 1997)

- stroke family care worker (Dennis et al,1997)

- mental health worker (Glass et al, 2004)

- workbook-based intervention (Johnston et al, 2007a)

- structured exercise and education programme (Harrington et al, 2010)

- home visits by physician or physiotherapist (Andersen et al, 2002)

- case management (Joubert et al, 2006; Claiborne, 2006; Mayo, 2008; Allen et al, 2009)

- stroke family support organisers (Lincoln et al, 2003; Mant et al, 2000; Tilling et al, 2005).

Such services are usually multidimensional and can include emotional and social support, assistance with referral to other services, development of tailored care plans, coordination between stroke specialists and general practitioners, and the provision of information to people with stroke and their families/carers. The evidence is difficult to interpret and no one service has been shown to be clearly beneficial. Studies suggest a modest advantage when providing tailored education, although no clear functional benefits have been found and further studies are needed.

A simple approach often incorporated into other multidimensional interventions is the use of telephone contact after discharge. One Cochrane review (33 RCTs) failed to demonstrate consistent benefits in a range of non-stroke populations (Mistiaen & Poot, 2006). Several stroke studies involving telephone calls as part of complex intervention have also reported conflicting findings (Boter, 2004; Middleton, et al, 2005; Claiborne, 2006; Johnston et al, 2007a; Mayo et al, 2008).

As the early post-discharge period is consistently reported by people with stroke and their family/carers to be a difficult time, the provision of simple and relevant services appears important (NSF, 2007a). The needs identified by the stroke team and the person with stroke and family/carer via the pre-discharge needs assessment, and availability of local community services, will determine which option is preferred.

Usually all people with stroke will have a specialist medical review to assess progress and need for additional support or therapy services in the first few months following discharge from hospital. However, many issues or difficulties may not become evident for a considerable time following a stroke. Access to rehabilitation services later in recovery may be needed to prevent deterioration or to realise potential for improvement, especially for those in residential facilities who have made little progress earlier due to co-existing illness. One RCT compared a structured re-assessment system for patients and their carers at six months post stroke with existing care from their GP (Forster et al, 2009). No difference was found on any outcome.

A systematic review (three RCTs and several observational studies) of coordinated care planning involving general practice did not show that it makes an unequivocal difference to outcomes for people with stroke compared with usual care (Mitchell et al, 2008). The review noted interpretation was difficult, as results of the two largest studies appear contradictory, and analysis is complicated by the diversity of outcome measures.

Recommendations	
Community rehabilitation services and follow-up	**Grade**
Interdisciplinary community rehabilitation services and support services should be made available whenever possible to enable early supported discharge to be offered to all people with stroke who have mild to moderate disability (Larsen et al, 2006; ESD Trialists, 2005).	**A**
Health services with organised inpatient stroke services should provide comprehensive, experienced interdisciplinary community rehabilitation and adequately-resourced support services for people with stroke and their family/carers (Larsen et al, 2006; ESD Trialists, 2005).	**A**
Rehabilitation services after hospital discharge should be offered to all stroke patients as needed and where available, delivered in the home setting (Hillier & Gakeemah, 2010).	**B**
Contact with and education by trained staff should be offered to all people with stroke and family/carers after discharge (Middleton et al, 2005; Boter, 2004).	**C**
People with stroke can be managed using a case management model after discharge. If used, service providers should incorporate education of the recognition and management of depression, screening and assistance to coordinate appropriate interventions via a medical practitioner (Joubert et al, 2006; Allen et al, 2009).	**C**
People with stroke and their carers/families should be provided with the contact information for the specialist stroke service and a contact person (in the hospital or community) for any post-discharge queries for at least the first year following discharge.	✓
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

1.4.2 Long-term rehabilitation services

> **Perspectives of people with stroke**
>
> *'While most gains in recovery are made in the first 3 months, it doesn't stop there.'*

Access to 'top-up services' where further aspects of rehabilitation long term are provided is often raised by people with stroke and their families/carers. Limited health resources need to be managed in the most equitable way and ongoing rehabilitation is not feasible unless the person with stroke is making progress towards clear and realistic recovery goals. Community-based allied health practitioners can play a crucial role later in the recovery process in monitoring the need for, and encouraging actual participation in, community and exercise activities. A range of factors can substantially limit community participation in appropriate programmes, including access to appropriate transport, associated costs, fears related to limited communication ability and awareness of appropriate services and their location. Consideration is therefore needed in planning or referring to such programmes. The GP also plays an important role in appropriately referring people in the months and years after formal rehabilitation services have ended where clear needs are identified.

It is generally recognised that the major part of physical recovery following stroke occurs in the first months after stroke. As noted previously, one Cochrane review (14 RCTs) found rehabilitation therapy services in the community (home or centre-based) within the first year after stroke reduced the odds of a poor outcome (OR 0.72, 95% CI 0.57–0.92) and improved personal ADL scores (SMD 0.14, 95% CI 0.02–0.25) (OST 2003). Another Cochrane review (nine RCTs) that focused on practice of personal ADL found that Occupational Therapy (OT) targeted at personal ADL increased performance scores (SMD 0.18, 95% CI 0.04–0.32) and reduced the risk of death and deterioration or dependency in personal ADL (OR 0.67, 95% CI 0.51–0.87) (Legg et al, 2006). A subsequent cluster RCT (Sackley et al, 2006) carried out in 12 nursing and residential homes found that the intervention group receiving OT interventions targeted at improving independence in personal ADL, such as feeding, dressing, toileting, bathing, transferring and mobilising, were less likely to deteriorate or die and demonstrated improvements in functional measures compared to controls.

The effectiveness of rehabilitation services more than one year after stroke is less clear. One Cochrane review (five RCTs) compared therapy-based rehabilitation with conventional care for chronic stroke patients (study inclusion criteria was that at least 75% of the participants were recruited one year post-stroke) (Aziz Noor et al, 2008). The study found that overall there was inconclusive evidence as to whether therapy-based rehabilitation intervention one year after stroke was able to influence any relevant patient or carer outcome. Trials varied in design, type of interventions provided, quality and outcomes assessed.

Another Cochrane review (nine RCTs) specifically looking at walking practice in chronic stroke patients found some benefits (improved walking speed, timed up and go, endurance) but no change in gait function on specific assessment scales (States et al, 2009).

Motivation and practical assistance to facilitate regular exercise following stroke should be considered. Strategies such as regular check-ups can be used; however, the optimum frequency of contact is unclear (Boysen et al, 2009; Langhammer et al, 2007).

Perspectives of people with stroke

'I privately funded a physio to work intensively with my wife (six hours plus per day) for three weeks, 18 months post stroke. The resulting improvement in abilities enabled us to remove her from permanent residential facility care and bring her home.'

Recommendations

Long-term rehabilitation services	Grade
The duration of the formal rehabilitation phase of care should be tailored to the individual patient based on their response to interventions, not on an arbitrary time limit.	✔
People with stroke who have residual impairment at the end of the formal rehabilitation phase of care should be reviewed regularly (ie, at least annually) usually by the general practitioner to consider whether access to further interventions are needed. This includes consideration of whether the person's physical or social environment has changed.	✔
People with stroke with residual impairment identified as having further rehabilitation needs should receive therapy services to set new goals and improve task-orientated activity (OST 2002; Legg et al, 2007).	B
People with stroke with confirmed difficulties in performance of personal tasks, instrumental activities, vocational activities or leisure activities should have a documented management plan updated and initiated to address these issues.	✔
People with stroke should be encouraged to participate long term in appropriate exercise programmes (Langhammer et al, 2007).	C

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✔ Consensus-based recommendations (GPP)

1.5 Services for transient ischaemic attack

There are various models suggested for organising services for those with transient ischaemic attack (TIA). The three main models discussed in this section are admission to hospital, rapid access TIA clinics, and management by primary care.

1.5.1 Admission to hospital

While there is very strong evidence for admission to hospital and care on a stroke unit for all levels of stroke severity (SUTC, 2007), it is unclear if there are benefits for those with TIA and very minor stroke. Hospital admission to a stroke unit increased the likelihood of receiving necessary diagnostic tests (eg, carotid imaging, MRI) and was associated with higher adherence to protocols and processes of care consistent with best practice stroke care compared to a conventional hospital ward (Cadilhac et al, 2004). Another Australian cohort study (Kehdi & Cordato, 2008) found that patients assessed in the ED and then admitted to hospital (mostly to specialist stroke care) rather than discharged back to the community had a significantly lower rate of recurrent events (TIA or stroke) at 28 days (2.3% vs 5.3%). A Canadian cohort study found admission to a 'rapid evaluation unit' for those deemed at high risk significantly reduced subsequent stroke by about half (4.7% vs 9.7%) compared to usual care as an inpatient or outpatient (Wu et al, 2009). It is noted that two studies of rapid TIA services (clinics) both admitted approximately 25% of the TIA patients (generally those deemed to be higher risk) for specialist management (Rothwell et al, 2007; Lavellee et al, 2007).

An RCT of a diagnostic protocol in ED found shorter hospital stays compared to normal admission for TIAs (25.6 hours vs 61.2 hours) and greater access to diagnostic tests with similar 90 day event rates (Ross et al, 2007). The authors suggested the protocol was also associated with reduced costs.

While mild or recovering symptoms are one reason for not administering tPA initially, there is some indication of a correlation between TIA and a subsequent deterioration in symptoms in a significant minority of cases (Johnston & Easton, 2003; Smith et al, 2005; Aslanyan et al, 2007). Hence a short hospital admission may provide the opportunity for administration of tPA should the patient deteriorate. One study found a policy of admission to hospital for 24 hours after TIA is cost neutral if considering tPA alone (Nguyen-Huynh & Johnston, 2005).

1.5.2   Rapid TIA clinic

One UK study of a rapid access TIA clinic reported significant reductions in event rates (80%) after introduction of the new service (Rothwell et al, 2007). The same study noted that three-quarters of the patients returned home on the same day, potentially reducing health costs, and 90-day stroke rates were 2.1% after the new service was introduced. Another French study of a 24/7 rapid TIA clinic (attached to a large urban stroke unit hospital) found much lower rates of subsequent events compared to those predicted by the $ABCD^2$ tool (1.24% actual vs 5.96 expected risk) (Lavallee et al, 2007). In both studies approximately 25% of the 'high risk' TIA patients were admitted, with an average length of stay for the French study of four days. One retrospective study in the UK found that a TIA clinic was cost-effective if all relevant investigations had been completed prior to the visit allowing informed decisions to be made at a 'one stop' service (Blight et al, 2000). Another case series reported a rapid assessment clinic was useful to screen for patients eligible for carotid surgery but found only a small number of patients (4.8%) underwent carotid surgery (Widjaja et al, 2005).

A 2008 survey of TIA services in New Zealand found that most DHBs used acute medical admissions to hospital, emergency departments or acute medical assessment units to manage patients presenting with TIA (Brownlee & Fergus, 2009). Only three DHBs saw most TIA patients in outpatient clinics, with a usual wait to be seen of more than one week and delays of more than one week were common for carotid ultrasound scans. The New Zealand National Acute Stroke Services Audit 2009 reported that 57% of hospitals had a rapid assessment outpatient clinic for TIAs or mild stroke (SFNZ, 2010), suggesting some improvement in service provision following publication of the New Zealand TIA guideline (Gommans et al, 2008b). Availability of such services was more common where there was a stroke care unit. There is no current New Zealand data to indicate the average waiting time from referral to actually being seen in a clinic. Data from the UK indicates that while 78% of hospitals have a neurovascular clinic, only 34% are seen within seven days with the average waiting time being 12 days (RCPL, 2006). Local services in New Zealand have begun to provide earlier access to special clinics for people with TIA or minor stroke, especially for those assessed as having a lower risk of stroke. It is vital that any such service should provide timely access to routine investigations.

1.5.3   Management by primary care

There is little published data on the role of the GP in initial assessment and management of TIA and stroke in New Zealand or Australia. Information collected in one ongoing Australian study found that TIA represents only 0.1% of GP consultations (Senes & Britt, 2001).

Overall, cohort studies report the lowest risk of stroke in services that provide emergency intervention in specialised stroke centres (Giles & Rothwell, 2007). However, due to limited resources, access to services may need to be determined on the basis of risk of stroke. The ABCD^2 score has modest but clinically useful predictive ability (Giles & Rothwell, 2010) but Amarenco et al (2009) report may miss 20% to 30% of cases with an urgently modifiable mechanism (atrial fibrillation [AF], carotid stenosis) and hence other important indications of risk, particularly presence of AF or carotid disease, should be considered to determine high and low risk – see section 3.1 (Assessment of TIA). Further studies may be warranted to understand the utility of the ABCD^2 score in the New Zealand context. In the meantime, whichever model is utilised should focus on rapid assessment and early initiation of proven therapies (eg, antiplatelet therapy, blood pressure lowering and cholesterol lowering) and be based on local resources and needs.

Recommendations	
Services for TIA	**Grade**
All patients with suspected TIA should be managed in services that allow rapid assessment and early treatment to be undertaken within 24 hours of symptom onset.	
• Those identified at high risk (ABCD^2 score 4–7 or those with any one of the following: atrial fibrillation, tight carotid stenosis, or crescendo TIA) should be transferred urgently to hospital (preferably admitted to a stroke unit or where available referred to a specialist TIA clinic if the person can be assessed within 24 hours) to facilitate rapid assessment and treatment (Rothwell et al, 2007; Lavelle et al, 2007; Giles & Rothwell, 2007; Giles & Rothwell, 2010; Kehdi & Cordato, 2008; Wu et al, 2009).	**C**
• Those identified at lower risk (ABCD^2 score 0–3 or late presentations, ie, after a week) can be managed in the community by a general practitioner, private specialist or where possible referred to a specialist stroke/TIA clinic and seen within seven days. Note: a low ABCD^2 score does not obviate the need for urgent carotid ultrasound to exclude carotid stenosis and an ECG/history to exclude AF, with appropriate urgent actions (surgery, anticoagulation) to be considered if these are present.	✔
Grade description	
A Body of evidence can be trusted to guide practice	
B Body of evidence can be trusted to guide practice in most situations	
C Body of evidence provides some support for recommendation(s) but care should be taken in its application	
D Body of evidence is weak and recommendation must be applied with caution	
✔ Consensus-based recommendations (GPP)	

1.6   Standardised assessment

Complete assessment requires input from all members of the stroke team. Such assessments are fundamental to identify deficits, set goals and plan for management. While there is some evidence to suggest a structured assessment helps to identify particular problems (Wikander et al, 1998) there is little direct evidence guiding what should be included and when such assessments should be carried out. It is recommended that all assessments occur as soon as possible after admission (aiming for within two days of admission) with the stroke team working together so as not to overburden the patient by duplicating questions. Weekend cover and workforce shortages are a continual issue for many centres and such issues will affect the timeliness of assessments. Although reassessment is useful to monitor recovery and assist in planning, the timing of such assessments should consider the needs of the patient along with the usefulness of the findings. Communication of assessment findings to the patient and family/carers is essential. Where possible a patient's premorbid functioning, both general and domain specific should be determined, to estimate prior functioning in that area so that current results can be compared.

Given the enormous variety of assessment tools and measures it is beyond the scope of this guideline to make specific recommendations regarding which measures or tools should be used in each circumstance. It is important that all staff carefully choose a specific tool based on the validity, reliability and availability of such tools, and for available tools, whether a particular tool has been validated in a stroke population. Staff should also be trained in the use of the chosen tool. It is also important to balance the use of a detailed assessment (which may take considerable time) with the need to provide early and active interventions.

Recommendation	
Standardised assessment	**Grade**
Clinicians should use validated and reliable assessment tools or measures that meet the needs of the patient to guide clinical decision-making.	✔
Grade description	
A Body of evidence can be trusted to guide practice	
B Body of evidence can be trusted to guide practice in most situations	
C Body of evidence provides some support for recommendation(s) but care should be taken in its application	
D Body of evidence is weak and recommendation must be applied with caution	
✔ Consensus-based recommendations (GPP)	

1.7 Goal setting

Active involvement of the person with stroke and their family/carer in goal setting was one important component noted in the systematic review by the Stroke Unit Trialists' Collaboration (2007). One systematic review (19 RCTs) examining the effectiveness of goal planning in rehabilitation found some limited evidence that goal planning can influence patient adherence to treatment regimes and strong evidence that prescribed, specific, challenging goals can improve immediate patient performance in some specific clinical contexts (Levack et al, 2006). There is clear consensus both from the New Zealand Reference Group and in published literature that goal setting is instrumental to the rehabilitation process and should always take place with the person with stroke and their family/carer (Playford et al, 2009). Goals developed in team meetings should be 'signed off' as agreed upon by the person with stroke and/or family/carer. Outcome measures based on goal-attainment scales can be considered by the team to improve the use of goal setting.

Recommendations

Goal setting	Grade
Every person with stroke and their family/carer involved in the recovery process should have their wishes and expectations established and acknowledged.	✔
Every person with stroke and their family/carer should be provided with the opportunity to participate in the process of setting goals unless they choose not to or are unable to participate (SUTC, 2007).	B
Health practitioners should collaboratively set goals with the patient for rehabilitation. Goals should be prescribed, specific and challenging. They should be recorded, reviewed and updated regularly (Levack et al, 2006).	C
People with stroke should be offered training in self-management skills, which include active problem-solving and individual goal setting.	✔

Grade description

A   Body of evidence can be trusted to guide practice

B   Body of evidence can be trusted to guide practice in most situations

C   Body of evidence provides some support for recommendation(s) but care should be taken in its application

D   Body of evidence is weak and recommendation must be applied with caution

✔   Consensus-based recommendations (GPP)

1.8   Team meetings

Ongoing communication between the members of the stroke team is a key element of an organised stroke service. Data from trials included in the stroke unit meta-analysis found that organised stroke units were characterised by formal weekly meetings of the interdisciplinary team, along with one or more informal meetings (Langhorne & Pollock, 2002). While this evidence relates to the total stroke unit 'package' rather than the individual elements of that package, team meetings appear essential to foster good communication and coordinated services. Telemedicine facilities should be considered in rural and remote centres to effectively link members of the team.

Recommendations	
Team meetings	**Grade**
The interdisciplinary stroke team should meet regularly (at least weekly) to discuss assessment of new patients, review patient management and goals, and plan for discharge (Langhorne & Pollock, 2002).	**C**
Grade description A Body of evidence can be trusted to guide practice B Body of evidence can be trusted to guide practice in most situations C Body of evidence provides some support for recommendation(s) but care should be taken in its application D Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

1.9   Patient and carer/family support

1.9.1   Information and education

The provision of information and education is particularly important for people with stroke and their family/carers (NSF, 2007a). This may need to be offered repeatedly over various timeframes as people with stroke and their family's/carer's information needs change over time (NSF, 2007a). Information should also be provided in a language and format that can be understood (Hoffmann & McKenna, 2006).

The updated Cochrane review (Smith et al, 2008) characterised interventions into two types:

i)   'passive interventions' were defined as where information was provided on a single occasion and there was no subsequent systematic follow-up or reinforcement procedure

ii)   'active interventions' were defined as where purposeful attempts were made to allow the participant to assimilate the information and a plan for subsequent clarification and consolidation or reinforcement was agreed.

The review which included 17 RCTs found that for people with stroke, both active and passive interventions significantly improved their knowledge, but active interventions (compared to passive) had a greater positive impact on anxiety and depression (Smith et al, 2008). There were no effects on activity, participation or mortality for either intervention (Smith et al, 2008). For family/carers, any information provision was found to improve knowledge. However, there was no effect on carer mood, QOL or satisfaction. One previous systematic review involving 10 RCTs also found interventions targeting family education that involved more active approaches led to a greater change in knowledge than passive approaches (Bhogal et al, 2003a).

Numerous other trials have assessed interventions to educate people with stroke and their family/carer, particularly after discharge from hospital. In most of these trials the intervention was multifactorial and it is difficult to gauge the effect of education or information provision alone. Hence such trials were excluded from the most recent Cochrane review (Smith et al, 2008). Special consideration and attention is needed for people with aphasia.

Recommendations

Information and education	Grade
All people with stroke and their families/carers should be offered information that is tailored to meet their needs and provided using relevant language and communication formats (Smith et al, 2008).	**A**
Information should be provided at different stages in the recovery process (Smith et al, 2008).	**B**
Routine, follow-up opportunities should be provided to people with stroke and their families/carers with opportunities for clarification or reinforcement of the information provided (Smith et al, 2008).	**B**

Grade description
A Body of evidence can be trusted to guide practice
B Body of evidence can be trusted to guide practice in most situations
C Body of evidence provides some support for recommendation(s) but care should be taken in its application
D Body of evidence is weak and recommendation must be applied with caution
✓ Consensus-based recommendations (GPP)

1.9.2　Family meetings

Early and ongoing communication between the stroke team, the person with stroke and the family/carer is also a key element of an organised stroke service. Communication is established through formal and informal meetings to initially discuss assessment results on admission, plan management including intervention goals during the hospital stay and to also plan for discharge prior to leaving hospital. Formal family meetings that involve members of the stroke team (or the whole team) may not occur in every individual case. Organised stroke unit care should incorporate processes that inform and involve the person with stroke and their family in all aspects of care (Langhorne & Pollock, 2002).

Recommendations	
Family meetings	**Grade**
The stroke team should meet regularly with the person with stroke and their family/carer to involve them in management, goal setting and planning for discharge (Langhorne 2002).	**C**
Grade description	
A　Body of evidence can be trusted to guide practice	
B　Body of evidence can be trusted to guide practice in most situations	
C　Body of evidence provides some support for recommendation(s) but care should be taken in its application	
D　Body of evidence is weak and recommendation must be applied with caution	
✓　Consensus-based recommendations (GPP)	

1.9.3　Counselling

Perspectives of people with stroke

'Psychological support is needed at the earliest possible stage of the process in order to help the person with stroke be mentally prepared for the journey of recovery.'

Many aspects of life are affected by stroke and complex adjustments are required not only for the person with stroke but also for the family and carer. Observational studies have found that family dynamics have an impact on rehabilitation and recovery; for example, a well-functioning family has been shown to result in improved function for people with stroke (Evans et al 1987a; 1987b). Furthermore, the needs of the person with stroke and their family/carer will change during the stages of care, from acute care where there is often an initial crisis through to discharge and community reintegration which may highlight significant changing social roles. Palliation may also require careful support for the carer/family.

Evidence for counselling is limited with most studies based in the community setting. A systematic review of interventions (10 RCTs), including counselling targeting family education and adjustment, concluded that there was evidence for the benefits of an active educational counselling approach (Bhogal, 2003a). An RCT (n=62) found an information package and three visits from a social worker trained in family counselling provided functional and social benefits, but had no impact on depression, anxiety, understanding, skill levels or health status (Clark et al, 2003). One RCT (n=213), included in the above review, found problem-solving counselling plus education commencing while in hospital, was more effective than routine care or education alone (Evans et al, 1988). Some of the included trials are noted elsewhere in this document – see section 1.4.1 (Community rehabilitation service and follow-up), 1.9.1 (Information and education) and 8.8 Carer support). Evidence for counselling in those with depression is discussed in section 7.11 (Management of mood).

The general practitioner plays an important role in providing a coordinated approach to accessing relevant counselling services once the person with stroke is in the community.

Recommendations	
Counselling	**Grade**
Counselling services should be available to all people with stroke and their families/carers during rehabilitation and community reintegration and can take the form of:	
• an active educational counselling approach (Bhogal, 2003a)	**B**
• information supplemented by family counselling (Clark et al, 2003)	**C**
• a problem-solving counselling approach (Evans et al, 1988).	**C**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

1.9.4 Respite care

Respite care can be defined as any service or group of services designed to provide temporary relief and/or rest for caregivers. Providing care for someone with stroke is often a challenge both physically and emotionally, and often the main burden lies with the carer. Evidence on respite care is lacking. There are no stroke-specific studies. A systematic review of respite care for people with dementia and their carers found no quality studies to draw conclusions from on the benefits for caregivers of respite care (Lee & Cameron, 2004).

Recommendation	
Respite care	**Grade**
People with stroke and their carers/families should have access to respite care options. The respite care may be provided in their own home or an institution.	✓
Grade description	
A Body of evidence can be trusted to guide practice	
B Body of evidence can be trusted to guide practice in most situations	
C Body of evidence provides some support for recommendation(s) but care should be taken in its application	
D Body of evidence is weak and recommendation must be applied with caution	
✓ Consensus-based recommendations (GPP)	

1.10 Palliative care

Fourteen percent of acute stroke patients admitted to hospital die in hospital (9% within seven days) (NSF, 2009a) and approximately 20% of stroke patients die as a result of the stroke in the first 30 days (Thrift et al, 2000). A systematic review of the palliative care needs of stroke patients identified only seven studies (Stevens et al, 2007). The review showed that carers have a different needs profile from those targeted for specialist palliative care in cancer. Carers require more support, particularly as they are likely to be older and in poor health and caring for their family members in difficult circumstances, often unsupported.

Evidence to guide palliative care in stroke is lacking. Only one observational study was identified that developed and implemented a care pathway for palliative care in acute stroke. The study reported improved processes of care based on national standards (Jack et al, 2004).

While there are a number of systematic reviews in this area (primarily for cancer), there are insufficient studies to support specific interventions (Goodwin et al, 2002; Forte et al, 2004). A subsequent RCT that compared an inpatient palliative care service (IPCS) with usual care demonstrated greater patient satisfaction, more advanced directives at index hospitalisation discharge, reduced intensive care unit (ICU) admissions on subsequent hospitalisation, and lower total health costs for patients in the IPCS intervention (Gade et al, 2008). While not specific to stroke the results of the study may be applicable to those with stroke but is dependent on the availability of such services. There is evidence from systematic reviews to suggest that

communication skills training can have a small beneficial effect on behaviour change in health practitioners working with people with cancer (Fellowes, 2004; Gysels et al, 2004). Thus, education and training may be provided to those caring for stroke patients and their families to assist in the care of non-complex patients where specialist services are not routinely involved.

People with stroke who are dying, their families and caregivers, should have care that is consistent with the principles and philosophies of palliative care. This includes aiming to optimise an individual's quality of life until death by addressing the person's physical, psychosocial, spiritual and cultural needs, and to support the individual's family, whānau, and other caregivers where needed, through the illness and after death (Palliative Care Subcommittee, 2007).

Practical end-of-life issues, such as the use of enduring power of attorney (EPOA) and advance care directives, should be discussed. Organ donation may be sensitively raised if appropriate. Issues of bereavement may become part of the responsibility of the stroke team.

Recommendations	
Palliative care	**Grade**
An accurate assessment of prognostic risk factors or imminent death should be made for patients with severe stroke or those who are deteriorating.	✔
People with stroke and their family/carers should have access to specialist palliative care teams as needed and have care that is consistent with the principles and philosophies of palliative care (Gade et al, 2008).	B
A pathway for stroke palliative care can be used to support people with stroke and their families/carers and improve palliation for people dying after stroke (Jack et al, 2004).	D
Grade description A Body of evidence can be trusted to guide practice B Body of evidence can be trusted to guide practice in most situations C Body of evidence provides some support for recommendation(s) but care should be taken in its application D Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

1.11   Stroke service improvement

Stroke unit care has been shown to involve higher rates of adherence to key processes of care (Cadilhac & Ibrahim, 2004). Thus it is important to monitor key processes and patient outcomes to foster improved service delivery. One important strategy to improve quality of care involves the process of audit and feedback. Audit and feedback have been found to produce small to modest improvements from a large number of wide-ranging studies in one Cochrane review (n=118 studies) (Jamtvedt et al, 2006). Audit and feedback have also been successfully used locally and internationally to both prompt service improvement and demonstrate improved services (Cadilhac & Ibrahim, 2008, Irwin et al, 2005). However, quality improvement (QI) activities often use a

multifaceted strategy such as educational meetings, reminders, printed material, or opinion leaders with or without audit and feedback (Jamtvedt et al, 2006, Grimshaw et al, 2006).

One cluster RCT (Wright et al, 2007) in UK primary care (n=76 practices) found a multifaceted approach led to a 36% increase (95% CI 4–78) in diagnosis of AF, and improved treatment of TIA (OR of complying with guidelines 1.8, 95% CI 1.1–2.8). The approaches used included guideline recommendations, audit and feedback, interactive educational sessions, patient prompts and outreach visits. Several QI programmes incorporating data collection, team planning review, decision-support education, key opinion leaders and team planning have demonstrated improvements in processes and outcomes for patients (Strasser et al, 2008; Schwamm et al, 2009b).

Based on the experience from the National Sentinel Audit of Stroke in the UK, a cycle of comprehensive audit at least every two years has been established in Australia by the NSF in the National Stroke Audit; a similar approach is considered appropriate for New Zealand. However, services may benefit from more frequent audit (eg, registry of all patients) based on a smaller number of key indicators (eg, stroke unit access, timely imaging, aspirin within 48 hours, and secondary prevention measures on discharge) by providing the ability to monitor continuous QI activities.

Recommendations	
Stroke service improvement	**Grade**
All stroke services should be involved in quality improvement activities that include regular audit and feedback ('regular' is considered at least every two years) (Jamtvedt et al, 2006).	**B**
Indicators based on nationally agreed standards of care should be used when undertaking any audit.	✔
General practitioners should classify stroke patients within current practice datasets to enable audit and review of relevant stroke and TIA management (Wright et al, 2007).	**B**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

Chapter 2: Stroke recognition and pre-hospital care

Early recognition and the subsequent response of individuals to having a stroke or transient ischaemic attack (TIA) and the timing and method by which people are transferred to hospital are critical to ensure optimal outcomes (Kwan et al, 2004a; Sprigg et al, 2009). In this hyper-acute phase of care, the ambulance service provides a central, coordinating role. Stroke patients should not only receive a high triage priority, comparable to other similarly lethal or disabling medical emergencies, but the system should facilitate early notification of the receiving hospital and ensure that the correct hospital is selected, that is, one with stroke unit care, where a choice exists.

2.1   Stroke recognition

One RCT (n=75,720) of a population-based intervention (letter, bookmark and sticker) reduced delays to hospital presentation in women but not in men (Muller-Nordhorn et al, 2009). Another RCT (n=274) failed to demonstrate any difference between two different poster messages aiming to improve knowledge after six weeks (Davis et al, 2009). Other population-based before-after studies, mainly focused on television and/or print media, have been shown to increase knowledge of stroke (Jones et al, 2010; Hodgson et al, 2009; Fogle et al, 2008; Marx et al, 2008; Reeves et al, 2008). Despite this, knowledge can remain poor for some high-risk groups, for instance, those aged 75 years and older, men, minorities and people with lower education levels (Reeves et al, 2008). Other innovative education interventions have also been found to improve stroke knowledge (Chan et al, 2008; Kleindorfer et al, 2008; Leifeld et al, 2009; Bell et al, 2009). Education programmes among children and adolescents have been shown to be effective in increasing their knowledge of stroke signs and symptoms as well as risk factors and their intention to call emergency services (Miller et al, 2007; Williams 2008; Morgenstern et al, 2007). However, it is not clear from this research whether this knowledge results in changes in behaviour. A New Zealand study investigating how people with stroke had made their decision to seek help identified four themes which played a role in people's decision to seek help: making sense of symptoms, maintaining a sense of normalcy, presence and influence of another, and perception of medical services (Moloczij et al, 2008). This study of 20 people with stroke included four Māori and four Pacific people. The authors suggested that any public education programme should emphasise not only recognition of symptoms and taking an appropriate course of action, but also the seriousness of even minor symptoms and to seek help as soon as they notice something is wrong.

While the link between increased knowledge and actions taken is complex, several studies have found that population-based awareness interventions reduce delays to hospital and increase the number of presentations to ED for stroke (Alberts et al, 1992; Barsan et al, 1994; Hodgson et al, 2007). The FAST mnemonic (face, arm, speech, time) identified 88.9% of stroke and TIA cases in one cohort study (Kleindorfer et al, 2007). The FAST mnemonic is used for public awareness campaigns in Australia, New Zealand, the UK and parts of Europe.

Recommendations	
Stroke recognition	**Grade**
The general public should receive ongoing education emphasising how to recognise the symptoms of stroke and the importance of early medical assistance (Jones et al, 2010; Muller-Nordhorn et al, 2009).	**B**
The FAST (face, arm, speech, time) message is appropriate for public awareness campaigns about both TIA and stroke.	✔
The delivery of public awareness programmes should be tailored to specific target audiences, such as Māori and Pacific people.	✔

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✔ Consensus-based recommendations (GPP)

2.2   Pre-hospital care

Education delivered to ambulance staff and ED staff regarding the signs of stroke and the critical nature of stroke increased the use of ambulance transport, decreased admission delays and improved the number of patients receiving thrombolysis (Kwan et al, 2004a; Wojner-Alexandrov et al, 2005; Mosley et al, 2007).

High priority designation by ambulance services and early notification to hospital EDs improves efficient acute stroke management (Bray et al, 2005b; Belvis et al, 2005; Lindsberg et al, 2006; Quain 2008). However, these were evaluated as components of a multifaceted strategy and it is difficult to determine the effect of these strategies alone.

Several validated pre-hospital screening tools have been developed, for example, the Los Angeles Pre-hospital Stroke Screen and the Melbourne Ambulance Stroke Screen (Bray et al, 2005a; Kidwell et al, 2000; Nor et al, 2004, Kothari et al, 1999).

Specific training for ambulance staff improves diagnostic accuracy and reduces pre-hospital delays (Kwan et al, 2004c; Bray et al, 2005b). For example, a one-hour training session based on the only Australian tool, the MASS, increased the diagnostic accuracy of pre-hospital emergency service staff from 78% to 94% (Bray et al, 2005b).

A large, cluster RCT (n=4900) based in Italy found a pre-hospital care pathway which included using validated tools, selection criteria for pathway activation, preferential transportation to known stroke specialist centres, communication links (pre-hospital notification), and education led to a non-significant increase in the number of patients being transferred to a stroke unit and significantly more patients receiving r-tPA (de Luca et al, 2009). Importantly, the protocol of hospital bypass (ie, preferential transportation to known stroke specialist centres) did not greatly lengthen transportation times (plus 13 minutes) in suburban regions (de Luca et al, 2009). Multiple observational studies have also found pre-hospital services organised for hospital bypass led to modest improvement in access to proven stroke interventions, specifically stroke unit care and r-tPA (Mosley et al, 2007; Price et al, 2009a, Quain et al, 2008).

Currently only two DHBs in New Zealand report arrangements with local ambulance services (SFNZ, 2010). Ambulance services throughout New Zealand are regionally-based and have differing geography, clinical and administrative arrangements. Ambulance services should work closely with their local stroke services to establish pre-notification strategies for stroke.

Recommendations

Pre-hospital care	Grade
Stroke patients should be given a high priority designation by ambulance services (Quain et al, 2008; Mosely et al, 2007; Lindsberg et al, 2006; Bray et al, 2005b; Belvis et al, 2005).	**C**
Ambulance services should use a validated rapid pre-hospital stroke-screening tool and incorporate such tools into pre-hospital assessment of people with suspected stroke (Bray et al, 2005a; Nor et al, 2004; Kidwell et al, 2000; Kothari et al, 1999).	**B**
Health and ambulance services should develop and use pre-notification systems for stroke (de Luca et al, 2009; Quain et al, 2008; Mosley et al, 2007).	**C**
Ambulance services should preferentially transfer suspected stroke patients to a hospital with stroke unit care (de Luca et al, 2009; Quain et al, 2008; Silverman et al, 2005; Kwan et al, 2004c; Rymer et al, 2003).	**C**
Grade description	
A Body of evidence can be trusted to guide practice	
B Body of evidence can be trusted to guide practice in most situations	
C Body of evidence provides some support for recommendation(s) but care should be taken in its application	
D Body of evidence is weak and recommendation must be applied with caution	
✓ Consensus-based recommendations (GPP)	

Chapter 3: Early assessment and diagnosis

The aim of assessment of a patient with suspected stroke or transient ischaemic attack (TIA) is to confirm the diagnosis, identify and treat the cause, and guide relevant early secondary prevention to prevent complications or stroke reoccurrence. Appropriate diagnosis of stroke and immediate referral to a stroke team is vital given advances in hyper-acute treatments. Strong working relationships are required between emergency department (ED) staff and the stroke team to improve timely assessment and early management.

3.1   Assessment of TIA

There are strong similarities between minor ischaemic stroke and TIA and therefore principles of assessment and management of TIA, including secondary prevention, should follow that outlined for people with ischaemic stroke. This section discusses aspects of care that are specific for people with TIA. The organisation of care for people with TIA is discussed in section 1.5 (Services for transient ischaemic attack).

3.1.1   Definition and prognosis

TIA is defined as 'rapidly developed clinical signs of focal or global disturbance of cerebral function lasting fewer than 24 hours, with no apparent non-vascular cause' although revision of this definition has been suggested to shorten the timeframe to one hour as TIAs rarely last longer than this (Albers et al, 2002). Pooled analysis of the risk of subsequent stroke after TIA was 5.2% (95% CI 3.9–6.5) at seven days in one meta-analysis (Giles & Rothwell, 2007) and 3.5%, 8.0%, and 9.2% at 2, 30, and 90 days after TIA, respectively, in another meta-analysis (Wu et al, 2007a). Both analyses reported substantial heterogeneity due to different study methods, settings, and interventions (Giles & Rothwell, 2007; Wu et al, 2007a). It is noted that a significant proportion of the risk is seen within the first 48 hours, necessitating early diagnostic work-up and early interventions to prevent further events.

3.1.2   Assessment

Rapid expert assessment and management has been shown to reduce rates of subsequent stroke to low levels – see section 1.5 (Services for TIA) (Rothwell et al, 2007; Lavellee et al, 2007). As with stroke, the diagnosis of TIA is based on careful clinical history and examination. It is vital that an accurate history and clinical assessment should initially be undertaken to elicit the onset and nature of symptoms, and also to identify treatable causes that can reduce the risk of further events. As with stroke, there is limited evidence for specific aspects of history and clinical assessment.

Input from a stroke expert may improve diagnosis and decision-making regarding the likely cause of the TIA and the investigations that are required (Lavelle et al, 2007).

Several factors identified in the history and clinical assessment have been found to be prognostic indicators of the risk of stroke after TIA. These include age (>60 years), diabetes mellitus, longer symptom duration (>10 minutes), motor or speech symptoms of TIA, and high blood pressure (BP) (>140/90 mm Hg) (Johnston et al, 2007b). The $ABCD^2$ risk stratification tool includes these risk factors. The tool has a maximum score of 7 and is described in Box 2. Based on a study looking at the original ABCD tool, a cut-off score of 4 has been suggested to differentiate between high and low risk of stroke (Bray et al, 2007) – see Box 2.

Box 2: $ABCD^2$ tool

A = Age: ≥60 years (1 point)

B = Blood pressure: ≥140 mm Hg systolic and/or 90 mm Hg diastolic (1 point)

C = Clinical features: unilateral weakness (2 points), speech impairment without weakness (1 point)

D = Duration: >60 minutes (2 points), 10–59 minutes (1 point)

D = Diabetes (1 point)

Source: Johnston SC, Rothwell PM, Nguyen-Huynh MN, et al. (2007). Validation and refinement of scores to predict very early stroke risk after transient ischaemic attack. Lancet, 369(9558), 283–92.

Several studies have questioned the utility of the tool (Weimer et al, 2009; Amarenco et al, 2009; Asimos et al, 2010; Kehdi & Cordato, 2008). One systematic review that included 20 validation studies (9808 participants and 456 strokes at seven days) found overall the predictive value (pooled areas under the ROC curves) to be a modest but clinically useful 0.72 (Giles & Rothwell, 2010). This review found the predictive value varied significantly between studies, but 75% of this variance was accounted for by study method and setting, with the methodologically less robust studies (retrospective case note review) found to have lower stroke prediction rates. The $ABCD^2$ tool have been found useful to assist decisions on further investigations and management in several overseas studies (Sheehan et al, 2009; Ong et al, 2010; Byrne et al, 2007). However if used, the $ABCD^2$ score should be considered in addition to other factors which would suggest the patient is clinically at high risk of a stroke. Important factors include tight carotid stenosis, a new diagnosis of atrial fibrillation (AF) or two or more TIAs within the last week (known as 'crescendo TIA') which may account for approximately 25% of patients with TIA (Koton & Rothwell, 2007). Further studies in New Zealand populations may be warranted to better understand the utility of the $ABCD^2$ tool here.

An electrocardiogram (ECG) should also be conducted routinely in all cases to screen for AF. Studies have found that 5% to 8% of patients with subsequent stroke after TIA have AF which has not been found to be related to higher scores on risk stratification tools (Quinn et al, 2009; Calvert et al, 2009; Koton & Rothwell, 2007). Clearly, a new diagnosis of AF (or where INR levels are non-therapeutic) would indicate a patient is at high risk and further rapid investigations and management required (Purroy et al, 2009).

Early (within 24–48 hours) carotid investigations should be carried out routinely for patients with suspected anterior circulation TIAs – see section 3.3 (Imaging) – as the presence of symptomatic carotid disease increases risk of stroke in patients with TIA (Eliasziw et al, 2004; Ois et al, 2008). The prevalence of carotid disease has been reported to be 5% to 17% in recent cohort studies (Calvet et al, 2009; Cucchiara et al, 2009a; Amarenco & Labreuche, 2009). Where symptomatic carotid stenosis is found, early (within two weeks) carotid endarterectomy significantly reduces the risk of subsequent stroke – see section 5.7 (Carotid surgery).

Brain imaging should also be performed. The presence of new brain computed tomography (CT) changes within 48 hours after TIA was found to predict stroke risk in a retrospective prognostic study; however, such changes were only identified in a small number of cases (4%) (Douglas et al, 2003). As with ischaemic stroke, CT is useful to exclude differential diagnoses that could mimic TIA and is used to exclude subdural haematoma or brain tumour and should be undertaken early in all patients (Wardlaw et al, 2004). Magnetic resonance diffusion-weighted imaging (MRI DWI) is the imaging strategy of choice for patients with suspected TIA with studies detecting ischaemic changes signifying infarction in 16% to 67% of those with TIA (Redgrave et al, 2007). A positive MRI DWI test has clinically important additional prognostic information (Redgrave et al, 2007, Coutts et al, 2008, Ay et al, 2009, Calvet et al, 2009). MRI DWI in addition to ABCD[2] has been found to increase the utility of the ABCD[2] to more acceptable levels (Coutts et al, 2008; Asimos et al, 2009; Ay et al, 2009; Calvet et al, 2009; Cucchiara et al, 2009a). AF (OR 2.75, 95% CI 1.78–4.25) and ipsilateral ≥50% carotid stenosis (OR 1.93, 95% CI 1.34–2.76) were associated with a positive MRI DWI in one systematic review (Redgrave et al, 2007). However, the routine use of MRI DWI for patients with TIA is currently limited to less than 20% of hospitals and these are in large urban centres (Price et al, 2009b). In settings with limited or no brain or carotid imaging facilities referral within 24 hours should be made to the nearest possible centre where these tests can be quickly undertaken.

The measurement of D-dimer or C-reactive protein levels during assessment does not improve the accuracy of clinical or imaging assessment scores (Cucchiara et al, 2009b). However, lipoprotein-associated phospholipase A2 levels may be useful in addition to ABCD[2] risk stratification (Cucchiara et al, 2009b).

Recommendations

Assessment of TIA	Grade
All patients with suspected TIA should have a full assessment that includes thorough history and clinical, prognostic (eg, ABCD^2 score) and investigative tests (eg, blood tests, brain and carotid imaging and ECG) at the initial point of health care contact whether first seen in primary or secondary care (Rothwell et al, 2007; Lavelle et al, 2007; Giles & Rothwell, 2010).	B
The following investigations should be undertaken routinely for all patients with suspected TIA: full blood count, electrolytes, erythrocyte sedimentation rate (ESR), renal function tests, lipid profile, glucose level, and ECG.	✓
Patients classified as high risk (ABCD^2 4–7 or those with any one of the following: AF, tight carotid stenosis, or crescendo TIA) should have urgent brain imaging (preferably MRI); ('urgent' is immediately where available, but within 24 hours). Carotid imaging should also be undertaken urgently (within 24 hours) in patients with carotid territory symptoms who would potentially be candidates for carotid re-vascularisation. In settings with limited access to these investigations referral within 24 hours should be made to the nearest centre where such tests can be quickly conducted (Giles & Rothwell, 2010; Redgrave et al, 2007; Douglas et al, 2003; Wardlaw et al, 2006; Wardlaw 2009b).	B
Patients classified as low risk (ABCD^2 0–3 or late presentations, ie, after a week) should have brain and carotid imaging (where indicated) within seven days (Giles & Rothwell, 2010, Wardlaw et al, 2004; Wardlaw et al, 2006; Wardlaw 2009b).	B

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✓ Consensus-based recommendations (GPP)

3.2   Rapid assessment in the emergency department

Initial clinical assessment remains the cornerstone in the diagnosis of stroke and TIA although further investigations and brain imaging are undertaken to confirm the diagnosis and are essential for an intervention decision (Hand et al, 2006; Goldstein & Simel, 2005). The history should as a minimum determine if the patient has acute, focal or neurological deficits (Goldstein & Simel, 2005). However, accuracy and reliability of stroke or TIA diagnosis varies significantly but does improve with experience and training (Hand et al, 2006).

A standardised assessment tool should be used to improve reliability of assessment and several stroke-specific scales have been developed (Goldstein & Simel, 2005). The more commonly used acute assessment scales, for example, the National Institutes of Health Stroke Scale (NIHSS) or the Scandinavian Stroke Scale (SSS), only measure stroke impairment or severity but such scales have prognostic value (Muir et al, 1996; Weimar et al, 2004; Christensen et al, 2005a). Such scales also require experience and formal training.

A small number of studies have found generally good diagnostic accuracy (approximately 90% sensitivity) by emergency medical staff (Kothari et al, 1995; Ferro et al, 1998; Morgenstern et al, 2004). However, the selection of hyper-acute therapy often depends on an accurate diagnosis to be confirmed by a stroke specialist as approximately 20% to 30% of cases are incorrectly diagnosed as stroke or TIA (Martin et al, 1997). Furthermore, the reliability of the bedside clinical assessment improves with experience and confidence suggesting the need for a close working relationship between ED staff and stroke specialists and the need for rapid referral processes to be developed (Morgenstern et al, 2004; Hand et al, 2006).

Of the diagnostic screening tools that have been developed specifically for ED staff to aid the rapid assessment and referral process, only the Recognition of Stroke in the Emergency Room (ROSIER) scale has been adequately studied (Nor et al, 2005). The scale incorporates elements of history and physical assessment in line with tools developed for the pre-hospital setting but also includes other important aspects such as assessing consciousness (Glascow Coma Scale), BP and blood glucose. The ROSIER scale has been found to sensitively identify stroke mimics thereby helping ED staff make appropriate referrals to the stroke team (Nor et al, 2005). The usefulness of the ROSIER scale has also been confirmed in a subsequent small Irish study (Jackson et al, 2008). ROSIER has not been validated for use by non-medical staff. Other stroke screening tools, developed primarily for the pre-hospital setting, exist but they have not been compared directly.

The use of pathways or protocols has been found to reduce hospital delays for acute care in several, mostly non-randomised, studies (Kwan et al, 2004b; Asimos et al, 2004; Mehdiratta et al, 2006; Sattin et al, 2006; Suzuki et al, 2004; Quain et al, 2008; Hamidon & Dewey, 2007; Nazir et al, 2009). Such tools ensure that patients receive appropriate and timely medical and nursing assessments along with crucial investigations – see section 1.2.3 (Care pathways).

Several studies have now demonstrated that rapid assessment as part of a coordinated system of hyper-acute stroke care, including pre-hospital or very early notification to the stroke service, improves processes of care (eg, door to CT times) and can improve access to thrombolysis and stroke unit care (Kwan et al, 2004c; Bray et al, 2005a; Belvis et al, 2005; Lindsberg et al, 2006; de Luca et al, 2009; Quain et al, 2008; Hamidon & Dewey, 2007). Such services have also been shown to reduce length of acute stay and potentially reduce in-hospital mortality (Hamidon & Dewey, 2007). A cluster RCT in Italy reported that training in, and use of a pathway reduced time in ED (193 minutes vs 228 minutes; not significant) but did not increase the numbers referred from ED to stroke unit care or who received r-tPA, although there were high rates of patient 'drop out' (~37% in intervention arm) (de Luca et al, 2009). The creation of stroke systems with pre-hospital notification and diversion of selected patients may centralise stroke care to particular institutions. A rapid response stroke team and associated protocols for early notification appears critical to such services.

One non-randomised study reported benefits from a process of reorganisation of services that included establishing a nurse led triage team specifically for neurological patients, improved pre-notification by ambulance staff of patients eligible for tPA, and introducing a small CT imaging unit within the ED for priority imaging (Lindsberg et al, 2006). While the proximity of the CT imaging unit was seen as a key component in this study, it is optimistic to consider this a feasible strategy for most departments.

Education of ED staff has also been undertaken as part of a multidimensional strategy with improvements noted in processes of care, for example reduced delays to CT and increased numbers receiving thrombolysis (Kwan et al, 2004c; Wojner-Alexandrov et al, 2005; Moser et al, 2006; Quain et al, 2008; Hamidon & Dewey, 2007; Nazir et al, 2009).

The Australian National Institute of Clinical Studies has published an ED stroke and TIA 'care bundle' that focuses on implementation of key components of assessment and management of stroke and TIA. This resource can be accessed at: www.nhmrc.gov.au/nics/programs/emergency/stroke_tia.html.

Recommendations	
Rapid assessment in emergency department	**Grade**
Diagnosis should be reviewed by a clinician experienced in the evaluation of stroke (Martin et al, 1997; Morgenstern et al, 2004; Hand et al, 2006).	**C**
Local protocols developed jointly by staff from pre-hospital emergency services, the hospital emergency department and the acute stroke team should be used for all people with suspected stroke. Such protocols should include systems to receive early notification by paramedic staff, high priority transportation and triage, rapid referrals from ED staff to stroke specialists and rapid access to imaging (Kwan et al, 2004b; Bray et al, 2005a; Belvis et al, 2005; Lindsberg et al, 2006; de Luca et al 2009; Quain et al, 2008; Hamidon & Dewey, 2007).	**C**
Emergency department staff should use a validated stroke screen tool to assist in rapid accurate assessment for all people with stroke (Nor et al 2005; Jackson et al, 2008).	**C**
Stroke severity should be assessed and recorded on admission by a trained clinician using a validated tool (eg, National Institutes of Health Stroke Scale or Scandanavian Stroke Scale) (Muir et al, 1996; Weimar et al, 2004; Christensen et al, 2005a).	**C**

Grade description

A   Body of evidence can be trusted to guide practice

B   Body of evidence can be trusted to guide practice in most situations

C   Body of evidence provides some support for recommendation(s) but care should be taken in its application

D   Body of evidence is weak and recommendation must be applied with caution

✓   Consensus-based recommendations (GPP)

3.3   Imaging

3.3.1   Brain imaging

Stroke and TIA are clinical diagnoses with brain imaging available to confirm cerebral ischaemia or haemorrhage and exclude stroke mimics. MRI DWI has high sensitivity (0.99, 95% CI 0.23–1.00) and specificity (0.92, 95% CI 0.83–0.97) for acute stroke (Brazzelli et al, 2009). CT also has high specificity (1.00, 95% CI 0.94–1.00) but low sensitivity (0.39, 95% CI 0.16–0.69) for acute stroke (Brazzelli et al, 2009). CT is sensitive to intracerebral haemorrhage (ICH) in the acute phase but not after 8 to 10 days when MRI should be used to differentiate ICH and ischaemic stroke (Wardlaw et al, 2004). Thus to confirm diagnosis and differentiate ICH from ischaemic stroke, MRI is now considered the imaging strategy of choice. Consideration of several factors, including longer imaging time and limited availability of MRI scanners in many centres compared to CT, however, limits the application of MRI as a routine strategy and it is likely that CT will remain the imaging modality of most use for the foreseeable future. One modelling study reported the most cost-effective strategy in acute stroke is for all patients to undergo immediate imaging (Wardlaw et al, 2004).

Advanced MRI and CT imaging techniques may be used to identify ischaemic but potentially viable brain tissue and thus guide intervention decisions in the hyper-acute phase. The evidence for such an approach is evolving; however, to date there is no evidence of a difference in outcomes with plain CT or advanced imaging (Wardlaw et al, 2009b).

3.3.2   Carotid imaging

For patients with carotid territory symptoms and where large artery disease is suspected, carotid imaging studies should be performed. Systematic reviews and individual patient data meta-analysis indicate that non-invasive imaging methods (eg, contrast-enhanced magnetic resonance angiography [CE-MRA]) compared to intra-arterial angiography provide good diagnostic accuracy in patients with 70% to 99% stenosis (sensitivity 0.85–0.95; specificity 0.85–93) (Wardlaw et al, 2006; Debrey et al, 2008; Chappell et al, 2009). Non-invasive methods (Doppler ultrasound, MRA, CT angiography [CTA]) have similar accuracy, with CE-MRA having the highest. Non-invasive imaging for symptomatic events was much less accurate for patients with 50% to 70% stenosis, but this was based on limited data (Wardlaw et al, 2006).

Carotid surgery is most beneficial early after non-severely disabling stroke – see section 5.7 (Carotid surgery) – and hence carotid imaging should be undertaken as part of the initial diagnostic work-up in selected patients. One modelling study found Doppler ultrasound was the most useful strategy for assessing patients soon after a TIA or mild stroke and led to earlier surgery even when a confirmatory test was undertaken (Wardlaw et al, 2009b). Non-invasive tests tend to overestimate stenosis which is less of an issue when surgery is performed early due to the benefits of earlier surgery; however, when patients present later more specific imaging such as CE-MRA or CTA is needed to

ensure that only those with definite 70% to 99% stenosis receive endarterectomy (Wardlaw et al, 2009b). The availability of resources will determine which strategy is adopted locally. Intra-arterial angiography conferred no advantage over non-invasive imaging in the modelling study (Wardlaw et al, 2009b).

3.3.3 Cardiac imaging

There is insufficient evidence to recommend routine cardiac imaging (AHRQ, 2002). However, echocardiography may be considered to determine a potential cardioembolic source of infarction in selected patients, for example those with a history of cardiac abnormalities or an abnormal ECG where there are no current indications for anticoagulation, or for patients with stroke of unknown origin after standard diagnostic work-up (Kapral et al, 1999). Transthoracic echocardiography (TTE) is less invasive but less sensitive than transesophageal echocardiography (TEE) in detecting sources of cardiac emboli in patients with TIA or stroke (Kapral et al, 1999). TEE also appears more useful than TTE in assisting clinical decision-making (ie, aiding the decision whether to commence anticoagulation or not) (De Bruijn et al, 2006).

Recommendations	
Imaging	**Grade**
All patients with suspected stroke should have an urgent brain CT or MRI ('urgent' is immediately where available, but within 24 hours). Patients who are candidates for thrombolysis should undergo brain imaging immediately (Brazzelli et al, 2009; Wardlaw et al, 2004).	**A**
When a patient's condition deteriorates acute medical review and a repeat brain CT or MRI should be considered urgently.	✔
All patients with carotid territory symptoms who would potentially be candidates for carotid re-vascularisation should have urgent carotid imaging (Wardlaw et al, 2006; Debrey et al, 2008; Chappell et al, 2009).	**B**
Further brain, cardiac or carotid imaging should be undertaken in selected cases including: • patients where initial assessment has not confirmed the likely source of the ischaemic event • patients with a history of more than one TIA • patients likely to undergo carotid surgery (Wardlaw et al, 2006; Wardlaw, 2009b).	**B**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

3.4　Other investigations

Once a clinical diagnosis of stroke has been made, additional investigations are used to confirm the diagnosis and to determine the potential cause of the event, specifically if there is a cardiac or arterial source. Routine investigations should include full blood count, electrolytes, erythrocyte sedimentation rate, C-reactive protein, renal function tests, cholesterol and glucose levels although direct evidence is lacking for each of these investigations. An ECG should also be conducted routinely to detect AF (Khechinashvili & Asplund, 2002; Christensen et al, 2005b). If clinical history, imaging and routine investigations do not adequately identify the underlying cause then further investigations may be warranted. Some tests should be regularly repeated to allow for careful monitoring in the acute period. Many tests exist and need to be considered based on individual patient needs. For example, thrombophilia screening may be needed when the clinical history identifies a family history of thrombosis (particularly for those <50 years of age). Further, a Holter monitor (24–72 hours) alone or combined with an event loop recorder may be useful to detect intermittent AF but only a small number of new cases (4.6–7.7%) are found using such investigations (Liao et al, 2007). While biomarker tests have been suggested to aid diagnosis (particularly for cardioembolic or haemorrhagic stroke) there is little indication that such tests (or particularly a combination of tests) are more effective than existing screening tools or clinical expertise and further research is needed (Whiteley et al, 2009; Haapaniemi & Talisumak, 2009; Laskowitz et al, 2009; Vanni et al, 2009; Sibon et al, 2009).

Recommendations	
Investigations	**Grade**
The following investigations should be obtained routinely for all patients with suspected stroke: full blood count, electrocardiogram, electrolytes, renal function tests, fasting lipids, erythrocyte sedimentation rate and/or C-reactive protein, and glucose.	✔
Selected patients may require the following additional investigations: angiography, chest x-ray, syphilis serology, vasculitis screen, prothrombotic screen and Holter monitor. These tests should be performed as soon as possible after stroke onset, and in selected patients, some of these tests may need to be performed as an emergency procedure.	✔
Grade description **A**　Body of evidence can be trusted to guide practice **B**　Body of evidence can be trusted to guide practice in most situations **C**　Body of evidence provides some support for recommendation(s) but care should be taken in its application **D**　Body of evidence is weak and recommendation must be applied with caution ✔　Consensus-based recommendations (GPP)	

Chapter 4: Acute medical and surgical management

4.1 Thrombolysis

Treatment of ischaemic stroke patients with tPA is low in Australia and New Zealand (~3%). (NSF, 2009a; SFNZ, 2010). However, some Australian centres have demonstrated rates of up to 20% are possible (Quain et al, 2008). Pre-hospital delays (particularly time to seek medical help) remain one of the main challenges although 33% of patients arrive in hospital under three hours from onset and 38% arrive under 4.5 hours (SFNZ, 2010).

One updated Cochrane review included 26 trials involving four different thrombolytic agents: tPA, streptokinase, recombinant pro-urokinase, and urokinase (Wardlaw et al, 2009a) 56% of the data coming from trials of intravenous thrombolysis involving tPA. Results found:

- thrombolysis in all trials and all agents combined resulted in a significant reduction in the composite end-point of death or disability (OR 0.81, 95% CI 0.73–0.90)

- thrombolysis (all agents pooled) showed a net benefit, but was associated with a definite increase in risk of intracerebral haemorrhage at the end of three- or six-month follow-up (OR 3.49, 95% CI 2.81–4.33)

- the effect of the intervention (on death or dependency) for tPA was similar whether given within three hours (OR 0.69, 95% CI 0.44–1.09), or more than three hours after stroke (OR 0.88, 95% CI 0.73–1.06), although there was a strong trend towards better outcome with earlier intervention (I^2=25%, p=0.09)

- there was no difference between agents in terms of symptomatic intracranial haemorrhage or death or dependency but this is based on indirect comparisons and heterogeneity was noted. More robust data is needed before agents other than tPA can be recommended

- concurrent antithrombotic therapy increased adverse events with the odds of death by the end of follow-up found to increase (OR 1.92 when all patients received antithrombotic drugs within 24 hours of thrombolysis; and OR 0.89 for no antithrombotic drugs within the first 10 to 14 days, p=0.02); although this data is based on non-randomised comparisons

- only 0.5% of trial data was for patients over 80 years of age

- therapy appears most beneficial if provided in experienced centres in highly selected patients. Widespread use of thrombolytic therapy in routine clinical practice in non-organised stroke care is not recommended (Wardlaw et al, 2009a).

Another pooled analysis from six tPA trials confirmed that intervention with IV tPA had a clear net benefit in reducing the odds of death or dependency if given within three hours (ATLANTIS ECASS and NINDS tPA Study Group Investigators, 2004). For patients treated within three hours the odds of functional independence were 30% greater ,with a 12% absolute difference between the tPA intervention group and placebo-treated patients (ATLANTIS ECASS and NINDS tPA Study Group Investigators, 2004). Based on the same six RCTs the NNT/NNH estimates were 3.6/65 (0–90 minutes), 4.3/38 (91–180 minutes), 5.9/30 (181–270 minutes), and 19.3/14 (271–360 minutes) (Lansberg et al, 2009a). The ECASS III RCT (included in the updated Cochrane review by (Wardlaw et al, 2009a) found IV tPA to be effective (OR 1.34, 95% CI 1.02–1.76) when provided up to 4.5 hours post stroke onset. There was a significant increase in symptomatic intracranial haemorrhage (2.7% vs 0.3%, p=0.008) but no significant effect on deaths (6.7% vs 8.2%) (Hacke et al, 2008). A systematic review of seven trials including the ECASS III study confirmed that tPA given 3 to 4.5 hours after stroke onset is associated with an increased chance of favourable outcome (OR 1.31, 95% CI 1.10–1.56) with no significant difference in mortality (OR 1.04, 95% CI 0.75–1.43) compared to placebo (Lansberg et al, 2009b).

Phase IV studies and large registries have shown rt-PA to be safe (often lower adverse events reported) and as effective in clinical practice as in the major trials (Graham, 2003; Wahlgren et al, 2007; Wahlgren et al, 2008). Careful patient selection, strict protocol adherence, including close monitoring of vital signs, particularly high blood pressure which is clearly associated with poor outcomes (Ahmed et al, 2009; Butcher et al, 2010), audit and quality improvement activities are strongly recommended for all centres delivering tPA (Levi et al, 2009).

Based on the evidence, IV tPA therapy is beneficial for selected patients but should be delivered in well-equipped and skilled EDs and/or stroke care units with adequate expertise and infrastructure for monitoring, rapid assessment and investigation of acute stroke patients (Levi et al, 2009). Collaboration between clinicians in pre-hospital emergency services, emergency medicine, neurology and neuroradiology is recommended to foster prompt identification of potentially eligible patients, expert patient selection along with audit and quality improvement initiatives (Levi et al, 2009). Models for improving access to tPA for rural and regional centres including telestroke and/or transfer protocols urgently need to be developed and tested to ensure greater equity of services across New Zealand.

Advanced MRI and CT imaging techniques may be a more accurate method to identify ischaemic but potentially viable brain tissue for patients considered for thrombolysis, particularly those presenting beyond the currently accepted maximum time window for tPA (4.5 hours). Of the many observational studies in this area, the largest registry (n=1210) reported that MRI selection, compared to standard CT selection, significantly reduced symptomatic intracranial haemorrhage (OR 0.520, 95% CI 0.270–0.999). Beyond three hours, the use of MRI significantly predicted a favourable outcome (OR 1.467, 95% CI 1.017–2.117). Within three hours and for all secondary end-points, there was a trend in favour of MRI-based selection over standard CT-based intervention (Schellinger et el, 2007). While MRI selection thrombolysis has been

shown to attenuate infarct growth (Davis et al, 2008) overall no difference in patient outcomes with advanced imaging has been demonstrated in RCTs (Wardlaw et al, 2009a, Mishra et al, 2010).

One systematic review, including six RCTs and three non-randomised trials, found sonothrombolyis (ultrasound-assisted thrombolysis) was associated with higher likelihood of complete recanalisation for high-frequency applications compared to routine tPA alone (OR 2.99, 95% CI 1.70–5.25) and did not increase the risk of symptomatic intracranial haemorrhage (OR 1.26, 95% CI 0.44–3.60). However, low-frequency ultrasound was found to have higher rates of symptomatic intracranial haemorrhage compared to use of tPA alone (35.7% vs 17.2%) (Tsivgoulis et al, 2010).

The failure to implement stroke thrombolysis is an international problem but numerous studies have demonstrated rates of up to 20% are a realistic target. In New Zealand, new models of care need to be developed and assessed and it is likely that there is no 'one-size-fits-all' solution. Local and network interventions will need to be developed and evaluated. Such interventions may need to include: telemedicine resources and training for regional and rural centres; systems level coordination and changes; and appropriate numbers of trained acute stroke personnel (with implications for ongoing training and support). Given the potential risks of thrombolysis, there is also the potential for adverse outcomes with inappropriate use and routine audit and ongoing quality improvement will be important to identify problem areas and local solutions.

Recommendations	
Thrombolysis	**Grade**
Intravenous tPA in acute ischaemic stroke should only be undertaken in patients satisfying specific inclusion and exclusion criteria (Wardlaw et al, 2009a).	**A**
Intravenous tPA should be given as early as possible in carefully selected patients with acute ischaemic stroke as the effect size of thrombolysis is time-dependent. Where possible, intervention should commence in the first few hours but may be used up to 4.5 hours after stroke onset (Wardlaw et al; 2009a; Lansberg et al, 2009b).	**A**
Intravenous tPA should be given under the authority of a physician trained and experienced in acute stroke management (Wardlaw et al, 2009a).	**B**
Thrombolysis should only be undertaken in a hospital setting with appropriate infrastructure, facilities and network support. This includes:	
• an interdisciplinary acute care team with expert knowledge of stroke management who are trained in delivery and monitoring of patients treated with thrombolysis	✓
• pathways and protocols used to guide medical, nursing and allied health acute phase management. Pathways or protocols must include guidance in acute blood pressure management (Graham, 2003; Ahmed et al, 2009; Butcher et al, 2010)	**C**
• immediate access to imaging facilities and staff trained to interpret the images.	✓
A minimum set of de-identified data from all patients treated with thrombolysis should be recorded in a central register to allow monitoring, review, comparison and benchmarking of key outcomes measures over time (Wahlgren et al, 2007).	**C**
The commencement of aspirin for patients who have received thrombolysis should be delayed for 24 hours (usually after a follow-up scan to exclude significant bleeding).	✓

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✓ Consensus-based recommendations (GPP)

4.2   Neurointervention

Neurointerventional therapy in this section includes intra-arterial (IA) thrombolysis and mechanical clot removal. Most of the studies reported in the literature have been small observational studies based in highly specialised centres (ie, those with advanced imaging, neurosurgical specialisation and infrastructure). There are currently only a few very large urban centres which offer such services in New Zealand.

One updated Cochrane review (Wardlaw et al, 2009a) identified four IA thrombolysis RCTs – two trials used urokinase and two trials used recombinant pro-urokinase. IA thrombolysis resulted in a significant reduction in the combined odds of death or dependency at follow-up (OR 0.49, 95% CI 0.31–0.79). The largest RCT (n=180) of IA thrombolysis (in addition to heparin) found high recanalisation rates (66% vs 18%, p<0.001), similar mortality, improved outcomes (p=0.04) but higher symptomatic intracranial haemorrhage (10% vs 2%, p=0.06) (Furlan et al, 1999).

One systematic review involving 13 case series describing outcomes for IA thrombolysis or IV thrombolysis in basilar artery occlusion (BAO) found no difference in outcomes between IV or IA thrombolysis even though significantly greater recanalisation rates were noted for patients with IA thrombolysis (Lansberg et al, 2006b). One small RCT of IA thrombolysis within 24 hours in posterior circulation strokes reported potential benefits but numbers were too small for meaningful analysis (Macleod et al, 2005). A subsequent large registry cohort found 68% of patients with BAO had a poor outcome (Modified Rankin Scale >3). No statistically significant superiority was found for any intervention strategy (antiplatelet therapy, IA or IV thrombolysis) (Schonewille et al, 2009). More robust data is required.

No RCTs were found for mechanical thrombolysis. A systematic review of 23 small observational studies found those treated with clot removal devices were 14.9 times (95% CI 4.4–50.0, p <0.01) more likely to have a good outcome (mRS $\leq$2) and 2.2 times less likely to die (95% CI 0.98–5.1, p=0.06) after adjustment for age, sex, and pre-intervention NIHSS (Stead et al, 2008). Overall a good outcome (mRS<2) was reported in 36% of the pooled population. However, the mortality rate was 29% and haemorrhage rate was 22% (Stead et al, 2008). More robust data is required.

Large urban centres could organise the limited neurointerventional services to allow appropriate referral for highly selected patients within the metropolitan areas. In rural areas, appropriate network arrangements would also facilitate such referral – see section 1.2.5 (Specific services for rural and regional centres: telemedicine and networks). It is highly likely that these services will continue to be limited due to the small number of trained personnel and high associated costs.

Recommendations	
Neurointervention	**Grade**
Intra-arterial thrombolysis within six hours can be used in carefully selected patients (Wardlaw et al, 2009a).	**B**
Each major centre should consider establishing facilities and systems for IA thrombolysis.	✔
Currently there is insufficient evidence for the use of mechanical clot retrieval in routine clinical practice. Consideration should be given to enrolling patients in a suitable clinical trial evaluating this intervention.	✔
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

4.3   Antithrombotic therapy

An updated Cochrane review (12 RCTs) found consistent but modest net reduction in death or disability (NNT=79) of acute antiplatelet therapy in ischaemic stroke (Sandercock et al, 2008c). Almost all of the data was from trials involving aspirin (160–300 mg) that was commenced within 48 hours and continued in the weeks following stroke onset (Sandercock et al, 2008a). While there was a small increase in intracranial haemorrhage there was a definite net benefit with use of this therapy (Sandercock et al, 2008a). Two RCTs testing early (within 24 hours) combination treatment of clopidogrel plus aspirin (Kennedy et al, 2007) or extended-release dipyridamole plus aspirin (Dengler et al, 2010), in patients with TIA or minor ischaemic stroke, have reported similar or potential benefits compared to aspirin monotherapy. However, large (well-powered) RCTs are needed before treatment other than aspirin can be recommended for routine clinical care.

If patients receive thrombolysis, aspirin should be deferred for at least 24 hours, and only prescribed if the follow-up brain imaging has excluded intracranial haemorrhage – see section 4.1 (Thrombolysis). Another updated Cochrane review (24 RCTs) found no evidence that early anticoagulant therapy (standard unfractionated heparin, low-molecular-weight heparins, heparinoids, oral anticoagulants, or thrombin inhibitors) reduced the odds of death or dependency at the end of follow-up for ischaemic stroke (OR 0.99, 95% CI 0.93–1.04) (Sandercock et al, 2008b). Although there were fewer recurrent ischaemic strokes (OR 0.76, 95% CI 0.65–0.88) and fewer pulmonary emboli (OR 0.60, 95% CI 0.44–0.81), early anticoagulant therapy was associated with an increase in symptomatic intracranial haemorrhage (OR 2.55, 95% CI 1.95–3.33) and extracranial haemorrhage (OR 2.99, 95% CI 2.24–3.99) (Sandercock et al, 2008b). Another meta-analysis (seven RCTs) similarly found no overall effect on death or disability of anticoagulant treatment for acute cardio embolic stroke at the end of follow-up (OR 1.01, 95% CI 0.82–1.24) (Paciaroni et al, 2007).

Uncommon presentations may lead to consideration of early anticoagulation in special circumstances. Patients with arterial dissection may be one such case. Arterial dissection involves a tear developing along the inner lining of the artery, which is then prone to clotting and causing stroke. Dissection is rare (2.5% of all strokes) but is more frequent for patients less than 45 years of age (5–22%) (Lyrer & Engelter, 2003). There is currently no RCT evidence for the choice of antithrombotic therapy. However, a systematic review of 26 small, lower level studies suggested there was no difference in outcomes between antiplatelet and anticoagulation therapy, with only a small number (0.5%) of ICH in such patients (Lyrer & Engelter, 2003).

A recent national audit of hospital acute stroke care reported unexpectedly low rates of aspirin administration within the first 24 hours of stroke onset (22%) (SFNZ, 2010). Increased awareness and use of rectal administration of aspirin for patients who are made 'nil by mouth' is recommended in the audit report as a method for increasing early aspirin use in this patient group.

Recommendations

Antithrombotic therapy	Grade
Aspirin orally (or via nasogastric tube or as a suppository for those with dysphagia) should be given as soon as possible after the onset of stroke symptoms if CT/MRI scanning excludes haemorrhage. The first dose should be at least 150 to 300 mg. Dosage thereafter can be reduced (eg, 100 mg daily) in the following few weeks (Sandercock et al, 2008a).	A
The routine use of early anticoagulation in unselected patients following ischaemic stroke/TIA is NOT recommended (Sandercock et al, 2008c).	A

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✓ Consensus-based recommendations (GPP)

4.4   Acute blood pressure lowering therapy

While there is strong evidence for lowering BP for secondary prevention – see section 5.3 (Blood pressure lowering) – acute BP therapy (ie, within the first 48 hours) remains controversial, with both high and low BP found to negatively affect patient outcomes (Mistri et al, 2006; Willmot et al, 2004). Aggressive changes in BP appear to lead to poorer outcomes while modest intervention may produce benefits (Geeganage & Bath, 2009). Acute BP should be lowered to <185 mm Hg systolic blood-pressure (SBP) and <110 mm Hg diastolic blood pressure (DBP) for ischaemic stroke patients eligible for thrombolysis – see section 4.1 (Thrombolysis).

There have been a number of studies investigating different agents for lowering and raising BP. One Cochrane review involving 65 RCTs of BP lowering within 24 hours of an acute CVD event (six RCTs specific to stroke, all assessing calcium channel blockers [CCBs]), found no difference in mortality at 10 days (RR 0.81, 95% CI 0.54–1.21) (Perez et al, 2009). Another updated Cochrane review which included 12 RCTs of BP lowering within one week of stroke found angiotensin converting enzyme (ACE) inhibitors, angiotensin II receptor antagonists, CCBs, clonidine and glyceryl trinitrate (GTN) each lowered BP, while phenylephrine appeared to increase BP (Geeganage & Bath, 2008). However, there is no evidence that therapy reduces mortality or improves functional outcomes (Geeganage & Bath, 2008).

One RCT that included 25 patients with symptomatic intranial haemorrhage and 147 patients with ischaemic stroke (SBP>160 mm Hg) found that labetalol or lisinopril can effectively reduce BP acutely without adverse events; IV labetalol worked more rapidly than oral doses and may have a better safety profile (Potter et al, 2009). No difference in death or dependency at two weeks was found but three-month mortality was halved (9·7% vs 20·3%, HR 0·40, 95% CI 0·2–1·0) although the study was underpowered for clear outcomes data and a larger study is needed. Potential adverse events for those with intracranial haemorrhage were also reported at two weeks but

numbers were too low (14 vs 3) for meaningful analysis (Potter et al, 2009). In the absence of clear data there was consensus that for patients with severe hypertension, commencing or increasing BP therapy should be considered. Close monitoring of BP, with or without therapy is also recommended.

There is currently insufficient evidence to recommend precise BP thresholds or targets in acute primary ICH. In the absence of such data, there is a general consensus that severe sustained elevated BP (eg, SBP >180 mm Hg) can be treated, especially if there is evidence of suspicion of raised intracranial pressure. Evidence from the vanguard phase of the INTERACT trial has shown that BP lowering to this type of standard treatment, and more intensive BP lowering didn't appear to have a major hazard (eg, haematoma growth) in the first few hours from stroke onset (Anderson et al, 2008). The results of the INTERACT-2 and other trials will be available in the coming years to determine clinical efficacy and help refine the ideal BP targets for these patients.

Recommendations	
Acute blood pressure lowering therapy	**Grade**
If blood pressure is extremely high (eg, for ischaemic stroke BP >220/120, for intracerebral haemorrhage >180/100 mm Hg) antihypertensive therapy can be started or increased, but blood pressure should be cautiously reduced (eg, by no more than 10–20%) and the patient monitored for signs of neurological deterioration.	✔
In acute primary intracerebral haemorrhage, medication (that could include intravenous treatment) can be used to maintain a blood pressure below 180 mm Hg systolic (mean arterial pressure of 130 mm Hg) if severe hypertension is observed over several repeated measures within the first 24 to 48 hours of stroke onset.	✔
Pre-existing antihypertensive therapy can be continued (orally or via nasogastric tube) provided there is no symptomatic hypotension or other reason to withhold treatment.	✔

Grade description

A   Body of evidence can be trusted to guide practice

B   Body of evidence can be trusted to guide practice in most situations

C   Body of evidence provides some support for recommendation(s) but care should be taken in its application

D   Body of evidence is weak and recommendation must be applied with caution

✔   Consensus-based recommendations (GPP)

4.5   Surgery for ischaemic stroke and management of cerebral oedema

4.5.1   Surgery for ischaemic stroke

Hemicraniectomy for ischaemic stroke should be considered for large life-threatening, space-occupying brain oedema or middle cerebral artery (MCA) infarcts where prognosis is poor, so called 'malignant infarction' (Vahedi et al, 2007). A meta-analysis of three RCTs found benefits (reduced mortality and improved functional outcomes for those surviving) of decompressive surgery in conjunction with medical therapy compared with medical therapy alone (Vahedi et al, 2007). Such benefits were seen in selected patients only who fulfilled clear inclusion criteria (eg, those aged between 18–60 years who can undergo surgery within 48 hours of symptom onset, with clinical deficits suggesting significant MCA involvement) (Vahedi et al, 2007). Given the prognosis for patients with 'malignant infarcts', an urgent referral to a neurosurgical consultant is strongly recommended.

One Cochrane review failed to find any RCTs for the use of angioplasty and stenting for intracranial artery stenosis (Cruz-Flores & Diamond, 2006). Evidence from case series with three or more cases, demonstrated an overall perioperative rate of stroke of 7.9%, perioperative death of 3.4%, and peri operative stroke or death of 9.5%. Further data is required before clear conclusions can be made regarding this intervention.

4.5.2   Management of cerebral oedema

Cerebral oedema in the infarcted or peri-lesional brain tissue often leads to early deterioration and death (Morley et al, 2002).

A meta-analysis of three RCTs found benefits of decompressive surgery in conjunction with medical therapy compared with medical therapy alone – see section 4.5.1 (Surgery for ischaemic stroke) (Vahedi et al, 2007).

One Cochrane review which included seven RCTs found corticosteroids have no benefit and may cause harm and are therefore not recommended (Qizilbash et al, 2002).

Another Cochrane review which included 11 RCTs found osmotherapy using glycerol reduced short-term (~1 week) mortality in those with ischaemic stroke (OR 0.65, 95% CI 0.44–0.97) but this reduction was no longer significant when all strokes were considered together (OR 0.78, 95% CI 0.58–1.06) or at the end of scheduled trial follow-up (OR 0.98, 95% CI 0.73–1.31) (Righetti et al, 2004). There was a non-significant improvement in a good outcome at the end of follow-up based on two RCTs (OR 0.73, 95% CI 0.37–1.42). Hence osmotherapy use should be considered in selected cases, such as, while assessing use of decompressive surgery (Righetti et al, 2004).

There is insufficient evidence that mannitol leads to benefits (or harms) in acute stroke based on a Cochrane review involving three small RCTs (Bereczki et al, 2007).

Hyperventilation has not been rigorously evaluated in stroke but short-term effects have been found in patients with traumatic brain injury (Hofmeijer et al, 2003).

Recommendations	
Surgery for ischaemic stroke and management of cerebral oedema	**Grade**
Selected patients (eg, 18–60 years where surgery can occur within 48 hours of symptom onset) with significant middle cerebral artery infarction should be urgently referred to a neurosurgeon for consideration of hemicraniectomy (Vahedi et al, 2007).	A
Corticosteroids are NOT recommended for management of patients with brain oedema and raised intracranial pressure (Qizilbash et al, 2002).	A
Osmotherapy and hyperventilation can be trialled while a neurosurgical consultation is undertaken. (Righetti et al, 2004 for potential short term benefit of glycerol; Hofmeijer et al, 2003 for hyperventilation).	C
There is currently insufficient evidence to make recommendations about the use of intracranial endovascular intervention (Cruz-Flores & Diamond, 2006).	D

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✓ Consensus-based recommendations (GPP)

4.6   Intracerebral haemorrhage management

In general the treatment of ICH is similar to that for ischaemic stroke (eg, rapid assessment, routine investigations, and prevention of complications). This section addresses medical and surgical management that is specific for patients with ICH.

4.6.1   Medical management

Haematoma growth is predictive of mortality and poor outcomes after ICH (Davis et al, 2006). One Cochrane review which included 6 RCTs found recombinant activated factor VII (rFVIIa) reduced haematoma growth but did not reduce death or dependency at three months (RR 0.91, 95% CI 0.72–1.15) (Al-Shahi Salman, 2009). At this time the use of rFVIIa in the treatment of ICH should be considered experimental and further trials are needed before recommendations on the usefulness in routine clinical practice can be made (You & A-Shahi, 2006).

Neuroprotective agents that have been tested (eg, gavestinel) have shown no clear benefits for patients with ICH (Haley et al, 2005). Citicoline has been evaluated in a very small phase I study and further larger studies are needed (Secades et al, 2006). Corticosteroids, glycerol and mannitol have all failed to demonstrate benefits for patients with ICH (Righetti et al, 2004; Misra et al, 2005; Feigin et al, 2005; Bereczki et al, 2007).

While there is consensus that patients with ICH associated with anticoagulation therapy should have the anticoagulation urgently reversed, there is no clear consensus about which strategies to choose due to the lack of good quality data (Aguilar et al, 2007; Steiner et al, 2006). Traditional approaches include administration of fresh-frozen plasma (FFP) and vitamin K (if used in addition to other strategies), with prothrombin complex concentrate (PCC) becoming more widely used in recent times (Aguilar et al, 2007; Steiner et al, 2006). Off-label use of rFVIIa alone or in combination with FFP has also been reported in small observational studies but is viewed as experimental only (Freeman et al, 2004; Brody et al, 2005).

Management of acute BP is particularly important in ICH and is covered in section 5.3 (Blood pressure lowering) and the subject of a current large RCT (INTERACT-2).

4.6.2   Surgical management

Supratentorial ICH

An updated Cochrane review which included 10 RCTs found surgery (including craniotomy, stereotactic endoscopic evacuation or stereotactic aspiration) for supratentorial ICH results in significant reduction in the odds of death or dependency at final follow-up (OR 0.71, 95% CI 0.58–0.88) (Prasad et al, 2008). The reviewers concluded that any surgery should be performed within 72 hours and the strongest evidence for benefit with surgery is for patients aged <85 years, with a Glasgow Coma Scale score between 5 and 15, with altered consciousness or severe neurological deficit and presenting within 24 hours. However, there was variability in the trial outcomes and the results should be interpreted with caution. Less invasive surgery may be better (OR 0.66 stereotactic techniques vs OR 0.82 craniotomy) but this was only an indirect comparison of the two techniques and no firm conclusions can be made until direct trial comparisons are available. It is noted that the largest trial included in the review (STICH) found no clear benefits for routine surgery over conservative management (Mendelow et al, 2005). Another systematic review of seven RCTs including the STICH trial, suggested that there is no overall benefit of surgery (Teernstra et al, 2006). However, sub-group analysis found two specific groups of patients who may benefit from surgery: patients with deep ICH if stereotactic surgery is used and patients with superficial (<1 cm from surface) haematoma when craniotomy is performed (Mendelow et al, 2005; Teernstra et al, 2006). Given advances in medical therapy it is prudent to very carefully consider the risks and benefits of surgery compared with medical therapy, with advice from a neurosurgeon. The American Stroke Association (ASA) recently published an updated guideline entitled Guidelines for the Management of Spontaneous Intracerebral Haemorrhage (Morgenstern et al,

2010). The ASA recommendations in the guidelines include that for most patients with ICH, the usefulness of surgery is uncertain but that specific exceptions to this for supratentorial ICH include patients with lobar clots >30 ml and within 1 cm of the surface, for whom evacuation of supratentorial ICH by standard craniotomy might be considered.

Cerebellar haemorrhage

There is currently no prospective RCT to guide decisions on surgery for those with cerebellar haemorrhage. Again, there is general agreement that surgery should be considered if cerebellar haematomas are >3 cm in diameter or where hydrocephalus occurs, although advanced age and coma reduce favourable outcomes and need to be considered (EUSI Writing Committee, 2006). The ASA guideline recommends that patients with cerebellar haemorrhage who are deteriorating neurologically or who have brainstem compression and/or hydrocephalus from ventricular obstruction should undergo surgical removal of the haemorrhage as soon as possible (Morgenstern et al, 2010).

Recommendations

Intracerebral haemorrhage	Grade
The use of haemostatic drug treatment with recombinant activated factor VII (rFVIIa) is currently considered experimental and is NOT recommended for use outside a clinical trial (You & Al-Shahi, 2006).	B
If patients with ICH were receiving anticoagulation prior to the stroke (and have elevated INR), therapy to reverse the anticoagulation therapy should be initiated immediately, eg, using a combination of prothrombin complex concentrate, vitamin K and fresh frozen plasma (Aguilar et al, 2007; Steiner et al, 2006).	D
Corticosteroids should NOT be used routinely for patients with ICH, but could be considered for patients with suspected underlying neoplasm (Feigin et al, 2005).	C
Osmotic diuretics including glycerol and mannitol are NOT recommended for patients with primary ICH (Righetti et al, 2004; Misra et al 2005; Bereczki et al, 2007).	C
For most patients with ICH, the usefulness of surgery is uncertain. Surgery for supratentorial ICH can be considered in carefully selected patients. For patients presenting with lobar clots >30 ml and within 1 cm of the surface, evacuation of supratentorial ICH by standard craniotomy might be considered (Morgenstern et al, 2010).	C
Patients with supratentorial ICH should be referred for neurosurgical review if they have hydrocephalus.	✔
Patients with cerebellar haemorrhage who are deteriorating neurologically or who have brainstem compression and/or hydrocephalus from ventricular obstruction should be considered for surgical removal of the haemorrhage as soon as possible.	✔

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✔ Consensus-based recommendations (GPP)

4.7   Physiological monitoring

One small RCT (Sulter et al, 2003) and three non-RCTs (Silva et al, 2005; Cavallini et al, 2003; Roquer et al, 2008) have found that monitoring in the first two days after stroke enhances the benefits of conventional stroke unit care. However, the intensity (eg, continuous or every 2–6 hours) and duration (eg, 24–72 hours) of such monitoring is still unclear and further larger studies including cost-effectiveness data is required. Regular monitoring should be provided for patients who receive tPA – see section 4.1 (Thrombolysis) – but this should also consider the need for early rehabilitation to commence.

Recommendations	
Physiological monitoring	**Grade**
Patients should have their neurological status (eg, Glasgow Coma Scale) and vital signs including pulse, blood pressure, temperature, oxygen saturation, glucose, and respiratory pattern monitored and documented regularly during the acute phase, the frequency of such observations being determined by the patient's status (Sulter et al, 2003; Silva et al, 2005; Cavallini et al, 2003; Roquer et al, 2008).	**C**
Grade description A Body of evidence can be trusted to guide practice B Body of evidence can be trusted to guide practice in most situations C Body of evidence provides some support for recommendation(s) but care should be taken in its application D Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

4.8   Oxygen therapy

An updated Cochrane review (six RCTs) of hyperbaric oxygen therapy concluded that there were no significant differences in the case fatality rate at six months (RR 0.61, 95% CI 0.17–2.2, p=0.45) (Bennett et al, 2009). One quasi-RCT found no benefits of routine low oxygen therapy for the first 24 hours in all people with stroke (Rønning & Guldvog,1999). A small RCT of eight hours of high flow normobaric oxygen therapy started within 12 hours of onset in patients with perfusion-diffusion 'mismatch' on MRI found short-term improvements in stroke severity scales but no difference in patient outcomes at three months (Singhal et al, 2005). Low level nocturnal normobaric oxygen therapy commencing within 72 hours of stroke onset increased mean nocturnal oxygen saturation by 2.5% and reduced episodes of desaturation but no difference in any other outcomes was found in a recent RCT (Roffe et al, 2010).

Many centres represented in the stroke unit trials data had management policies for oxygen therapy (Langhorne & Pollock, 2002). Until further evidence is available there is consensus that in patients found to be hypoxic (<95% oxygen saturation) at any time (ie, from pre-hospital to post acute wards) oxygen therapy should be provided.

Recommendations	
Oxygen therapy	**Grade**
Patients who are hypoxic (ie, <95% O_2 saturation) should be given oxygen supplementation.	✓
The routine use of supplemental oxygen is NOT recommended in people with acute stroke who are not hypoxic (Ronning & Guldvog, 1999).	**C**
Grade description	
A Body of evidence can be trusted to guide practice	
B Body of evidence can be trusted to guide practice in most situations	
C Body of evidence provides some support for recommendation(s) but care should be taken in its application	
D Body of evidence is weak and recommendation must be applied with caution	
✓ Consensus-based recommendations (GPP)	

4.9   Glycaemic control

Hyperglycaemia after stroke is found in approximately one-third of patients although reported prevalence varies between 8% and 83% depending on the cohort and definition (Capes et al, 2001). Observational data indicates that hyperglycaemia fluctuates in the first 72 hours in non-diabetic as well as diabetic patients even with current best practice (Allport et al, 2006). Observational data also indicates poorer outcomes for non-diabetic patients with hyperglycaemia (Capes et al, 2001). The prevalence of undetected diabetes ranges from 16% to 24% of patients (Gray et al, 2004; Kernan et al, 2005). Glucose intolerance after stroke is also common in patients (approximately 25%) (Kernan et al, 2005; Matz et al, 2006) and linked to higher stroke recurrence – see section 5.8 (Diabetes management) (Vermeer et al, 2006). Given this data, acute monitoring and management appear important although the volume of evidence is not large. Tight early glucose control via various regimes (eg, IV insulin) has been shown in several small RCTs to be feasible and relatively safe, although demanding for staff (Walters et al, 2006; Scott et al,1999; Bruno et al, 2008; Kreisel et al, 2009; Johnston et al, 2009). One, small RCT failed to demonstrate usefulness of two different basal bolus regimens compared to normal therapy (Vriesendorp et al, 2009). However, a large follow-up of one study investigating aggressive maintenance of euglycaemia via glucose-potassium-insulin infusion failed to demonstrate benefits (Gray et al, 2007). This is consistent with a large meta-analysis of surgical and medical trials involving 29 RCTs (including three stroke trials) of patients in ICU which failed to demonstrate significant reduction in mortality, but also found significantly higher risks of hypoglycaemia (Wiener et al, 2008). There is consensus that management should be commenced for patients with hyperglycaemia; however, further data is needed to determine the most appropriate management strategies. Implementation of effective glycaemic control requires education of nursing staff across all shifts, which can be challenging. Glucometers also need to be readily available.

Recommendations	
Glycaemic control	**Grade**
Intensive, early maintenance of euglycaemia is currently NOT recommended (Gray et al, 2007).	**B**
On admission, all patients should have their blood glucose level monitored and appropriate glycaemic therapy instituted to ensure euglycaemia, especially if the patient is diabetic.	✔
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

4.10 Neuroprotection

A large number of neuroprotective agents have been studied in clinical trials; however, none have demonstrated clear benefits and hence cannot be recommended for routine use (Krams et al, 2003; Ladurner et al, 2005; Lees et al, 2004; Muir & Lees, 2003). NXY-059 is the most recent agent studied; it was not shown to improve outcomes in two large trials (Diener et al, 2008; Lyden et al, 2007).

There is insufficient data on other groups of agents, including colony stimulating factors (including erythropoietin, granulocyte colony stimulating factor and analogues) (Diener et al, 2008; Doesborgh et al, 2004; Rose et al, 2002) theophylline, aminophylline, caffeine and analogues (Bath, 2004) and further trials are required before clear conclusions can be made. A number of trials have found potential benefits from initial small trials, for example albumin (Palesch et al, 2006), Edaravone (Otomo et al, 2003), minocycline (Lampl et al, 2007) and arundic acid (ONO2506) (Pettigrew et al, 2006) but larger trials are required to confirm the preliminary study results. Another example is citicoline which may improve the chance of a good recovery at three months (OR 1.38, 95% CI 1.10–1.72) (Dávalos et al, 2002) but a further large phase III trial is ongoing.

Recent studies have assessed the feasibility of reducing body temperature (via physical cooling or acetaminophen) as an acute intervention. However, while such interventions appear promising a Cochrane review which included eight RCTs/CCTs found cooling via pharmacological or physical methods does not reduce the risk of death or dependency (OR 0.9, 95% CI 0.6–1.4) or death (OR 0.9, 95% CI 0.5–1.5) (den Hertog et al, 2009a). Both interventions were associated with a non-significant increase in the occurrence of infections (den Hertog et al, 2009a). A subsequent large RCT (n=1400) (den Hertog et al, 2009b) of paracetamol 6 g within 12 hours of onset, for stroke patients with temperatures between 36 and 39 degrees Celsius showed a non-significant trend to improved outcomes (OR 1.20, 95% CI 0.96–1.50). Post hoc analysis in those with temperatures of 37 to 39 degrees Celsius was significant, indicating paracetamol may be appropriate only where fever exists rather than routinely applied to all stroke patients. Further trials are needed, particularly for physical cooling.

Observational studies suggest that prior intervention (ie, pre-stroke) with statin therapy may have a neuroprotective effect. One small RCT in patients with ischaemic stroke (n=89) compared the effect of continuing statin therapy (atorvastatin 20 mg/day) to ceasing therapy for the first three days. Statin withdrawal was found to be associated with a 4.7-fold increase in the risk of death or dependency at three months and an 8.67-fold increase in the risk of early neurological deterioration (Blanco et al, 2007). In contrast, a study of commencing new statin therapy (simvastatin 40 mg/day first week, then 20 mg/day) for patients admitted within 3 to 12 hours found no difference in function at 90 days or any difference in biological markers (Montaner et al, 2008). While there was a significant improvement in impairment (>4 NIHSS; 46.4% vs 17.9%) found by the third day of treatment, there was also a non-significant increase in mortality and a greater rate of infections (OR 2.4, 95% CI 1.06–5.4) in the simvastatin group (Montaner & Chacon, 2008). Further large interventional studies are needed to clarify the role of continuing or commencing statin therapy in people with acute stroke.

Recommendations	
Neuroprotection	**Grade**
The use of putative neuroprotectant therapies (including hypothermic cooling) should only be used if part of a randomised controlled trial (den Hertog et al, 2009a; Diener et al, 2008; Doesborgh et al, 2004; Rose et al, 2002; Bath, 2004).	**A**
People with acute ischaemic stroke who were receiving statins prior to admission can continue statin treatment (Blanco et al, 2007).	**B**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

4.11 Pyrexia management

Pyrexia is associated with poorer outcomes after stroke (Greer et al, 2008). The most common causes of pyrexia are chest or urinary infections (Langhorne et al, 2000). A number of trials have evaluated different techniques for reducing body temperature as a means of neuroprotection in the acute phase rather than specifically responding to pyrexia – see 4.10 (Neuroprotection). Paracetamol and physical cooling for those with pyrexia have been found to be modestly effective therapies to reduce temperature in acute stroke (Mayer et al, 2004; Dippel et al, 2003). A subsequent phase III RCT of high dose paracetamol (6 g) within 12 hours of stroke onset resulted in a non-significant trend to improved outcomes (adjusted OR 1.20, 95% CI 0.96–1.50) (den Hertog et al, 2009a). Adverse events were similar in treatment and control groups (8% vs 10%). Post hoc analysis suggested significant effects for those with baseline temperature of 37 to 39 degrees Celsius (OR 1.43, 95% CI 1.02–1.97) but this should be confirmed in another large trial. One small RCT (n=60) found a significant reduction in infection and fever with prophylactic antibiotic therapy with mezlocillin plus sulbactam

after severe acute ischaemic stroke (Schwarz et al, 2008). However, there was an increase in adverse events. A larger study is required. Clearer data is also needed to reach a consensus definition of fever in stroke.

Recommendations	
Pyrexia	**Grade**
For acute stroke, antipyretic therapy comprising regular paracetamol and/or physical cooling measures, should be used routinely where fever occurs (Mayer et al, 2004; den Hertog et al, 2009a).	**C**

Grade description
A   Body of evidence can be trusted to guide practice
B   Body of evidence can be trusted to guide practice in most situations
C   Body of evidence provides some support for recommendation(s) but care should be taken in its application
D   Body of evidence is weak and recommendation must be applied with caution
✓   Consensus-based recommendations (GPP)

4.12   Seizure management

The incidence of post-stroke seizures varies widely in epidemiological studies, ranging from 2% to 33% for early seizures (<7 days) and 3% to 67% for late seizures (Camilo & Goldstein, 2004). Three percent of acute stroke patients across New Zealand were found to have had a seizure (SFNZ, 2010). People with severe stroke, haemorrhagic stroke, and/or a stroke involving the cerebral cortex are at increased risk of developing seizures, but there is still debate about risk factors. Multiple Cochrane reviews have reported the effectiveness of different anticonvulsant medications (eg, carbamazepine, phenytoin, phenobarbitone, oxcarbazepine, lamotrigine) for people with seizures (Tudur Smith et al, 2002; Tudur Smith et al, 2003; Gamble et al, 2006; Muller & Pfefferkorn, 2007). One Cochrane review on managing seizures post stroke failed to identify any RCTs that met the inclusion criteria (Kwan & Wood, 2009). Findings from three studies identified but not included in the review suggest that lamotrigine may be more useful than carbamazepine (Gilad et al, 2007; Rowan et al, 2005; Marson et al, 2007) although further trials are needed before firm conclusions can be made. There was consensus that general principles of seizure management using anticonvulsant medication is appropriate for stroke patients with recurrent seizures although the preferred medication, dosages and duration of treatment is unclear.

Recommendations	
Seizures	**Grade**
Anticonvulsant medication should be used for people with recurrent seizures after stroke.	✔
Grade description	
A Body of evidence can be trusted to guide practice	
B Body of evidence can be trusted to guide practice in most situations	
C Body of evidence provides some support for recommendation(s) but care should be taken in its application	
D Body of evidence is weak and recommendation must be applied with caution	
✔ Consensus-based recommendations (GPP)	

4.13   Complementary and alternative therapy

Complementary and alternative therapies for stroke cover a range of practices including acupuncture, homoeopathy, traditional Chinese medicine, aromatherapy, music therapy, Reiki therapy, conductive education, naturopathy, reflexology and osteopathy. This section focuses on acute interventions only.

One Cochrane review (14 RCTs) found no clear benefit for treatment of acute ischaemic or haemorrhagic stroke (Zhang et al, 2005). Several traditional Chinese herbal medicines have been included in Cochrane reviews (Li et al, 2009; Yan & Hui-Chan, 2008; Cao et al, 2008; Tan et al, 2008; Zeng et al, 2005; Wu et al, 2007b; Chen et al, 2008; Zhuo et al, 2008). Some therapies report improvement in impairment (eg, ginkgo biloba, dan shen, Sanchi, acanthopanax) but it is unclear if they improve important outcomes such as death and dependency or measures of functional activity or participation. Few adverse events are generally reported. Methodological limitations of trials related to most traditional Chinese interventions, including acupuncture, make conclusions difficult. No additional robust trials for other therapies were found and hence no conclusions can be made. Herbal preparations may have harmful interactions with certain medications and should be discussed with relevant health practitioners.

Since complementary medicine may relate to particular cultural backgrounds or other belief systems, health practitioners should be aware of, and sensitive to, the needs and desires of the person with stroke and the family/carer. Health practitioners should be willing to discuss the effectiveness of therapy and different options of care within the context of the current health care system.

Recommendations	
Complementary and alternative therapy	**Grade**
The routine use of the following complementary and alternative therapies is NOT recommended:	
• acupuncture (Zhang et al, 2005)	**B**
• traditional Chinese herbal medicines (Li et al, 2009; Yan & Hui-Chan, 2008; Cao et al, 2008; Tan et al, 2008; Zeng et al, 2005; Wu et al, 2007b; Chen et al, 2008; Zhuo et al, 2008).	**B**
Health practitioners should be aware of different forms of complementary and alternative therapies and be available to discuss these with people with stroke and their families.	✔
Grade description	

Grade description

A   Body of evidence can be trusted to guide practice

B   Body of evidence can be trusted to guide practice in most situations

C   Body of evidence provides some support for recommendation(s) but care should be taken in its application

D   Body of evidence is weak and recommendation must be applied with caution

✔   Consensus-based recommendations (GPP)

Chapter 5: Secondary prevention

A person with stroke has an accumulated risk of subsequent stroke of 43% over 10 years with an annual rate of approximately 4% (Hardie et al, 2004). The rate of strokes after transient ischaemic attack (TIA) is significantly higher (up to 10% after three months) suggesting greater opportunities to prevent stroke after TIA (Giles & Rothwell, 2007). Secondary prevention therefore relates to both stroke and TIA. Long-term management of risk factors, particularly medication compliance, is the primary role of GPs and good communication between secondary and primary care is important. There is substantial commonality between secondary prevention measures in stroke and TIA and primary/secondary prevention of other cardiovascular diseases. The New Zealand Cardiovascular Guidelines Handbook on management of cardiovascular disease and diabetes was updated in 2009 (New Zealand Guidelines Group, 2009) and can be accessed at: www.nzgg.org.nz.

5.1   Lifestyle modifications

Evidence on behaviour change strategies targeting lifestyle factors to prevent recurrence of stroke is limited and often derived from cohort studies of primary prevention.

- **Smoking** increases the risk of ischaemic stroke due to vascular narrowing and changes in blood dynamics (Paul et al, 2004; Kurth et al, 2003a; Kurth et al, 2003b; Shinton & Beevers,1989). However, its role in haemorrhagic stroke is not as clear (Ariesen, 2003; Paul et al, 2004). While no RCTs have been conducted, observational studies have found the risk from smoking decreases after quitting, with the risk disappearing altogether after five years (Wannamethee et al,1995; Kawachi et al, 1992). Several Cochrane reviews have been undertaken related to different therapies for smoking cessation. Nicotine replacement therapy is beneficial and doubles the chances of smoking cessation (Silagy et al, 2004). Some antidepressants, for example bupropion and nortriptyline but not selective serotonin reuptake inhibitors aid long-term smoking cessation (Hughes et al, 2007). Varenicline, a nicotine receptor partial agonist, has recently been developed for long-term smoking cessation with a threefold success rate compared with non-drug quit attempts (Cahill et al, 2007). Varenicline has also been found to be more effective than the antidepressant bupropion (Cahill et al, 2007). A number of behavioural therapies delivered by different health practitioners in different settings have demonstrated modest effects for smoking cessation in general populations and should be provided via an individualised approach either in a group or on a one-to-one basis (Stead & Lancaster, 2005; Sinclair et al, 2004; Rice & Stead, 2004; Lancaster & Stead, 2005). One good example of such behavioural therapies involves telephone counselling, which improved smoking cessation rates, particularly when three of more call-backs were made (Stead et al, 2006).

- **Diet** has an impact on a number of risk factors and can provide additional benefits to pharmacological interventions in people with vascular disease. Reducing sodium in people with cardiovascular disease, especially in those with high BP, modestly reduces BP and may therefore help to prevent stroke (He & MacGregor, 2004; Hooper et al, 2004). A meta-analysis of cohort studies found a diet high in fruit and vegetables (>5 servings per day) reduced the risk of stroke (He et al, 2006; Dauchet et al, 2005). Meta-analysis of cohort studies also found a diet high in oily fish was associated with a lower risk of stroke (He K et al, 2004). Reduced dietary fat has also been shown to reduce cardiovascular disease (Hooper et al, 2001). Similarly, a diet that is low in fat but high in fruit and vegetables has been shown to be effective in risk reduction for those with cardiovascular disease (Sacks et al, 2001; Appel et al, 1997; Barzi et al, 2003; de Lorgeril et al, 1999). Dietary modification has also been shown to be beneficial for those with dyslipidemia (Hooper et al, 2001; Jula et al, 2002; Sdringola et al, 2003) and obesity to assist in controlling hypertension (Mulrow et al, 1998). Supplementary antioxidants and vitamins, however, have not been found to reduce stroke (Toole et al, 2004; HPS Collaborative Group, 2004). Recommendations for dietary intake are available from other guidelines and provide useful information based on cardiovascular disease and general populations (NHMRC, 2003; NHF, 2008; NZGG, 2009; NHF, 2010). For information about the National Heart Foundation's nine steps to healthy eating see *A Guide to Heart Healthy Eating* at: www.nhf.org.nz – search on title.

- There is strong evidence from a meta-analysis of cohort studies that **physical activity** has a protective effect on stroke (Lee et al, 2003; Wendel-Vos et al, 2004). Cardiorespiratory fitness training is feasible for people with stroke and can lead to improved measures of aerobic fitness, improved walking speed, and improved endurance (Pang et al, 2006; Saunders et al, 2009). While there is insufficient data to evaluate the impact of physical activity on secondary stroke prevention, it would be logical to assume that adequate exercise would reduce the risk of subsequent cardiovascular events. Physical activity also has clear benefits for reducing hypertension in at-risk people (Whelton et al, 2002) and improving glycaemic control for those with type 2 diabetes (Thomas et al, 2006). The New Zealand Cardiovascular Guidelines Handbook recommends a minimum goal of 30 minutes of moderate intensity physical activity on most days of the week (NZGG, 2009).

- **Obesity** and being **overweight** is thought to be associated with an increased risk of stroke, and it has been suggested that weight loss may lead to a reduction in primary stroke occurrence. One study found that markers of abdominal adiposity showed a graded and significant association with risk of stroke/TIA (Winter et al, 2008). However, a Cochrane review failed to find any RCTs evaluating weight reduction for primary prevention of stroke (Curioni et al, 2006).

- **Excessive alcohol consumption** increases the risk of stroke (Reynolds et al, 2003), so reducing alcohol levels could be expected to modify the risk of further strokes although no studies specific to secondary stroke prevention have been found. However, light alcohol intake may be protective of stroke events (Reynolds et al, 2003). Australian national guidelines recommend limiting alcohol consumption to two standard drinks per day, possibly lower for women (NHMRC, 2003; NHMRC,

2009). The same recommendation is given by the Stroke Foundation of New Zealand at: www.stroke.org.nz.

- A multifactorial **behavioural intervention** strategy that targets several risk factors can be effective. One study found a programme of initiating tailored secondary prevention, including lifestyle interventions, while in hospital led to improved rates of adherence both prior to discharge and three months after discharge (Ovbiagele et al, 2004; Touze et al, 2008). Educational interventions during and after discharge have also reported improved adherence to dietary advice (Nir & Weisel-Eichler, 2006; Middleton et al, 2005) but other trials of post-discharge support have been mixed – see section 1.3.1 (Safe transfer of care from hospital to community). Systematic reviews have found behavioural techniques, for example dietary or motivational counselling, provided by specialist, trained clinicians are effective at changing behaviour in primary care settings (Rubak et al, 2005; Pignone & Mulrow, 2001). A subsequent stroke study found simply providing the advice to change to a healthy diet modestly reduced CVD risk factors, specifically BP, lipids and sodium intake (Brunner et al, 2007).

Recommendations	
Lifestyle modification	**Grade**
Every person with stroke should be assessed and informed of their risk factors for a further stroke and possible strategies to modify identified risk factors. The risk factors and interventions include:	
• smoking cessation: nicotine replacement therapy, bupropion or nortriptyline therapy, nicotine receptor partial agonist therapy and/or behavioural therapy should be considered (Silagy et al, 2004; Hughes et al, 2007; Cahill et al, 2007, Stead & Lancaster, 2005; Sinclair et al, 2004; Rice & Stead, 2004; Lancaster & Stead, 2005; Stead et al, 2006)	**A**
• improving diet: a diet that is low in fat (especially saturated fat) and sodium, but high in fruit and vegetables should be consumed (He et al, 2006; Dauchet et al, 2005; He & MacGregor, 2004; Hooper et al, 2004; Sacks et al, 2001; Appel et al, 1997; Barzi et al, 2003; de Lorgeril et al, 1999)	**A**
• increasing regular exercise (Lee et al, 2003; Wendel-Vos et al, 2004)	**B**
• avoidance of excessive alcohol (ie, no more than two standard drinks per day) (Reynolds et al, 2003; NHMRC, 2003; NHMRC, 2009).	**C**
Interventions should be individualised and delivered using behavioural techniques (such as educational or motivational counselling) (Rubak et al, 2005; Lancaster & Stead, 2005; Stead & Lancaster, 2005; Stead et al, 2006; Sinclair et al, 2004).	**A**
For Māori and Pacific people, involvement of whānau and culturally-appropriate service providers is advised, where these are available.	✔
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

5.2   Adherence to pharmacotherapy

Failure to take prescribed medication is a major barrier to optimal secondary prevention. In one large Swedish cohort the proportion of patients who continued using hospital prescribed medication after two years was 74.2% for antihypertensive drugs, 56.1% for statins, 63.7% for antiplatelet drugs, and 45.0% for warfarin (Glader et al, 2010). An Auckland study found adherence to stroke secondary prevention medications of 87% to 100% at six weeks and similar findings at six months. The authors considered that the high adherence rates were due, at least in part to one-on-one stroke nurse counselling and the use of stroke information packs, which included information about the importance of adherence to secondary prevention medication (Johnson et al, 2010). However, the literature concerning interventions to improve adherence to medications remains surprisingly weak.

An updated Cochrane review (78 RCTs) found only modest effects for interventions to improve adherence to medications, but few, if any, were specifically in the stroke population (Haynes et al, 2008). Conflicting evidence for short-term interventions on adherence were found and very few studies reported changes in patient outcomes. Almost all of the interventions that were effective for long-term adherence were complex, including combinations of more convenient care, information, reminders, self-monitoring, reinforcement, counselling, family therapy, psychological therapy, crisis intervention, manual telephone follow-up, and supportive care. Another Cochrane review (8 RCTs) involving the use of dose administration aide or other reminder packing strategies found some improvements in terms of the number of pills taken but no appropriate data was available to make conclusions on the clinical outcomes (Heneghan et al, 2006).

One subsequent RCT found a pharmacist-led education programme improved modifiable lifestyle factors, specifically BP and lipids, in a risk-free intervention that supplemented usual care offered in an outpatient setting (Chiu et al, 2008). A three-year follow-up of an RCT (McManus et al, 2009) found that a brief education or counselling intervention, while having short-term effects on behaviour, did not have any long-term benefits (same level of controlled risk factors, medication adherence, and event rates).

Two cohort studies have found a programme of initiating tailored secondary prevention medications while in hospital is important for adherence after discharge (Ovbiagele et al, 2004; Touze et al, 2008). Commencing strategies early may be a key to improving medication adherence and improving secondary prevention, along with regular follow-up.

Recommendations	
Adherence to pharmacotherapy	**Grade**
Effective interventions to promote adherence with medication regimes are often complex and should include combinations of the following:	
• reminders, self-monitoring, reinforcement, counselling, family therapy, telephone follow-up, supportive care, or dose administration aids (Haynes et al, 2008; Heneghan et al, 2006)	**B**
• information and education while in hospital and/or in the community (Haynes et al, 2008; Chiu et al, 2008).	**B**

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✓ Consensus-based recommendations (GPP)

5.3   Blood pressure lowering

High BP is the major risk factor for both first and subsequent stroke. Only 71% of eligible patients are discharged on BP lowering therapy (SFNZ, 2010). In general, effective BP management requires that BP is maintained below acceptable limits, that is, lower than 130/80 mm Hg (NHF, 2008). A systematic review which included 10 RCTs (Lakhan & Sapko, 2009) found therapy to lower BP, even when initial BP was within normal range, reduced recurrent stroke (OR 0.71, 95% CI 0.59–0.86) and cardiovascular events (OR 0.69, 95% CI 0.57–0.85) in patients with a previous stroke or TIA (Lakhan & Sapko, 2009). The review indicated that therapy may reduce the rate of MI (OR 0.86, 95% CI 0.73–1.01) but does not lower all-cause mortality (OR 0.95, 95% CI 0.83–1.07). The most direct evidence of benefit is for the use of an ACE inhibitor (alone or in combination with a diuretic; however, different agents have generally been found to be effective in lowering BP, with the exception of beta blockers (Rashid et al, 2003). A recent large scale RCT (n=20,332) did not demonstrate an early benefit of an angiotensin II receptor antagonist in addition to usual therapy to prevent recurrent stroke (Yusuf et al, 2008).

The timing of commencing therapy remains unclear. Acute therapy (within first 48 hours) is discussed separately as it relates to acute medical intervention rather than secondary prevention – see section 4.4 (Acute blood pressure lowering therapy). However, two small studies in those with mild stroke or TIA without major carotid disease, found BP lowering therapy (with an angiotensin II receptor antagonist or ACE inhibitor) was safe when commenced two to four days after stroke, although follow-up was only two weeks (Nazir et al, 2004; Nazir et al, 2005). Commencement of secondary prevention medications, including BP lowering therapy, while in hospital appears to be an important aspect for improving rates of adherence after discharge (Ovbiagele et al, 2004; Touze et al, 2008).

Lifestyle change including diet and exercise, by themselves or in conjunction with pharmacotherapy can also be used to reduce BP – see section 5.1 (Lifestyle modifications).

Recommendations	
Blood pressure lowering	**Grade**
All patients after stroke or TIA, whether normotensive or hypertensive, should receive blood pressure lowering therapy for secondary prevention, unless contraindicated by symptomatic hypotension (Lakhan & Sapko, 2009).	**A**
New blood pressure lowering therapy should commence prior to discharge for those with stroke or TIA or soon after TIA if the patient is not admitted (Nazir et al, 2004; Nazir et al, 2005).	**B**
Cautious introduction of BP lowering medication may be required in older people with frailty due to risk of complications such as symptomatic hypotension.	✔
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

5.4 Antiplatelet therapy

A systematic review which included 21 RCTs (n>23,000) of patients with previous ischaemic stroke or TIA found antiplatelet therapy compared with control significantly reduced the risk of subsequent serious vascular events including stroke, MI or vascular death (17.8% compared with 21.4%) (Antithrombotic Trialists, 2002). Antiplatelet therapy may have adverse effects, particularly a small risk of haemorrhage, but the benefits outweigh the risks (Serebruany et al, 2004). Although the benefits of antiplatelet therapy are well known and intervention can commence soon after stroke – see section 4.3 (Antithrombotic therapy) – compliance drops off after discharge, with 21% of people post stroke in Australia found to not be taking any antiplatelet therapy based on primary care data (Reid et al, 2008).

Aspirin remains the most readily available, cheapest and most used antiplatelet agent. A systematic review (10 RCTs) found aspirin reduced the risk of serious vascular events by about 13% (95% CI 4–21) in patients with previous ischaemic stroke or TIA (Algra & van Gijn, 1996). Aspirin at low doses (75–150 mg) is just as effective as higher doses (300–1300 mg) and is associated with a lower risk of gastrointestinal adverse effects (Antithrombotic Trialists, 2002). The lowest therapeutic dose of aspirin remains unclear, but the Dutch TIA trial showed that in more than 3000 patients with TIA, 30 mg was as effective as 283 mg in preventing serious vascular events (Algra & Van Gijn, 1996).

A number of systematic reviews and one Cochrane review found that clopidogrel (75 mg) or extended release dipyridamole (200 mg bd) plus low dose aspirin was more effective than aspirin alone (Halkes et al, 2008; de Schryver et al, 2007; Sudlow et al, 2009). No difference in the net risk of recurrent stroke or major haemorrhagic event was found in a large RCT (n=20,332) comparing clopidogrel and extended release dipyridamole plus low dose aspirin (11.7% vs 11.4% hazard ratio 1.03, 95% CI 0.95–1.11) (Sacco et al, 2008).

One Cochrane review which included three RCTs found there was no difference between dipyridamole alone and aspirin in the avoidance of vascular death (RR 1.08, 95% CI 0.85–1.37) or the prevention of vascular events (RR 1.02, 95% CI 0.88–1.18) (de Schryver et al, 2007).

Several RCTs have found that the combination of low dose aspirin (75–162 mg) plus clopidogrel (75 mg) had no net benefit compared with clopidogrel alone (RRR 6%) or aspirin alone (RRR 7%) because any long-term benefits with combination therapy are offset by an increase in bleeding (1.7–2.6% vs 1.3%) (Diener et al, 2004; Bhatt et al, 2006; Active Investigators et al, 2009). Careful consideration of combined therapy of aspirin plus clopidogrel should be undertaken only where clear indications exist (ie, coexisting acute coronary disease or recent coronary stent).

Recommendations	
Antiplatelet therapy	**Grade**
Long-term antiplatelet therapy should be prescribed to all people with ischaemic stroke or TIA who are not prescribed anticoagulation therapy (Antithrombotic Trialists, 2002).	**A**
Low dose aspirin and modified release dipyridamole or clopidogrel alone should be prescribed to all people with ischaemic stroke or TIA taking into consideration patient comorbidities (Sacco et al, 2008).	**B**
Aspirin alone can also be used, particularly in patients who do not tolerate aspirin plus dipyridamole or clopidogrel (Antithrombotic Trialists, 2002).	**A**
The combination of aspirin plus clopidogrel is NOT recommended for the secondary prevention of cerebrovascular disease in patients who do not have acute coronary disease or recent coronary stent (Diener et al, 2004; Bhatt et al, 2006).	**A**

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✓ Consensus-based recommendations (GPP)

5.5 Anticoagulation therapy

5.5.1 Anticoagulation after ischaemic stroke

Patients with non-cardioembolic ischaemic stroke

An updated Cochrane review (11 RCTs) has provided evidence against the routine use of anticoagulant therapy in people with non-cardioembolic ischaemic stroke or TIA due to the increased risk of adverse events (fatal intracranial haemorrhage OR 2.54, 95% CI 1.19–5.45; major extracranial haemorrhage OR 3.43, 95% CI 1.94–6.08) (Sandercock et al, 2009).

Patients with non-rheumatic atrial fibrillation and ischaemic stroke

Two separate Cochrane reviews (each with two RCTs) found that for patients with non-rheumatic atrial fibrillation (AF) and a recent TIA or minor ischaemic stroke, the benefits of anticoagulants outweigh the risks and anticoagulants are more effective than antiplatelet therapy for long-term secondary prevention (Saxena & Koudstaal, 2004a; Saxena & Koudstaal, 2004b). A large subsequent RCT (n=973) found that in an elderly population (over 75 years) with AF and stroke, warfarin was more effective than aspirin (RR 0.48, 95% CI 0.28–0.80) with no difference in the rates of major haemorrhage (Mant et al, 2007). Until recently, only warfarin had been found to be beneficial; however, an RCT (n=18,113) suggested dabigatran is an alternative to warfarin for secondary prevention in patients with ischaemic stroke/TIA who have AF (paroxysmal, persistent or permanent) (Connolly et al, 2009). While more information is required regarding potential differences in adverse events (eg, dyspepsia, MI, PE) dabigatran does not require regular blood tests, and importantly appears to lower ICH rates. The cost-effectiveness of dabigatran is not yet known in the New Zealand market and subsidised funding for patients with stroke is not available at the time of writing.

Studies suggest that warfarin use requires the INR to be within therapeutic range more than 60% to 70% of the time in order to achieve overall benefits. Clearly issues around monitoring should be considered as studies have shown INR control is variable and dependent on monitoring intensity and duration of anticoagulant therapy. One systematic review which included 36 RCTs found more structured and intense monitoring led to a small improvement (~5%) in time spent within INR 2 to 3 (Dolan et al, 2008). Structured monitoring was defined as a frequency of more than once monthly, using strict protocol-driven monitoring schemes in RCTs or study groups that were evaluating self-managed monitoring.

There remains uncertainty about the ideal time to commence therapy and no clear data is available to inform this decision. Trials generally enrolled patients after one or two weeks to reduce the risk of haemorrhage (only 12% of patients in the ESPRIT trial were enrolled within one week). One Level III-3 trial (n=247) commenced appropriate anticoagulation prior to discharge from acute hospital care. In 100% of cases all were still adhering to the therapy at three months post discharge (Ovbiagele et al, 2004). International guidelines recommend delaying the start of treatment for two to four weeks for patients with acute stroke. Aspirin or other antiplatelet therapy should be used between an acute stroke event and the time when anticoagulation is commenced. For patients with TIA, anticoagulation therapy should be commenced as soon as imaging has excluded ICH or a stroke mimic as the cause of the symptoms.

Compliance and the need for careful monitoring is a major issue. Anticoagulation therapy is consistently found to be underutilised in primary care. Many reasons for non-intervention using warfarin are not based on evidence (Gattellari et al, 2008).

Recommendations	
Anticoagulation therapy after ischaemic stroke	**Grade**
Anticoagulation therapy for secondary prevention for those people with ischaemic stroke or TIA from presumed arterial origin should NOT be routinely used as there is no evidence of additional benefits over antiplatelet therapy (Sandercock et al, 2009).	**A**
Anticoagulation therapy for long-term secondary prevention should be used in all people with ischaemic stroke or TIA who have atrial fibrillation or cardioembolic stroke and no contraindication (Saxena & Koudstaal, 2004a; Saxena & Koudstaal, 2004b).	**A**
In acute ischaemic stroke, the decision to commence anticoagulation therapy can be delayed for up to two weeks but should be made prior to discharge (Ovbiagele et al, 2004).	**C**
In patients with TIA, commencement of anticoagulation therapy should occur once CT or MRI has excluded intracranial haemorrhage as the cause of the current event.	✔
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

Anticoagulation after intracerebral haemorrhage

Some patients with ICH may have a coexisting condition such as the presence of a mechanical heart valve, AF or previous ischaemic events that would otherwise be an indication for antithrombotic or anticoagulant treatment. In general, anticoagulant therapy can be stopped for a 'considerable' time with a low thrombotic event rate in patients with acute ICH (De Vleeschouwer et al, 2005). However, it is not clear if and when to restart oral anticoagulant therapy with little good evidence to guide such a decision. Patients who do not restart warfarin after ICH are at higher risk of thromboembolic events, but patients who do re-start warfarin have more risk of ICH and other haemorrhagic events (Claassen et al, 2008). The appropriateness of restarting therapy will depend on whether intracerebral bleeding has been stopped, the estimated existing risk of thromboembolism and the presumed pathophysiology of the ICH, which will determine the risk of ICH recurrence (European Stroke Initiative, 2006).

A systematic literature search for published or ongoing systematic reviews and RCTs found no RCTs or well-controlled studies. Four published guidelines American Stroke Association (Broderick et al, 2007), European Stroke Initiative (EUSI, 2006), ACC/AHA (Bonow et al, 2008), European Society of Cardiology (Vahanian, 2007); two systematic reviews (Romualdi et al, 2009; Aguilar et al, 2007), a narrative review (Appelboam & Thomas, 2009) and two cohort studies (Claassen et al, 2008; De Vleeschouwer et al, 2005) were identified. All of the primary studies identified were of poor quality (see Table 4). The ages and the comorbidities of the study participants were not always recorded and patient numbers were small. Not all of the studies identified the indication for anticoagulant therapy making it difficult to interpret the data. The American Stroke Association guideline (Broderick et al, 2007) concluded that:

> 'the clinical dilemma of whether and when to restart anticoagulants in patients with ICH who have cardio-embolic risk will not be solved until prospectively generated data on rates of ICH recurrence after warfarin reinstitution become available'.

Table 4:   Anticoagulation after intracerebral haemorrhage

Study	Indication	No. of patients (n)	Restart of therapy	ICH (any bleed)*	Embolic stroke (any embolism)†
Romualdi et al, 2009 Systematic review	MHV#	6 cohort studies and case reports n=138	7–14 days	2 (2)	4
Aguilar et al, 2007 Narrative review	MHV	Safety of restart (5 case series) n=14		2 (3%/year)	
		Timing and risk of thromboembolic event (8 case series) n=132	7–14 days		4 (5)
Appelboam & Thomas, 2009 Narrative review	Mixed	Timing of restart (9 case series) n=298 (MHV=188)	Median 7 days (range 3–19)		4
		Risk of bleeding (9 prospective case series) n=128 (MHV=59)		4	
Claassen et al, 2008 Retrospective cohort study	Mixed	Restart: n=23	Within 60 days	3 (5)	0 (2)
		No restart: n=29		0 (2)	5 (7)
De Vleeschouwer et al, 2005 Prospective cohort study	Mixed	Restart n=25	Median 11 days (IQR=14)	1 (8)	0 (0)
		No restart n=81		0	2 (8)

*   Any bleed includes ICH; † Any embolism/ischaemic event includes thromboembolic stroke.

Abbreviations: MHV = mechanical heart valve; n=number; ICH = intracerebral haemorrhage; IQR = interquartile range.

Summary of findings

a)   **Mechanical heart valves**: Trial conclusions range from the cautious statement that restarting anticoagulation should be considered in patients with prosthetic heart valves (considered high risk) (Appelboam & Thomas, 2009), to the definite statement that in patients with prosthetic heart valves, risk-benefit assessment favours reinitiation of anticoagulation (Aguilar et al, 2007).

b)   **Atrial fibrillation**: The conclusions range from that the long-term risk of recurrent ICH may outweigh benefits of restarting anticoagulants in patients with AF and no history of ischaemic stroke (Aguilar et al, 2007), to that restarting anticoagulation should be considered in patients with chronic AF with prior ischaemic events (considered high risk) (Appelboam & Thomas, et al, 2009) and that the risk-benefit assessment favours reinitiation of anticoagulation in patients with AF and a history of ischaemic stroke (Aguilar et al, 2007).

c) **Past vascular disease:** Restarting anticoagulation should be considered in patients with chronic AF with prior ischaemic events (considered high risk) (Appelboam & Thomas, 2009).

d) **Restarting therapy:** It seems that after ICH, warfarin therapy can be safely restarted at 7 to 14 days (Aguilar et al, 2007; Romualdi et al, 2009) or 10 to 14 days after the event, depending on perceived risk of thromboembolic occlusion and ICH recurrence (European Stroke Initiative, 2006).

Individual patient factors and risks and benefits of therapy will need to be taken into account before the decision is made to restart therapy after ICH. The risk of recurrent ICH is thought to be greatest in those with lobar and previous ICH, and less with deep 'hypertensive ICH' when blood-pressure control can be optimised. In general, thromboembolism risk is highest in patients with mechanical heart valves (particularly mitral valves), and is high in those with AF and patients with previous ischaemic events.

Recommendations

Anticoagulation therapy after intracerebral haemorrhage	Grade
There is insufficient evidence to allow firm recommendations regarding the use of anticoagulant or antiplatelet therapy in patients with ICH who are considered to be at high risk of future thromboembolic events.	D
All patients with ICH should have their individual risk of future thromboembolic events and their risk of recurrent ICH assessed, taking into account patient specific factors. The risk of recurrent ICH is thought to be greatest in those with lobar and previous ICH and less with deep 'hypertensive ICH' when blood-pressure control can be optimised. In general, thromboembolism risk is highest in patients with mechanical heart valves (particularly mitral valves), and is high in those with atrial fibrillation and patients with previous ischemic events.	✔
Expert advice should be sought and the potential benefits and risks of anticoagulant and antiplatelet therapy after ICH discussed with patients and their families, and documented.	✔

Grade description
A Body of evidence can be trusted to guide practice
B Body of evidence can be trusted to guide practice in most situations
C Body of evidence provides some support for recommendation(s) but care should be taken in its application
D Body of evidence is weak and recommendation must be applied with caution
✔ Consensus-based recommendations (GPP)

5.5.3 Self-monitoring of oral anticoagulation

The introduction of portable monitors (point-of-care devices) for the management of anticoagulant therapy allows self-testing by a patient at home. A systematic review (18 RCTs including 4723 participants) of oral anticoagulation, including both self-monitoring (home testing with clinic-based dose adjustment) and self-management (home testing and home adjustment according to a pre-determined algorithm) found that patients who self-managed had significant reductions in thromboembolic events, major haemorrhages (RR 0.56, 95% CI 0.35–0.91) and mortality. These benefits were not seen in patients who self-monitored alone (Garcia-Alamino et al, 2010). Twelve of the trials reported improvements in the percentage of mean INR measurements in the therapeutic range. However, self-monitoring or self-management was not feasible for up to half of the patients requiring anticoagulant therapy. Reasons included patient refusal, exclusion by their GP, and inability to complete training.

None of the RCTs specifically examined home monitoring in a population of patients presenting with stroke. Most of the trials included patients with any indication for oral anticoagulation and participants had a younger mean age than would be expected in a stroke population. Two RCTs have compared an intervention including home measurement of INR with standard care for patients with AF using warfarin anticoagulation for stroke prevention (Khan et al, 2004; Völler et al, 2005). In Khan et al's study (n=84), INR results improved in both intervention and control groups. Of 40 patients randomised to self-monitoring completing the study, 30 reported no problems with the technique and would have wanted to continue with self-monitoring for its ease and convenience (Khan et al, 2004). In the SMAAF study (Völler et al, 2005), the self-management group of patients was significantly more likely to be within the target range than the usual care group (67.8 ± 17.6% vs 58.5 ± 19.8%, p=0.0061). This study had anticipated recruiting 2000 patients but only recruited 202 (Völler et al, 2005).

One other study reported on an elderly sample with a range of indications for anticoagulation, including patients with AF (Fitzmaurice et al, 2005). Of all the patients invited to participate, only 25% were recruited. 337 subjects were randomised to self-monitoring, of whom 193 (57%) completed the intervention. There was no difference in time spent within the therapeutic INR range before or during the study for either the intervention or routine care arm. Patients in the intervention group who were poorly controlled at baseline demonstrated a significant improvement over time.

Recommendations	
Self-monitoring of oral anticoagulation	**Grade**
Home monitoring using a point-of-care INR testing device can be offered to selected patients (Khan et al, 2004; Völler et al, 2005).	**B**
Patients need to be trained and reassessed periodically for safe self-monitoring.	✓

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✓ Consensus-based recommendations (GPP)

5.6   Cholesterol lowering

Seventy-three percent of eligible ischaemic stroke patients were on lipid lowering therapy on discharge from hospital, according to a recent New Zealand audit of stroke care (SFNZ, 2010). Australian data is similar (NSF, 2009a); however, records from a large Australian GP registry indicate that once in the community the rate fell to 65% (Reid et al, 2008). There is conflicting evidence regarding the link between elevated cholesterol and stroke subtypes; epidemiological studies suggest that higher cholesterol levels are associated with a higher risk of ischaemic stroke but a lower risk of intracerebral haemorrhage (Hankey, 2002). Meta-analysis involving 14 RCTs demonstrated that benefits (reduced stroke risk) occur within 12 months of commencing therapy and are related to low-density lipoprotein (LDL) cholesterol reduction (Cholesterol Treatment Trialists' Collaboration, 2005). Meta-analysis also indicated that statins have a good safety profile and are not associated with liver toxicity (Law & Rudnicka, 2006; de Denus et al, 2004).

Two recent meta-analyses (four RCTs) and one Cochrane review (eight RCTs), based predominantly on two large RCTs (Heart Protection Study and SPARCL trial), reported consistent findings (Vergouwen et al, 2008; Amarenco et al, 2009; Manktelow & Potter, 2009). Statin therapy was found to marginally reduce all stroke in those with prior stroke or TIA (OR 0.88, 95% CI 0.77–1.00) (Manktelow & Potter, 2009; Vergouwen et al, 2008; Amarenco & Labreuche, 2009). Statin therapy clearly reduced subsequent ischaemic stroke (OR 0.80, 95% CI 0.70–0.92 [Vergouwen et al, 2008; Amarenco & Labreuche, 2009], OR 0.78, 95% CI 0.67–0.92 [Manktelow & Potter, 2009]) but this was partly offset by an increase in intracerebral haemorrhage (OR 1.73, 95% CI 1.19–2.50 (Vergouwen et al, 2008; Amarenco & Labreuche, 2009), OR 1.72, 95% CI 1.20–2.46 (Manktelow & Potter, 2009). Statin therapy reduces serious vascular events, defined as non-fatal stroke, non-fatal myocardial infarction, or vascular death (OR 0.74, 95% CI 0.67–0.82) (Manktelow & Potter, 2009). No difference in all-cause mortality rates was found (OR 1.00, 95% CI 0.83–1.20) (Manktelow & Potter, 2009; Vergouwen et al, 2008). The Heart Protection Study included patients with total cholesterol >3.5 mmol/L; the SPARCL trial included those with LDL≥2.6 mmol/L.

Lifestyle change strategies involving dietary modification has been shown to lower cholesterol levels in those with cardiovascular risks and should be used as an alternative or in addition to pharmacotherapy – see section 5.2 (Adherence to pharmacotherapy). Dietary advice and interventions should be undertaken either prior to or alongside drug therapy to reduce cholesterol and be reviewed annually – see section 5.1 (Lifestyle modifications).

One study reported higher rates of adherence for statin therapy commenced prior to discharge from hospital (Sanossian et al, 2006).

Recommendations	
Cholesterol lowering	**Grade**
Therapy with a statin should be considered for all patients with ischaemic stroke or TIA (Amarenco & Labreuche, 2009; Manktelow & Potter, 2009).	**A**
Statins should NOT be used routinely for patients with intracerebral haemorrhage (Amarenco & Labreuche, 2009; Manktelow & Potter, 2009).	**B**

Grade description
A   Body of evidence can be trusted to guide practice
B   Body of evidence can be trusted to guide practice in most situations
C   Body of evidence provides some support for recommendation(s) but care should be taken in its application
D   Body of evidence is weak and recommendation must be applied with caution
✓   Consensus-based recommendations (GPP)

5.7   Carotid surgery

Carotid disease detected early by non-invasive imaging – see section 3.3 (Imaging) – usually requires independent verification by repeated tests (Wardlaw et al, 2009b).

If carotid disease is confirmed, there is well-established evidence for the use of carotid endarterectomy (CEA) as the management of choice, particularly for symptomatic patients with ipsilateral moderate to severe stenosis (>50% [NASCET criteria]) (Rothwell et al, 2003). The choice of carotid surgery or stenting is still under study but current evidence favours CEA. Two systematic reviews (12 and 8 RCTs) found CEA to have a lower rate of any stroke or death within 30 days of intervention compared to stenting (OR 1.38, 95% CI 1.04–1.83) (Ringleb et al, 2008; Ederle et al, 2007). Endovascular stenting may be an alternative to CEA for carefully selected patients (especially for symptomatic carotid lesions which are difficult to expose surgically due to previous surgery or radiotherapy). Endovascular surgery had lower rates of cranial neuropathy compared to CEA (OR 0.07, 95% CI 0.03–0.20) but may be associated with increased restenosis (Ederle et al, 2007; Eckstein et al, 2008).

The benefits of CEA for those with symptomatic stenosis are greatest among those with more severe stenosis, those aged over 75 years, men, patients with recent stroke (rather than TIA), and those who undergo surgery early (Rothwell et al, 2003, Rothwell et al, 2004). For stabilised patients, the greatest benefit was found if surgery was undertaken within two weeks (NNT=5) with less effect at 12 or more weeks (NNT=125) (Rothwell et al, 2004). The risks of surgery need to be considered and discussed with the patient and their family/carer. For example, gender, age and comorbidity should be carefully considered in patients with symptomatic stenosis between 50% and 69%, as the balance between benefit and risk is less than that for more severe degrees of stenosis (Rothwell et al, 2003; Rothwell et al, 2004). There is no net benefit of CEA for those with symptomatic stenosis <50% (Cina et al, 1999). One systematic review (47 studies) found no difference in operative risk of stroke or death between early and later surgery in stable patients but did find a much higher risk for unstable patients (crescendo TIA and stroke in evolution) undergoing early surgery (Rerkasem & Rothwell, 2009).

While the low risk of stroke in patients with asymptomatic carotid stenosis of 60% to 99% can be reduced even further by surgery, the overall effect of surgery is small (Chambers & Donnan, 2005). CEA for asymptomatic carotid stenosis is more beneficial for men than women, and for younger rather than older patients (Chambers & Donnan, 2005). There is no clear association between stenosis severity and stroke risk for asymptomatic stenosis >60% and selection of a high-risk sub-group with asymptomatic carotid disease is difficult to determine (Chambers & Donnan, 2005). With advances in medical therapy, the overall community benefit of surgery for asymptomatic stenosis is thought to be small and the best approach for these patients is controversial (Chambers & Donnan, 2005; Abbott, 2009; Marquardt et al, 2010).

It is important that centres undertaking CEA participate in ongoing, independent and systematic audits of surgical complication rates (Rothwell et al, 1996) as this often determines the balance between benefits and harms, particularly for those with 50% to 69% stenosis. The evidence suggests low complication rates are needed (<6%) in patients with 70% to 99% stenosis to achieve net benefits (Cina et al, 1999). Extremely low complication rates (<3%) are indicated where centres are considering CEA for patients with symptomatic stenosis of 50% to 69% or asymptomatic stenosis of 60% to 99% (Cina et al, 1999; Chambers & Donnan, 2005).

Treatment with antiplatelet therapy (predominantly aspirin monotherapy) commencing either before or after CEA has been shown to reduce stroke recurrence although no effect was found on other outcomes (Engelter & Lyrer, 2003). In two studies, combination therapy of clopidogrel and aspirin has been found to be beneficial using surrogate markers (eg, microembolic signals on carotid ultrasound); however, no patient outcomes have been reported – see section 4.3 (Antithromboic therapy) (Payne et al, 2004; Markus et al, 2005).

Implementation of best practice for carotid surgery requires:

- availability of well-trained sonographers with validated reproducible carotid imaging in an appropriate vascular or imaging centre

- availability of skilled specialists with clinical and interventional experience

- appropriate referral processes to facilitate rapid assessment and intervention

- appropriate skilled staff and processes to undertake routine audits.

Recommendations

Carotid surgery	Grade
Carotid endarterectomy should be undertaken in patients with non-disabling carotid artery territory ischaemic stroke or TIA with ipsilateral carotid stenosis measured at 70–99% (NASCET criteria) only if it can be performed by a specialist surgeon with low rates (<6%) of peri-operative mortality/morbidity (Cina et al, 1999; Rothwell et al, 2003; Ederle et al, 2007).	A
Carotid endarterectomy can be undertaken in highly selected ischaemic stroke or TIA patients (considering age, gender and comorbidities) with symptomatic carotid stenosis of 50–69% (NASCET criteria) or asymptomatic carotid stenosis >60% (NASCET criteria) only if it can be performed by a specialist surgeon with very low rates (<3%) of peri-operative mortality/morbidity (Chambers & Donnan, 2005; Cina et al, 1999; Ederle et al; 2007).	A
Eligible stable patients should undergo carotid endarterectomy as soon as possible after stroke event (ideally within two weeks) (Rothwell et al, 2004).	A
Carotid endarterectomy should only be performed by a specialist surgeon in centres where outcomes of carotid surgery are routinely audited (Rothwell et al, 1996; Cina et al, 1999).	B
Carotid endarterectomy is NOT recommended for those with symptomatic stenosis <50% (NASCET criteria) or asymptomatic stenosis < 60% (NASCET criteria) (Cina et al, 1999; Chambers & Donnan, 2005).	A
Carotid stenting should NOT routinely be considered for patients with carotid stenosis (Ederle et al, 2007; Eckstein et al, 2008).	A

Grade description

A   Body of evidence can be trusted to guide practice

B   Body of evidence can be trusted to guide practice in most situations

C   Body of evidence provides some support for recommendation(s) but care should be taken in its application

D   Body of evidence is weak and recommendation must be applied with caution

✓   Consensus-based recommendations (GPP)

5.8 Diabetes management

Diabetes and glucose intolerance post stroke have been found to be independent risk factors for subsequent strokes (Vermeer et al, 2006; Petty et al, 1998; Hillen et al, 2003). Hyperglycaemia in the first few days after stroke is very common and levels fluctuate – see section 4.9 (Glycaemic control). Assessment of glucose tolerance after stroke or TIA would allow identification and subsequent management for patients with undiagnosed diabetes or glucose intolerance and provide additional secondary prevention measures for stroke recurrence. Evidence for the management of diabetes is primarily based on primary prevention. Important aspects of care include aggressive management of BP and cholesterol, and careful management of glycaemic status using behavioural modification (eg, diet and exercise) and pharmacotherapy. Appropriate guidelines for the management of diabetes should be followed. The Scottish Intercollegiate Guidelines Network (SIGN) guideline published in 2010 is available at: www.sign.ac.uk/pdf/sign116.pdf.

Recommendations	
Diabetes management	**Grade**
Patients with glucose intolerance or diabetes should be managed in line with appropriate guidelines for diabetes (see SIGN 116 *Management of Diabetes 2010*).	✔
Grade description	
A Body of evidence can be trusted to guide practice	
B Body of evidence can be trusted to guide practice in most situations	
C Body of evidence provides some support for recommendation(s) but care should be taken in its application	
D Body of evidence is weak and recommendation must be applied with caution	
✔ Consensus-based recommendations (GPP)	

5.9 Patent foramen ovale management

Patent foramen ovale (PFO) is more common in those with cryptogenic stroke, especially those aged under 55 years (Messe et al, 2004). While much debated, PFO has not been found to increase the risk of subsequent stroke or death in cryptogenic stroke (Messe et al, 2004; Di Tullio et al, 2007; Almekhlafi et al, 2009). However, there are sub-groups that may be at increased risk, for example, if PFO is present in combination with an atrial septal aneurysm, but further studies are needed.

Two systematic reviews (Messa et al, 2004; Khairy et al, 2003) have identified only one RCT (Homma et al, 2002) for medical management that compared warfarin (INR 1.4–2.8) to aspirin (325 mg). The study was not designed to evaluate superiority between agents; however, no differences in recurrent stroke or death rates over two years were found (Homma et al, 2002). Warfarin use was found to have higher rates of minor bleeding (Homma et al, 2002).

No RCT has compared surgical closure to standard medical care and level IV data is conflicting. One systematic review involving 10 studies suggested surgery is beneficial compared to medical care (Khairy et al, 2003). Three other subsequent studies failed to find any difference in stroke recurrence and reported a non-significant increase in harms (Harrer et al, 2006; Schuchlenz et al, 2005; Windecker et al, 2004). Until clear evidence exists from RCTs, no recommendation can be made on the surgical closure of PFO.

Recommendations	
Patent foramen ovale management	**Grade**
All patients with an ischaemic stroke or TIA and a patent foramen ovale should receive antiplatelet therapy as first choice (Homma et al, 2002).	**C**
Anticoagulation can also be considered for those with ischaemic stroke or TIA and a patent foramen ovale, taking into account other risk factors and the increased risk of harm (Homma et al, 2002).	**C**
Currently there is insufficient evidence to recommend closure for patent foramen ovale.	✔
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

5.10   Hormone replacement therapy

Observational studies had suggested that hormone replacement therapy (HRT) may have a protective effect for cardiovascular events. However, meta-analysis of 10 RCTs found no protective effect of HRT for any cardiovascular outcomes (Gabriel Sanchez et al, 2005). Conversely, several meta-analyses (7–31 RCTs) consistently found that HRT increased the risk of stroke by 29% to 44% (Sare et al, 2008; Magliano et al, 2006; Gabriel Sanchez et al, 2005; Bath & Gray, 2005). The severity of the stroke event was also found to be increased for those who had used HRT (Sare et al, 2008). The increased risk of stroke was found to only be significant for ischaemic stroke and not for TIA or intracerebral haemorrhage (Bath & Gray, 2005). However, this data on the risk of stroke is from trials of primary prevention. HRT also significantly increases the risk of VTE (Gabrel Sanchez et al, 2005; Sare et al, 2008).

Notwithstanding the above information, some women may wish to continue with HRT for control of symptoms and an enhanced QOL. In these situations, women should be provided with clear information about the risks of HRT and any decision should carefully consider the wishes of the patient considering the overall assessment of risk and benefit.

Recommendations	
Hormone replacement therapy	**Grade**
Use of hormone replacement therapy (HRT) at the time of stroke should be stopped. The decision whether to start or continue HRT in patients with previous stroke or TIA should be discussed with the individual patient and based on an overall assessment of risk and benefit (Sare et al, 2008; Magliano et al, 2006; Gabriel Sanchez et al, 2005; Bath & Gray, 2005).	**B**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

5.11 Oral contraception

Stroke in women of childbearing age is uncommon, with a rate of 28 strokes per 100,000 women aged 15 to 44 years reported in a community-based incidence study (Thrift et al, 2000). Observational studies linking oral contraception and stroke risk are focused on primary prevention and it is unclear if these findings should be extrapolated to secondary prevention. Several meta-analyses have reported conflicting findings depending on the oral contraceptive formulations of the included studies. Older studies used pills with higher concentrations of estrogens (>50 mcg) whereas later studies have used newer combination pills and progesterone-only pills have been used in some studies.

One meta-analysis of 14 case-controlled studies found the risk of stroke was significantly increased using combined low-dose contraceptives (OR 2.12, 95% CI 1.56–2.86) (Baillargeon et al, 2005). Another meta-analysis which included four cohort studies and 16 case-controlled studies found combined low-dose oral contraceptives increased stroke risk overall (OR 1.79, 95% CI 1.62–1.97) but found significant heterogeneity (p<0.001) (Chan et al, 2004). In this meta-analysis, pooled analysis of the four cohort studies found no significant difference in stroke risk (OR 0.95, 95% CI 0.51–1.78), whereas pooled analysis from the 16 case-controlled studies did find an increase in risk (OR 2.13, 95% CI 1.59–2.86) (Chan et al, 2004). One Australian cohort study found no statistical increase in risk by combined low-dose oral contraception use (OR 1.76, 95% CI 0.86–3.61, p=0.124) (Siritho et al, 2003). Another meta-analysis including six case-controlled studies of progesterone-only contraceptives showed no increase in the risk of stroke (OR 0.96, 95% CI 0.70–1.31) (Chakhtoura et al, 2009). Finally, risk of stroke for those taking oral contraception appears to increase for women who experience migraine, particularly migraine with aura (Schurks et al, 2009) and there may also be an increased risk for those who smoke or are hypertensive, although the association is less clear (Chakhtoura et al, 2009). If an association between oral contraception and stroke does exist it is likely to be small, in relative and absolute terms, given the small number of events in this age group, particularly in women younger than 35 years who do not smoke and are normotensive.

Recommendations

Oral contraception	Grade
The decision whether to start or continue oral contraception in women with stroke in the childbearing years should be discussed with the individual patient and based on an overall assessment of risk and benefit. Non-hormonal methods of contraception should be considered (Chakhtoura et al, 2009; Baillargeon et al, 2005; Chan et al, 2004).	**C**

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✓ Consensus-based recommendations (GPP)

Chapter 6: Rehabilitation and recovery

Rehabilitation is a holistic process that should begin the first day after stroke and ultimately maximises the participation of the person with stroke in the community. Individuals are not passive recipients of rehabilitation services. Rather, they experience themselves as recovering a new sense of self and of purpose within and beyond the limits of their disability (Deegan, 1988). Effort is needed by service providers to assess and manage aspects of care targeting interventions, based on the World Health Organization International Classification of Functioning model, at the impairment, activity and participation level.

This chapter discusses interventions targeting the impairment level (grouped into sensorimotor, language and cognitive/perceptual impairments) and at the activity level. Chapter 7 discusses secondary impairments or complications, that is, impairments that result from the primary impairments. Chapter 8 then discusses aspects of care related to participation or reintegration into the community and long-term recovery.

Perspectives of people with stroke

'During the first two weeks on average, as a patient, the key factors on your mind are unrelated to some extent to your rehabilitation and more related to key things in your life, such as how will this affect my relationships with my family, my job, why did this happen to me, was it all my fault, how will my family cope without me working, who will pay the bills ...'

6.1   Amount, intensity and timing of rehabilitation

6.1.1   Amount and intensity of rehabilitation

Observational studies have found that stroke patients often receive very little rehabilitation in the acute phase of care (Bernhardt, 2004) and spend long periods of the day inactive, even within stroke rehabilitation programmes. Most people are able to tolerate an increase in therapy session time (Lincoln et al, 1999). It is noted that studies providing increased intensity are often provided in the context of more organised services and it is unclear if there is a minimal threshold for benefit. UK guidelines recommend patients in the early stages of recovery should undergo as much therapy as the patient is willing and able to tolerate but stipulate a minimum of 45 minutes daily for each therapy that is required (RCPL, 2008).

Walking and activities of daily living

A systematic review (20 RCTs) found a small but significant benefit of more exercise therapy on activities of daily living (ADL) if at least 16 hours of additional physical therapy (ie, occupational therapy and physiotherapy), on top of therapy already being provided, is delivered within the first six months after stroke (Kwakkel et al, 2004). Increasing practice was also found to be beneficial for extended ADL and gait speed but not dexterity (Kwakkel et al, 2004). The mean duration of additional therapy provided in the trials was approximately one hour per day.

Task-orientated circuit class training as a method of increasing the amount of training provided has been shown in one systematic review (six RCTs) to improve aspects of walking, offering a way of increasing the amount of practice while making efficient use of therapist time (Wevers et al, 2009).

An RCT of video self-modelling (ie, exercise performance video recorded with subsequent feedback from a therapist using the video footage) was found to be an effective and efficient way of increasing the amount of practice (McClellan & Ada, 2004).

Upper limb activity

Interventions to improve upper limb (UL) activity, particularly constraint-induced movement therapy (CIMT) or electromechanical and robot-assisted therapy may increase the amount of practice – see section 6.3.5 (Upper limb activity). One systematic review (five RCTs specific to UL) found no effect of increased intensity (SMD 0.03, 95% CI -0.13-0.19) (Kwakkal et al, 2004). A post-hoc analysis of seven RCTs aimed at repetitive training (five CIMT and two repetitive task training trials) also failed to find any effect of increased therapy (French et al, 2008). A subsequent trial of CIMT found early (mean 10 days post stroke) intense therapy resulted in lower functional improvements at 90 days compared with less intense CIMT or routine therapy (Dromerick et al, 2009).

Communication

One systematic review (10 RCTs and non-RCTs) of studies examining the intensity of aphasia therapy found benefits for more intense therapy provided over a shorter duration (Bhogal et al, 2003b). Four positive trials in this review provided an average of 8.8 hours of therapy per week for an average of 11.2 weeks (three hours per week was the minimum intensity of any positive trial). The four negative trials provided an average of 2.0 hours per week for an average of 22.9 weeks. One subsequent systematic review (10 trials) found increased intensity was associated with positive outcomes in language impairment but did not state a target threshold (Cherney et al, 2008). However, the interventions provided ranged in amount and intensity and were tailored to individuals. An additional RCT found that in the first 12 weeks post stroke, many people with aphasia find it difficult to tolerate intensive therapy and two hours per week produced more benefits on a broad battery of tests compared to four hours per week (Bakheit et al, 2007). Another RCT of very early aphasia therapy (within median

3.2 days of stroke onset) for people with moderate to severe aphasia found daily therapy, five days a week aiming for at least 45 minutes per session (averaged two hours therapy per week) was better than only one session per week (average 11 minutes therapy) (Godecke, 2009). Overall, the current evidence appears to indicate therapy should aim for at least two hours each week during the acute and rehabilitation phase of recovery.

Dysphagia

One RCT found a higher intensity of intervention for dysphagia lowers the risk of complications (chest infections) in acute stroke (Carnaby et al, 2006).

Recommendations	
Amount and intensity of rehabilitation	**Grade**
Rehabilitation should be structured to provide as much practice as possible within the first six months after stroke (Kwakkel et al, 2004).	**A**
For patients undergoing active rehabilitation, physical therapy (physiotherapy and occupational therapy) should be provided as much as possible but should be a minimum of one hour active practice per day (at least five days a week).	✔
Task-specific circuit class training or video self-modelling should be used to increase the amount of practice in rehabilitation (Wevers et al, 2009; McClellan & Ada, 2004).	**B**
For patients undergoing active rehabilitation, therapy for dysphagia or communication difficulties should be provided as much as tolerated (Bhogal et al, 2003b; Bakheit et al, 2007; Godecke, 2009; Carnaby et al, 2006).	**C**
Patients should be encouraged by staff members, with the help of their family and/or friends if appropriate, to continue to practise skills they learn in therapy sessions throughout the remainder of the day.	✔

Grade description
A   Body of evidence can be trusted to guide practice
B   Body of evidence can be trusted to guide practice in most situations
C   Body of evidence provides some support for recommendation(s) but care should be taken in its application
D   Body of evidence is weak and recommendation must be applied with caution
✔   Consensus-based recommendations (GPP)

6.1.2   Timing of rehabilitation

Patients managed in acute stroke units that have active rehabilitation programmes spend less time in bed and more time standing, walking and being active; however, not all stroke units are the same (Bernhardt et al, 2008). Studies indicate that commencing rehabilitation within hours or days of stroke is feasible and may help recovery. The amount of therapy that can be tolerated in this early phase remains to be determined.

Early mobilisation

Early mobilisation (ie, sitting out of bed, standing and walking within 24 hours of stroke onset) has been described as an important component of stroke unit care (Langhorne & Pollock, 2002) and there is indirect evidence supporting this practice (Indredavik et al, 1999). A Cochrane review of very early versus delayed mobilisation after stroke identified one RCT (Bernhardt et al, 2009). This Phase II study found early mobilisation was feasible and safe, with those in the intervention group tolerating earlier and more frequent mobilisation well (Bernhardt et al, 2009). Based on this same trial, very early mobilisation was associated with a reduced likelihood of depression at seven days (OR 0.14, 95% CI 0.03–0.61) (Cumming et al, 2008a), and with reduced costs of care (Tay-Teo et al, 2008). Non-significant trends in patient outcomes (death or disability at three months) were found; however, the trial was not powered to detect changes in these outcomes and a large Phase III trial is ongoing (Bernhardt et al, 2009). Another recent small (n=32) RCT of early mobilisation versus intensive monitoring post stroke found that patients in the early mobilisation group were more likely to walk by day 5 and less likely to have immobility-related complications (Langhorne et al, 2010).

Upper limb activity

A few trials of constraint-induced movement therapy (CIMT) commenced within two weeks of onset (Sirtori et al, 2009). One subsequent trial demonstrated CIMT can be used within the first week of recovery after admission to a rehabilitation unit but an equal amount of traditional therapy was equally as effective (Dromerick et al, 2009). A higher-intensity protocol of early CIMT was associated with worse outcomes (Dromerick et al, 2009).

Communication

An RCT of very early aphasia therapy, commencing within a median 3.2 days of stroke onset, for people with moderate to severe aphasia found daily therapy, five days a week (average two hours therapy per week) for first few weeks improved communication outcomes compared to only one session per week (average 11 minutes therapy) (Godecke, 2009). This study also demonstrated a greater rate of improvement of aphasia severity and verbal efficiency for those treated daily in the very early recovery phase (Godecke, 2009).

Recommendations	
Timing of rehabilitation	**Grade**
Patients should be mobilised as early and as frequently as possible (Bernhardt et al, 2009).	**B**
Treatment for aphasia should be offered as early as tolerated (Godecke, 2009).	**B**
Upper limb training using constraint-induced movement therapy (CIMT) can commence within the first week of stroke for highly-selected patients; however, early high-intensity CIMT may be harmful (Dromerick et al, 2009).	**C**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

6.2   Sensorimotor impairments

6.2.1   Dysphagia

Dysphagia is a common consequence of acute stroke, occurring in nearly half of all patients admitted to hospital with stroke (NSF, 2009a). Dysphagia is also associated with an increased risk of complications, such as aspiration pneumonia, dehydration and malnutrition (Carnaby et al, 2006; Foley et al, 2009). Dysphagia was also found to lead to poor clinical outcomes (chest infection, death, disability, discharge destination, longer length of stay) reinforcing the need for early detection and management (NICE, 2008).

The adherence to a formal dysphagia screening protocol reduces the incidence of pneumonia in acute stroke patients (Hinchey et al, 2005; Odderson et al, 1995). Another study implementing evidence-based acute care involving dysphagia screening; referral and assessment demonstrated improved process and patient outcomes (Perry & McLaren, 2003). However, further studies are needed to clarify the key elements that improve outcomes including which screening tool is most useful.

There is agreement from several systematic reviews on the value of early screening using bedside tools (Westergren, 2006; Ramsay et al, 2003). Three systematic reviews were unable to conclude which screening tool was most useful due to variability in the studies (Perry & Love, 2001; Martino et al, 2000; Ramsay et al, 2003). While most tests had sensitivities of 70% to 90% some were much lower, with the lowest reported to be 42%. Specificity was almost always lower, with ranges from 22% to 67% in one review (Perry & Love, 2001) and 59% to 91% in another (Ramsey et al, 2003). Subsequent studies of bedside clinical screening have demonstrated similar sensitivities with other bedside tests (Lim et al, 2001; Leder & Espinosa, 2002; Chong et al, 2003; Wu et al, 2004; Trapl et al, 2007; Martino et al, 2009; Diniz et al, 2009). Two more recent well-developed and validated tests include the Gugging

Swallowing Screen (GSS) (Trapl et al, 2007) and the Toronto Bedside Swallowing Screening Test (TOR-BSST) (Martino et al, 2009). The GSS involves an indirect and then a direct swallowing test (compared to fibreoptic endoscopic evaluation of swallowing [FEES]). Accuracy was good after development: sensitivity 100%, specificity 50% to 69%, positive predictive value (PPV) 74% to 81%, negative predictive value (NPV) 100%, area under ROC curve 0.933. Interrater reliability was excellent (Trapl et al, 2007). The TOR-BSST was designed to be used by any professional trained in assessment of stroke across all settings and includes five items: Kidd water swallow test, pharyngeal sensation, tongue movement and general dysphonia (divided into voice before and voice after). Overall (acute and rehabilitation phase) accuracy was similar to other tests: sensitivity 91.3%, specificity 66.7%, PPV 50% to 77%, NPV 90% to 93%. Interrater reliability was also very good (ICC=0.92) (Martino et al, 2009). The combination of a bedside screening test and monitoring of oxygen saturations improved the sensitivity of bedside tests (87–100%) (Smith et al, 2000; Lim et al, 2001; Chong et al, 2003). Importantly, the gag reflex was not found to be a valid screen for dysphagia and should therefore not be used (Martino et al, 2000; Perry & Love, 2001).

Screening tools have been developed for use by non-specialist staff who must undertake essential training prior to using such tools (Perry & Love, 2001). Ideally the initial screen would be undertaken by a speech-language therapist as part of a comprehensive assessment. However, it is not feasible to offer such a service 24 hours a day, seven days a week and hence consideration needs to be given to resource and training requirements for establishing and maintaining effective dysphagia screening. Additional resources may need to be considered for provision of initial and ongoing training (particularly in view of high staff turnover in some EDs) and local protocols developed to ensure the implementation of dysphagia screening (including rostering that ensures appropriately trained staff are available on all shifts).

Videofluoroscopic modified barium swallow (VMBS) study may be considered the reference standard to confirm swallowing dysfunction and the presence of aspiration. However, several limiting factors have been noted including: the relatively complex, time-consuming and resource intensive nature of the test; small exposure to radiation; and that patients may have difficulty being positioned appropriately for the test. In addition, the results of the test can be difficult to interpret and variation among individual raters may occur (Ramsey et al, 2003). There is currently no agreed criteria for when a VMBS study is required and local policies should be developed that take into consideration local resources and the potential limitations noted.

FEES has also been used as a reference standard in studies assessing screening tools (Lim et al, 2001; Leder & Espinosa, 2002; Chong et a, 2003; Wu et al, 2004) and has been found to have similar sensitivity and specificity compared with VMBS (Langmore et al, 1991). FEES is portable (possibly allowing more immediate access and time saving), requires less staff and is therefore cheaper, and reduces radiation exposure (Langmore et al, 1991). FEES is generally well-tolerated but does have a small increase in nose bleeds (6%), and adverse effects on systolic blood pressure, heart rate, and O_2 saturation (although not deemed severe) (Warnecke et al, 2009). While

speech-language therapists currently coordinate and conduct VMBS studies, specialists with recognised training and credentialing only can conduct FEES and it is not yet commonly available in Australia or New Zealand.

Strategies to prevent complications and restore the normal swallow have been described as either **direct**/compensatory, such as fluid and diet modification, safe swallowing strategies and optimising the position of the person with stroke while eating; or **indirect** interventions such as oral musculature exercises and stimulation of the oral and pharyngeal structures (Bath et al,1999). Discussion about the intensity of interventions is included in section 6.1 (Amount, intensity and timing of rehabilitation).

A systematic review involving 15 RCTs looked at a range of interventions and concluded there is general support for dysphagia interventions; however, as few RCTs utilised the same intervention or outcomes it limited the interpretation of the evidence (Foley et al, 2008). Two RCTs within this review found compensatory and intervention-swallowing techniques, in combination with texture-modified diets can reduce dysphagia. No conclusions could be made on the effect of dietary texture modifications and/or alteration of fluid viscosity based on four trials (significant heterogeneity) (Foley et al, 2008). One subsequent RCT found thickened consistency reduced the risk of aspiration compared with fluid consistencies (RR 0.13, 95% CI 0.04–0.39) (Diniz et al, 2009).

One Cochrane review found insufficient evidence (one trial, n=66) to determine the effects of acupuncture on dysphagia (Xie et al, 2008).

In a number of small trials, both neuromuscular electrical stimulation (NMES) and thermal tactile stimulation (TTS) reduced the severity of swallow impairment (Rosenbek, et al, 1998; Freed et al, 2001; Leelamanit et al, 2002). In one subsequent small RCT (n=25) no difference between NMES and traditional therapy was found (Bulow et al, 2008). Both interventions together resulted in measurable improvement in patient's perception, nutrition and oral motor function test but not in differences in videoradiographic findings, suggesting that patient perception of the improvement in swallowing may be erroneous (Bulow et al, 2008). Another small quasi-RCT (n=28) found sensory stimulation plus TTS was better than TTS alone (Lim et al, 2009). Electrical stimulation therapy for dysphagia remains an evolving area of dysphagia treatment. Possible contraindications to this therapy must be assessed (eg, pregnancy, presence of pacemaker). The current position of the New Zealand Speech-Language Therapy Association is that NMES is not recommended for New Zealand Speech and Language Therapy practice because of concerns regarding the potential for adverse effects should the wrong muscle groups be stimulated.

Therapy targeting specific muscle groups (eg, 'Shaker' therapy) appears beneficial for people with specific dysphagia, based on two small RCTs (n=27; n=19) (Shaker et al, 2002; Logemann et al, 2009). Another small RCT (n=26) found that repetitive transcranial magnetic stimulation (rTMS) in addition to usual care may improve functional swallowing (assessed by bedside assessment) (Khedr et al, 2009).

Dysphagia commonly improves within a few weeks following stroke. However, it can persist, requiring long-term intervention and/or alternative feeding strategies – see section 7.1 (Nutrition and hydration). Patients with significant dysphagia who are unable to manage their secretions sometimes have a tracheostomy. Management of such patients should incorporate relevant local and international protocols regarding tracheostomy, as well as recommended specific dysphagia interventions.

Recommendations

Dysphagia	Grade
All stroke patients should have their swallowing screened as soon as possible, but at least within 24 hours of admission.	✔
The gag reflex is not a valid screen for dysphagia and should NOT be used as a screening tool (Martino et al, 2000; Perry & Love, 2001).	B
Patients should be screened for swallowing deficits before being given food, drink or oral medications. Personnel specifically trained in swallowing screening should undertake screening using a validated tool (Westergren, 2006; Ramsay et al, 2003).	B
Patients who fail the swallowing screening should be referred to a speech-language therapist for a comprehensive assessment. This may include instrumental examination, eg, videofluoroscopic modified barium swallow [VMBS] and/or fibreoptic endoscopic evaluation of swallowing [FEES]. Special consideration should be given to assessing and managing appropriate hydration. These assessments can also be used for monitoring during rehabilitation.	✔
Compensatory strategies such as positioning, therapeutic manoeuvres or modification of food and fluids to facilitate safe swallowing should be provided for people with dysphagia based on specific impairments identified during comprehensive swallow assessment (Carnaby et al, 2006).	B
One or more of the following methods can be provided to facilitate resolution of dysphagia:	
• therapy targeting specific muscle groups (eg, 'Shaker' therapy) (Shaker et al, 2002; Logemann, 2009)	C
• thermo-tactile stimulation (Rosenbek et al, 1998; Leelamanit et al, 2002; Lim et al, 2009).	C
Dysphagic patients on modified diets should have their intake and tolerance to diet monitored. The need for continued modified diet should be regularly reviewed.	✔
Patients with persistent weight loss and recurrent chest infections should be urgently reviewed.	✔
All staff and carers involved in feeding patients should receive appropriate training in feeding and swallowing techniques.	✔

Grade description
A Body of evidence can be trusted to guide practice
B Body of evidence can be trusted to guide practice in most situations
C Body of evidence provides some support for recommendation(s) but care should be taken in its application
D Body of evidence is weak and recommendation must be applied with caution
✔ Consensus-based recommendations (GPP)

6.2.2 Weakness

Weakness is the most common impairment after stroke with approximately 70% of those with stroke presenting with arm or leg weakness (NSF, 2009a). Several systematic reviews have been conducted in this area. One systematic review (15 RCTs) of strength training found across all stroke participants, strengthening interventions had a small positive effect on both strength (SMD 0.33, 95% CI 0.13–0.54) and activity (SMD 0.32, 95% CI 0.11–0.53). There was very little effect on spasticity (SMD -0.13, 95% CI -0.75–0.50) (Ada et al, 2006). Strength training was defined as interventions that involved attempts at repetitive, effortful muscle contractions and included biofeedback, electrical stimulation, muscle re-education, progressive resistance exercises, and mental practice. Upper limb strength training was found to improve grip strength (SMD 0.95, 95% CI 0.005–1.85) but did not improve measures of activity (Harris & Eng, 2010). Strength training was effective in people with mild and moderate stroke severity (Harris & Eng, 2010). Another systematic review (18 RCTs, 11 specific to stroke) of electrical stimulation found modest beneficial effects on strength in several studies but study variability limited clear conclusions (Glinsky et al, 2007). Electromyographic biofeedback may maximise the benefits of electrical stimulation. One further systematic review (11 studies) found high-intensity resistance training increased strength, gait speed and functional outcomes and improved QOL, without exacerbation of spasticity (Pak & Pattern, 2008).

Effect sizes were generally small in the studies overall. Heterogeneity was noted which probably reflects patient selection, different muscle groups targeted in interventions, different interventions and different intensities.

Recommendations	
Weakness	**Grade**
One or more of the following interventions should be used for people who have reduced strength:	
• progressive resistance exercises (Ada et al, 2006; Pak & Pattern, 2008; Harris & Eng, 2010)	**B**
• electromyographic biofeedback in conjunction with conventional therapy (Ada et al, 2006)	**C**
• electrical stimulation (Glinsky et al, 2007; Ada et al, 2006).	**B**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

6.2.3   Loss of sensation

Almost 50% of people assessed have sensory deficits (NSF, 2009a). Although common there is currently limited evidence regarding interventions to improve sensation. One systematic review (14 studies of mix methodology) identified studies that utilised active training (exercises to train sensory function, eg, proprioceptive training) and passive stimulation (non-specific cutaneous stimulation) (Schabrun & Hillier, 2009). Only studies of active training used measures of sensation as a primary outcome; however, pooling of data across the studies was not possible (Schabrun & Hillier, 2009). All included studies had small sample sizes, used a variety of outcome measures and had methodological limitations, and no clear conclusions can be made.

Some individual studies have found that tactile and kinaesthetic sensation was improved by sensory-specific training (Carey et al,1993; Yekutiel & Guttman, 1993; Byl et al, 2003; Hillier & Dunsford, 2006) but not all studies (Lynch et al, 2007; Smania et al, 2003). Tactile sensation of novel, untrained stimuli was also improved by sensory training designed to facilitate transfer of training effects within the somatosensory domain (Carey & Matyas, 2005). Meta-analysis of outcomes from task-specific and transfer-enhanced approaches to sensory retraining across 30 single-case experiments supports the effectiveness of both modes of training (Carey, 2006). Sensory-specific training has been reported to improve functional activities in some studies but there were inconsistent effects on proprioception (Schabrun & Hillier, 2009). There is conflicting evidence of non-specific cutaneous stimulation for benefits of sensation (Van Deusen-Fox, 1964; Peurala et al, 2002) but it may improve activity (Schabrun & Hillier, 2009).

Recommendations	
Loss of sensation	**Grade**
People with stroke should be assessed by an appropriate health practitioner for loss of or reduction or alteration of sensation, including hypersensitivity. This information should be shared with the person, their family/carers and the interdisciplinary team in order to implement specific strategies for optimising function and safety.	✔
Sensory-specific training can be provided to people with stroke who have sensory loss (Carey et al, 1993; Yekutiel & Guttman, 1993; Byl et al, 2003; Hillier & Dunsford, 2006).	**C**
Sensory training designed to facilitate transfer can also be provided to people with stroke who have sensory loss (Carey & Matyas, 2005).	**C**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

6.2.4   Visual impairment

Visual field loss occurs in approximately one-third of people with stroke (NSF, 2009a) and usually affects half of the field of vision in both eyes (homonymous hemianopia). Visual impairments can cause significant functional difficulties, and can include diplopia (double vision), difficulties with ocular convergence (both eyes looking at the same point), impaired saccadic movement (both eyes looking from one point to another), oversensitivity to light, nystagmus (rapid involuntary rhythmic movement of the eyes from the midline to one side) and dry eyes. Pre-existing visual deficits should be clarified as many people with stroke are elderly and normal visual loss is also common.

Evidence for interventions aimed at visual dysfunction is limited. Restorative (visual field training) and compensatory approaches (hemianopic reading training and visual exploration training) have been described in a large narrative review of mostly low level trials (Kerkhoff, 1999). Limited evidence based on two systematic reviews was found for visual scanning compensatory strategies (Bouwmeester et al, 2007; Riggs et al, 2007). The evidence for visual field training was inconsistent and it was not recommended (Bouwmeester et al, 2007; Riggs et al, 2007). Not enough evidence for eye movement disorders, such as diplopia or convergence has been found to make conclusions (Riggs et al, 2007).

Four related RCTs have been identified. Treatment with 15-diopter Fresnel prisms improved visual perception test scores but not ADL function in stroke patients with homonymous hemianopia (Rossi et al, 1990). Computer-based training of stimulus detection provided benefits in the ability to detect visual stimuli in people with brain injury (including stroke) (Kasten et al, 1998). A visual attention retraining programme was no more beneficial than traditional perceptual training in improving on-road-driving performance amongst people with stroke (Mazer et al, 2003) – see section 8.2 (Driving). Vision restoration therapy with attentional cueing was shown to be superior to vision restoration therapy alone; however, there were methodological limitations to this study (Poggel et al, 2004).

Single eye patching for diplopia (often alternating on a daily basis) is common practice. Eye patching provides practical compensation for diplopia; however, this intervention also has disadvantages (eg, reduced stimulation to the affected eye, decreased depth perception, spatial bias (Barrett et al, 2004). If function is affected, then an eye patch can be beneficial to maximise the effects of active therapy, and can be removed during other parts of the day.

Recommendations

Visual field loss	Grade
People with stroke who report or appear to have difficulties with vision and/or perception should be screened using specific assessment instruments, and if a deficit is found, referred on for comprehensive assessment by relevant health practitioners.	✔
15-diopter Fresnel prism glasses can be used to improve visual function in people with homonymous hemianopia but there is no evidence of benefit in activities of daily living (Rossi et al, 1990).	C
Computer-based visual restitution training can be used to improve visual function in people with visual field deficits (Kasten et al, 1998).	C

Grade description
A   Body of evidence can be trusted to guide practice
B   Body of evidence can be trusted to guide practice in most situations
C   Body of evidence provides some support for recommendation(s) but care should be taken in its application
D   Body of evidence is weak and recommendation must be applied with caution
✔   Consensus-based recommendations (GPP)

6.3   Physical activity

6.3.1   Sitting

Sitting training, that is, getting people to reach beyond arms length when sitting ideally while undertaking everyday tasks (eg, reaching for a cup) is beneficial based on two RCTs (Dean & Shepherd, 1997; Dean & Channon, 2007). Other training strategies including additional therapy sessions aimed at lateral weight transfer or general trunk exercises had mixed results (Howe et al, 2005, Verheyden 2009), probably reflecting particular outcome measures used. Vibration or standing frames are not effective (Van Nes et al, 2006; Bagley et al, 2005).

Recommendation

Sitting	Grade
Sitting practice with supervision/assistance should be provided for people who have difficulty sitting (Dean et al, 2007; Dean & Shepherd, 1997).	B

Grade description
A   Body of evidence can be trusted to guide practice
B   Body of evidence can be trusted to guide practice in most situations
C   Body of evidence provides some support for recommendation(s) but care should be taken in its application
D   Body of evidence is weak and recommendation must be applied with caution
✔   Consensus-based recommendations (GPP)

6.3.2   Standing up

One Cochrane review (seven RCTs) (French et al, 2007) and another systematic review (seven RCTs) (Langhorne et al, 2009) have found repetitive task specific

training has consistent, moderate benefits in ability to stand from sitting (SMD 0.35, 95% CI 0.13–0.56). The use of biofeedback via a force platform may have additional benefits for standing up but confidence intervals were wide (SMD 0.85, 95% CI -0.15–1.84) and based on two small studies (Langhorne et al, 2009).

Recommendation	
Standing up	**Grade**
Practising standing up should be undertaken for people who have difficulty in standing up from a chair (Langhorne et al, 2009; French et al, 2007).	**A**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

6.3.3   Walking

A large number of trials have been undertaken to improve walking after stroke. However, no intervention approach (orthopaedic, neurophysiologic, motor learning) has been found to be superior to any other in improving walking (Pollock et al, 2007).

One Cochrane review (14 RCTs) found repetitive, task-specific training significantly improved walking distance (MD 54.6 m, 95% CI 17.5–91.7); walking speed (SMD 0.29, 95% CI 0.04–0.53); activities of daily living (SMD 0.29, 95% CI 0.07–0.51) (French et al, 2007). There was also borderline statistical significance for functional ambulation (SMD 0.25, 95% CI 0.00–0.51), and global motor function (SMD 0.32, 95% CI -0.01–0.66). No difference in QOL, impairment measures or long-term outcomes (six or 12 months) was found. There was no evidence of adverse effects (French et al, 2007).

A systematic review found that rhythmic cueing of cadence improved walking speed (SMD=0.97, 95% CI -0.10–1.22) and step length (SMD 1.26, 95% CI 0.20–2.33) based on three RCTs (Langhorne et al, 2009). The same systematic review found that joint position biofeedback had a moderate mean effect (SMD 1.29, 95% CI -0.78–3.37) based on five RCTs but the confidence intervals were wide, thus making the effectiveness unclear (Langhorne et al, 2009). One Cochrane review (13 RCTs) found electromyographic (EMG) biofeedback did not improve aspects of walking compared to conventional therapy (Woodford & Price, 2007). A systematic review (five RCTs) found electrical stimulation when added to conventional therapy does not confer benefits on walking speed (SMD -0.02, 95% CI -0.30–0.26) or step length (SMD 0.35, 95% CI -0.93–1.63) (Langhorne et al, 2009).

As noted in other relevant sections high intensity resistance training improved gait speed and functional outcomes – see section 6.2.2 (Weakness). Likewise fitness training has significant positive effect on walking – see section 7.8 (Loss of cardiorespiratory fitness).

One Cochrane review (11 RCTs) found that electromechanical-assisted gait training in combination with physiotherapy increased the odds of becoming independent in walking (OR 3.06, 95% CI 1.85–5.06) and increased walking capacity (MD=34 metres walked in six minutes, 95% CI 8–60). The intervention did not increase walking velocity significantly (MD 0.08 m/sec, 95% CI -0.01–0.17) (Mehrholz et al, 2007).

Another Cochrane review (15 RCTs) found no differences between treadmill training, with or without body weight support, and other interventions (Moseley et al, 2005). Among participants who could walk independently at the start of intervention, treadmill training with body weight support produced modestly higher walking speeds (MD 0.09 m/s, 95% CI -0.02–0.20), but this result was not statistically significant. Adverse events occurred more frequently in participants receiving treadmill training but these were not judged to be clinically serious events (Moseley et al, 2005). Subsequent studies have reported mixed results. Three subsequent RCTs reported improved aspects of walking (speed, step length) and fitness with treadmill training compared to conventional therapy or control (stretching) (Macko et al, 2005; Luft et al, 2008; Yen et al, 2008). Another RCT reported improved walking speed but not walking distance with treadmill training compared to strength training (Sullivan et al, 2007). A further RCT found no difference between body weight support treadmill training and conventional walking training (Franceschini et al, 2009).

One systematic review (13 non-RCTs) found a non-significant trend in improved walking speed in people with foot drop using an ankle-foot orthosis (AFO) (Leung & Moseley, 2003). Many subsequent cross-over RCTs on AFOs were found but these have methodological limitations (eg, unclear randomisation procedures, underpowered). Some studies found AFO use improved walking speed (Bleyenheuft et al, 2008; de Wit et al, 2004; Wang et al, 2005; Wang et al, 2007) and other aspects of gait symmetry (eg, stance duration, functional ambulation measures) (Pohl & Mehrholz, 2006; Sheffler et al, 2006; Wang et al, 2005; Wang et al, 2007; Tyson & Rogerson, 2009; Chen et al, 1999). Two studies failed to find any difference in walking speed (Tyson & Rogerson, 2009; Wang et al, 2005) and step length (Tyson & Rogerson, 2009). People with stroke reported improved satisfaction/confidence when using AFOs (Tyson & Rogerson, 2009, de Wit et al, 2004). If used, AFO use should be reviewed regularly to ensure appropriate fit and benefits.

Five RCTs of virtual reality training (VRT) in chronic stroke patients were identified (You et al, 2006 ;Mirelman et al, 2009; Kim et al, 2009; Yang et al, 2008; Jaffe et al, 2004). Interventions and outcomes were mixed; however, all studies reported positive results on different measures related to walking. All studies were underpowered and all except one (Mirelman et al, 2009) did not maintain any difference at follow-up. Further research is required.

One RCT reported no change in walking speed or step length but did find improved functional ambulation and improved satisfaction with the use of a walking cane in non-ambulant people with stroke undertaking rehabilitation (Tyson & Rogerson, 2009). However, this study had methodological limitations and further trials are needed before recommendations for routine care can be made.

Recommendations	
Walking	**Grade**
After thorough assessment and goal setting by a trained clinician, all people with difficulty walking should be given the opportunity to undertake tailored, repetitive practice of walking (or components of walking) as much as possible (French et al, 2007).	**A**
One or more of the following interventions can be used in addition to conventional walking therapy:	
• cueing of cadence (Langhorne et al, 2009)	**B**
• mechanically assisted gait (via treadmill, automated mechanical or robotic device) (Mehrholz et al, 2007)	**B**
• joint position biofeedback (Langhorne et al, 2009)	**C**
• virtual reality training (You et al, 2005; Mirelman et al, 2009; Kim et al, 2009; Yang et al, 2008; Jaffe et al, 2004).	**C**
Ankle-foot orthoses can be used for people with persistent drop foot. If used, the ankle-foot orthosis should be individually fitted (Leung & Moseley, 2003; Bleyenheuft et al, 2008; de Wit et al, 2004; Pohl & Mehrholz, 2006; Sheffler et al, 2006; Wang et al, 2005; Wang et al, 2007; Tyson & Rogerson, 2009; Chen et al, 1999).	**C**
Grade description	
A Body of evidence can be trusted to guide practice	
B Body of evidence can be trusted to guide practice in most situations	
C Body of evidence provides some support for recommendation(s) but care should be taken in its application	
D Body of evidence is weak and recommendation must be applied with caution	
✓ Consensus-based recommendations (GPP)	

6.3.4   Upper limb activity

In this section arm function is used to denote proximal upper limb (UL) function (ie, shoulder/elbow) whereas hand function is used to denote distal UL function (ie, wrist and hand/fingers). The effect for neurophysiological approaches (Bobath) is unclear for both arm function (SWD 0.11, 95% CI -0.14–0.36) and hand function (SWD 0.13, 95% CI -0.19–0.44) (Langhorne et al, 2009).

One Cochrane review (14 RCTs) found the impact of repetitive task training (RTT) indicated a possible small but non-significant effect on arm function (SMD 0.17, 95% CI -0.03–0.36) and hand function (SMD 0.16, 95% CI -0.07–0.40) (French 2007). No effect of the intervention on UL function (all outcomes) was found at six- to 12-month follow-up (SMD -0.02, 95% CI -0.31–0.26) (French et al, 2007). Greater duration of training for UL function showed a somewhat larger and borderline statistically significant result versus lesser duration of task practice (French et al, 2007). The use of

a device to enable repetitive practice in those with severe paresis resulted in a significant improvement in function (Barker et al, 2008).

One systematic review (nine RCTs, two non-randomised trials) found a significant effect in favour of bilateral movement training for improving motor recovery post stroke (ES 0.73, 95% CI 0.66–0.80) (Stewart et al, 2006). However, studies were small and included different interventions, patient populations (subacute vs chronic) and outcomes. Subsequent RCTs had conflicting results (Summers et al, 2007; Cauraugh et al, 2009; Lin et al, 2009; Desrosiers et al, 2005; Morris et al, 2008; McCombe et al, 2008).

One systematic review (13 RCTs) of electrical stimulation found modest improvement in arm function (SWD 0.47, 95% CI -0.03–0.97) but no difference for hand function (SMD 0.12, 95% CI -0.34–0.59) (Langhorne et al, 2009). EMG-triggered electrical stimulation appears more effective than normal electrical stimulation based on five RCTs (Langhorne et al, 2009). Another systematic review (eight RCTs) specific to hand and finger extensor stimulation found no significant difference in effects between EMG-triggered electrical stimulation and usual care (Meilink et al, 2008). Most studies had poor methodological quality, low statistical power, insufficient intervention contrast between experimental and control groups, and most were conducted in the chronic phase after stroke (Meilink et al, 2008).

In another systematic review only four out of 16 studies involving stroke reported benefits from use of augmented feedback (mostly EMG biofeedback) (van Dijk et al, 2005). One subsequent review (five RCTs) found EMG biofeedback in addition to routine therapy produced modest improvements in arm function (SMD 0.41, 95% CI 0.05–0.77) (Langhorne et al, 2009).

Conflicting effects were found in a systematic review (10 RCTs) of robotic interventions (Kwakkel et al, 2008). Meta-analysis found an overall moderate but non-significant effect of robotic intervention for motor recovery (SES 0.65, 95% CI -0.02–1.33). The intervention group received almost 20 minutes more therapy on average than controls. The methodological quality of the included studies also varied (Kwakkel et al, 2008). A Cochrane review (11 RCTs) found electromechanical and robot-assisted arm training improved arm motor function and strength (SMD 0.68, 95% CI 0.24–1.11 and SMD 1.03, 95% CI 0.29–1.78, respectively) but did not improve activities of daily living (SMD 0.29, 95% CI -0.47–1.06, p=0.45) (Mehrholz et al, 2008).

One systematic review (21 RCTs) found constraint-induced movement therapy had clear benefits for arm function (SMD 0.73, 95% CI 0.54–0.91) (Langhorne et al, 2009). There was a small and non-significant benefit for hand function (SMD 0.17, 95% CI -0.07–0.42) (Langhorne et al, 2009). A Cochrane review (19 RCTs) found moderate improvements in arm motor function (SMD 0.72, 95% CI 0.32–1.12) and modest improvements in disability immediately after intervention (SMD 0.36, 95% CI 0.06–0.65) although no difference was found at follow-up assessment (Sirtori et al, 2009). Methodological concerns were also noted (eg, limited adequate allocation concealment, small study sizes) (Sirtori et al, 2009). Most studies involved people with

stroke who were four or more months post stroke. Studies also only included participants with a minimum of 10 degrees active finger/wrist extension with no cognitive or balance difficulties, no pain, spasticity or limitation in range of movement and clear non-use.

The effect of repetitive transcranial magnetic stimulation (rTMS) for UL recovery was found to have conflicting results in nine small heterogeneous RCTs. Five studies assessed the effect of a single session of rTMS, with most reporting some benefits of stimulation of the affected motor cortex for measures of impairment (eg, speed of movement) (Takeuchi et al, 2005; Takeuchi et al, 2008; Liepert et al, 2007; Mansur et al, 2005; Kim et al, 2006). No difference with rTMS was reported in one trial when used in addition to constraint-induced therapy (Malcom et al, 2007). Two of the larger trials involving acute or subacute patients involved daily sessions for 8 to 10 days but reported contradictory results (Khedr et al, 2005; Pomeroy et al, 2007). Further large robust trials are needed.

Mirror therapy in addition to conventional therapy (neurodevelopmental facilitation approach) improved some measures of UL activity (eg, Brunnstrom stages for the hand and upper extremity, Functional Independence Measure self-care score) but not others (eg, Modified Ashworth Scale) compared to conventional therapy alone in one RCT (Yavuzer et al, 2008). There was no change in spasticity. Another RCT (Dohle et al, 2009) reported a non-significant trend towards improvement on a primary outcome measure (Fugl-Meyer subscores for the upper extremity). Authors reported significant positive effects for those with distal deficits in sub-group analysis, but this should be considered with caution.

Mental practice with motor imagery improves arm function based on four small RCTs (SMD 0.84, 95% CI 0.34–0.33) (Langhorne et al, 2009).

Two systematic reviews reported conflicting results for virtual therapy (Henderson et al, 2007; Crosbie et al, 2007). Methodological concerns were clearly noted in both reviews and no clear conclusions can be made. Three subsequent RCTs found virtual therapy is feasible in the subacute or chronic phase and is generally as effective as conventional UL therapy with occasional additional benefits in motor performance (Broeren et al, 2008; Piron et al, 2009; Housman et al, 2009). Further studies are needed.

Recommendations

Upper limb activity	Grade
For people with difficulty using their upper limb one or more of the following interventions should be given in order to encourage using their upper limb as much as possible:	
• constraint-induced movement therapy (Langhorne et al, 2009; Sirtori et al, 2009)	**B**
• mechanical assisted training (Mehrholz et al, 2008)	**B**
• repetitive task-specific training (French et al, 2007).	**C**
One or more of the following interventions can be used in addition to interventions listed above:	
• mental practice (Langhorne et al, 2009)	**B**
• mirror therapy (Yavuzer et al, 2008; Dohle et al, 2009)	**C**
• EMG biofeedback in conjunction with conventional therapy (Langhorne et al, 2009; Meilink et al, 2008)	**C**
• electrical stimulation (Langhorne et al, 2009)	**C**
• bilateral training (Stewart et al, 2006).	**C**

Grade description
A Body of evidence can be trusted to guide practice
B Body of evidence can be trusted to guide practice in most situations
C Body of evidence provides some support for recommendation(s) but care should be taken in its application
D Body of evidence is weak and recommendation must be applied with caution
✓ Consensus-based recommendations (GPP)

6.4 Activities of daily living

Assessment and management of daily activities fall into two areas:

• personal ADL including basic self-maintenance tasks such as showering, toileting, dressing and eating

• extended ADL including domestic and community tasks such as home maintenance tasks, management of financial affairs and community access, including driving.

Interventions targeting specific areas such as sensorimotor impairments and motor activities, cognition, communication, leisure and driving all impact on activities of daily living – see related sections in this chapter.

A Cochrane review (nine RCTs) found patients who received occupational therapy (OT) interventions focused on personal ADL had a reduced likelihood of a poor outcome (OR 0.67, 95% CI 0.51–0.87, NNT 11) and increased personal ADL scores (SMD 0.18, 95% CI 0.04–0.32) (Legg et al, 2006). It was unclear what specific factors contributed to these benefits, for example, simple practice effect or intervention specific effects. Included studies were undertaken during subacute care in the community with no included studies in the hospital setting; although early OT involvement was typical of stroke units described in the Stroke Unit Triallist Collaboration (Langhorne et al, 2002). Another Cochrane review (14 RCTs) found rehabilitation therapy services in the

community within the first year after stroke reduced the odds of a poor outcome (OR 0.72, 95% CI 0.57–0.92) and improved personal ADL scores (SMD 0.14, 95% CI 0.02–0.25) (OST, 2003). A subsequent cluster RCT (Sackley et al, 2006) carried out in 12 nursing and residential homes found that the intervention group receiving OT interventions (targeted at improving independence in personal ADLs such as feeding, dressing, toileting, bathing, transferring and mobilising) were less likely to deteriorate or die and demonstrated improvements in functional measures compared to controls. Training should occur in the actual environment of task performance as often as possible or in an environment that has been designed to replicate the home or other environment as closely as practical.

A review and meta-analysis (eight RCTs) found occupational therapy interventions in the community were associated with improved scores reflecting extended ADL (WMD, 1.61 points; 95% CI 0.72–2.49) (Walker et al, 2004). One subsequent RCT found that a simple intervention by an occupational therapist increased the likelihood of people getting out of the house as often as they wanted, as well as the number of actual outdoor journeys (Logan et al, 2004). The trial compared the distribution of leaflets describing local transport options (control group), with the same leaflets plus delivery of up to seven individual sessions in the home, over a three-month period (intervention group). Participants in the intervention group were escorted by therapists on walks, bus and taxi trips until they felt confident to go out alone. They were assisted to return to driving in some cases, find alternatives to cars and buses, or become more independent with aids and equipment. After four months (median six sessions) twice as many people from the intervention group reported getting out as often as they wanted (RR 1.72, 95% CI 1.25–3.27), compared to control group participants. Between-group differences were maintained at 10 months (Logan et al, 2004).

An updated Cochrane review (10 RCTs) and a subsequent systematic review (11 RCTs) of amphetamine use found a non-significant trend towards increased mortality (OR 2.78, 95% CI 0.75–10.23) and improved motor function (WMD 3.28, 95% CI -0.48–7.08) (Martinsson et al, 2007; Sprigg & Bath, 2009). No difference was found in combined death or dependency but effects were found for blood pressure and heart rate increases (Sprigg & Bath, 2009).

Two Cochrane reviews (14 RCTs or quasi RCTs in acute phase; five RCTs in subacute/chronic phase) found acupuncture is relatively safe (1.5% incidence of severe adverse events) but there is no clear evidence of benefit in any phase of recovery (Wu et al, 2006, Zhang et al, 2005). Subsequent RCTs report conflicting outcomes but those with more rigorous methods failed to demonstrate clear benefits of functional recovery (Hopwood et al, 2008; Mao et al, 2008; Hsieh et al, 2007; Wayne et al, 2005; Park et al, 2005). Another systematic review (34 RCT or quasi RCTs) of treatments that combine acupuncture and traditional Chinese herbal medicines noted methodological concerns and concluded there was scant information regarding effect on motor recovery (Junhua et al, 2009). For further information regarding alternative therapy for acute stroke see section 4.13 (Complementary and alternative therapy).

Recommendations	
Activities of daily living	**Grade**
Patients with difficulties in performance of daily activities should be assessed by a trained clinician (Legg et al, 2006; OST, 2003).	**A**
Patients with confirmed difficulties in personal or extended activities of daily living should have specific therapy (eg, task-specific practice and trained use of appropriate aids) to address these issues (Legg et al, 2006; Walker et al, 2004).	**B**
Other staff members, the person with stroke and carer/family should be advised regarding techniques and equipment to maximise outcomes relating to performance of daily activities and life roles, and to optimise sensorimotor, perceptual and cognitive capacities.	✓
People with difficulties in community transport and mobility should set individualised goals and undertake tailored strategies such as multiple escorted outdoor journeys (ie, up to seven) which may include practice crossing roads, visits to local shops, bus or train travel, help to resume driving, aids and equipment, and written information about local transport options/alternatives (Logan et al, 2004).	**B**
Administration of amphetamines to improve activities of daily living is NOT currently recommended (Martinsson et al, 2007; Sprigg & Bath, 2009).	**B**
The routine use of acupuncture alone or in combination with traditional herbal medicines is NOT currently recommended in stroke rehabilitation (Wu et al, 2006; Zhang et al, 2005; Junhua et al, 2009).	**B**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

6.5   Communication

This section covers communication disorders following stroke. Sixty-seven percent of acute patients are admitted with speech/communication deficits (aphasia, dyspraxia of speech and dysarthria) (NSF, 2009a). Communication deficits can be complicated by hearing and visual loss or the requirement to have a tracheostomy. An audiology assessment may be useful as hearing loss is particularly common in the elderly population and can impact on assessment. The impact of visual loss or neglect associated with the stroke should also be addressed as it impacts on communication. The specific needs of patients from culturally and/or linguistically diverse backgrounds and those of people with cognitive communication difficulties also need to be considered.

6.5.1   Aphasia

The term 'aphasia' in these guidelines is used not to signify absolute loss of language but to incorporate the full spectrum of language severity and it is used synonymously with 'dysphasia' for the purposes of this document. Specific discussion about intensity of treatment for aphasia is included in section 6.1 (Amount, intensity and timing of rehabilitation).

One systematic review examined six screening tools and found the Frenchay Aphasia Screening Test was the most thoroughly evaluated and widely-used measure, with sensitivity of 87% and specificity of 80% (Salter et al, 2006). The Frenchay Aphasia Screening Test was developed in the UK to be used by health practitioners other than speech-language therapists and it also includes references specific to European countries. This must be taken into account when using the tool in the New Zealand setting. While there are a range of other screening tests reported in the literature, further evaluation of their reliability, validity and practical application in the New Zealand setting is needed.

A Cochrane review (12 RCTs) demonstrated that evidence for therapy for communication deficits is limited with most of the trials having methodological shortcomings and small numbers (Greener et al, 1999).

Another Cochrane review (10 RCTs) found insufficient evidence for various pharmacological interventions for aphasia although there was weak evidence (due to methodological concerns and possible harms) for piracetam to improve language (OR 0.46, 95% CI 0.3–0.7) (Greener et al, 1999). One small RCT found dextroamphetamine in addition to moderately intensive speech therapy to be beneficial compared to speech therapy and placebo during the post-acute phase (Walker-Batson et al, 2001). One additional small RCT found significant short-term and long-term improvement with memantine when used alone or with constraint induced language therapy (CILT) in people with stroke with chronic aphasia (Berthier et al, 2009).

A systematic review (one RCT, two CCTs and two case series) found CILT was associated with a modest positive effect on impairment and activity in people with stroke with chronic aphasia (Cherney et al, 2008).

Like CILT, other therapies targeting specific underlying deficits or optimising preserved abilities, for example, phonological therapy and semantic therapy (Doesborgh et al, 2004), or the use of gesture (iconic and cued articulation) (Rose et al, 2002), improved language function.

Interventions delivered via computer have been found to provide some benefits (Katz & Wertz, 1997; Crerar et al, 1996; Aftonomos et al, 1997).

While it is important to provide information to patients and carers, communication deficits need to be carefully considered. One study found that the reading level for those with aphasia was well below the level of that provided in written material (Hoffmann & McKenna, 2006). Small case series have found that modifying written materials using aphasia-friendly principles significantly improved the comprehension of the materials for people with aphasia (Brennan et al, 2005; Rose et al, 2003).

Use of volunteers, including communication partners, with training in either basic communication techniques or in the particular communication needs of the person with stroke, has been shown to be an effective adjunct to aphasia therapy in improving functional communication (Wertz et al, 1986; Kagan et al, 2001).

Studies of group versus individual therapy have produced conflicting results. A Cochrane review, which included only one trial, found no difference between individual intervention and group intervention, although the authors of the trial did report a difference (Greener et al, 1999). A subsequent trial reported a beneficial effect of group training (Elman & Bernstein-Ellis, 1999).

A non-systematic review of single case studies (Jacobs et al, 2004) reported positive effects of augmentative and alternative communication (AAC) devices for people with severe aphasia. However, there was no transfer of benefits into everyday activities.

People with stroke may experience a range of communication problems that either occur with, or exist independently of, aphasia. These difficulties may occur in pragmatic skills such as effective use of body language, facial expression, prosody (intonation), referencing and turn taking, as well as discourse skills such as organisation and cohesion of narrative, and fitting a conversation within its social context. While these problems have been identified, there is no evidence available on the efficacy of intervention strategies for people with stroke experiencing such difficulties.

Recommendations	
Aphasia	**Grade**
All patients should be screened for communication deficits using a screening tool that is valid and reliable (Salter et al, 2006).	**C**
Those patients with suspected communication difficulties should receive formal, comprehensive assessment by a specialist clinician.	✔
Where a patient is found to have aphasia, the clinician should:	
• document the provisional diagnosis	✔
• explain and discuss the nature of the impairment with the patient, family/carers and treating team and discuss/teach which strategies or techniques may enhance communication	✔
• in collaboration with the patient and family/carer, identify goals for therapy and develop and initiate a tailored intervention plan. The goals and plans should be reassessed at appropriate intervals over time	✔
• ensure all members of the interdisciplinary team are aware of and proficient in appropriate strategies for assessing impairment, activity and participation in the presence of aphasia; and are aware of how aphasia may impact on the way all rehabilitation interventions from the interdisciplinary team are best provided.	✔
All written information on health, aphasia, social and community supports should be available in an aphasia-friendly format (Brennan et al, 2005; Rose et al, 2003).	**D**
Alternative means of communication (such as gesture, drawing, writing, use of augmentative and alternative communication devices) should be facilitated as appropriate.	✔
Interventions should be individually tailored but can include:	
• treatment of aspects of language (including phonological and semantic deficits, sentence-level processing, reading and writing) following models derived from cognitive neuropsychology (Doesborgh et al, 2004)	**C**
• constraint-induced language therapy (Cherney et al, 2008)	**B**
• the use of gesture (Rose et al, 2002)	**D**
• supported conversation techniques (Wertz et al, 1986; Kagan et al, 2001)	**C**
• delivery of therapy programmes via computer (Katz & Wertz, 1997).	**C**
Until clinical safety is proven and any benefits clearly outweigh any harms, the routine use of the following interventions are NOT recommended:	
• piracetam (Greener et al, 2001)	**B**
• other pharmacological interventions.	✔
Group therapy and conversation groups can be used for people with aphasia, and should be available in the longer term for those with chronic and persisting aphasia (Elman 1999).	**C**
People with chronic and persisting aphasia should have their mood monitored.	✔
Environmental barriers facing people with aphasia should be addressed, such as through training communication partners, raising awareness of and educating about aphasia in order to reduce negative attitudes, and promoting access and inclusion by providing aphasia-friendly formats or other environmental adaptations. People with aphasia from culturally and linguistically diverse backgrounds may need special attention, for example, from trained health care interpreters.	✔

Recommendations

Aphasia	Grade
The impact of aphasia on functional activities, participation and quality of life, including the impact upon relationships, vocation and leisure, should be assessed and addressed as appropriate from early post onset and over time for those chronically affected.	✔

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✔ Consensus-based recommendations (GPP)

6.5.2   Dyspraxia of speech

Dyspraxia of speech (also known as verbal dyspraxia) is rare in isolation. Studies examining intervention for dyspraxia of speech (impaired planning and sequencing of muscles used for speech) often include participants with a co-existing aphasia. Clinical strategies described in the literature address either the accuracy of articulatory placement and transitioning (including modelling, feedback on the accuracy of articulatory positions, shaping of speech and non-speech sounds using oral exercises and the use of words of increasing length and phonetic complexity) or therapy targeting the prosody of speech with timing or melody (West et al, 2008). Few of these approaches have been tested empirically and no RCTs have been identified (West et al, 2008).

One systematic review (58 single subject studies or small case series) grouped and described studies into four treatment approaches: interventions to promote improved articulatory kinematic functioning; rate/rhythm control interventions; intersystemic facilitation/reorganisation interventions (utilising relatively intact systems/abilities to facilitate speech production); and augmentative and alternative communication interventions (Wambaugh et al, 2006). Half of the studies focused on articulatory kinematic functioning such as sound training techniques including modelling, visual cueing, integral stimulation and articulatory placement cueing. The PROMPT system which is using tactile cues on the face and neck to cue the articulatory position of the target sound was also noted in this review (Wambaugh et al, 2006). Overall, while most studies reported some improvements from the interventions the overall evidence is weak.

There is growing evidence for the application of motor relearning principles used widely in rehabilitation of other deficits following stroke to people with dyspraxia of speech (Maas & Robin, 2008; Austermann Hula et al, 2008; Ballard et al, 2007).

Recommendations	
Dyspraxia of speech	**Grade**
Patients with suspected motor speech difficulties should receive comprehensive assessment.	✓
Interventions for motor speech skills should be individually tailored and can target articulatory placement and transitioning, speech rate and rhythm, increasing length and complexity of words and sentences, prosody including lexical, phrasal, and contrastive stress production. In addition therapy can incorporate:	
• integral stimulation approach with modelling, visual cueing, and articulatory placement cueing (Wambaugh et al, 2006)	**D**
• principles of motor learning to structure practice sessions (eg, order in which motor skills are practiced during a session, degree of variation and complexity of behaviours practised, intensity of practice sessions and delivery of feedback on performance and accuracy (Maas & Robin, 2008; Austermann Hula et al, 2008; Ballard et al, 2007)	**D**
• PROMPT therapy (Wambaugh et al, 2006).	**D**
The use of augmentative and alternative communication modalities such as gesture or speech generating devices is recommended in functional activities (Wambaugh et al, 2006).	**D**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

6.5.3 Dysarthria

One Cochrane review found no quality studies to guide clinical decisions for the treatment of dysarthria in non-progressive brain damage (Sellars et al, 2005) although there is evidence for the management of dysarthria in other neurological populations (eg, Parkinson's disease). Interventions described in the literature address the phonatory, respiratory, prosodic, articulatory and resonatory aspects of speech production and include stimulation of muscle function (with oral musculature exercises, biofeedback or thermal stimulation), augmentative communication devices, prosthetic devices (eg, palatal lifts), compensatory strategies (such as decreased rate), or interventions to assist the listener in interpreting dysarthric speech (Sellars et al, 2005).

Generally, small low level studies were identified. Biofeedback is effective in changing intensity and increasing loudness (Simpson et al, 1988). A voice amplifier is effective in increasing loudness (Simpson et al, 1988; Cariski & Rosenbek, 1999). Lee Silverman Voice Treatment (LSVT) improved loudness, articulatory precision and speech intelligibility (Wenke et al, 2008). Subjective ratings by participants and partners also showed some improvements in communication, participation and wellbeing (Wenke et al, 2008) but there was a lack of compliance with follow-up. LSVT requires significant further training.

An individually-tailored intervention programme (conversation, and reading aloud of connected speech and of single words) of 16 sessions during an eight-week period may be useful but results were inconsistent in one small series (Mackenzie & Lowit, 2007). Practice using a computer increased the total amount of practice (by 37%) but no difference in outcome to conventional therapy was found (Palmer & Enderby, 2007). A palatal lift can be effective in cases of velopharyngeal incompetence to correct hypernasality and improve speech production (Bedwinek & O'Brien, 1985; Kerman et al, 1973; Yorkston et al, 1989) but the relevance of this intervention to current practice in New Zealand is unclear.

If alternative and augmentative communication devices are required (ie, where speech remains unintelligible) practice with specific devices should preferably occur prior to discharge from hospital.

Recommendations	
Dysarthria	**Grade**
Patients with unclear or unintelligible speech should be assessed to determine the nature and cause of the speech impairment.	✔
Interventions for the treatment of dysarthria can include:	
• biofeedback or a voice amplifier to change intensity and increase loudness (Simpson et al, 1988; Cariski & Rosenbek, 1999)	**D**
• intensive therapy aiming to increase loudness (eg, Lee Silverman Voice Treatment) (Wenke et al, 2008)	**D**
• the use of strategies such as decreased rate, over-articulation or gesture.	✔
People with severe dysarthria can benefit from augmentative and alternative communication devices for use in everyday activities.	✔
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

6.5.4   Cognitive-communication deficits

A stroke in the non-dominant hemisphere can result in cognitive-communication difficulties which may be described as right hemisphere syndrome (RHS) (Jordan & Hillis, 2005). Individuals with RHS may present with reduced attention, neglect, high-level cognitive-linguistic (eg, word finding, and discourse impairments), affective (eg, facial expression), prosodic (eg, 'melody' of speech) and pragmatic (eg, turn-taking) disorders which impact on their communication success, literacy abilities, and participation in vocational and social life (Cherney & Halper, 2000). There is currently a lack of controlled clinical trials to make conclusions regarding interventions for RHS (Lethlean, 2008).

Recommendations	
Cognitive-communication deficits	**Grade**
Stroke patients with cognitive involvement who have difficulties in communication should have a comprehensive assessment undertaken and a management plan developed, and family education, support and counselling as required.	✔

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✔ Consensus-based recommendations (GPP)

6.6   Cognition

This section provides an overview to assessment of cognitive impairment including perception impairment with relevant impairments discussed in the following sections in more detail. Cognitive impairment commonly involves attention, memory, orientation, language, executive functions, neglect, apraxia and agnosia. Stroke has also been linked to dementia, with one systematic review (30 cohorts) finding approximately 10% of patients had dementia before first stroke, 10% developed new dementia soon after first stroke, and more than a third had dementia after recurrent stroke (Pendlebury & Rothwell, 2009).

Cognitive impairment is common in acute stroke with 45% of those assessed having cognitive deficit on admission (NSF, 2009a). Cognitive impairment may be missed in those who present with mild stroke and can have significant impact on life after stroke (Tellier & Rochette, 2009).

6.6.1   Assessment of cognition

Early screening for cognitive impairment is important although no gold standard currently exists (Srikanth et al, 2006; Blake et al, 2002). Non-linguistic tests should be considered where communication deficits are present as language-based assessments are inadequate in these patients (Blake et al, 2002). Currently there are a significant number of screening and assessment tools used for neglect but there is no universally agreed gold standard (Bowen et al, 1999; Azouvi et al, 2006; Menon & Korner-Bitensky, 2004). As with neglect, there are a number of screening and assessment tools used to detect the presence of apraxia; however, there is no universally agreed gold standard (Butler, 2002; van Heugten et al, 1999). If cognitive or perceptual deficits are suspected (or found on screening) a more detailed assessment, including a functional assessment, conducted by a trained team member (eg, neuropsychologist, occupational therapist, or speech-language therapist) can clarify the type of impairments and guide the team in providing the most appropriate rehabilitation interventions.

Recommendations	
Assessment of cognition	**Grade**
All patients should be screened for cognitive and perceptual deficits using validated and reliable screening tools.	✔
Patients identified with cognitive or perceptual deficits during screening should be referred for comprehensive domain specific assessment by a clinical neuropsychologist or other appropriately-trained health practitioner.	✔
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

6.6.2   Attention and concentration

Attention can be defined as the ability to redirect thoughts and actions towards a stimuli or event for a set period of time, despite the presence of extraneous or unrelated stimuli. Attention is a fundamental component of most cognitive and perceptual processes and as such an impairment of attention may have a significant effect on function.

A Cochrane review (two RCTs) found that cognitive rehabilitation improved measures of alertness and sustained attention (Lincoln et al, 2000). The review defined cognitive rehabilitation as any form of practice based on attention tasks with the aim of improving attention abilities. Only one trial in this review included a measure of functional independence and this showed no significant change. Two trials failed to show a significant change in function with a range of interventions (Mazer et al, 2003; Giaquinto & Fraioli, 2003). Another subsequent RCT (Barker-Collo et al, 2009) found attention process training (a multi-level intervention, including sustained, selective, alternating, and divided attention) resulted in a significantly greater improvement on a measure of attention (which combines auditory and visual attention scores) although effects on other secondary measures were not significant.

Recommendations	
Attention and concentration	**Grade**
Cognitive rehabilitation can be used in people with stroke with attention and concentration deficits (Lincoln et al, 2000; Barker-Collo et al, 2009).	**C**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

6.6.3 Memory

An updated Cochrane review (two small RCTs) found insufficient evidence to make conclusions about cognitive rehabilitation for memory deficits (das Nair & Lincoln, 2007). The review defined cognitive rehabilitation as any attempt to change memory function by practice, special internal methods or techniques, or compensatory strategies.

One RCT (n=143, 25% with stroke) demonstrated that an external cueing device (pager) can be effective in assisting with memory deficits (Wilson et al, 2001). A subsequent RCT (n=62) demonstrated that memory retraining using process-orientated memory training strategies resulted in significant improvement compared to controls in the area of auditory rote memory but not auditory prose memory or prospective memory. The results suggest that the frequency of the retraining makes a difference (Hildebrandt et al, 2006).

Recommendations

Memory	Grade
Any patient found to have memory impairment causing difficulties in rehabilitation or activities/participation should:	
• be referred for a more comprehensive assessment of their impaired and preserved memory abilities	✔
• have their nursing and therapy sessions tailored to use techniques which capitalise on preserved memory abilities	✔
• be assessed to see if compensatory techniques to reduce their disabilities, such as using notebooks, diaries, audiotapes, electronic organisers and audio alarms, are useful (Wilson et al, 2001)	D
• be taught approaches aimed at directly improving their memory	✔
• have therapy delivered in an environment that is as like the usual environment for that patient as possible to encourage generalisation.	✔

Grade description
A   Body of evidence can be trusted to guide practice
B   Body of evidence can be trusted to guide practice in most situations
C   Body of evidence provides some support for recommendation(s) but care should be taken in its application
D   Body of evidence is weak and recommendation must be applied with caution
✔   Consensus-based recommendations (GPP)

6.6.4 Executive functions

Executive function is a broad term that includes abstract reasoning, initiation and inhibition of behaviour, planning, problem-solving and self-monitoring. Evidence for interventions in impaired executive function is sparse. One trial demonstrated a positive effect on executive function when using a pager to prompt function (Wilson et al, 2001). A small RCT found the way in which therapy is delivered can impact upon task performance in a stroke population and careful attention is needed to the information provided during rehabilitation (Boyd & Winstein, 2006).

Recommendations	
Executive functions	**Grade**
Patients considered to have problems associated with executive functioning deficits should be formally assessed using reliable and valid tools including measures of behavioural symptoms.	✔
External cues, such as a pager, can be used to initiate everyday activities in people with impaired executive functioning (Wilson et al, 2001).	**C**
Information should be provided to individuals with impaired executive functioning in an appropriate way that supports their learning (Boyd & Winstein, 2006).	**C**

Grade description
A   Body of evidence can be trusted to guide practice
B   Body of evidence can be trusted to guide practice in most situations
C   Body of evidence provides some support for recommendation(s) but care should be taken in its application
D   Body of evidence is weak and recommendation must be applied with caution
✔   Consensus-based recommendations (GPP)

6.6.5   Apraxia

Apraxia is impaired planning and sequencing of movement that is not due to weakness, uncoordination, or sensory loss. Speech dyspraxia is discussed separately – see section 6.5.2 (Dyspraxia of speech). There are few studies of interventions for apraxia, which may include strategy training in ADL (eg, verbalisation of actions), sensory stimulation (touching the limbs), proprioceptive stimulation (eg, applying weight to the limbs), cueing, chaining (ie, breaking tasks into individual steps), and normal movement approaches (in which a clinician guides the body through normal patterns of movement).

One Cochrane review (three RCTs) found that specific therapeutic interventions for motor apraxia following stroke cannot be supported or refuted (West et al, 2008). Based on two of the three RCTs in the Cochrane review, another systematic review concluded that apraxia can be treated effectively through specific cognitive rehabilitation (Cicerone et al, 2005). The largest RCT included in these reviews involved strategy training (which included self-verbalisation, writing action sequence, and viewing pictures of action sequences) combined with OT and was found to lead to greater gains in ADL than OT alone. However, differences between groups were no longer apparent at five-month follow-up (Donkervoort et al, 2001). A subsequent RCT (Smania et al, 2006) used specific interventions for limb apraxia (gestural or strategy training) and found there was significant improvement in ideational apraxia, ideomotor apraxia and gesture comprehension test. The study reported carry-over to improvement in performance in untreated tasks (Smania et al, 2006).

Recommendations

Apraxia	Grade
People with suspected difficulties executing tasks but who have adequate limb function should be screened for apraxia and if indicated complete a comprehensive assessment.	✔
For people with confirmed apraxia, tailored interventions (eg, strategy training) can be used to improve activities of daily living (Donkervoort et al, 2001; Smania et al, 2006).	C

Grade description

A   Body of evidence can be trusted to guide practice

B   Body of evidence can be trusted to guide practice in most situations

C   Body of evidence provides some support for recommendation(s) but care should be taken in its application

D   Body of evidence is weak and recommendation must be applied with caution

✔   Consensus-based recommendations (GPP)

6.6.6   Agnosia

Agnosia is the inability to recognise sounds, smells, objects or body parts (other people's or one's own) despite having no primary sensory deficits. It is a disabling and potentially dangerous condition in that people may fail to recognise dangerous objects; for example, using the stove or turning on the hot tap. Agnosia is usually described by the modality it affects (ie, visual agnosia or auditory agnosia). The person with stroke is often unaware of their problem.

It has been suggested that people with agnosia are most likely to benefit from brief compensatory interventions such as increasing a person's awareness of their deficit, followed by training to recognise stimuli using senses or perceptual abilities that remain intact (Burns, 2004). Such interventions may include, for example, using cues such as labels or pieces of Velcro stuck to objects, recognising faces by their distinctive features, verbal reasoning, or 'caller ID' for people with phonagnosia (inability to recognise people by their voice) (Burns, 2004). There are insufficient quality studies to guide recommendations regarding interventions for agnosia.

Recommendations

Agnosia	Grade
The presence of agnosia and implications on function and safety should be assessed by an appropriate health practitioner.	✔
Information from assessment should be shared with the person with agnosia, their family/carers and the interdisciplinary team. Specific strategies for optimising function and safety should be implemented.	✔

Grade description

A   Body of evidence can be trusted to guide practice

B   Body of evidence can be trusted to guide practice in most situations

C   Body of evidence provides some support for recommendation(s) but care should be taken in its application

D   Body of evidence is weak and recommendation must be applied with caution

✔   Consensus-based recommendations (GPP)

6.6.7   Neglect

Unilateral spatial neglect, or hemi-inattention, is the failure to attend to sensory or visual stimuli or to make movements towards one side of the environment, typically the left side due to lesions in the right hemisphere. The presence of a unilateral spatial neglect has deleterious effects on all aspects of a person's ADL and neglect is a predictor of functional outcome (Jehkonen et al, 2006).

An updated Cochrane review (12 RCTs) of cognitive rehabilitation found that overall, there was no clear evidence for or against any of the interventions (Bowen & Lincoln, 2007). However, the included RCTs did not sufficiently distinguish between the different types of neglect, they generally had small sample sizes and there was limited ability to compare RCTs due to the variety of outcome measures used (Bowen & Lincoln, 2007). Cognitive rehabilitation was defined as therapeutic activities designed to reduce directly the level of cognitive deficits or the resulting disability, and could include structured therapy sessions, computerised therapy, prescription of aids and modification of the patient's environment.

Another wide-ranging systematic review identified 54 observational and experimental studies that included a variety of interventions to alleviate neglect, such as visual scanning training (VST), limb activation, mental imagery, sustained attention training, feedback training, sensory stimulation, eye patching and prismatic adaptation (Luaute et al, 2006). The results were mixed. Long-term functional gains were found for VST, mental imagery, feedback training and prismatic adaptation (Luaute et al, 2006). The evidence was only considered sufficient for VST but results of this review should be interpreted with caution due to the inclusion of mixed methodological studies.

An additional RCT found improved scanning performance when scanning training was combined with contra-lesion hand stimulation compared with scanning training alone (Polanowska et al, 2009). Another RCT found application of a right half-field eye patch in addition to conventional therapy significantly improved neglect but this did not carry-over to changes in activity (Tsang et al, 2009).

Recommendations

Neglect	Grade
Any patient with suspected or actual impairment of spatial awareness eg, hemi-inattention or neglect should have a full assessment with appropriate tests (Bowen & Lincoln, 2007; Jehkonen et al, 2006).	**C**
Patients with unilateral neglect can be trialled with one or more of the following interventions:	
• simple cues to draw attention to the affected side	✔
• visual scanning training in addition to sensory stimulation (Luaute et al, 2006; Polanowska et al, 2009)	**C**
• mental imagery training or structured feedback (Luaute et al, 2006)	**D**
• half-field eye patching (Luaute et al, 2006; Tsang 2009).	**C**

Grade description

A   Body of evidence can be trusted to guide practice

B   Body of evidence can be trusted to guide practice in most situations

C   Body of evidence provides some support for recommendation(s) but care should be taken in its application

D   Body of evidence is weak and recommendation must be applied with caution

✔   Consensus-based recommendations (GPP)

Chapter 7: Managing secondary complications

Management of secondary complications involves initial efforts at prevention. Where this is not successful, management involves strategies to reduce impairments. Therefore, the following sections present evidence for both prevention and reduction strategies.

7.1   Nutrition and hydration

Dehydration is common after stroke due to consequences of stroke such as swallowing impairment, immobility and communication difficulties and leads to poor outcomes (Kelly et al, 2004; Bhalia et al, 2000; Finestone et al, 2001; Whelan, 2001). Malnutrition is also common with Australian data indicating that 16% to 19% of stroke patients are malnourished on admission (Martineau et al, 2005; Davis et al, 2004). Dehydration and malnutrition increases in the first week of hospitalisation and are associated with poor outcomes post stroke, including increased complications and mortality and hence constant monitoring is needed within acute and subacute hospital care (Martineau et al, 2005; Perry, 2004; Foley et 2006). Furthermore, the nutritional needs of those with haemorrhagic strokes may be higher than previously calculated and therefore these patients may be at particular risk of malnutrition (Esper et al, 2006). Additional evidence-based practice guidelines for the nutritional management of malnutrition in adult patients across the continuum of care (DAA, 2009) *also* exist. For details on diet and secondary prevention of stroke – see section 5.1 (Lifestyle modifications).

Validated nutritional screening tools should be used for patients with acute stroke on admission and at regular intervals throughout admission. A number of validated nutrition screening tools, including the Malnutrition Screening Tool (MST) and the Malnutrition Universal Screening Tool (MUST) have been used in studies of acute hospitalised patients including those with stroke (Stratton et al, 2004; Martineau et al, 2005; Ferguson et al, 1999; Davis et al, 2004). Incorporating such screening tools into patient admission protocols and documentation may facilitate routine screening of nutritional status in patients with acute stroke.

Currently, there is no universally accepted gold standard for the assessment of nutritional status in the acute stroke patient. Malnutrition is typically diagnosed using a number of parameters including unintentional weight loss, decreased oral intake and evidence of muscle wasting/subcutaneous fat loss. A number of validated assessment tools, including Subjective Global Assessment (SGA), Mini Nutritional Assessment (MNA) and patient generated SGA (pgSGA) have been used in studies of patients in acute hospital and rehabilitation settings, including those with stroke (Banks et al, 2007; Martineau et al, 2005). Such validated tools should be used alone or in addition to objective nutritional parameters in the assessment of nutritional status.

Simple strategies such as making fluid accessible, offering preferred fluids and providing supervision during meals have been found to increase fluid intake in elderly people who are able to take fluids orally (Hodgkinson et al, 2003; Simmons et al, 2001). Where additional hydration is required for patients not able to swallow, fluid can be administered via intravenous, subcutaneous or enteral routes (using a nasogastric [NG] tube or percutaneous endoscopic gastrostomy [PEG]). There is no clear evidence to suggest one route is more beneficial than the other (Challiner et al, 1994).

One systematic review (55 RCT or quasi RCTs) found oral nutritional supplementation of elderly patients, including stroke-specific trials, deemed to be undernourished at baseline reduces infectious complications (OR 0.72, 95% CI 0.53–0.97) and mortality (OR 0.66, 95% CI 0.49–0.90) when compared with placebo/standard care (Milne et al, 2006). No effect was found for those not undernourished at baseline. A subsequent RCT found that intensive nutritional supplementation, compared to routine nutritional supplementation in undernourished patients admitted to specialist stroke rehabilitation, improves motor recovery and increases the chance of being discharged home (Rabadi et al, 2008). Given the observational data regarding poorer outcomes it is considered good practice for staff to monitor food and fluid intake to maximise nutrition and outcomes for patients with acute stroke.

A prospective observational study also found early nutritional support (via tube feeding) improved outcomes for patients with severe stroke compared with standard care (James et al, 2005; Horn et al, 2005). The FOOD trial found no significant difference in death and disability or incidence of pneumonia for patients provided with early nasogastric (NG) enteral feeding compared with intravenous or subcutaneous fluids (without nutrition) (FOOD Trial, 2005a). However, there was a non-significant trend for those who received early NG tube feeding to have a reduced risk of death but an increased likelihood of being severely disabled (FOOD Trial, 2005a). Unfortunately this trial had insufficient power to determine such changes.

There is conflicting evidence for the preferred method of enteral feeding for those with dysphagia. In by far the largest and most robust study, NG tube feeding in the first month after stroke was associated with increased functional recovery and was more likely to be associated with normal feeding six months after stroke when compared with PEG feeding (FOOD Trial, 2005b). Three other much smaller studies reported benefits of PEG feeding compared with NG feeding (Norton et al, 1996; Kostadima et al, 2005; Hamidon & Abdullah, 2006). Given the FOOD trial is almost 10 times larger than other trials and much more robust, it is prudent to base decisions on the data from this study suggesting NG is preferred in the acute phase for those requiring enteral feeding.

Implementation of locally developed evidence-based guidelines for nutritional support using opinion leaders and educational programmes linked to audit and feedback improved adherence to guidelines by staff and reduced patient complications (infections) (Perry & McLaren, 2003). Training and resourcing of staff is needed to ensure adequate monitoring of nutritional intake, and proper use of nutritional risk screening tools.

Recommendations	
Nutrition and hydration	**Grade**
All stroke patients should have their hydration status assessed, monitored and managed as required. Appropriate fluid supplementation should be used to treat or prevent dehydration (Bhalla et al, 2000; Kelly et al, 2004; Whelan, 2001; Hodgkinson et al, 2003; Challiner et al, 1994).	B
All patients with acute stroke should be screened for malnutrition (Martineau et al, 2005; FOOD Trial, 2005a).	B
All patients with acute stroke who are at risk of malnutrition, including those with dysphagia, should be referred to a dietitian for assessment and ongoing management.	✔
Screening and assessment of nutritional status should include the use of validated nutritional assessment tools or measures.	✔
Nutritional supplementation should be offered to people with stroke whose nutritional status is poor or deteriorating (Milne et al, 2006).	A
Nasogastric feeding is the preferred method during the first month post stroke for people who do not recover a functional swallow (FOOD Trial, 2005b).	B
Food intake and weight should be monitored for all people with acute stroke.	✔

Grade description

A   Body of evidence can be trusted to guide practice

B   Body of evidence can be trusted to guide practice in most situations

C   Body of evidence provides some support for recommendation(s) but care should be taken in its application

D   Body of evidence is weak and recommendation must be applied with caution

✔   Consensus-based recommendations (GPP)

7.2   Oral hygiene

Routine oral care can present a considerable challenge after stroke due to a variety of factors including physical weakness, dysphagia, lack of coordination and cognitive problems.

There is little evidence for strategies to maintain or improve good oral hygiene after stroke. A Cochrane review identified eight RCTs but only one provided actual stroke-specific information (Brady et al, 2006). A staff-led oral care education training programme delivered to nursing home care assistants showed that denture plaque scores were significantly reduced up to six months after the intervention. Staff knowledge and attitude toward oral care also improved significantly and was retained at six months. There was no change in other oral hygiene measures. Other evidence relating to oral care interventions is severely lacking, in particular with reference to care in hospital for those following stroke, and further research is needed.

Recommendations	
Oral hygiene	**Grade**
All patients, particularly those with swallowing difficulties, should have assistance and/or education to maintain good oral and dental hygiene (including dentures).	✔
Staff or carers responsible for the care of patients disabled by stroke (in hospital, in residential care and in home care settings) can be trained in assessment and management of oral hygiene (Brady et al, 2006).	C

Grade description
A   Body of evidence can be trusted to guide practice
B   Body of evidence can be trusted to guide practice in most situations
C   Body of evidence provides some support for recommendation(s) but care should be taken in its application
D   Body of evidence is weak and recommendation must be applied with caution
✔   Consensus-based recommendations (GPP)

7.3   Spasticity

It is unclear if the presence of spasticity (ie, hyperactive stretch reflexes) limits activity levels. Interventions to reduce spasticity may be considered when the level of spasticity interferes with activity or the ability to provide care to the person with stroke (ie, moderate to severe spasticity) (Van Kuijk et al, 2002). There are conflicting views as to whether spasticity is a primary or secondary impairment. However, spasticity may be present with other impairments, such as contracture or shoulder pain, and interventions for these are listed elsewhere and should be considered – see sections 7.4 (Contracture) and 7.6.1 (Shoulder pain).

Three systematic reviews were consistent in finding botulinum toxin A decreased spasticity (Rosales & Chua-Yap, 2008; Elia et al, 2009; Garces et al, 2006). Few adverse events were reported with no difference between control and intervention groups. Global improvement noted by patient and carer based on the goal attainment scale was statistically significant. However, effectiveness at the activity level is less clear and no change in quality of life (QOL) was found with the use of botulinum toxin A. Subsequent RCTs also report reduced spasticity, improved goal attainment, but not changes in QOL (McCrory et al, 2009; Jahangir et al, 2007). There are conflicting results from several small RCTs on the effect of botulinum toxin A for spasticity at the shoulder to treat pain, with some showing a reduction and others no change in pain or spasticity (Kong & Neo, 2007; Lim & Koh, 2008; Marco & Duarte, 2007; Yelnik & Colle, 2007; de Boer & Arwert, 2008). The benefits of botulinum toxin A may be enhanced by electrical stimulation (Hesse et al, 1998; Johnson et al, 2004; Baricich et al, 2008); use of night splints (Farina et al, 2008) and taping (Baricich et al, 2008).

One small cross-over RCT (n=21) found that an active, targeted therapy programme was found to be as effective as botulinum toxin A in reducing spasticity in the upper limb; however, it is also found that injections in addition to therapy may improve the quality and amount of movement (Meythaler et al, 2009).

Intrathecal baclofen decreased severe spasticity (Creedon et al,1997; Sampson et al, 2002; Meythaler et al, 2001) but adverse events such as infection and functional decline have been reported in a small proportion of cases (Steinbok & O'Donnell, 2000; Kofler et al, 2009). This intervention is currently uncommon in New Zealand and Australia.

Dynamic splinting (Gracies et al, 2000) decreased spasticity without harm being reported.

One systematic review (10 RCTs and 11 other clinical trials) found overall the evidence for stretching to reduce spasticity was inconclusive and heterogeneity precluded meta-analysis. Some evidence was reported in individual studies supporting short-term effects of a stretching session but it is unclear how long effects last and further evidence is needed (Bovend'Eerdt et al, 2008).

A thermoplastic resting wrist and finger splint did not significantly improve spasticity (Sheehan et al, 2006).

Electrical stimulation did not decrease spasticity in one trial (Heckmann 1997) but has been shown to do so in two more recent RCTs (Bakhtiary & Fatemy, 2008; Yan & Hui-Chan, 2009). EMG biofeedback in combination with electrical stimulation has also been shown to reduce spasticity (Heckmann et al, 1997; Hara et al, 2006). EMG biofeedback to reduce overactivity or during exercise (Swaan et al, 1974) decreased spasticity without harm being reported.

The efficacy of oral anti-spastic medication was marginal at best, and accompanied by high levels of adverse reactions (Montane et al, 2004). Two subsequent studies found little evidence for tolperisone (Stamenova et al, 2005) and tizanidine was not as effective as botulinum toxin A (Simpson et al, 2009).

Recommendations	
Spasticity	**Grade**
In addition to general therapy (eg, task specific practice) other interventions to decrease spasticity should NOT be routinely provided for people with stroke who have mild to moderate spasticity (ie, spasticity that does not interfere with their activity or personal care).	✓
In people with stroke who have persistent, moderate to severe spasticity (ie, spasticity that interferes with their activity or personal care):	
• botulinum toxin A should be trialled in conjunction with rehabilitation therapy which includes setting clear goals (Rosales & Chua-Yap, 2008; Elia et al, 2009; Garces et al, 2006)	**B**
• electrical stimulation in combination with EMG biofeedback can be used (Bakhtiary & Fatemy, 2008; Yan & Hui-Chan, 2009).	**C**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

7.4   Contracture

Contracture is a shortening of soft tissues that results in reduced joint range of motion due to the presence of impairments (eg, weakness or spasticity). Particularly common is loss of shoulder external rotation, elbow extension, forearm supination, wrist and finger extension, ankle dorsiflexion and hip internal rotation. People with severe weakness are particularly at risk of developing contractures.

There are now several small RCTs that consistently failed to find any effect of maintained range of movement by static stretching either using splints, machines or prolonged positioning in addition to conventional therapy (Horsley et al, 2007; Lannin et al, 2003; Lannin et al, 2007; Burge et al, 2008; Turton & Britton, 2005; Gustafsson & McKenna, 2006; Rydwik et al, 2006; Harvey et al, 2006). Only two studies found an effect for isolated muscle groups (shoulder internal rotators in one study and shoulder abductors in the other) (Ada et al, 2005; de Jong et al, 2006). Poor compliance and increased pain have been reported with prolonged positioning (Turton & Britton, 2005; Gustafsson & McKenna, 2006). It is noted that interventions were in addition to conventional therapy that would include active rehabilitation. Hence in order to ensure rehabilitation is maintaining range of motion, muscles at risk of shortening should be monitored.

The risks of pain outweigh any maintained range of motion with use of overhead pulleys and hence should be avoided (Kumar et al,1990).

Electrical stimulation of the forearm muscles increased range of motion at the wrist but the effects were only short term (ie, benefits occurred while intervention was applied but quickly reduced when intervention ceased) (Pandyan et al, 1997). If used, electrical stimulation should move the joint to the end of range in order to maximise its effect.

One RCT found no difference between tilt table use and night splints for ankle range of motion (Robinson et al, 2008). One other small RCT found manual ankle mobilisations plus functional training led to a small increase in ankle range of motion (5.5 degree difference), however, no functional benefits were found (Kluding & Santos, 2008).

A systematic review of casting (ie, casting at the ankle, knee, wrist or elbow either with one cast or a series of casts) in people with traumatic brain injury or stroke found casting improved range of motion (Mortenson & Eng, 2003). However, there was little or no effect on the level of spasticity or activity.

Recommendations	
Contracture	**Grade**
For people at risk of developing contractures undergoing active rehabilitation, the addition of prolonged positioning of muscles in a lengthened position to maintain range of motion is NOT recommended (Turton & Britton, 2005; Gustafsson & McKenna, 2006).	**B**
Overhead pulley exercise should NOT be used to maintain range of motion of the shoulder (Kumar et al, 1990).	**C**
For people who have contracture, management can include the following interventions to increase range of motion:	
• electrical stimulation (Pandyan et al, 1997)	**C**
• casting/serial casting (Mortenson & Eng, 2003).	**C**
Grade description	
A Body of evidence can be trusted to guide practice	
B Body of evidence can be trusted to guide practice in most situations	
C Body of evidence provides some support for recommendation(s) but care should be taken in its application	
D Body of evidence is weak and recommendation must be applied with caution	
✓ Consensus-based recommendations (GPP)	

7.5   Subluxation

There is no evidence that subluxation can be reduced after it occurs; prevention is therefore paramount. Management of subluxation once it occurs consists of strategies to prevent it worsening.

A systematic review of seven trials found that electrical stimulation compared to conventional therapy alone, prevented some of the subluxation resulting from immobility as a result of weakness (WMD 6.5 mm, 95% CI 4.4–8.6), but did not reduce it once it had occurred (WMD 1.9 mm, 95% CI -2.3–6.1) (Ada & Foongchomcheay, 2002). An additional RCT of intramuscular electric stimulation found no effect on subluxation compared to intervention with a sling but that it did reduce shoulder pain (Yu & Chae, 2005; Chae et al, 2005).

One systematic review found there was insufficient evidence to draw conclusions on the effect of supportive devices (such as slings, wheelchair attachments) in preventing subluxation (Ada et al, 2005).

Low level trials suggest that firm support (from devices such as laptrays, arm troughs, and triangular slings) temporarily reduces an already subluxed shoulder, but support from extension slings (such as the Bobath sling, Hook Harness slings and hemi-slings) does not (Ada et al, 2005; Moodie et al, 1986; Williams et al; 1988; Zorowitz et al, 1995). One additional study found the GivMohr sling reduced subluxation compared to Roylan sling (Dieruf et al, 2005).

Recommendations	
Subluxation	**Grade**
For people with severe weakness who are at risk of developing a subluxed shoulder, management should include one or both of the following interventions to minimise subluxation:	
• electrical stimulation (Ada & Foongchomcheay, 2002)	**B**
• firm support devices.	✓
For people who have developed a subluxed shoulder, management can include firm support devices (eg, lap trays, arm troughs and triangular slings) to prevent further subluxation (Ada et al, 2005).	**C**
People with stroke, carers and staff should receive appropriate training in the care of the shoulder and use of support devices to prevent/minimise subluxation.	✓

Grade description

A   Body of evidence can be trusted to guide practice

B   Body of evidence can be trusted to guide practice in most situations

C   Body of evidence provides some support for recommendation(s) but care should be taken in its application

D   Body of evidence is weak and recommendation must be applied with caution

✓   Consensus-based recommendations (GPP)

7.6   Pain

Pain from any cause can affect people with stroke. Pain may be due to reduced movement as a result of the stroke, pre-existing disease or stroke-specific pain (central post-stroke pain).

7.6.1   Shoulder pain

The cause of shoulder pain remains unclear. Shoulder pain often occurs secondary to or alongside other impairments and hence the evidence for management of shoulder pain should be considered along with the evidence for contracture, spasticity and subluxation.

Electrical stimulation improved pain-free shoulder range of motion but there was not enough evidence to demonstrate that it prevented or reduced severity of shoulder pain in one Cochrane review (Price & Pandyan, 1999). Results from three subsequent RCTs are mixed. Two studies failed to find any benefits of electrical stimulation (Church & Price, 2006; Mangold & Schuster, 2009). Another study did report reductions in pain but this was compared to an intervention using a sling (Yu & Chae, 2005; Chae et al, 2005). Electrical stimulation can prevent subluxation, which may impact on pain – see section 7.5 (Subluxation).

There was insufficient evidence to draw conclusions on the effect of supportive devices (such as slings, wheelchair attachments) in preventing pain (Ada et al, 2005).

One Cochrane review found strapping delayed the onset of pain (WMD14 days, 95% CI 9.7–17.8) but did not decrease the severity of pain (WMD -0.7 cm on a visual analogue scale, 95% CI -2.0–0.7) based on three trials (Ada et al, 2005). One additional trial also found strapping of at risk stroke patients delayed the onset of pain compared to controls (Griffin & Bernhardt, 2006). Strapping consistently failed to improve range of motion or activity (Ada et al, 2005; Griffin & Bernhardt, 2006).

Only one RCT has assessed intra-articular corticosteroid injections specifically in a stroke population. The study found the treatment did not significantly improve shoulder pain and a high percentage of people also reported adverse effects (Snels et al, 2000). Systematic reviews of corticosteroid injection (mostly subacromial rather than intra-articular) in non-stroke populations with shoulder pain due to rotator cuff disease, adhesive capsulitis or mixed eitiologies have reported mixed results (Arroll & Goodyear-Smith, 2005; Buchbinder et al, 2003; Koester et al, 2007). Study characteristics and methodological quality were variable making pooling of studies difficult.

Cryotherapy and Bobath therapy were not effective in reducing the frequency of pain in people with chronic shoulder pain but may reduce the reported severity of pain (Partridge et al, 1990). Ultrasound was not effective in reducing shoulder pain (Inaba & Piorkowski, 1972).

Preventing contracture and subluxation should help to prevent pain, but interventions aimed at reducing trauma to the shoulder, such as educating all staff, carers and people with stroke, should also help to prevent shoulder pain. Such education may include strategies to care for the shoulder during manual handling and transfers and advice regarding positioning. As there is no clear evidence for effective interventions once shoulder pain is already present in people with stroke, management should be based on evidence-based guidelines for acute musculoskeletal pain (AAMPGG, 2003).

Recommendations	
Shoulder pain	**Grade**
For people with severe weakness who are at risk of developing shoulder pain, management can include:	
• shoulder strapping (Ada et al, 2005; Griffith & Bernhardt, 2006)	**B**
• interventions to educate staff, carers and people with stroke to prevent trauma to the shoulder.	✓
For people with severe weakness who are at risk of developing shoulder pain or who have already developed shoulder pain, the following interventions are NOT recommended:	
• ultrasound (Inaba & Piorkowski, 1972).	**C**
As there is no clear evidence for effective interventions once shoulder pain is already present in people with stroke, management should be based on other guidelines for acute musculoskeletal pain (eg, AAMPGG, 2003).	✓
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

7.6.2   Central post-stroke pain

Central post-stroke pain (CPSP) occurs in approximately 2% to 8% of people with stroke (Andersen et al, 1995) and is a superficial and unpleasant burning, lancinating, or pricking sensation, often made worse by touch, water or movement. While the evidence for interventions for CPSP is inconclusive, a trial of different interventions should be considered where CPSP interferes with functional tasks.

A Cochrane review (61 RCTs) found tricyclic antidepressants and venlafaxine were very effective for neuropathic pain (NNTs ~3) (Saarto & Wiffen, 2007). There is evidence to suggest that other antidepressants may be effective but numbers of participants are insufficient to calculate robust NNTs. None of these studies focused on people with stroke and hence it is unclear to what extent these findings can be generalised to people with stroke who have CPSP. Selective serotonin reuptake inhibitors are generally better tolerated by patients but more high-quality studies are required. The known cardiotoxic risks of tricyclic antidepressants (especially in overdose) need to be balanced by these analgesic benefits for the more elderly patients with stroke.

Another Cochrane review (12 RCTs of which only one included CPSP) reported effectiveness of carbamazepine compared to placebo but also showed that amitriptyline was not significantly different to carbamazepine (OR 3.3, 95% CI 0.8–13.8) in post-stroke pain (Wiffen et al, 2005). The relative benefit was 2.1 (95% CI 1.5–2.7) for carbamazepine producing at least moderate pain relief in any neuropathic pain. The NNT for moderate relief from carbamazepine in any neuropathic pain was 2.5 (95% CI 1.8–3.8). Lampl et al (2002) report that carbamazepine only has a small effect on reducing CPSP.

Another updated Cochrane review (seven small RCTs) found tramadol is effective for neuropathic pain (NNT to reach at least 50% pain relief was 3.8, 95% CI 2.8–6.3) (Duhmke et al, 2006). None of these studies focused on people with stroke and hence it is unclear to what extent these findings can be generalised to people with CPSP. Other pharmacotherapy has been advocated specifically for CPSP, without clear evidence of benefit (Attal et al, 2000; Attal et al, 2002; Bainton et al,1992; Vestergaard et al, 2001).

Other forms of pain relief including transcutanial electrical nerve stimulation, acupuncture or psychological interventions (eg, desensitisation or cognitive behavioural therapy) have also been suggested and can be considered prior to or concurrently with medication, but evidence for these is also limited (Nnoaham & Kumbang, 2008). Surgical and chemical sympathectomy interventions require further evidence (Mailis & Furlan, 2002). If the reason for the pain remains unclear, then referral to a pain specialist team should be considered.

Recommendations	
Central post-stroke pain	**Grade**
People with stroke found to have unresolved central post-stroke pain should receive a trial of:	
• tricyclic antidepressants (eg, trial amitriptyline first followed by other tricyclic agents or venlafaxine) (Saarto & Wiffen, 2007)	**B**
• anticonvulsants (eg, carbamazepine) (Wiffen et al, 2005).	**C**
Any patient whose central post-stroke pain is not controlled within a few weeks should be referred to a specialist pain management team.	✓
Other muscular skeletal conditions should be considered as a cause for the patient's pain.	✓
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

7.7 Swelling of the extremities

People who are upright (standing or sitting) with their arm or leg hanging and immobile as a result of weakness are at risk of developing swelling of the hand and foot. Limited robust evidence exists for interventions to prevent and treat swelling. Electrical stimulation to mimic the action of the muscle pump was more effective than elevation alone in reducing swelling (Faghri & Rodgers, 1997). Intermittent pneumatic compression was not effective in reducing swelling when provided in addition to routine therapy (Roper et al, 1999). Dynamic pressure garments for the upper limb were beneficial in reducing swelling (Gracies et al, 2000). Continuous passive motion with elevation was more effective than elevation alone in reducing swelling (Giudice, 1990). Encouraging active movement where possible, should also be considered to prevent or reduce swelling.

Recommendations	
Swelling of the extremities	**Grade**
For people who are immobile, management can include the following interventions to prevent swelling in the hand and foot:	
• dynamic pressure garments for the upper limb (Gracies et al, 2000)	**C**
• electrical stimulation (Faghri & Rodgers, 1997)	**C**
• elevation of the limb when resting.	✓
For people who have swollen extremities, management can include the following interventions to reduce swelling of the hand and foot:	
• dynamic pressure garments for the upper limb (Gracies et al, 2000)	**C**
• electrical stimulation (Faghri & Rodgers, 1997)	**C**
• continuous passive motion with elevation (Giudice, 1990)	**D**
• elevation of the limb when resting.	✓

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✓ Consensus-based recommendations (GPP)

7.8 Loss of cardiorespiratory fitness

Severe cardiovascular de-conditioning occurs as a result of the immobility imposed early after stroke (Kelly et al, 2003). Two relevant systematic reviews with meta-analyses were identified. The older review which included seven RCTs found cardiorespiratory training improved peak VO2 (statistical effect size [SES] 0.42, 95% CI 0.15–0.69) and peak workload (SES 0.50, 95% CI 0.26–0.73) (Pang et al, 2006). There was also a significant homogeneous SES in favour of cardiorespiratory training to improve walking velocity (SES 0.26, 95% CI 0.05–0.48) and walking endurance (SES 0.30, 95% CI 0.06–0.55) (Pang et al, 2006). The recently updated Cochrane review which included 24 RCTs confirmed cardiorespiratory training improves physical fitness (eg, peak VO2, $P < 0.0001$), walking velocity (MD 6.47 m/min, 95% CI 2.37–10.57) and gait endurance (MD 38.9 metres, 95% CI 14.3–63.5) (Saunders et al, 2009). Overall, no increase in adverse events was found but there is too little data to determine the effect of fitness training on death and disability (Saunders et al, 2009). Included studies mostly employed ergometry (cycle, treadmill or Kinetron) but task-related circuit training was also used. Fitness training requires sufficient muscle mass to achieve a cardiorespiratory effect and hence sufficient strength in lower limb muscles are required to achieve intervention targets and benefits.

Recommendations	
Loss of cardiorespiratory fitness	**Grade**
Rehabilitation should include interventions to increase cardiorespiratory fitness once the person with stroke has sufficient strength in the large lower limb muscle groups (Sanders et al, 2009; Pang et al, 2006).	**A**
People with stroke should be encouraged to undertake regular, ongoing fitness training.	✔

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✔ Consensus-based recommendations (GPP)

7.9   Fatigue

Over the past few years, evidence has been emerging that fatigue is a common, long-term problem after stroke. Estimates of the prevalence of fatigue after stroke range from 16% to 70% (McGeough et al, 2009). In this section, fatigue is defined as abnormal (or pathological) fatigue which is characterised by weariness unrelated to previous exertion levels and usually not ameliorated by rest (de Groot et al, 2003). This is different to normal fatigue, which is a general state of tiredness which can be improved with rest. The aetiology of fatigue after stroke is uncertain (McGeoughet al, 2009). Recently, diagnostic criteria and an associated structured interview have been developed to identify which stroke patients have clinically significant fatigue (Lynch et al, 2007).

One Cochrane review identified only three RCTs with interventions for fatigue post stroke (McGeough et al, 2009). Two trials of different medications (fluoxetine, tirilazad) and one trial of a chronic disease self-management programme all failed to demonstrate any change in fatigue. Further studies are needed.

Health practitioners should recognise people with stroke who have excess levels of fatigue and provide information and practical strategies, such as negotiating therapy times and times for rest on a case-by-case basis. However, enforced rest periods should not be used.

Recommendations	
Fatigue	**Grade**
Therapy sessions should be scheduled and paced to coincide with periods of the day when the person with stroke is most alert and least likely to be physically or cognitively fatigued.	✔
People with stroke and their families/carers should be provided with information and education about fatigue including potential management strategies.	✔
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

7.10   Incontinence

Dysfunction of the bladder and/or bowel may be caused by a combination of stroke-related impairments (eg, weakness, cognitive or perceptual impairments). Forty-three percent of stroke patients are incontinent of urine in the first 72 hours and 26% of patients have catheterisation within one week of admission (NSF, 2009a).

7.10.1   Urinary incontinence

Several types of urinary incontinence occur after stroke and hence assessment is important to identify the distinct aetiology to enable commencement of targeted interventions. Methods of diagnostic assessment have been described as a five step sequential process (Martin et al, 2006):

1.   clinical history-taking, including history of incontinence before the stroke, nature, duration and reported severity of symptoms, and exacerbating factors including diet, fluid and medications

2.   validated scales, that measure the severity of symptoms and impact of symptoms on QOL

3.   physical examination, including abdominal, perineal (pelvic floor strength), rectal and neurological examinations, and measurement of body mass index

4.   simple investigations, including urinalysis, midstream specimen of urine, measurement of post-void residual volume, provocation stress test, frequency–volume charts and pad tests

5.   advanced investigations, including urodynamics tests such as cystometry, urethral pressure measurement, pressure–flow studies, videourodynamics and ambulatory monitoring.

Clinical history alone had high sensitivity (92%) but low specificity (56%) in determining a diagnosis of incontinence when compared to urodynamic testing (Martin et al, 2006). Post-void bladder ultrasound scanning may also be useful to guide assessment and

management and has generally high specificity (84–89%) and sensitivity (82–86%) compared with urodynamics (Martin, 2006). Therefore all patients should have at least a clinical history taken. If incontinence is identified after obtaining the clinical history then a physical examination and simple investigations should be undertaken. Advanced investigations are not justified routinely but may be considered later for those whose incontinence has not resolved.

In general there is a lack of evidence for effective interventions, particularly in the acute phase. One updated Cochrane review (12 RCTs) noted two particular studies that demonstrated benefits (Thomas et al, 2008). One study found a structured functional approach to assessment and management, compared with a traditional neurodevelopmental approach in early rehabilitation increased the likelihood of being continent at discharge. The other study demonstrated benefits of care provided by a specialist continence nurse compared with GP care once in the community. This review found trials of physical, behavioural, complementary and pharmacotherapy interventions were inconclusive and more robust data is needed to guide continence care after stroke.

Another systematic review (five trials) focused on behavioural approaches to manage urinary incontinence. This review found limited evidence that bladder retraining with urge suppression in combination with pelvic floor exercises reduced urinary incontinence (Dumoulin et al, 2005).

Two Cochrane reviews (3 and 61 RCTs) found that bladder training and/or anticholinergic drugs provided small benefits for people with urge incontinence in a general population (Wallace et al, 2004; Nabi et al, 2006). Other approaches described in the literature without clear evidence include eliminating bladder irritants, prompted voiding, pelvic floor exercises, biofeedback, electrical stimulation and urge suppression techniques (Gross & Faulkner, 2001). Containment aids (eg, pads) may be used to prevent social inconvenience and embarrassment.

There are no studies regarding the treatment of functional incontinence specific to stroke. One Cochrane review (nine RCTs) found short-term benefits of prompted voiding interventions in a general population (Eustice et al, 2000). Other interventions described in the literature without clear evidence of effectiveness include eliminating or minimising environmental barriers to access toileting (eg, appropriate equipment and/or clearly marked doors), habit training, and appropriate clothing that accommodates the person's dexterity.

There is consensus that catheterisation should be avoided in stroke care. Where necessary, intermittent catheterisation is preferred over indwelling catheters for people requiring intervention in hospital (Niel-Weise & van den Broek, 2005; UIGP, 1993; Johanna Briggs Institute, 2000). Evidence suggests a closed (sterile) catheterisation technique should be used by health practitioners for such interventions, to reduce the risk of infection (Quigley & Riggin, 1993). If intermittent catheterisation is still required in the community, then a clean, self-catheterisation technique can be used (UIGP, 1993; Johanna Briggs Institute, 2000).

Recommendations

Urinary incontinence	Grade
All people with stroke with suspected continence difficulties should be assessed by trained personnel using a structured functional assessment (Thomas et al, 2008; Martin et al, 2006).	**B**
A portable bladder ultrasound scan can be used to assist in diagnosis and management of urinary incontinence (Martin et al, 2006).	**B**
People with stroke who have confirmed continence difficulties should have a continence management plan formulated and documented, implemented and monitored (Thomas et al, 2008).	**C**
The use of indwelling catheters should be avoided as an initial management strategy except in acute urinary retention.	✔
A post-discharge continence management plan should be developed with the person with stroke and family/carer prior to discharge and should include how to access continence resources and appropriate review in the community.	✔
If incontinence persists the person with stroke should be re-assessed.	✔
For people with urge incontinence:	
• a prompted or scheduled voiding regime programme/bladder retraining can be trialled	✔
• anticholinergic drugs can also be trialled (Wallace et al, 2004; Nabi et al, 2006)	**B**
• if continence is unachievable, containment aids can assist with social continence.	✔
For people with urinary retention:	
• the routine use of indwelling catheters is NOT recommended. However, if urinary retention is severe, then intermittent catheterisation should be used to assist bladder emptying during hospitalisation. If retention continues, intermittent catheterisation is preferable to indwelling catheterisation	✔
• if using intermittent catheterisation, then a sterile catheterisation technique should be used in hospital (Quigley & Riggin, 1993)	**C**
• where management of chronic retention requires catheterisation and intermittent catheterisation is not feasible, consideration should be given to choice of appropriate route, whether urethral or suprapubic	✔
• any patient discharged with either intermittent or indwelling catheterisation will require education of patient/carer for management, where to access supplies and a contact point in case of problems.	✔
For people with functional incontinence, a whole-team approach is recommended	✔
• strategies to improve mobility (and reduce delirium) can also assist management of functional incontinence.	✔
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

7.10.2 Faecal incontinence

Faecal incontinence has been found to occur in 30% of acute stroke patients; however, only 11% are incontinent at three to 12 months post stroke (Harari et al, 2003). Symptoms of bowel dysfunction include constipation and diarrhoea. Toilet access and constipating drugs are two modifiable risk factors after stroke. Constipation is also common post stroke with one community-based study reporting an incidence of 66% (Harari et al, 2003). The research base for management for faecal incontinence and constipation is extremely limited and is based on patients in rehabilitation and community settings. Efforts should be made to effectively manage any problems during the acute period in order to prevent further complications. Further research in the acute phase is needed.

One RCT found a nurse-led assessment and education intervention was effective in improving 'normal' bowel movements and changing bowel-modifying lifestyle behaviours (diet and fluid intake), and the intervention also influenced patient-GP interaction and GP prescribing patterns for laxatives (Harari et al, 2004). There was a non-significant trend towards reduced faecal incontinence with this multi-factorial intervention. This suggests that practical issues such as adequate fluid intake, use of stimulatory laxatives, dietary manipulation and modifying the environment are considerations in the management of bowel problems. One-fifth of all the patients involved in this study (including half of all those who had faecal incontinence) were found to have faecal loading/impaction, emphasising the importance of a rectal examination in the evaluation of bowel problems (or faecal incontinence) (Harari et al, 2004).

Two additional low level trials were identified. One trial found a bowel regime (time of day plus suppository) that replicates pre-stroke function to be effective (Venn et al, 1992). Another form of bowel training, digital stimulation of the anus, may also provide some benefit (Munchiando & Kendall, 1993). There is consensus that compensatory, non-medical strategies (eg, containment pads) can be useful to prevent social inconvenience and embarrassment.

Recommendations	
Faecal incontinence	**Grade**
All people with stroke who have suspected continence difficulties should be assessed by trained personnel using a structured functional assessment (Harari et al, 2004).	**B**
For those with constipation or bowel incontinence, a full assessment (including a rectal examination) should be carried out and an appropriate management plan of constipation, faecal overflow or bowel incontinence should be established, and targeted education should be provided (Harari et al, 2004).	**B**
Bowel habit retraining using diet, regular dietary habits and exploiting the gastro-colic reflex can be used for people who have bowel dysfunction (Venn et al, 1992).	**C**
If continence is unachievable, containment aids can assist with social continence.	✔
Education and careful discharge planning and preparation are required for any patient being discharged with bowel incontinence.	✔

Grade description

A   Body of evidence can be trusted to guide practice

B   Body of evidence can be trusted to guide practice in most situations

C   Body of evidence provides some support for recommendation(s) but care should be taken in its application

D   Body of evidence is weak and recommendation must be applied with caution

✔   Consensus-based recommendations (GPP)

7.11   Management of mood

Mood is frequently affected following a stroke. Depression is the most common mood disturbance with a meta-analysis of 51 observational studies finding approximately one-third of patients have depression after stroke (Hackett et al, 2005). Depression is slightly more common in women than men (Poytner et al, 2009). Depression is common in the acute, medium and long-term phases after stroke, and often resolves within a few months of onset without any specific antidepressant therapy or active management (Hackett et al, 2005). Anxiety and emotional lability which includes rapid fluctuation in mood and/or decreased inhibition of emotional expression may also occur, either separately or in combination. While some people with mood disturbances may recover spontaneously over a few months, others may have problems that persist despite active interventions (Hackett et al, 2005). Physical disability, stroke severity and cognitive impairment are reported to predict depression; however, methodological limitations to current studies do not allow for accurate predictive models to be developed (Hackett & Anderson, 2005).

Assessment can be difficult due to the complex interaction of stroke-specific deficits (especially aphasia or cognitive impairments) and the normal adjustment needed to cope with a potentially devastating situation. Assessment of abnormal mood may occur via psychiatric interview using standard diagnostic criteria such as the Diagnostic and Statistical Manual of Mental Disorders (eg, DSM IV), psychiatric rating scales (eg, Hamilton Depression Rating Scale, Geriatric Depression Scale) or a self-rating mood scale (eg, Patient Health Questionnaire-9 [PHQ-9]). Rating scales and single screening questions have been found to have adequate sensitivity but generally lack specificity and hence are useful for screening rather than to diagnose depression and are not useful for anxiety (Aben et al,2002; Bennett et al, 2006). It is not always clear what contribution the physical symptoms of stroke make to the total score on a rating scale (House et al, 1991). To address this, some scales have been designed specifically for use in medically ill populations, such as the Depression in the Medically Ill (DMI-10) scale and these have been shown to perform well in discrimination of depression in the context of physical illness (McHale et al, 2008). Scales specifically for people with aphasia have also been developed (Benaim et al, 2004). Cultural awareness is seen as an important issue in the assessment of mood. It is not certain that mood assessment tools developed internationally will always be applicable in a New Zealand population. In New Zealand there is a particular need for clinicians to be aware of cultural issues relevant to the Māori and Pacific Island communities when considering mood assessment. For example, TaPasefika, a Pacific Primary Health Organisation, uses open questions about sleep, appetite and interests to lead into a mental health screening tool. Care with language is vital to support the destigmatisation of mental disorders and to improve access to culturally-appropriate talking therapy (Tiatia, 2008) – see also part 2, 'Māori and stroke' and 'Pacific people and stroke'.

An updated Cochrane review (14 RCTs) that compared pharmacological agents or psychological therapy versus placebo or standard care for the prevention of depression following stroke found that the small positive benefit of psychological strategies probably endorses the use of more structured approaches to the delivery of education and advice targeting emotional recovery and adjustment to the effects of stroke (Hackett et al, 2008a). However, the amount of evidence to support the routine use of psychological approaches in stroke rehabilitation is limited, as is the generalisability of these findings to all people with stroke due to the narrow inclusion and exclusion criteria for participants in these trials. The review also found that there is inadequate evidence at present to support the routine use of antidepressants, psychostimulants, or other drugs to prevent depression and improve recovery after stroke (Hackett et al, 2008a).

Another updated Cochrane review (16 RCTs) for people with stroke with existing depression found benefits of pharmacotherapy in terms of a complete remission of depression and a reduction (improvement) in scores on depression rating scales, but also an associated increase in adverse events. There was no evidence of benefit of psychotherapy (Hackett et al, 2008b). The combination of psychotherapy with pharmacotherapy may be useful. One RCT (Mitchell et al, 2009) found that a brief psychosocial-behavioural intervention (problem solving sessions and pleasant events scheduling) in addition to usual care (information booklet and normal medical care including use of antidepressants) is effective in reducing depression in both the short term and long term compared to usual care alone.

A further updated Cochrane review (seven RCTs) found antidepressants could reduce the frequency and severity of crying or laughing episodes in people with emotional lability. The effect does not seem specific to one drug or class of drugs (Hackett et al, 2010).

A Cochrane review (24 RCTs) found that fitness training does not change mood (Saunders et al,2009). Similarly, most subsequent trials of exercise have also found either no effects or a non-significant trend only with exercise (Sims et al, 2009; Brittle et al, 2009; Smith & Thompson, 2008; Lai et al, 2006; Lennon et al, 2008).

No RCTs have been undertaken to evaluate electroconvulsive therapy (ECT) for stroke, and a robust systematic review of ECT in an elderly population with depression was unable to draw any conclusions due to the lack of good quality evidence (Van der Wurff et al, 2003).

Although depression is common, there remain many challenges regarding assessment and management. For example, there is no clear data to suggest how long pharmacotherapy should continue after a stroke, at what dosage, rate of side effects may be expected or what is the best process for ending treatment. Patients and families/carers should be informed that mood problems after stroke are common at any stage in recovery and should be encouraged to contact a health practitioner if any mood changes persist for two weeks or longer and interfere with daily activities.

Recommendations	
Management of mood	**Grade**
Identification	
All people with stroke should be screened for depression using a validated tool, preferably one that has been designed for use in a medically ill population.	✔
Screening for depression should be introduced in a way that is culturally appropriate.	✔
Patients with suspected altered mood (eg, depression, anxiety, emotional lability) should be assessed by trained personnel using a standardised and validated scale (Benaim et al, 2004; Aben et al, 2002; Bennett et al, 2006).	B
Prevention	
Psychological strategies (eg, problem solving, motivational interviewing) can be used to prevent depression after stroke (Hackett et al, 2008a).	B
Routine use of antidepressants to prevent post-stroke depression is NOT currently recommended (Hackett et al, 2008a).	B
Intervention	
Antidepressants can be used for people with stroke who are depressed (following due consideration of the benefit and risk profile for the individual) and for those who have emotional lability (Hackett et al, 2008b).	B
Psychological (cognitive and behavioural) intervention can be used for people with stroke who are depressed (Hackett et al, 2008b).	B
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

7.12 Deep venous thrombosis or pulmonary embolism

Deep venous thrombosis (DVT) and the associated complication of pulmonary embolism (PE) are significant risks in the first few weeks post stroke, with PE accounting for 5% of deaths and being the third most common cause of death after stroke (Sherman, 2006). Risk factors reported in the literature include reduced mobility, stroke severity, age, dehydration, increasing time between stroke and the introduction of preventive measures, haemorrhagic stroke and cryptogenic ischaemic stroke (Andre et al, 2007). While there is often a high number of DVTs reported in studies (15–80%), many of these are asymptomatic. Clinically apparent incidence is low for both DVT (<1–10%) and PE (<1–6%) (Andre et al, 2007).

In high-risk populations, duplex or triplex ultrasound techniques are useful to confirm or rule out suspected DVT (sensitivity 91–92%, specificity 94%) (Goodacre et al, 2006). However, the most cost-effective testing strategy has been to use the Wells Score to categorise the risk and the D-dimer prior to ultrasound (Goodacre et al, 2006).

Observational data suggests that acute stroke patients spend significant time inactive (Bernhardt et al, 2004). Early mobilisation is not supported by direct evidence; however, studies of stroke unit care that encourage early mobilisation have been found to have lower rates of DVT (Langhorne & Pollock, 2002). Further, early mobilisation has been identified as one of the most important factors contributing to better outcomes with stroke unit care – see section 6.1 (Amount, intensity and timing of rehabilitation) (Indredavik et al, 1999). Hydration, similarly, has not been evaluated directly in trials, but studies have found dehydration to be strongly associated with DVT (Kelly et al, 2004) and early hydration, a component of stroke unit care, could be expected to provide some protection against DVT.

Routine antiplatelet therapy using aspirin 160 mg to 300 mg daily, given orally (or by nasogastric tube or per rectum in patients who cannot swallow), and started within 48 hours of onset of presumed ischaemic stroke modestly reduces the risk of PE (OR 0.71, 95% CI 0.52–0.95; NNT 693) (Sandercock et al, 2008a).

An updated Cochrane review (24 RCTs) found that intervention with anticoagulants significantly reduced DVT (OR 0.21, 95% CI 0.15–0.29; NNT 114), and PE (OR 0.60, 95% CI 0.44–0.81) in acute stroke, but the benefits were offset by an increase in extracranial haemorrhages (OR 2.99, 95% CI 2.24–3.99). The data did not support the routine use of any of the currently available anticoagulants in unselected patients with acute ischaemic stroke as the risks outweigh the benefits (Sandercock et al, 2008b). However, the benefits of prophylactic therapy may outweigh the risks for certain sub-groups, for example, those with leg paresis, who are immobile, those with a prior history of DVT or PE, those with an inherited thrombophilic tendency or those who are morbidly obese (Andre et al, 2007).

If used, low-molecular-weight heparin (LMWH) or heparinoid is more effective than unfractionated heparin (UFH) in preventing DVT (heparinoid OR 0.52, 95% CI 0.31–0.86; LMWH OR 0.56, 95% CI 0.44–0.73) (Sandercock et al, 2008c; Shorr et al, 2008). However, LMWH is associated with an increase in bleeding complications and there is insufficient evidence to determine whether LMWH has any advantage (or disadvantage) compared to standard heparin for clinically important end-points such as symptomatic venous thromboembolism, intracranial haemorrhage, major extracranial haemorrhage and mortality (Andre et al, 2007; et al, 2008c). LMWH may be more convenient to administer (often once a day dosing), but dosing precautions apply (such as for patients with renal failure) should prophylactic anticoagulant therapy be considered.

The evidence for physical methods of preventing DVT is less clear. Two systematic reviews concluded there is currently insufficient evidence of the effectiveness of physical methods to prevent DVT (Andre et al, 2007; Mazzone et al, 2004). One subsequent RCT found no significant reduction of proximal DVT after stroke but an increase in adverse effects with the use of thigh-length graduated compression stockings in patients admitted to hospital with acute stroke who were immobile (Clots Trials Collaboration, 2009).

Recommendations	
Deep venous thrombosis/pulmonary embolism	**Grade**
Early mobilisation and adequate hydration should be encouraged for all acute stroke patients to help prevent deep venous thrombosis (DVT) and pulmonary embolism (PE).	✔
Antiplatelet therapy should be used for people with ischaemic stroke to assist in preventing DVT/PE (Sandercock et al, 2008a).	**A**
Low molecular weight heparin or heparin in prophylactic doses can be used with caution for selected people with acute ischaemic stroke at high risk of DVT/PE. If low molecular weight heparin is contraindicated or not available, unfractionated heparin can be used (Sandercock et al, 2008c; Shorr et al, 2008).	**B**
Antithrombotic therapy is NOT recommended for the prevention of DVT/PE in patients with intracerebral haemorrhage.	✔
Thigh-length antithrombotic stockings are NOT recommended for the prevention of DVT/PE post stroke (Clots Trials Collaboration, 2009).	**B**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

7.13 Pressure ulcers

Pressure ulcers are defined as 'areas of localised damage to the skin and underlying tissue due to pressure, shear or friction' (Cullum et al, 2004). One large multicentre trial reported 1% of patients developed pressure ulcers during acute stroke admission (FTC, 2005a). Age, stroke severity, immobility, incontinence, nutritional status and diabetes are contributing risk factors. The skin of those deemed at high risk should be examined initially and reviewed as regularly as needed based on individual factors.

Pressure care policies are a common characteristic of stroke unit care (Langhorne & Pollock, 2002). Risk assessment scales, such as the Braden, Norton or Waterlow Risk Assessment scales, have only modest sensitivity and specificity but may be more useful than clinical judgement alone (Pancorbo-Hidalgo et al, 2006). There is no evidence that the use of risk assessment scales reduces the incidence of pressure ulcers (Pancorbo-Hidalgo et al, 2006).

The four main strategies for the treatment of pressure ulcers (not specific to stroke) involve:

1. local treatment of the wound using wound dressings and other topical applications
2. pressure relief using beds, mattresses or cushions, or by repositioning the patient

3. treating concurrent conditions which may delay healing, eg, poor nutrition, infection

4. use of physical therapies such as electrical stimulation, electromagnetic therapy, ultrasound, laser therapy (Baba-Akbari et al, 2006).

One Cochrane review which included eight RCTs found no firm conclusions could be made on the effect of enteral and parenteral nutrition on the prevention and treatment of pressure ulcers (Langer et al, 2003). One subsequent RCT of nutritional support reported no difference in complications of pressure sores for those receiving nutritional supplementation (FTC, 2005a). However, supplementation was only recommended in the small number of patients with malnutrition and further large trials would be needed to confirm or deny any benefits of nutritional support in this sub-group.

An updated Cochrane review which included 52 RCTs found that foam alternatives to the standard hospital mattress reduced the incidence of pressure ulcers in people at risk (McInnes et al, 2008); however, included trials varied greatly in quality and comparisons were difficult. The relative merits of alternating and constant low-pressure devices and of the different alternating pressure devices or seat cushions for pressure ulcer prevention are unclear. Medical grade sheepskins were associated with a decrease in pressure ulcer development based on two RCTs (RR 0.42, 95% CI 0.22–0.81) (McInnes et al, 2008).

Another Cochrane review which included three RCTs found that there was not enough evidence to clearly determine if physical therapies were beneficial (Baba-Akbari et al, 2006).

There is also insufficient evidence to guide decisions about which dressings or topical agents are most effective in pressure ulcer management (Royal College of Nursing, 2005).

No evidence was found for the effects of repositioning as a pressure relieving strategy.

A management plan is useful for those assessed as having an increased risk of developing pressure ulcers. Such a plan needs to be tailored to each individual situation in response to identified risk factors. Careful monitoring should also be incorporated with the frequency determined by individual factors.

Recommendations	
Pressure care	**Grade**
All people with stroke with reduced mobility should have a pressure care risk assessment and regular evaluation completed by trained personnel.	✔
All people with stroke assessed as high risk for developing pressure ulcers should be provided with appropriate pressure-relieving aids and strategies, including a pressure-relieving mattress as an alternative to a standard hospital mattress (McInnes et al, 2008).	B
Grade description A Body of evidence can be trusted to guide practice B Body of evidence can be trusted to guide practice in most situations C Body of evidence provides some support for recommendation(s) but care should be taken in its application D Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

7.14   Falls

An increase in falls has been found after stroke in both hospital and community settings (Jorgensen et al, 2002; Tutuarima et al, 1997; Yates et al, 2002; Teasell et al, 2002; Hyndman et al, 2002; Wagner et al, 2009). Six percent of acute patients were reported to have fallen in the most recent New Zealand acute stroke audit (SFNZ, 2010). In Australia, 79% of inpatient stroke rehabilitation patients were assessed as 'at risk' of falls and 83% of those had a falls management plan documented (NSF, 2008).

To date, evidence for falls intervention is primarily based on research in older people with a range of diagnoses (including healthy people) and in different settings, but mainly in the community. The extent to which these findings can be generalised to people with stroke remains unclear. Assessment of falls needs to consider the specific underlying cause. However, balance (eg, using Berg Balance Scale) or mobility do not predict falls (Harris et al, 2005; Blum & Komer-Botemsky, 2008). Where problems are stroke-specific (eg, difficulty standing) then interventions should target these difficulties. Reasons for a fear of falling (eg, cognitive and emotional factors along with physical factors) should also be considered (Schmid et al, 2009).

A Cochrane review that included 111 RCTs found that group and home-based exercises reduced the rate and risk of falling, as did Tai Chi. Assessment and multifactorial interventions reduced the rate of falls but not the risk of falling. Other interventions such as vitamin D, home safety interventions, reduction of psychotropic medications had more mixed results (Gillespie et al, 2009). Another Cochrane review that included 15 RCTs found insufficient evidence regarding the efficacy of other interventions including individual hip protectors (Parker et al, 2005). One subsequent Australian cluster RCT (n=3999) examined the efficacy of a targeted multifactorial fall prevention programme in elderly care wards. The intervention involved a nurse and physiotherapist working 25 hours a week for three months in all intervention wards. They provided a targeted multifactorial intervention that included a risk assessment of falls, staff and patient education, drug review, modification of bedside and ward

environments, an exercise programme and alarms for selected patients. No difference was found in fall rates during follow-up between intervention and control wards (9.26 falls per 1000 bed days vs 9.20 falls per 1000 bed days, p=0.96) (Cumming et al, 2008b).

Stroke-specific studies have produced conflicting results. One RCT (n=48) found extra sit-to-stand practice did not result in fewer falls (Barreca et al, 2004). Another RCT (n=61) showed that community group exercise programmes reduced rates of falls, particularly when exercises focused on agility (Marigold et al, 2005). In another RCT (n=170) individualised physiotherapy did not reduce falls in people more than one year after a stroke (Green et al, 2002). However, falls were a secondary outcome in this study and the intervention was of low intensity. Symmetrical standing training and repetitive sit-to-stand training reduced falls compared to neuromuscular facilitation techniques in one CCT (n=54) (Cheng 2001). Another similar CCT (n=52) using visual feedback to train sit-to-stand ability found a non-significant trend in falls reduction (Cheng et al, 2004).

Recommendations	
Falls	**Grade**
Falls risk assessment should be undertaken using a valid tool on admission to hospital. A management plan should be initiated for all those identified as at risk of falls.	✔
Multifactorial interventions in the community, including an individually prescribed exercise programme, should be provided for people who are at risk of falling (Gillespie et al, 2009).	B
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

7.15   Sleep apnoea

Observational studies have reported incidences of obstructive sleep apnoea (OSA) between 32% and 80% following stroke (Yaggi & Mohsenin, 2004). There is debate as to whether OSA is a risk factor for stroke, a consequence of stroke, or both (Yaggi & Mohsenin, 2004).

Several Cochrane reviews of OSA in adults with mixed aetiologies were found; however, few of the included studies are specific to stroke. One Cochrane review that included 36 RCTs found continuous positive airway pressure (CPAP) was effective in reducing OSA (Giles et al, 2006). Stroke-specific trials have found CPAP was a more effective intervention than postural therapy or oral devices but may not be tolerated by all people with OSA (Wessendorf et al, 2001; Sandberg et al, 2001). A subsequent small RCT (n=30) found no benefit from CPAP treatment but compliance was poor with only 1.4 hours of use per night (Hsu et al, 2006). Another Cochrane review including 16 RCTs found oral devices improved subjective sleepiness and sleep-disordered breathing (Lim et al, 2006). CPAP appears to be more effective in improving sleep-disordered breathing than oral devices but people prefer oral devices to CPAP (Lim et al, 2006). The benefit of surgery for OSA is unclear based on seven RCTs included in a Cochrane review (Sundaram et al, 2005). Similarly, most drug interventions used for OSA have not been shown to reduce apnoea episodes or improve wellbeing in the long term in another Cochrane review involving 26 RCTs (Smith et al, 2006). Postural therapy demonstrated similar benefits to CPAP in people with positional OSA in one small RCT (n=13) (Jokic et al, 1999).

Recommendations	
Sleep apnoea	**Grade**
For people with sleep apnoea after stroke, continuous positive airway pressure (CPAP) or oral devices should be used (Giles et al, 2006; Lim et al, 2006).	**B**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

Chapter 8: Community participation and long-term recovery

> **Perspectives of people with stroke**
>
> *'Motivation is difficult for someone with stroke due to pain, fatigue, depression, feelings of hopelessness. This is where external help is necessary ... the coach, if you like.'*

8.1   Self-management

People with stroke may have a decreased ability to manage aspects of their day-to-day life independently. At the same time, they need to adapt to the impact of the stroke and any resulting disability, and to be active in managing their daily lives in spite of any long-term consequences of stroke. Self-management is a process by which this may be achieved. As self-managers, people with stroke work actively with health practitioners, family members and other people to optimise recovery and maximise independence from the very start of the recovery process. Self-management addresses any lifestyle interventions necessary to reduce the risk of recurrence of stroke as well as strategies to assist in adapting to changes in physical and cognitive ability, relationships, and place of residence or participation restrictions.

There are many models by which people with stroke may be encouraged to manage their own recovery, but few have been comprehensively developed and tested. The most thoroughly tested model is a generic six-week self-management programme in which people with stroke (without cognitive impairment) were provided with education about communicating with health practitioners, managing change, and setting and achieving goals (Fu et al, 2003; Lorig et al, 2001; Lorig et al, 1999). A systematic review (71 trials) of self-management education found small to moderate positive changes in health outcomes for people participating in such generic self-management programmes (Warsi et al, 2004). Other models of self-management may be based on written material only or on individual contact with health practitioners and peers.

An RCT (n=100) that used an existing stroke-specific self-management programme found the intervention group maintained aspects of function such as family roles, activities of daily living, self-care and work productivity while a decline in function was observed for the control group (Kendall et al, 2007). However, there were no differences in the groups evident after one year. Currently there are limited stroke-specific self-management programmes available.

Recommendations	
Self-management	**Grade**
People with stroke who are cognitively able should be made aware of the availability of generic (chronic disease) self-management programmes before discharge from hospital and be supported to access such programmes once they have returned to the community (Kendall et al, 2007; Lorig et al, 2001).	**C**
Stroke-specific programmes for self-management should be provided to people who require more specialised programmes.	✔
A collaboratively developed self-management care plan can be used to harness and optimise self-management skills.	✔
Community-based rehabilitation programmes can use self-management approaches to optimise recovery and social reintegration.	✔
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

8.2   Driving

The effects of a stroke can lead to isolation and reduced quality of life (QOL) as people reduce the amount of community access they had prior to the stroke (Pound et al, 1998). The inability to return to driving in particular often has a profound impact on community participation (Griffen et al, 2009). The issue of returning to driving can be confusing and the topic is often raised by the patient or their family/carer, especially for patients with minor stroke or TIA.

Motor, sensory, visual or cognitive impairments can have a major impact on a person's ability to drive after stroke. Studies have found that the impairments most likely to predict poor on-road driving ability are visuospatial and attention deficits, reduced motor processing, homonymous hemianopia and a right cerebral hemisphere lesion (Radford & Lincoln, 2004; Korner-Bitensky et al, 2000; Nouri & Lincoln, 1993; Mazer et al, 1998).

The publication entitled: *Medical aspects of fitness to drive. A guide for medical practitioners* (NZTA, 2009) has been prepared to assist medical practitioners in assessing the fitness to drive of any individual. It also sets out the responsibilities and obligations of medical practitioners. That guideline describes criteria for all classes of motor vehicle licence, including commercial drivers. The guideline is available at: www.nzta.govt.nz – search on title.

For private drivers (class 1 or class 6 licence and/or a D, F, R, T or W endorsement): people with stroke are not to return to driving for a minimum of one month. Individuals should not drive until clinical recovery is complete, with no significant residual disability likely to compromise safety. Individuals with the presence of homonymous hemianopia are generally considered permanently unfit to drive. The presence of other disorders such as ataxia, vertigo and diplopia will also generally make individuals permanently unfit to drive unless there is a full level of functional recovery. The presence of epilepsy, associated significant cardiovascular disorders and recurrent transient ischaemic attacks (TIA) following a stroke will generally result in individuals being considered unfit to drive.

A medical assessment should be undertaken before returning to drive. Whenever there is doubt about fitness to drive in terms of cognitive or physical defects, an occupational therapist with training in driving assessment should make a full assessment. In many cases, it may be possible to allow a return to driving after suitable vehicle modifications have been made.

For commercial drivers (class 2, 3, 4 or 5 licence and/or a P, V, I or O endorsement): individuals who have suffered from a cerebrovascular event are generally considered permanently unfit to drive unless sound reasons exist for a less stringent approach. The presence of secondary epilepsy will generally result in individuals being considered permanently unfit to drive.

For TIA, private drivers should be warned not to drive for a period of at least one month following a single attack. Individuals with recurrent or frequent attacks should not drive until the condition has been satisfactorily controlled, with no further recurrence for at least three months. Commercial driving should cease for at least six months following a single attack, subject to the cause being identified and satisfactorily treated, and a specialist medical assessment being carried out. Commercial licence-holders should not drive if they have multiple TIAs that impair consciousness or awareness, cause vertigo or cause visual disturbances. Licences will generally not be issued to applicants with a history of TIAs.

In all cases, people with stroke who held a driving licence pre-stroke should be provided with written information about returning to drive, including legal obligations and necessary assessments (including occupational therapy driver assessment). This information should be provided prior to discharge from hospital or at the first medical appointment in the case of those not admitted to hospital after a TIA.

There is little agreement regarding the most appropriate method of assessing ability to drive; however, a three-step process is generally followed (Unsworth, 2007; Lovell & Russell, 2005).

1. Medical assessment of fitness to drive (NZTA, 2009).

2. A comprehensive off-road driving test of motor, sensory, visual and cognitive skills that may incorporate tests such as the Dynavision Performance Assessment Battery or the Cognitive Behavioural Driver's Inventory (Klavora et al, 2000; Unsworth et al, 2005); or the OT-DORA (Occupational Therapy Driver Off-Road Assessment) Battery (Unsworth et al, 2010).

3. An on-road test (Akinwuntan et al, 2003; DiStefano & Macdonald, 2003).

Evidence for interventions to improve driving ability is limited. One RCT found a visual attention retraining programme was no more beneficial than traditional perceptual training in improving on-road-driving performance amongst people with stroke (Mazer et al, 2003). Another RCT found a simulator-based driving training in a stationary full-sized car with adaptive aids (compared with standard training) significantly improved aspects of driving (Akinwuntan et al, 2005). Access to simulated driver training is very limited in New Zealand. A further small RCT found retraining visual processing skills (such as executing a continuous wide scan, combining motor and visual processing into a motor response) using the Dynavision apparatus did not improve any outcome (Crotty & George, 2009).

Recommendations	
Driving	**Grade**
All patients admitted to hospital should be asked if they intend to drive again.	✔
Any patient who does wish to drive should be given information about driving after stroke and be assessed for fitness to return to driving using the NZ Transport Agency Medical aspects of fitness to drive guideline.	✔
Patients with stroke or TIA should NOT return to driving for a minimum of one-month post event (refer to Medical aspects of fitness to drive guideline). A follow-up assessment (normally undertaken by a GP or specialist) should be conducted prior to driving.	✔
If a person is deemed medically fit but is required to undertake further testing, they should be referred for an occupational therapy driving assessment. Relevant health practitioners should discuss the results of the test and provide a written record of the decision to the patient as well as informing the GP.	✔

Grade description

A Body of evidence can be trusted to guide practice

B Body of evidence can be trusted to guide practice in most situations

C Body of evidence provides some support for recommendation(s) but care should be taken in its application

D Body of evidence is weak and recommendation must be applied with caution

✔ Consensus-based recommendations (GPP)

8.3   Leisure

The majority of people with stroke are over retirement age, and leisure and social activities are a significant part of their life. Many people with stroke are often unable to continue with their usual leisure activities and/or do not take up new ones, which may lead to social isolation, depressed mood and negative effects on their relationships with their family/carers (Sjogren & Fugi-Meyer, 1982).

A systematic review which included eight RCTs found community OT improved participation in leisure activities if targeted interventions were used, although there was no improvement in personal or extended activities of daily living (ADL) (Walker et al, 2004). Another RCT (n=26) evaluated a day service for younger people with stroke and found only small gains, with no effect on depression, anxiety or QOL (Corr et al, 2004). A subsequent RCT (n=56) compared a leisure education programme run in the home and/or in the community with weekly visits by a recreation officer (Desrosiers et al, 2007). This study found positive effects in terms of depressive symptoms, leisure participation and satisfaction for the intervention group. Both groups benefited significantly from the extra contact with health practitioners in terms of health-related QOL (with no differences between the groups).

Recommendations	
Leisure	**Grade**
Targeted occupational therapy programmes can be used to increase participation in leisure activities (Walker et al, 2004).	**A**
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

8.4   Return to work

Observational studies have reported wide-ranging estimates (most commonly ~40%) of people returning to work after stroke, with a direct correlation between returning to work and age and disability (Daniel et al, 2009; Wozniak & Kittner, 2002; van Helzen et al, 2009). Difficulty returning to work can significantly impact on family relationships, level of intimacy, economic situation and leisure activities (Daniel et al, 2009). If the person with stroke wants to work but is unable to return to their previous occupation, then other vocational options within the workplace (or other areas/workplaces) should be explored (eg, volunteer work or training in other vocational areas).

One small RCT (n=26) assessed a day service specifically for younger people with stroke and found a positive effect on occupational performance (Corr et al, 2004). The service offered opportunities to identify and pursue meaningful and realistic activities in the community, not specifically work-related. There is no evidence for interventions specifically to assist in returning to work. There are a number of specialised employment agencies and services within the community that can provide assistance in helping a return to work, supported by the skills of an occupational therapist and other relevant members of the person with stroke's team.

In New Zealand, data from the ARCOS study (Glozier et al, 2008) showed that a potentially modifiable and under-treated comorbidity, psychiatric wellbeing, predicted return to work and could be a focus for intervention in working-age stroke patients.

Recommendations	
Return to work	**Grade**
People with stroke who wish to work should be offered assessment (ie, to establish their cognitive, language and physical abilities relative to their work demands) and assistance to resume or take up work or referral to a supported employment service.	✔
Psychological wellbeing should be a focus for intervention in working-age stroke patients as it is a predictor of return to work.	✔
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

8.5   Intimacy and sexuality

Observational studies have found that sexual dissatisfaction is common post stroke (45–83%), despite no reported drop in libido, and is more common in people with communication disorders (Bray et al, 1981; Boldrini et al, 1991; Korpelainen et al, 1999). However, there are no studies that address the impact of interventions on sexual activity after stroke.

The causes of decreased sexual activity remain undefined empirically, but are thought to be in part organic and in part psychosocial (Korpelainen et al, 1999). They have been attributed to an inability to discuss relationships and sexuality, fear, anguish, sensory and physical changes, or changes in body image and self-esteem (Sjogren & Fugi-Meyer, 1982; Hawton, 1984; Giaquinto et al, 2003). A fear of further stroke during sex is also common (Giaquinto et al, 2003) despite the lack of evidence to support this.

Possible interventions need to consider the psychosocial aspects such as body image, anxiety and fear and include strategies such as counselling, information provision and effective communication. Such interventions should be provided by health practitioners with appropriate experience/expertise in sexuality counselling. Interventions may also need to consider physical aspects such as positioning and timing, or the use of non-invasive interventions for erectile dysfunction (Aloni et al, 1994; McCormick et al, 1986).

The Stroke Foundation of New Zealand has a factsheet available on intimacy after stroke which can be provided to patients. This can be accessed at: www.stroke.org.nz.

Recommendations	
Intimacy and sexuality	**Grade**
People with stroke and their partner should be offered:	
• the opportunity to discuss issues relating to sexuality with an appropriate health practitioner	✔
• written information addressing issues relating to sexuality post stroke	✔
Any interventions relating to sexuality should address psychosocial aspects as well as physical function.	✔
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

8.6   Support

Social support has been shown to correlate directly with outcomes post stroke. It is common for people with stroke to comment on a 'black hole' period when returning home, as they confront the difficulty adjusting to life after stroke, especially when formal interventions have been completed. Support during this phase would seem to be particularly important.

Three important aspects of support have been reported in descriptive studies: emotional, instrumental (practical support such as home help) and informational (Glass & Maddox, 1992). High emotional support along with moderate levels of instrumental support were found to be most the beneficial; however, a trial of a social support intervention based on these assumptions failed to produce significant effects, highlighting the complex nature of social support after stroke (Friedland & McColl, 1992). Counselling services may be important during the reintegration and long-term recovery phase to provide appropriate emotional and informational support – see section 1.9.3 (Counselling). Services that provide support in the community include support groups, community services (eg, meals on wheels, home help, transport), primary care workers (personal care, respite support), community rehabilitation team members and voluntary services (eg, providing social support).

8.7   Peer support

Peer support is a process by which people with stroke may share experiences with others who have undergone a similar experience. Peer support may be structured via groups, online or telephone. Many people with stroke are active in establishing and maintaining peer support groups in the community. Furthermore people with stroke report that peer support is beneficial for sharing experience, education and socialisation (leading to improved self-esteem and self-confidence) and thus is a critical component for recovery of good QOL after stroke (Ch'ng et al, 2008; Catalano et al, 2003; NSF, 2007a). Individual peer support may also be of value, either to supplement groups or for people who do not want involvement in a group.

There are currently no RCTs regarding the effectiveness of peer support for people with stroke. Peer support groups are present throughout New Zealand and are supported by the Stroke Foundation of New Zealand on a regional basis. For more information contact the Stroke Foundation of New Zealand at: www.stroke.org.nz.

Recommendations	
Peer support	**Grade**
People with stroke and family/carers should be provided with information about the availability and potential benefits of a local stroke support group and/or other sources of peer support prior to discharge from the hospital or in the community.	✓
Grade description A Body of evidence can be trusted to guide practice B Body of evidence can be trusted to guide practice in most situations C Body of evidence provides some support for recommendation(s) but care should be taken in its application D Body of evidence is weak and recommendation must be applied with caution ✓ Consensus-based recommendations (GPP)	

8.8   Carer support

The physical and emotional aspects of caring for someone with stroke can frequently alter family roles and dynamics and may result in significantly higher anxiety and depression, and lower perceived QOL (Greenwood et al, 2009; Rigby et al, 2009). Therefore carers, along with people with stroke, need long-term practical, emotional, social and financial support. Access and availability of carer support services is critical.

Interventions and guidance outlined in other sections are relevant to carer support – see sections 1.4.1 (Community rehabilitation services and follow-up), 1.9.1 (Information and education), 1.9.3 (Counselling) and 1.9.4 (Respite care).

Interventions to support informal carers have been considered in several systematic reviews (Brereton et al, 2007; Lee et al, 2007; Eldred & Sykes, 2008; Lui et al, 2005; Visser-Meily et al, 2005; Bhogal et al, 2003a). Interventions include caregiver training; problem-solving interventions; psycho-educational interventions; social support interventions, and a combination of education and counselling. While some benefits have been reported, particularly for interventions involving counselling and/or education, the heterogeneous nature of interventions makes it hard to draw clear conclusions. One systematic review (four RCTs) assessing interventions to improve mental health for informal carers (eg, education – particularly problem solving approaches, or support interventions including coping skills and emotional support) pooled data and found a small but beneficial effect overall (ES 0.277, 95% CI 0.118–0.435) (Lee et al, 2007).

Stroke-related personality and behavioural difficulties are known to have significant and longer-term impact on individuals with stroke and their family/carers and assessment and individualised interventions should be provided (Murray et al, 2007).

Different modes of delivering support to carers, for example using the telephone (Hartke & King, 2003; Grant, 1999) or the internet (Pierce et al, 2004; Pierce et al, 2009) have been used, and have potential benefits in reducing stress. Such interventions may be particularly useful for carers in more rural and remote parts of New Zealand.

Two New Zealand studies have analysed the experiences of carers of people with stroke. These qualitative studies consisted of interviews with Māori with stroke and their caregivers and whānau (Corbett et al, 2006; Dyall et al, 2008). The overall themes identified in these two studies highlighted the need for better communication between health services staff and family members, so that information could be shared regarding the previous health conditions of the person with stroke and to develop rehabilitation programmes in collaboration with the family. Many carers also felt they could be prepared better for what life might be like post-discharge. They expressed the need for clear information about the services available to families and for better access to post-discharge services, such as home help and carer relief. Access to rehabilitation services were also highlighted as an issue, with the recommendation made that services on the marae or in places accessible and comfortable for Māori be considered (Dyall et al, 2008).

Recommendations	
Carer support	**Grade**
Carers should be provided with tailored information and support during all stages of the recovery process. This includes (but is not limited to) information provision and opportunities to talk with relevant health practitioners about the stroke, stroke team members and roles, test or assessment results, intervention plans, discharge planning, community services and appropriate contact details (Brereton et al, 2007; Smith et al, 2008).	**C**
Where it is the wish of the person with stroke (and their family/carer), carers should be actively involved in the recovery process by assisting with goal setting, therapy sessions, discharge planning, and long-term activities.	✔
Carers of people with stroke should be provided with information about the availability and potential benefits of local stroke support groups and services, at or before the person's return to the community (Brereton et al, 2007; Lee et al, 2007; Eldred & Sykes, 2008; Visser-Meily et al, 2005).	**C**
Carers of people with stroke should be offered services to support them after the person's return to the community. Such services can use a problem-solving or educational-counselling approach (Lee et al, 2007; Eldred& Sykes, 2008; Lui et al, 2005; Bhogal et al, 2003a).	**C**
Assistance should be provided for family/carers to manage people with stroke who have behavioural problems.	✔
Advice about the financial support available should be provided for family/carers of people with stroke prior to discharge and as needs emerge and circumstances change.	✔

Grade description

A   Body of evidence can be trusted to guide practice

B   Body of evidence can be trusted to guide practice in most situations

C   Body of evidence provides some support for recommendation(s) but care should be taken in its application

D   Body of evidence is weak and recommendation must be applied with caution

✔   Consensus-based recommendations (GPP)

8.9   Access to resources

Studies of the effect of sociodemographic variables on mortality and inpatient length of stay (Arrich et al, 2005; Wong et al, 2006; Tan et al, 2009) and functional recovery (Putman et al, 2007) show conflicting results but this could be because of heterogeneity in the age of the patients, outcomes measured and lack of control for potential confounders such as stroke severity and age. It seems that social deprivation does not affect inpatient hospital length of stay or short-term functional recovery (Wong et al, 2006; Putman et al, 2007) but that income levels may have an effect on post-discharge functional recovery. These studies suggest that efforts to reduce the effects of socioeconomic status (SES) on stroke should be aimed at the pre-hospital stage in primary and secondary prevention, and in rehabilitation services post discharge. An Australian study (Nguyen et al, 2007) found no effect of area SES or immigrant status when marital status was taken into account among patients with low Functional Independence Measure scores on admission.

Several of the return to work studies commented on the overall low percentage of people returning to work after stroke, and the need for tailored resources to enable people to return to work if they choose to do so. A systematic review of the social consequences of stroke in younger stroke patients emphasised the need for work-related rehabilitation support (Daniel et al, 2009). The review also highlighted other important areas of concern in younger stroke patients, such as family relationships, sexual relationships, financial strain and participation in social activities (Daniel et al, 2009). Given the earlier stroke onset found in Māori and Pacific ethnic groups in New Zealand, the care and rehabilitation of younger stroke patients is an area deserving of extra attention – see also part 2, 'Stroke in younger adults'.

Issues related to the impact of access to resources on stroke outcomes are also discussed in part 2, 'Māori and stroke' and 'Pacific people and stroke'.

Recommendations	
Access to resources	**Grade**
Efforts to reduce the effects of socioeconomic disadvantage on stroke should be aimed at the pre-hospital stage in primary and secondary prevention, and in rehabilitation services post discharge (Wong et al, 2006; Putman et al, 2007).	**C**
A comprehensive assessment of the individual and their family/whānau's needs should be undertaken to facilitate access to appropriate secondary prevention and rehabilitation resources after stroke, including identification of any enablers and barriers.	✔
Grade description **A** Body of evidence can be trusted to guide practice **B** Body of evidence can be trusted to guide practice in most situations **C** Body of evidence provides some support for recommendation(s) but care should be taken in its application **D** Body of evidence is weak and recommendation must be applied with caution ✔ Consensus-based recommendations (GPP)	

Chapter 9: Cost and socioeconomic implications[1]

9.1   Introduction

The lifetime costs of first-ever stroke are substantial and have been recently estimated as more than $2 billion in Australia (net present value 2004) (Cadilhac et al, 2009; Carter, et al 2009) and $450 million annually in New Zealand (Brown, 2009). Therefore, providing cost-effective stroke care (prevention, management and treatment) is important to avoid unnecessary costs to society. This section presents an updated review of the cost and socioeconomic implications of providing evidence-based stroke care given the recommendations within these guidelines. Although a specific analysis of the cost and socioeconomic implications in New Zealand has not been completed, the guidelines development process has been intimately linked with the concurrent revision of the Australian guidelines (see Appendix 2) and the majority of the recommendations in these guidelines are identical to those in the Australian guidelines. The national stroke audit performed concurrently in New Zealand and Australia also confirmed that stroke care delivery in New Zealand and Australia is broadly similar (SFNZ, 2010; NSF, 2009a; NSF, 2009b). This analysis of the cost and socioeconomic implications of the guidelines for Australia is therefore likely to have significant indicative value for the New Zealand context, although cautious interpretation is required.

The Australian guidelines project team (including a search specialist) conducted a separate systematic review for this section. A broad search strategy was used to search the following databases: Econlit, Embase, Medline, Health Technology Assessment, NHS Evaluations and Australasian Medical Index (the search strategy used is available from the National Stroke Foundation [NSF]). The search yielded 1033 abstracts which were reviewed by one member of the project team. Forty-four potential studies were selected for further consideration.

Staff at the Australian National Stroke Research Institute, a subsidiary of Florey Neuroscience Institutes scrutinised the 44 abstracts published between 2005 and 2009 for omissions, and appropriate papers were retrieved and reviewed. As the breadth of topics was wide and the methods used quite disparate, a narrative review was deemed the most appropriate way to summarise the cost and socioeconomic evidence. There was also a preference to report evidence from studies undertaken in Australia. Therefore if similar work had been undertaken elsewhere, this information was not included in the summary unless the results were relevant to the findings in Australia.

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[1]   Prepared by T Gloede, DA Cadilhac and HM Dewey (National Stroke Research Institute, a subsidiary of Florey Neuroscience Institutes, Australia).

The discussion related to the cost-effectiveness evidence is presented to reflect the structure of the guidelines document. It should be noted that these guidelines include several consensus recommendations or recommendations based on levels of evidence below Level II for a number of 'micro' clinical practice issues (eg, physiological monitoring and oxygen therapy). As such, it is not possible to analyse the implications of these sorts of recommendations, as they in fact often form part of a larger package or programme of care, for which there is Level I evidence (for example, stroke unit care). Furthermore, there is limited cost-effectiveness evidence available for many acute stroke care interventions and often these types of studies have not been conducted. Therefore, evidence and discussion for the main (strongest) recommendations in this guideline are provided. This review is also an extension to the previous summaries provided in the earlier versions of the stroke clinical guidelines (NSF, 2005; NSF, 2007b).

There are two important points to keep in mind when reviewing the data presented in relation to cost-effectiveness. Firstly, an intervention can be cost-effective without being cost saving and secondly; what constitutes a cost-effective intervention is a value judgment. In previous Australian policy decisions, $30,000 to $50,000 per Disability Adjusted Life Year (DALY) recovered has been considered to represent value-for-money in the health sector (Vos et al, 2005).

Evidence related to socioeconomic implications is sparser than the cost-effectiveness evidence. Where relevant references to socioeconomic implications were identified these will be highlighted. Overall, we know that there are disparities between people with different socioeconomic status. Socioeconomic status and its definition can vary depending on both the wealth of a country and that of the individuals within that country. In addition, the socioeconomic status of countries and individuals does not tend to shift readily. The most disadvantaged people in society in terms of occupational status, level of education and financial resources tend to have the greatest burden of health risks, which cluster and accumulate over time (WHO, 2002). Evidence suggests that socioeconomic factors appear to outweigh classic risk factors in predicting stroke trends and it has been estimated that about 68% of the variation in stroke mortality rates can be explained by differences in gross domestic product (GDP) between countries (Asplund, 2005).

In Australia, evidence from the North East Melbourne Stroke Incidence study (NEMESIS) indicates that stroke incidence rates increase among people with increasing levels of social disadvantage (Thrift et al, 2004). People with the highest level of disadvantage were estimated to have about a 60% increased risk of stroke compared with those with the lowest level of disadvantage. Accounting for socioeconomic status is therefore an important aspect to consider when exploring the potential expected benefits of prevention interventions, as these may be overestimated or underestimated for different populations.

9.2　Organisation of care

The method of organising stroke services has an important impact on costs and health outcomes. This may include services within an individual hospital or a health system approach to organising services across the care continuum among acute, post-acute and community health care providers (van Exel et al, 2005). Understanding the economic implications of different options for providing stroke services is essential for planning and policy. However, it is important that health benefits and costs are measured appropriately, including with sufficient time to follow-up to ensure any benefits of upfront investments in health care treatment are captured.

9.2.1　Stroke unit care

Since the review for the 2007 Australian guidelines, two new papers from overseas have been identified, one assessing the cost-effectiveness of stroke unit care in one hospital in Germany and the other reporting a simulation model assessing the cost-effectiveness of stroke unit care coupled with early supported discharge (Epifanov et al, 2007; Saka et al, 2009). The results of these studies do not change the overall conclusions of previous economic studies which have included patient level data and longer-term (post hospital) costs and outcomes information.

To date there has been one systematic review identified that included three studies comparing the costs and outcomes of stroke units to that of general wards (Brady et al, 2005). All three studies were based in Europe (UK, Sweden and Germany) and included costs of community and outpatient care. All three studies found modest cost savings (3–11%) using stroke unit care; however, the figures failed to reach significance. The authors concluded that there was 'some' evidence for the costs to be at least equivalent to conventional care.

Evidence from Australia is limited to a prospective cohort study comprising 468 patients from Melbourne (Moodie et al, 2006). The investigators determined that care delivered in geographically-localised units was cost-effective compared with general medical wards or mobile stroke (inpatient) teams. Moreover, the additional cost in providing stroke units compared with general medical wards was found to be justified, given the greater health benefits in terms of delivering best practice processes of care and avoiding severe complications. When compared to general medical care costs ($12,251), costs for mobile teams were significantly higher ($15,903, p=0.024), but borderline for stroke units ($15,383, p=0.08). This was primarily explained by the greater use of specialist medical services. The incremental cost-effectiveness of stroke unit over general wards was $AUD9,867 per patient achieving thorough adherence to clinical processes and $AUD16,372 per patient with severe complications avoided, based on costs to 28 weeks. These findings generally accord with international studies, such as that conducted by Patel et al (2004a). This is the first Australian study to detail the costs and cost-effectiveness of different acute care models, and it provides important information to underpin increased investment in stroke units.

Further, other work by Moodie et al (2004) has demonstrated that when modelled over the lifetime of a cohort of first-ever stroke patients, stroke units when compared to general medical care, produced considerable gains in terms of health benefits with these additional benefits associated with additional costs. There was an additional lifetime cost of $1,288 per DALY recovered, or alternatively $20,172 per stroke averted or $13,487 per premature death averted (reference year: 1997). It was determined that the stroke unit intervention was cost-effective given the small additional costs per extra unit of benefit gained (Moodie et al, 2004).

9.2.2   Care pathways and clinical practice guidelines

The use of care pathways in stroke management is variable and evidence from systematic reviews suggest that use of care pathways may lead to a reduced length of hospital stay and reduced health care costs (Sulch et al, 2000; Kwan & Sandercock, 2004). No cost-effectiveness data for Australia has been published related to the use of care pathways. Australian authors have indicated that the benefits of using care pathways are related to greater adherence to important processes of care, such as early access to allied health, improved use of antithrombotic agents in eligible cases at discharge and estimation of blood glucose levels (Read & Levy, 2006).

To date there has only been one cost-effectiveness study for clinical guidelines in transient ischaemic attack (TIA) and atrial fibrillation (AF) (Wright et al, 2007). This UK-based study was designed to examine the cost-effectiveness of the implementation of stroke prevention guidelines for patients with either TIA or AF. The study was conducted in four districts of Bradford, Northern England, covering a population of 400,000 people. The two guidelines were implemented in primary care practices in two districts each. The practices that were trained for TIA guidelines treated 1117 patients, while the AF practices treated 873 patients. The authors extrapolated a surrogate outcome of the adherence to the guidelines to the potential impact on quality of life. Although the increase in guideline compliance was not significant for one of the TIA districts, the authors found the implementation of both guidelines to be effective and cost-effective. The incremental costs per quality adjusted life year (QALY) gained amounted to £1,540 (AF) and £1,313 (TIA), respectively (reference year: 2003). There has been one study conducted in Italy that has examined whether adherence to clinical practice guidelines influences the cost of acute stroke care. Non-compliance with guidelines was shown to be associated with increased costs (for every unit of non-compliance there was a 1.38% increase in hospital costs) (Quaglini et al, 2004). Australian evidence from the SCOPES study indicates that greater adherence to important clinical processes of care occurs more often in stroke units and there is also a reduction in severe complications, which when these measures are used as proxies of health outcome indicate that these units are more cost-effective than other care modalities (Moodie et al, 2006). In SCOPES, hospitals with stroke units that used care pathways were more likely to complete them (Cadilhac et al, 2004).

In most studies it is difficult to separate out the specific benefits of care pathways from other aspects of organised services, such as team meetings and experienced staff. Therefore, the fundamental conclusion from this review is that organised management for stroke that provides evidence-based clinical care, with or without care pathways, should be cost-effective.

9.2.3   Early supported discharge

A systematic review identified nine randomised controlled trials of early supported discharge (ESD), with seven selected for inclusion in a statistical meta-analysis of outcomes (Larsen et al, 2006). All of these studies compared ESD with standard care which was, in most cases, stroke unit care. The authors found the combined outcome 'death or institution', as well as 'referrals to nursing homes' significantly reduced with ESD. The odds ratios were 0.75 (95% CI 0.46–0.95) and 0.45 (95% CI 0.31–0.96), respectively. They also found a significantly reduced length of stay and statistically significant overall cost savings of US$140 per patient (reference year: 2005). However, one limitation was that four out of the seven studies (34% of all patients) only found a weak impact of ESD on patient functionality (<0.2). The other three studies found a strong impact (>0.8) and this may have influenced the odds ratios as these studies represented 66% of all patients. The authors of this review did not report any heterogeneity measures.

In addition to this meta-analysis, there have been three other relevant publications. In the UK trial-based study outcomes and costs of early domiciliary care were assessed compared to hospital-based care (Patel et al, 2004a). A societal perspective for costs was used based on 1997/8 prices. Mean costs for health care and social care costs over 12 months were £6840 for domiciliary care compared to £11 450 for stroke units. QALYs were less for domiciliary care when compared to stroke unit care (0.221 vs 0.297). Cost-effectiveness was calculated using incremental cost-effectiveness ratios (ICERs) for avoiding an additional 1% of deaths or institutionalisation and ranged from £496 (without informal costs) to £1033 (with highest estimate of informal costs) for stroke unit care compared with domiciliary care. Based on each additional QALY gained, the costs ranged from £64,097 to £136,609. Hence in this study, health outcomes were lower using this ESD model in comparison to inpatient stroke unit care, but ESD was found to be cheaper. A separate randomised controlled trial (RCT) of unselected hospital cases undertaken in Norway has also provided evidence that an ESD programme provided after two weeks in a stroke unit (as an alternative to inpatient rehabilitation) offered a cost neutral or cheaper option over a 12-month period. In particular, ESD was more cost-effective in cases of moderate stroke, rather than very mild or severe stroke (Fjaertoft et al, 2005).

In the most recent cost-effectiveness analysis, Saka et al (2009) looked specifically at stroke care on regular wards, stroke unit care and stroke unit care with subsequent ESD. These authors found stroke unit care with ESD to be the most cost-effective strategy and calculated incremental costs of £17,721 per additional QALY gained, when compared with stroke unit care alone (reference year: 2003).

Data specific to the Australian context was included in the Larsen et al (2006) review and warrant further discussion. Australian investigators used direct and indirect data following their own meta-analysis of ESD (seven trials, N=1277, search date March 2001) to undertake a cost-minimisation analysis (since health outcomes were found to be equivalent) from the perspective of the Australian health system (Anderson et al, 2002). Hospital costs were taken from the Australian National Hospital Cost Data for 1998/1999, domiciliary rehabilitation costs were taken from a single study of domiciliary rehabilitation care (Adelaide stroke study) (Andersen et al, 2000a; Andersen et al, 2000b) and costs related to other community services were taken from the Australian Department of Health and Family Services Report, 1996/1997. Overall mean ESD costs were found to be 15% lower than standard care ($16,016 vs $18,350). Cost estimates were based over a 12-month period and did not include any indication of set-up costs. It was highlighted that the included studies were all based in urban centres confirming the view that ESD should only be considered where appropriate resources are available to provide effective domiciliary care. A small shift of costs from the hospital sector to the primary care sector was noted (more GP visits with ESD care). However, no difference was found in the cost of routine community and outpatient services. Therefore, the authors concluded that ESD should be considered for certain sub-groups of people with stroke.

In summary, the above studies provide limited evidence regarding the cost-effectiveness of ESD in Australia. The New Zealand Reference Group are not aware of any similar New Zealand data. Nonetheless, the evidence suggests that ESD may offer an alternate option to inpatient care and produces equivalent outcomes for patients at similar or potentially reduced costs, in particular for urban settings and for patients with moderate severity strokes.

9.2.4   Community rehabilitation services[2]

Over the past few decades there has been a global organisational shift towards greater community-based (largely home-based) health service delivery for stroke. The provision of home-based rehabilitation has become an attractive health care model for patients with stroke. Advocates for community-based rehabilitation suggest many advantages including better patient satisfaction, reduction of hospital stay and savings in direct health care costs. Given the increasing demand on health services for stroke among aging populations, it is important to evaluate the cost-effectiveness and efficiency of community stroke rehabilitation.

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[2]   This section was summarised from a paper prepared by Brown & Te Ao, New Zealand (Brown & Te Ao, unpublished).

Brown & Te Ao (unpublished) at the University of Auckland have reviewed this literature and a preliminary summary of their findings are provided here. Community stroke rehabilitation was defined as care managed by a specialised team of health practitioners with a personalised approach to supporting and rehabilitating people with stroke in their communities. Home-based rehabilitation was also included. Inclusion criteria included primary studies that were an economic evaluation or cost analysis, in the English language, full articles and studies published between 1 January 1990 and 31 December 2009. The search revealed 25 published articles, including RCTs, systematic reviews and intervention studies, but only six met the inclusion criteria (Young & Forster,1993; Gladman et al, 1994; McNamee et al, 1998; Beech et al, 1999; Roderick et al, 2001; Andersson et al, 2002). These investigators reported that the findings made it difficult to draw conclusions in terms of the cost-effectiveness of community stroke rehabilitation when compared with other forms of care. Therefore, the data must be viewed with caution. Community stroke rehabilitation may appear to be less costly when compared to outpatient day hospital care. This is probably due to higher staffing levels in day hospital care. Other possible explanations for the difficulty of generalising these results could be due to inherent differences in stroke rehabilitation services. There seems to be some degree of variation in how rehabilitation care is organised between hospitals, thus varying costs of health services and health outcomes. More research into the clinical efficacy and cost implications of home-based stroke rehabilitation is needed in order to draw sound conclusions.

9.3 Specific interventions for the management of stroke

9.3.1 Intravenous thrombolysis

The use of intravenous recombinant tissue plasminogen activator (tPA) for treatment of eligible patients with acute ischaemic stroke within three hours of stroke symptom onset has been consistently demonstrated to be cost-effective. These findings have been independent of differences in included costs, modelling assumptions and the health care environments within which cost-effectiveness evaluations have been undertaken. A descriptive review of three comprehensive evaluations of tPA from the USA, Canada and the UK has been undertaken (Tseng & Chang, 2004). The authors of this review found that tPA was cost-effective in all three studies, with health benefits and cost savings over a 30-year time horizon.

The most current review of economic methods used to evaluate acute stroke therapies included economic models used to assess the cost-effectiveness of tPA. Within this review, eight out of 13 studies presented cost-effectiveness models for tPA therapy versus usual care and tPA was always found to be effective and cost-saving from a lifetime perspective (Earnshaw et al, 2009). This review included the cost-effectiveness evaluation undertaken for Australia by Moodie et al (2004). Therefore, the evidence for the cost-effectiveness of tPA therapy in acute stroke (<3 hours) remains unchanged.

In these updated clinical guidelines, it has been recommended that tPA may be used up to 4.5 hours following stroke – see section 4.1 (Thrombolysis). However, so far, there has only been one cost-effectiveness study for tPA therapy beyond the first three hours of stroke symptom onset. By using a Markov model, Sandercock et al (2004) estimated the cost-effectiveness of tPA therapy up to six hours after stroke onset compared to standard care. These authors calculated incremental costs of £13,581 per QALY gained within the first 12 months. The uncertainty analysis showed that the 5th and 95th percentiles for this cost increase were -£44,065 and £47,095, respectively. The corresponding percentiles for the gain in QALYs were -0.4020 and 1.8259 QALYs, respectively. An increase in QALYs occurred in 85.5% of all iterations. Over the lifetime perspective, tPA was found to be the dominant strategy, leading to cost savings of £96,565 per QALY gained. The 5th and 95th percentiles for the incremental cost-effectiveness ratio were -£908,153 (cost saving) and -£37,858 per QALY gained (cost saving), respectively. The probability for an increase in QALYs over the cohort lifetime was found to be 76.6%. The results were very sensitive to many of the assumptions in the model and hence the authors determined that these results may not be reliable. In another recent publication, a decision-analytic model was used to assess the cost-effectiveness of using penumbral-based MRI to select patients suitable for tPA and to reduce the likelihood of intracerebral haemorrhage (Earnshaw et al, 2009). The authors predicted that the use of penumbral-based MRI selection would be cost-effective in patients treated up to 6 hours after ischaemic stroke onset. This data provides some evidence that use of tPA beyond three hours may be worthwhile from an economic perspective; however, future research is required.

One of the major issues for using tPA is increasing access to the intervention. One method of increasing access is through technology solutions such as telemedicine, whereby specialist consultants can provide support to doctors in other locations. In a recent study from Denmark, the national use of thrombolysis via telemedicine was modelled using a Markov model (Ehlers et al, 2008). The authors calculated incremental costs of US$50,100 per incremental QALY gained (reference year: 2007). After two years, the use of telemedicine was considered to be dominant (ie, cost-saving); however, the authors did not perform any uncertainty analyses. Further research in this area is needed in considering the economic implications for Australia or New Zealand.

9.3.2   Aspirin after acute ischaemic stroke

These guidelines recommend the administration of aspirin as soon as possible after acute ischaemic stroke onset – see section 4.3 (Antithrombotic therapy).

There is, however, limited data on the cost-effectiveness of aspirin given within 48 hours of stroke. Economic modelling for Australia suggests that the treatment is cost-effective and the incremental cost/DALY lifetime benefit of treating one additional first-ever case of stroke with aspirin as an acute therapy is about $1,847 (Mihalopoulos et al, 2005). In contrast to other level I recommendations in these guidelines that have been compared using the same economic model, this result was less favourable to the

cost-effectiveness results of stroke units ($1,390), warfarin as primary and secondary prevention and intravenous tPA (these later two interventions being highly effective and cost saving). Although not cost saving, it should be noted that both stroke unit care and aspirin within 48 hours could be applied to many more patients than tPA and warfarin. Further, the stroke unit intervention represents a composite of these interventions as they are not independent and it is expected that patients treated in stroke units also receive these evidence-based therapies as required. In terms of 'value' each of these interventions would be considered highly cost-effective as they are much lower than the $30,000 to $50,000 per DALY recovered threshold expressed as representing value-for-money in the health sector.

9.3.3   Botulinum toxin A

These guidelines recommend therapy with botulinum toxin A in conjunction with rehabilitation therapy for stroke patients with persistent moderate to severe spasticity – see section 7.3 (Spasticity).

Cost-effectiveness information for this intervention is very limited. Investigators have attempted to assess the cost-effectiveness of using botulinum toxin A using a decision-analytic model approach. Ward et al (2005) examined the cost-effectiveness of botulinum toxin A and oral anti-spastic drugs in post-stroke patients with spasticity where the efficacy data was obtained from an expert Delphi panel of 14 clinicians and one physiotherapist. The authors considered botulinum toxin A to be cost-effective when compared with oral therapy. The costs for one 'successfully treated month' amounted to £942 for botulinum toxin A and to £1,697 for oral therapy (reference year: 2008). This data provides insufficient information to reliably conclude whether botulinum toxin A is cost-effective in the Australian context, and further research is needed.

9.3.4   Imaging modalities

9.3.4.1 CT and MRI in stroke

One systematic review of economic evaluations identified three studies that assessed the cost-effectiveness of CT scanning in acute stroke patients (Murtagh et al, 2006). The authors of this review concluded that immediate CT scanning (versus no CT scanning or later CT scanning) may reduce the cost of stroke care by shortening or avoiding inpatient stays. The absolute difference between scanning immediately, within 24 hours, or within 48 hours was minimal. These findings were sensitive to inpatient costs, the availability of non-hospital stroke care and the ability to effectively use saved bed-days. Although the authors' conclusions are based on the UK data from Wardlaw et al (2004), it is likely that this finding is applicable to the Australian setting.

As mentioned in the section about the cost-effectiveness of tPA, authors of a recent cost-effectiveness analysis have indicated that the combined use of CT and MRI might lead to cost-effective patient selection for intravenous thrombolysis (Earnshaw et al, 2009). The authors compared CT-based selection with CT- and MRI-based selection for tPA therapy in acute stroke patients. Eligible patients undergoing MRI were assumed to receive tPA up to six hours after stroke onset. The incremental costs per additional QALY gained were estimated to be US$1,004 (reference year: 2007). However, as the model did not use efficacy data for penumbral-based MRI selection from RCTs, further research is required to confirm the value of different imaging modalities to improve the selection of patients for tPA.

9.3.4.2 Carotid imaging

One cost-effectiveness study has provided evidence that carotid duplex ultrasound is the most efficient single examination strategy to detect high-grade carotid stenosis in symptomatic patients suitable for carotid endarterectomy (Buskens et al, 2004). This study used Markov modelling and incorporated both published data from randomised trials and data from a multicentre cohort study (n=350) performed to assess the diagnostic accuracy. The addition of magnetic resonance angiography slightly increased effectiveness but at disproportionately high costs. A different cost-effectiveness study of the assessment of carotid stenosis conducted in the UK provided evidence that non-invasive assessment of carotid stenosis, including use of ultrasound as the first or repeat test, could be used in place of intra-arterial angiography to select patients who are likely to benefit from carotid endarterectomy. However, the findings from the economic model were sensitive to the accuracy of non-invasive testing and to the cost and timing of surgery (Wardlaw et al, 2006).

In these updated guidelines there is a recommendation that there is no advantage of intra-arterial angiography over non-invasive imaging – see section 3.3.3 (Cardiac imaging). In terms of cost-effectiveness, evidence from a study shows that if either CT-angiography (CTA) or intra-arterial conventional angiography (CA) is done in addition to carotid ultrasound, CTA is the dominant strategy (Brown et al, 2008). By using a Markov model approach, the authors found that ultrasound and CTA led to more QALYs and lower costs than ultrasound and CA. However, the advantage of CTA was mainly driven by its lower costs as CA and CTA were almost equally effective. Hence, this study supports the recommendation in this guideline and highlights that there is also a cost advantage of non-invasive imaging.

These guidelines recommend further cardiac imaging in selected patients – see section 3.3.3 (Cardiac imaging). There is insufficient evidence for a cost-effective use of widespread cardiac imaging. The authors of one US study compared different strategies using transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) in patients with a first stroke or TIA (Meenan, Saha, et al 2007). Standard medical care was always dominant compared to TTE or TEE for all patients. When cardiac imaging was performed only in patients with an existing heart disease, the incremental costs for TEE came down to US$137,600 per additional QALY gained, whereas TTE led to incremental costs of US$159,800 per additional

QALY. The underlying assumption was that patients with a cardiac history have a prevalence of intracardiac thrombus of at least 5%. Although there is limited data, routine use of cardiac imaging does not appear to be cost-effective.

9.3.5 Rapid assessment clinics and management of transient ischaemic attack

So far, only one study has been published that examined the cost-effectiveness of early assessment and treatment of TIA and minor stroke (Luengo-Fernandez et al, 2009). The authors conducted a sequential, population-based study with two phases: pre-implementation and post-implementation of early assessment and management for TIA and minor stroke. The authors estimated a significant reduction in recurrent strokes and total days in hospital. The total mean costs for hospitalisation per patient decreased significantly from £1,056 to £432 with implementation of the TIA/minor stroke clinic. These authors did not report the reference year for the cost estimates. No information was given about the impact of increased costs in the community setting. This data provides insufficient information to reliably conclude whether rapid assessment clinics would be worthwhile from an economic perspective in the Australian context, and further research is needed.

9.3.6 Carer training

No further published cost-effectiveness studies could be identified since the Australian guideline (NSF, 2007b) where a recommendation was made to provide carers with tailored information and to involve them in the recovery process, if desired.

One study was identified that assessed the economic outcome of training carers (Patel et al, 2004b). Evidence was based on one RCT conducted in the UK. Costs were based at 2001 to 2002 prices and included health and other formal care costs as well as informal costs. Providing carer training during inpatient rehabilitation reduced total costs (mean saving of £4043), primarily reflecting savings due to earlier discharge from inpatient care, while also improving health outcomes. No difference in QALYs in carers were found; however, the authors suggested that this was likely to be influenced by the insensitivity of the outcome measure used (EuroQol five-dimensional questionnaire).

Since the burden of providing both formal and informal care after stroke in Australia is significant (Dewey et al, 2001), inpatient rehabilitation services in Australia should be encouraged to introduce formal carer training as part of their care. Further cost-effectiveness studies in this area are needed that include appropriate assessment of the impact on carers.

9.3.7 Stroke prevention

There are few economic evaluation studies available on secondary prevention based on Australian data for stroke. The majority of the literature related to the cost-effectiveness of prevention interventions relates to carotid surgery and pharmacological therapies, which may include stroke outcomes, but are not always stroke-specific.

9.3.7.1 Carotid endarterectomy in patients with high-grade stenosis

These guidelines recommend the use of carotid endarterectomy in patients with non-disabling carotid artery territory ischaemic stroke or TIA with ipsilateral carotid stenosis measured at 70% to 99% if surgery can be performed with low rates of perioperative mortality/morbidity. Under these conditions, carotid endarterectomy is also recommended for ischaemic stroke or TIA patients with symptomatic (50–69%) or in highly selected cases with asymptomatic (>60%) carotid stenosis – see section 5.7 (Carotid surgery).

There has been one systematic review of health economic studies that have assessed the costs and benefits of carotid endarterectomy and associated preoperative arterial imaging (Benade & Warlow, 2002). The authors of this review identified 21 studies for inclusion but only three were true cost-effectiveness studies. All three studies were set in the USA in the early 1990s and used modelling techniques incorporating data from published, randomised clinical trials. Although carotid endarterectomy was cost-effective in these evaluations, the authors of the review pointed to significant differences in the estimated costs and benefits between these studies and among the included partial economic evaluations. An important observation is that the use of trial data about peri-operative morbidity and mortality is likely to overestimate the benefits of carotid endarterectomy when applied in the real world situation. Nevertheless, it is very likely that carotid endarterectomy in recently symptomatic patients with high grade carotid stenosis is highly cost-effective when performed with low perioperative morbidity and mortality (Nussbaum et al, 1996).

In a recent cost-effectiveness model for Sweden, Henriksson et al (2008) compared best medical treatment with endarterectomy in patients with asymptomatic carotid artery stenosis. Patients were assumed to have a stenosis of at least 60% and to have had no stroke, transient cerebral ischaemia or other neurological symptoms in the past six months. The results indicate that carotid endarterectomy in asymptomatic patients can only be assumed to be cost-effective for men aged 73 years or younger. The costs of treating men aged 65 and 73 with carotid endarterectomy instead of best medical treatment resulted in incremental costs per additional QALY of €34,557 and €52,100, respectively (reference year: 2006). Treating women was never cost-effective. The incremental costs per additional QALY amounted to €311,133 for women who were aged 65 years. However, the study considered only costs and outcome of five years and did not take recurrent strokes into account.

9.3.7.2 Pharmacological therapies

Moodie (2004) has investigated the cost-effectiveness of antithrombotic **(warfarin)** treatment for people with AF as a primary and secondary prevention measure (Moodie et al, 2004). This investigator determined that 1851 DALYs could be recovered with a cost/DALY saved of $480. This finding was based on the 1997 Australian population modelled using MORUCOS, an economic model with resource utilisation data derived from the North East Melbourne Stroke Incidence Study. Authors of one published systematic review (Holloway et al, 1999) have identified three studies (Eckman et al,1992; Gage et al, 1998; Lightowlers & McGuire, 1998) assessing the cost-effectiveness of anticoagulation for primary prevention in people with AF. Warfarin was more cost-effective than aspirin for people with two or more stroke risk factors, and also for those with chronic non-valvular AF in one study. Warfarin was also found to be cost-effective for people with only one other stroke risk factor, costing US$8000 per QALY. However, warfarin use for people with no other stroke risk factors, apart from AF, was not cost-effective with costs of US$370,000 per QALY. A second study confirmed these findings. The third study found anticoagulation for AF caused by mitral stenosis to be cost-effective with costs of only US$3700 per QALY. Sorensen et al (2009) recently examined the costs of warfarin for a theoretical cohort of 1000 patients aged 70 years. They compared costs and QALYs of four different scenarios from a 'perfect warfarin' situation, where every patient received warfarin at the recommended dosage, to the most realistic situation where patients got lower dosages and were treated with warfarin and aspirin in combination or did not receive any treatment. The authors found the potential for greater health outcomes at lower costs, if more people received warfarin and if they received it within an INR of 2.0 to 3.0 (Sorensen et al, 2009). The total health gain for the model cohort amounted to 7.21 QALYs at costs of US$68,039 in the 'perfect warfarin' scenario. The most realistic scenario led to 6.67 QALYs at costs of US$87,248. The results indicated that there was potential for more health gains and cost savings if warfarin was given more often and if treatment resulted in a therapeutic INR. However, Sorensen et al (2009) had to use observational assessments for the relationship between INR distributions and stroke, as there was no evidence from any randomised trials available.

These guidelines recommend **blood pressure lowering therapy** for all patients after stroke or TIA, irrespective of their initial blood pressure. For pharmacotherapy, angiotensin-converting enzyme (ACE) inhibitors alone or in combination with a diuretic are recommended – see section 5.3 (Blood pressure lowering).

Two studies could be identified, comprising cost-effectiveness figures of ACE inhibitors in stroke prevention. Economic benefits of a specific blood pressure medication **(ramipril)** for people at high risk of heart disease and stroke has been studied (Smith, Neville et al, 2003). This Australian study reported a potential reduction of 9,188 strokes over five years. The incremental cost-effectiveness result, estimated as a cost per life-year saved, was $17,214 based on a combined cardiovascular death endpoint.

Authors of a UK-based study used data from the PROGRESS study to estimate the cost-effectiveness of **perindopril**-based blood pressure lowering for patients who had suffered a stroke or a TIA (PCG, 2001; Tavakoli et al, 2009). Although the model did only include costs that were associated with hospitalisation, the authors found perindopril to be cost-effective when compared with standard care, and calculated incremental costs of £6,927 per additional QALY gained (reference year: 2005).

Nine international studies were identified that assessed the cost-effectiveness of **antiplatelet therapy** in secondary stroke prevention. Two studies compared a combination of **dipyridamole plus aspirin** to **aspirin** alone (Chambers et al, 1999; Marissal et al, 2004). One study compared **clopidogrel** to aspirin (Schleinitz et al, 2004). The other six studies compared all three therapy options (Sarasin et al, 2000; Shah & Gondek, 2000; Jones et al, 2004; Matchar et al, 2005; Heeg et al, 2007; Malinina et al, 2007). The studies predicted costs in the UK, USA and France over a period of one year, two years, five years or over a lifetime. The combination therapy of dipyridamole plus aspirin was found to be cost-effective compared with aspirin alone in seven studies. In one study, this strategy seemed to be more cost-effective than aspirin alone, but based on statistical considerations, the simulations were not robust enough to make a reliable conclusion. There was conflicting evidence for the cost-effectiveness of clopidogrel. In five studies, the authors reported that using clopidogrel was not cost-effective (Shah & Gondek, 2000; Jones et al, 2004). In the two other studies, the authors found that clopidogrel was cost-effective and reported ICERs of US$31,200 and US$26,580 per QALY saved (Sarasin et al, 2000; Schleinitz et al, 2004). In summary, there is mixed cost-effectiveness evidence about different antiplatelet therapy agents for secondary stroke prevention. The use of dipyridamole plus aspirin appears to have the most consistent economic evidence, but a systematic review of this data would be beneficial.

An economic model based on data obtained in the Heart Protection Study has provided evidence that cholesterol lowering using **simvastatin** 40 mg daily is cost-effective, not only among the population of patients enrolled in this trial (aged 40–80 years with coronary disease, other occlusive arterial disease or diabetes) but also for people with an annual risk of major vascular events of 1% or more, independent of the age of commencement of statin treatment (Heart Protection Study Collaborative, 2006). Cost-effectiveness estimates remained favourable when proprietary (£29.69) versus generic simvastatin (£4.87) prices were assumed. Simvastatin treatment was cost saving or cost less than £2,500 per life year gained across the range of scenarios assessed (Heart Protection Study Collaborative, 2006).

9.3.7.3 Lifestyle (non-pharmacological) prevention interventions

Cost-effectiveness studies undertaken for lifestyle changes are limited in that they have not been undertaken for stroke specifically and most consider primary prevention measures. Only two new studies (Lowensteyn et al, 2000; Annemans et al, 2007) since the 2007 NSF guidelines publication were found (NSF, 2007b) and these were not specific to stroke or based on Australian data. Moreover, these studies did not alter the conclusions from the previous information presented. In the available studies, smoking cessation has been reported to cost between £270 and £1500 per QALY saved depending on the intervention (eg, advice from GP or nicotine replacement strategies) (Ebrahim, 2000). The use of quit lines or telephone counselling are also cost-effective (Tomson et al, 2004; Shearer & Shanahan, 2006). One large systematic review identified only five economic evaluations for lifestyle interventions (eg, dietary modifications and/or exercise) aimed at reducing obesity in those with diabetes (Avenell et al, 2004). Such interventions were found to be cost-effective when viewed over a five-year or longer period. One study in the UK suggested the costs saved far outweighed the costs spent on exercise in those aged over 45 years (Nicholl, 1994). There have also been several studies reporting the cost-effectiveness of physical activity counselling or activities, highlighting that interventions can offer value-for-money over usual care for sedentary adults (Sevick et al, 2000; Elley et al, 2004; Dalziel et al, 2006; Lowensteyn et al, 2000; Annemans et al, 2007). Clearly, stroke-specific studies are needed to assess the potential cost-effectiveness of lifestyle change interventions as well as other prevention interventions.

Several other authors have also highlighted the usefulness of multiple risk assessment models for improving the effectiveness and/or efficiency of treatment to prevent cardiovascular disease (Pignone & Mulrow, 2001; Pocock et al, 2001; Murray et al, 2003; Sesso et al, 2003; Marshall, 2005; Manuel et al, 2006). This is prefaced on the fact that risk factors are continuous and arbitrary cut-points for treatment do not discriminate well between those who will and will not have an event. Murray et al (2003) showed that combination pharmacological treatment for people with a 35% risk of a cardiovascular event over 10 years was cost-effective and would result in the recovery of 63 million DALYs worldwide (Murray et al, 2003) There has been one recent comparative evaluation of five international guidelines from English-speaking countries including Australia using the treatment recommendations within these guidelines and modelled for 'best practice'. It was reported that the cost per cardiovascular event prevented was lowest in older patients and very high in those aged less than 35 years. It was also expressed that clinical practice guidelines that used 'absolute risk' criteria as the principal determinant of treatment, were more cost-effective than those recommending management for thresholds of single risk factors (Marshall, 2005). In consideration of risk assessment, all persons who have experienced a stroke or TIA would be considered at high risk of another vascular event. Therefore, use of antiplatelet therapy, cholesterol lowering and BP lowering in eligible high-risk patients could be considered cost-effective.

9.4 Conclusions

In conclusion, there is good cost-effectiveness evidence for the most clinically effective stroke prevention and treatment strategies recommended in this clinical guideline. In particular, stroke unit care, thrombolysis, blood pressure lowering, warfarin for AF, aspirin for stroke prevention and carotid endarterectomy were all determined to be worthwhile from an economic perspective. The findings for intravenous thrombolysis with tPA administered within three hours in acute ischaemic stroke patients were consistently found to be cost-saving from a lifetime perspective. However, there is limited evidence for the cost-effectiveness of tPA used up to 4.5 hours and further research is needed. There is sufficient evidence for the cost-effectiveness of antithrombotic therapy with dipyridamole plus aspirin compared to aspirin alone in secondary stroke prevention. There is also sufficient evidence for blood pressure lowering with ACE inhibitors in all stroke and TIA patients, as recommended by these guidelines. This review also allowed us to identify a range of areas where additional cost-effectiveness studies would compliment health outcome data including an assessment of home-based stroke rehabilitation, rapid assessment clinics for TIA, carer training, the use of botulinum toxin A for stroke patients with persistent moderate to severe spasticity and imaging modalities for selecting patients for intravenous thrombolysis.

One major factor that may influence the economic implications of interventions found to be cost-effective is access and population coverage. In a recent modelling exercise in the Australian setting, it was found that more widely accessible, evidence-based stroke care could produce substantial economic and health-related benefits and would require only modest investment. The authors suggested that **if there was improved access of eligible stroke patients to effective acute care (stroke units and intravenous thrombolysis) and secondary prevention (BP lowering, warfarin for AF, aspirin in ischaemic stroke and carotid endarterectomy), as well as improved management of blood pressure and AF as primary prevention in the Australian population, then about $1.06 billion could be recovered as potential cost offsets with recovery of more than 85,000 DALYs** (Cadilhac et al, 2007).

Therefore, clinical guidelines such as these which promote improved treatment and prevention of stroke are an important contribution to achieving such increased access and the cost-effective use of health resources.

Chapter 10: Priorities for research

The guidelines reflect the current evidence base and its limitations. For some interventions, there is good evidence for or against their use; however, many other interventions in current use are not discussed because there is neither good quality evidence on their effectiveness, nor sufficient consensus in the field concerning their potential benefits. The substantial gaps in the evidence base highlight the need for practitioners to build quality research studies into their clinical practice.

Since the previous guidelines there has been an increase in the amount of research for different medical aspects (eg, antiplatelet agents for secondary prevention, thrombolysis, acute blood pressure intervention, TIA management). There has also been a great amount of rehabilitation research at the impairment and activity level (eg, strength, walking, upper limb, contracture) and secondary complications (eg, contracture, cardiorespiratory fitness, spasticity). However, further research is required at the participation level as clearly this impacts on the quality of life of people with stroke and their families/carers.

Areas in which research is particularly needed, where there was deemed by the New Zealand Reference Group to be limited current activity include (but are not limited to):

Improving health gain, reducing inequalities and disparities

- Access to, quality of process and outcomes of stroke care for Māori.
- Access to, quality of process and outcomes of stroke care for Pacific peoples.

Organisation and effectiveness of care

- Components of stroke units, eg, inpatient stroke care coordinator, organisation of nursing care.
- Monitoring of effectiveness of care, including reviewing of patient experiences.
- Pre-discharge needs assessment (including home visits).
- Post-discharge follow-up services.
- Stroke rehabilitation and community support services for patients aged under 65 years.
- Implementation strategies for proven evidence-based rehabilitation stroke care for environmental enrichment.
- Optimum organisation of care for people with TIA.
- Comparison of the cost-effectiveness of treatments for spasticity including therapy, splinting, botulinum toxin A, and interdisciplinary clinics.

Reducing the severity of stroke

- Effective neuroprotection.
- Thrombolysis access for rural centres.

Better diagnosis and management

- Assessment/screening of people with TIA using the ABCD^2 tool.
- Management of patent foramen ovale.
- Mood (screening, prevention and management).
- Cognitive and perceptual difficulties (screening, assessment and management).

Improving management of the consequences of stroke

- Bladder and bowel management (particularly in the acute phase).
- Management of hyperglycaemia.
- Management of intracerebral haemorrhage.
- Recognition and management of fatigue.
- Prevention and management of shoulder pain.
- Prevention and management of contracture.
- Management of central post-stroke pain.
- Management of agnosia.
- Management of apraxia (motor and speech).
- Management of dysarthria.
- Hospital (acute) falls prevention.

Further development of rehabilitation strategies

- Intensity and timing of rehabilitation (allied health and nursing interventions).
- Upper limb activity (particularly application of 'robotics' or ways to organise increased practice, bilateral interventions, repetitive transcranial magnetic stimulation, and mirror therapy).
- Virtual reality training for upper and lower limbs.
- Neuromuscular electrical stimulation for dysphagia.
- Repetitive transcranial magnetic stimulation for dysphagia, and upper limb recovery.

Quality of life for people with stroke

- Self-management strategies specific to stroke.
- Peer support interventions.
- Driving assessment and training.
- Interventions for returning to work.
- Long-term therapy needs for working-age people with stroke.
- Intimacy.
- Respite care.
- Support of carers.

Appendices, Glossary, Abbreviations, References

Appendix 1: Contributors and terms of reference

Background

The Stroke Foundation of New Zealand (SFNZ), funded by the Ministry of Health, partnered with the National Stroke Foundation of Australia (NSF) and the New Zealand Guidelines Group (NZGG) to develop a new acute and post-acute stroke guideline for New Zealand. It would replace *Life after Stroke: New Zealand guideline for management of stroke* published by SFNZ in 2003.

An Australasian Expert Working Group formed by NSF mid-2009 was well underway in their work to update and amalgamate the Australian *Clinical Guidelines for Acute Stroke Management* (NSF, 2007b) and *Clinical Guidelines for Stroke Rehabilitation and Recovery* (NSF, 2005) at the time that a New Zealand Reference Group was established in late 2009.

The Reference Group's brief was to work with Māori and Pacific sub-groups and NZGG support to:

- review the draft Australian recommendations and evidence summaries for relevance and completeness, adopting and adapting them as appropriate to the New Zealand situation

- identify research questions specific to New Zealand, review related-evidence summaries and formulate recommendations to address these questions.

Contributors to the draft Australian guideline on which the New Zealand guideline is based are therefore significant contributors to the New Zealand guideline, and they are also identified and acknowledged.

New Zealand

Reference Group members were invited by SFNZ or nominated by the Ministry of Health to ensure a comprehensive representation of expert clinical perspectives (acute and post-acute), and also consumer, health management and health economics perspectives. Five members had been involved in the development team for the 2003 New Zealand guideline. Two sub-groups, the Māori Advisory Rōpu in Stroke (MARiS) and Pacific Peoples Sub-group were to provide dedicated Māori and Pacific chapters for the guidelines. The sub-groups' Chairs were Reference Group members, which enabled an iterative process of critique and reflection from Māori and Pacific perspectives between the main group and sub-groups. Work in all the groups was to comply with strict guidelines methodology as directed by NZGG. Coordination and research support was provided by SFNZ and NZGG.

Reference Group members completed and signed a declaration of potential conflicts of interest. Most had no perceived conflicts of interest. The reasons for potential conflicts primarily involved receiving money from non-commercial and commercial organisations, specifically for undertaking clinical research. This was expected given the expertise of members in clinical research. No member had received financial support from commercial companies for consultancy or lecturing.

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Australia

The Clinical Guidelines for Stroke Management 2010 were developed by the NSF according to processes prescribed by the National Health and Medical Research Council (NHMRC) under the direction of an interdisciplinary Expert Working Group. An independent Advisory Committee (or Governance Committee) oversaw the process of guideline development on behalf of the Department of Health and Ageing (DOHA).

The Expert Working Group's process adhered to recognised international guidelines methodology with the expectation of the final Australian guideline receiving approval from Australia's NHMRC.

The interdisciplinary Expert Working Group was established in May 2009 following an invitation from the NSF to previous guideline working group members and to the following professional organisations involved in the management of stroke:

- Australasian College for Emergency Medicine
- Australasian Faculty of Rehabilitation Medicine
- Australian and New Zealand Society for Geriatric Medicine
- Australian Association of Neurologists
- Australian Association of Social Workers
- Australian College of Rural and Remote Medicine
- Australian Physiotherapy Association
- Council of Ambulance Authorities
- Dietitians Association of Australia
- Occupational Therapy Australia
- Royal Australian and New Zealand College of Psychiatrists
- Royal Australian and New Zealand College of Radiologists
- Royal Australian College of General Practitioners
- Royal College of Nursing Australia
- Society of Hospital Pharmacists of Australia
- Speech Pathology Australia.

The members of the Expert Working Group assisted in:

- reviewing the framework of existing guidelines
- determining the clinical questions for guidelines update
- identifying, reviewing and classifying relevant literature
- developing the draft clinical guidelines
- evaluating and responding to feedback from the consultation process
- developing a plan for communication, dissemination and implementation
- developing recommendations for periodically updating the guidelines.

All members of the Expert Working Group completed and signed a declaration of potential conflicts of interest. Members also declared any potential conflicts at the beginning of each meeting throughout the development process. Most had no perceived conflicts. The reasons for potential conflicts primarily involved receiving money from non-commercial and commercial organisations specifically for undertaking clinical research. This was expected given the expertise of members in clinical research. Only a small number of members had received financial support from commercial companies for consultancy or lecturing.

The Expert Working Group has collaborated with individuals and formal and informal groups from around Australia and overseas. Professor Alan Barber from Auckland has provided New Zealand representation to the Australian Expert Working Group from its inception, in addition to his role as a member of the New Zealand Reference Group.

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Assoc Prof Julie Bernhardt (Co-chair)	Physiotherapist, National Stroke Research Institute
Dr Geoff Boddice	Neuropsychologist, University of Queensland
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Prof Maria Crotty	Rehabilitation Specialist, Repatriation General Hospital
Prof Tricia Desmond	Neuroradiologist, Royal Melbourne Hospital
Ms Cindy Dilworth	Speech Pathologist, Royal Brisbane Hospital
Dr Steven Faux	Rehabilitation Physician, St Vincent's Hospital, Sydney
Prof Jonathan Golledge	Vascular Surgeon, Townsville Hospital
Dr Louise Gustafsson	Occupational Therapist, University of Queensland
Dr Hugh Grantham	Medical Director, SA Ambulance Service
Dr Deborah Hersh	Speech Pathologist, Australian Aphasia Association
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Additional expertise and significant input was gratefully received from:

| **Ms Julie Egan** | Science Communicator; independent consultant who undertook the medical editing of the guidelines |
| **Ms Anne Parkhill** | Information Manager, Aptly; independent consultant who carried out the systematic database searches |

The NSF is also very grateful for the expertise and input of the following people who collaboratively reviewed and developed chapter 9 'Cost and socioeconomic implications':

Dr Paul Brown	Health Systems and Centre for Health Services Research and Policy, University of Auckland
Assoc Prof Helen Dewey	Neurologist and Associate Director, National Stroke Research Institute and the Austin Hospital
Mr Tristan Gloede	Student, Health Economics, National Stroke Research Institute

Additional people who kindly contributed to the guideline development process during the appraisal and drafting process included:

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Appendix 2: Guideline development process report

Overview

The Ministry of Health (Ministry of Health) sought a provider for a comprehensive revision and update of the 2003 best practice evidence-based guideline *Life after stroke: New Zealand guideline for management of stroke.*

The Stroke Foundation of New Zealand (SFNZ) proposed a partnership with the National Stroke Foundation of Australia (NSF) and the New Zealand Guidelines Group (NZGG), enabling their respective experience, expertise and perspectives to be brought to this exercise through a New Zealand-based Stroke Guidelines Reference Group.

New Zealand Reference Group members were invited by SFNZ or suggested by the Ministry of Health to ensure a comprehensive representation of expert clinical perspectives (acute and post-acute), and also consumer, health management and health economics perspectives. Five members had been involved in the development team for the 2003 New Zealand guideline. Two sub-groups, the Māori Advisory Rōpu in Stroke (MARiS) and Pacific Peoples, were chaired by Reference Group members to provide an iterative process of critique and reflection from Māori and Pacific perspectives, along with dedicated Māori and Pacific chapters in the guidelines.

The Reference Group's brief was to:

- review the draft Australian recommendations and evidence summaries for relevance and completeness, adopting and adapting them as appropriate to the New Zealand situation

- identify researchable questions specific to New Zealand, review related evidence summaries and formulate recommendations to address these questions.

Additional research was to focus on topics unique to New Zealand, and thus expected to address disparities and inequalities for Māori and Pacific peoples, and implementation issues.

The partnership with NSF was to enable evidence-based recommendations developed for an Australian guideline to form the major part of the New Zealand guideline. New Zealand clinicians had been involved in NSF's development process through an Australasian Expert Working Group, and the Reference Group's consideration and critique of the draft NSF recommendations and evidence summaries was welcomed by the Expert Working Group. Given the process that the Expert Working Group was following, it was assumed that evidence-based recommendations for clinical

management of people with stroke would not differ significantly between Australian and New Zealand other than in relation to differences in the structure of service provision. The development process in Australia and New Zealand are reported separately below, but it should be understood that timelines overlapped, with the New Zealand Reference Group completing its review of draft Australian material at the time of the Australia consultation phase.

Guideline development process undertaken by Australasian Expert Working Group

The Australasian Expert Working Group's process adhered to recognised international guidelines methodology with the expectation of the final Australian guideline receiving approval from Australia's National Health and Medical Research Council (NHMRC).

Question formulation

Clinical questions used for previous Australian guidelines were initially reviewed and duplication removed. A draft set of questions was developed by the NSF project team and circulated to the Expert Working Group. One hundred and thirty four (134) clinical questions were agreed by the Expert Working Group to address interventions relevant to stroke care. The questions generally queried the effects of a specific intervention and were developed in three parts: the intervention, the population and the outcomes. An example is 'What is the effect of anticonvulsant therapy on reducing seizures in people with post-stroke seizures?'. In this example, anticonvulsant therapy is the intervention, reduction of post-stroke seizures is the outcome, and the population is people with post-stroke seizures. The list of questions used by NSF is available from the Guidelines Project Coordinator, SFNZ.

Finding relevant studies

Systematic identification of relevant studies was conducted between May and August 2009. An external consultant undertook all the electronic database searches. EMBASE, Medline and Cochrane databases were used for all questions. CINAHL and Psychinfo databases were searched where relevant (eg, questions relating to rehabilitation, discharge planning or long-term recovery). The PEDro database was used by the NSF project team to check studies related to physical therapy. A second updated search of the literature up to 19 February 2010 using Medline and EMBASE databases was conducted. Updated Cochrane reviews were also searched and included.

Where the questions were the same as those used in the previous acute management guidelines (2007), the literature was searched from the beginning of 2007. Where the questions were the same as those used in the previous rehabilitation guidelines (2005), the literature was searched from the beginning of 2005. For topics not previously addressed, searches were carried out from 1966 onwards.

Searching of Embase, Medline and Cochrane libraries was conducted in four broad steps.

1. Terms for the patient group were abridged from the Cochrane Collaboration's Stroke Group.

2. A second search term specific to the particular question (ie, specific terms relevant to an intervention or assessment) was added.

3. Relevant evidence filters (Cochrane sensitive filter or Medline diagnostic filter) were applied.

4. If the search was for an update to an authoritative meta-analysis (NSF or other), it was limited to the years after the relevant document was published.

Search strategies are available from the NSF. Table A outlines the number of articles found for each of the nine broad topic areas.

Table A: Results of database search for selected studies

Topic outline (number of questions)	Cochrane Library	Embase	Medline	CINAHL	Psych Info
1. Organisation of services (22)	418	5631	4059	403	
2. Pre-hospital care (6)		747	594		
3. Early assessment and diagnosis (9)		4702	3569		
4. Acute medical and surgical management (12)		3924	1991		
5. Assessment and management of the consequences of stroke (50)		6041	4623	632	340
6. Prevention and management of complications (10)		905	463		
7. Secondary prevention (4)	373	2013	1232		
8. Discharge planning and transfer of care (8)		463	275	26	
9. Community reintegration and long-term recovery (13)		2076	2013	565	

A total of 39,930 potential articles were identified up until August 2009 and an additional 7337 at February 2010. Reference lists of identified articles and other guidelines were then used to identify further studies. Existing international guidelines identified and used included those published by the Scottish Intercollegiate Guidelines Network (SIGN), the National Institute of Clinical Excellence (NICE), the Royal College of Physicians (London, UK), the Canadian Stroke Network and the Heart and Stroke Foundation of Canada, the American Heart/Stroke Association and the European Stroke Organisation. Correspondence with SIGN identified overlapping topics that had recently been systematically searched by SIGN and hence this information was kindly provided and used for several rehabilitation-related topics. A number of key journals were also searched by hand from October 2009 to March 2010: *Stroke*,

Cerebrovascular Disease, *Lancet* (and *Lancet Neurology*) and *Archives of Physical Medicine and Rehabilitation*. Further, an internet search was undertaken (using the 'Google' search engine). Finally, where possible, experts in the field were contacted to review the identified studies and suggest other new studies not yet identified.

One reviewer initially scanned the titles and available abstracts of all studies identified by the searches and excluded any clearly irrelevant studies. Based on the titles and abstracts of the remaining studies, two reviewers assessed and selected potentially eligible studies using the following inclusion criteria.

- Type of study. Relevant systematic reviews were first identified. Where no systematic review was found, RCTs were searched. If there was a scarcity of Level I or Level II evidence, the search was expanded to consider lower levels of evidence.

- Type of participant. Initially only studies which included adults (>18 years) with stroke or TIA were included. Studies in other related populations (eg, general elderly population or those with traumatic brain injury) were then included if the particular intervention was deemed to be transferable to those with stroke.

- Language. Only studies published in English were used.

Disagreements on inclusion of particular studies were resolved by consensus. If necessary a relevant member of the Expert Working Group provided a third and final vote.

In addition to the initial searches, economic literature was searched via the Australian Medical Index, Econlit, Embase, Medline, Health Technology Assessment, and NHS Economic Evaluation Databases. Searches were carried out from the beginning of 2005 to identify papers published after the rehabilitation guidelines (2005). A total of 1175 references were retrieved after de-duplication (Table B). One person initially reviewed all references and selected 44 potentially relevant articles. These abstracts were scrutinised by two people and 35 appropriate papers were retrieved and reviewed.

Table B: Results of database search for economic studies

Electronic database	References retrieved
Australasian Medical Index	41
Econlit	83
EMBASE	681
Health Technology Assessment database	2
Medline	337
NHS Economic Evaluation database	31

Appraising the selected studies

A standardised appraisal process was used based on forms that were adapted from the Guidelines International Network (G-I-N) and SIGN. Where available, appraisals already undertaken by SIGN for the rehabilitation section were used to avoid duplication. The standardised appraisal form assesses the level of evidence (design and issues of quality), size of effect, relevance, applicability (benefits/harms) and generalisability of studies. Examples of completed checklists can be obtained from the NSF. Evidence for diagnostic and prognostic studies was also appraised using the SIGN methodology.

Summarising and synthesising the evidence

Details of relevant studies were summarised in evidence tables, which form a supplement to *Clinical Guidelines for Stroke Management 2010.* Both the supplement and guidelines can be downloaded from the NSF website at: www.strokefoundation.com.au.

To assist in the formulation of recommendations for each question, the NMHRC Grades process (2008–2010) was applied. No pooling of data or meta-analysis was undertaken during the evidence synthesis process. For each question, the NSF project team developed a draft recommendation based on the NHMRC matrix (Table C). These recommendations were subsequently discussed and agreed on by the Expert Working Group. Final decisions were made by informal group processes after open discussion facilitated by the co-chairs. The body of evidence assessment and recommendation grading matrix (Table C) was used to guide the strength or grade of the recommendation (Table D).

Table C: NHMRC body of evidence assessment matrix and recommendation grading

Component	A	B	C	D
	Excellent	**Good**	**Satisfactory**	**Poor**
Volume of evidence	Several Level I or II studies with low risk of bias	One or two Level II studies with low risk of bias or a SR/multiple Level III studies with low risk of bias	Level III studies with low risk of bias, or Level I or II studies with moderate risk of bias	Level IV studies, or Level I to III studies with high risk of bias
Consistency	All studies consistent	Most studies consistent and inconsistency may be explained	Some inconsistency reflecting genuine uncertainty around clinical question	Evidence is inconsistent
Clinical impact	Very large	Substantial	Moderate	Slight or restricted
Generalisability	Population/s studied in body of evidence are the same as the target population for the guidelines	Population/s studied in the body of evidence are similar to the target population for the guidelines	Population/s studied in body of evidence different to target population for the guidelines but it is clinically sensible to apply this evidence to target population	Population/s studied in body of evidence different to target population and hard to judge whether it is sensible to generalise to target population
Applicability	Directly applicable to Australian health care context	Applicable to Australian health care context with few caveats	Probably applicable to Australian health care context with some caveats	Not applicable to Australian health care context

Table D: NHMRC draft grade of recommendation matrix

Grade	Description
A	Body of evidence can be trusted to guide practice
B	Body of evidence can be trusted to guide practice in most situations
C	Body of evidence provides some support for recommendation(s), but care should be taken in its application
D	Body of evidence is weak and recommendation must be applied with caution
Good practice points (GPP)	Consensus-based recommendations

Consultation

Public consultation about the draft document was undertaken over one month from February to March 2010. A specific feedback form was circulated via the Australian Stroke Coalition and members of the Expert Working Group and Advisory Group to relevant professional bodies, stroke clinical networks, consumers and consumer organisations. A public notice was published in *The Australian* newspaper (1 February 2010) in line with NHMRC requirements. The draft document was also posted on the NSF website.

Over 460 individual comments covering a wide range of topics were received from 77 individuals, groups or organisations. Feedback received was initially considered by the NSF project team with minor amendments such as formatting or spelling reviewed and actioned. Other feedback was forwarded to relevant members of the Expert Working Group depending on topic areas and suggested responses developed. All comments and suggested responses were collated and circulated to the full Expert Working Group for consideration and discussion, with several topics being further discussed during subsequent teleconferences. Informal consensus processes were used to modify any recommendations.

A significant number of the comments received during consultation related to the structure of the document, the size of some of the chapters and the ambiguity of some the recommendations. As a result of the feedback, significant structural changes to the order of contents of the guidelines were made. Other minor rewording and reformatting were also carried out. The sequencing of the recommendations was also reviewed and modified where appropriate.

Several topics received significantly more feedback than others and the Expert Working Group's responses are listed below:

- acute blood pressure therapy: recommendation specific to intracerebral haemorrhage added
- behavioural management: further section added to expand this information
- cognitive communication deficits: further section added to expand this information
- contracture: revision of preamble regarding prolonged stretches and relevant recommendation
- loss of sensation: revision of preamble and recommendations
- neurointervention: rewording of recommendation regarding mechanical retrieval devices
- spasticity: revision of preamble
- TIA management: revision of both organisational and clinical management preambles and minor changes to recommendations.

Minor changes were also made to aphasia, cognition, incontinence, thrombolysis and dysphagia. For other topics, apart from a change in order and minor wording changes, none of the recommendations were significantly changed after feedback from consultation.

Five questions, modified from key questions included in the Guidelines Implementability Tool, were also included in the consultation feedback form to provide general feedback. This feedback was used by the NSF project team when reviewing and updating the draft document. Recommendations that were unclear or ambiguous were reworded. A medical editor also reviewed the guidelines to ensure that there was consistency in the language used and the presentation of the evidence.

A letter of reply outlining the Expert Working Group's responses was sent to all individuals and organisations who provided feedback during the public consultation period. A list of individuals, groups or organisations who provided feedback during the consultation process can be obtained from the NSF.

The updated guideline document underwent one final round of peer review by international experts in the field of stroke and guideline development.

Guideline development process undertaken by New Zealand Reference Group

The terms of reference, project plan and New Zealand Reference Group membership were supplied to Ministry of Health in late 2009. The Reference Group, chaired by Dr John Fink, had two broad tasks:

1. to review the draft output (recommendations and evidence summaries) of the Australasian Expert Working Group towards development of a revised Australian guideline, for relevance and completeness, adopting and adapting them as appropriate for New Zealand implementation

2. to identify researchable questions specific to New Zealand, review related evidence summaries and formulate recommendations to address these questions.

Further, the New Zealand guideline was to address issues related to inequalities and disparities in stroke. Its process was to work with Māori and Pacific sub-groups and NZGG support to ensure completion of the above tasks. The two sub-groups, the Māori Advisory Rōpu in Stroke (MARiS) and Pacific Peoples, were chaired by Reference Group members to provide an iterative process of critique and reflection from Māori and Pacific perspectives, along with dedicated Māori and Pacific chapters in the guidelines.

The New Zealand Reference Group's work, and the work of the Māori and Pacific Peoples sub-groups, was to comply with strict guidelines methodology as directed by NZGG. The Reference Group was to hold two face-to-face meetings, in which NZGG training matched to the agenda tasks was to be delivered. It was expected that work would also be done in specialty groups, by email and teleconference.

Key members of the Reference Group and support team attended the Expert Working Group's face-to-face meeting in Sydney in October 2009, as follows:

- Professor P Alan Barber, consultant neurologist (New Zealand representative to the Expert Working Group)

- Dr Paul Brown, health economist

- Dr H Carl Hanger, consultant physician/geriatrician

- Shelley Jones, project coordinator

- Meagan Stephenson, NZGG researcher.

The Reference Group was asked for a 'rapid response' as to completeness of the Expert Working Group's researched questions and draft recommendations to inform the New Zealand clinicians' contributions to the meeting. The partnering project teams clarified that the Expert Working Group's output is more realistically considered an Australian guideline (with New Zealand input) than an Australasian guideline, and that the New Zealand guideline has the Australian guideline as its basis for adaptation and addition to fit the New Zealand situation.

Adaptation of Australian draft guideline

Review of recommendations and evidence summaries provided by the Expert Working Group was undertaken against the most recent drafts available in late 2009 and early 2010. Individual comment was sought and collated prior to consideration in a line-by-line review undertaken (as time permitted) at each of two face-to-face meetings held in December 2009 and March 2010 in Wellington. Further work was completed in smaller groups by email and teleconference. New Zealand Reference Group members focused on their areas of expertise, but given the interdisciplinary nature of stroke care, the material was in large part reviewed by all members.

The review process was completed at the end of March, resulting in a final draft of New Zealand recommendations adapted from the Australian draft. This document was welcomed by NSF as a form of peer review, as it detailed the rationale for changes where the New Zealand Reference Group identified further evidence or arrived at a different interpretation of evidence. The document also gave a rationale for any changes to the Australian draft related to style where the Reference Group had deemed such a change sufficiently important by consensus.

However, the recommendations common to Australian and New Zealand guidelines conform very closely in most cases.

Development of recommendations specific to New Zealand

Provision was made for the development of a number of questions to be researched in order to address inequalities and disparities in stroke care and outcomes in New Zealand. The Māori and Pacific Peoples sub-groups were to lead the Reference Group's decision-making in these areas by way of briefings by their respective Chairs to the face-to-face meetings on disparities in stroke outcomes and cultural differences in the experience of stroke and stroke care. These two sub-groups also contributed cultural perspectives in the process of adapting the Australian drafts.

Reference Group members were asked for an initial response as to gaps and areas to address in New Zealand-specific research as part of their 'rapid response' to the Expert Working Group's researched questions and draft recommendations. Discussion at the first face-to-face meeting on researchable questions was based on the following briefings:

- overview of findings in ARCOS[3] and the recent Australian and New Zealand stroke audits (Alan Barber)

- inequalities/disparities, issues in service provision (Vivian Blake and Paul Brown)

- Māori Advisory Rōpu in Stroke (Matire Harwood)

- Pacific Peoples Sub-group (Debbie Ryan).

Six questions were drafted and subsequently refined by NZGG researchers for further scrutiny by Reference Group members via email, as follows:

1. In the general population/for Māori/for Pacific peoples, what is the effect of public awareness/education programmes for early recognition of stroke on:
    a) recognition and awareness of stroke
    b) time of presentation to hospital.

2. In people with stroke, what effect does access to resources (family resources, financial situation, social deprivation, access to transport) have on patient discharge and recovery outcomes?

3. What is the economic cost of stroke in people of working age?

4. What is the effect of carer-support interventions on carer outcomes (anxiety, depression, wellbeing, mortality) among:
    a) carers of people with stroke
    b) Māori and Pacific people who care for people with chronic conditions or chronic disabilities.

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[3] Auckland Regional Community Stroke Study 2002 to 2003. See:
http://www.ctru.auckland.ac.nz/index.php/research-programmes/cardiovascular/154

5.   In patients with primary intracerebral haemorrhage, is restarting antiplatelet or antithrombotic therapy safe:

   a)   with mechanical heart valves

   b)   in atrial fibrillation (AF)

   c)   with past vascular disease (ischaemic stroke or ischaemic heart disease).

6.   In patients with AF taking warfarin for stroke prevention, what is the effect of home-monitoring of anticoagulation compared to GP-based/lab-based monitoring on serious adverse events (stroke of any kind, serious bleeding events [extracranial haemorrhage])?

For brevity, search strategies are not detailed here but are available from the Guidelines Project Coordinator, SFNZ. Evidence reviewed included relevant studies focusing on interventions to reduce disparities within populations, grey literature and reports published within New Zealand.

The following databases were searched: Cochrane Database of Systematic Reviews, DARE, HTA Database, CCTR, International Network of Agencies for Health Technology Assessment (INAHTA), Medline, Embase, CINAHL, Web of Science (citation searching), National Guideline Clearing House, G-I-N, CMA InfoBase, National Health and Medical Research Council (NHMRC) – Australia, SIGN, TRiP. New Zealand specific material was searched using the following sources: INNZ, Knowledge Basket, Te Puna, Australasian Digital Theses, KRIS (Kiwi Research Information Service), DigitalNZ.

Table E outlines the number of articles found for each of the six questions.

Table E: Results of database search for New Zealand-specific research

Question topic	References identified
1. Public awareness/education programmes	1152
2. Access to resources	870
3. Economic cost of stroke in working age	611
4. Carer support interventions	395
5. Restarting antiplatelet or antithrombotic therapy after ICH	1372
6. Effect of home-monitoring of anticoagulation	304

Evidence summaries were developed using NHMRC body of evidence assessment matrix and recommendation grading to enable consistency in appraisal with the NSF material. This material was made available to Reference Group members for individual review prior to the second face-to-face meeting, where the focus was on reviewing the evidence summaries and developing recommendations. While the clinical questions were of most interest to NSF, the draft recommendations for all New Zealand-specific questions were sent to the NSF project team.

Consultation with professionals, the public and consumers

The Reference Group reviewed and commented on a draft for consultation prepared by the Chair as editor of the guidelines, and signed off on it after incorporation of their feedback.

The consultation draft was made available for public viewing and comment on the NZGG website through June and July 2010. Additionally, letters inviting response were addressed to identified contact people in key organisations, and copies of the draft (hard or electronic copy) were circulated to a total of 59 people. The document was viewed 593 times on the NZGG website.

Organisations and groups approached directly included:

- Australasian College for Emergency Medicine

- Australasian Faculty of Rehabilitation Medicine

- Australian and New Zealand Association of Neurologists

- Australian and New Zealand Society for Geriatric Medicine (New Zealand chapter)

- Cardiac Society of Australia and New Zealand

- College of Nurses Aotearoa

- Diabetes New Zealand

- Heart Foundation of New Zealand

- Internal Medicine Society of Australia and New Zealand

- Māori managers in DHBs

- Massey University (School of Health and Social Services, Pacific Director)

- Ministry of Health

- New Zealand Aged Care Association

- New Zealand Association of Occupational Therapists

- New Zealand College of Mental Health Nurses Te Ao Maramatanga

- New Zealand Nurses Organisation

- New Zealand Speech Language Therapy Association

- Occupational Therapy Board of New Zealand

- Office for Disability Issues, Ministry of Social Development

- Pacifica Wellington Central Branch

- Pasifika Medical Association

- Royal Australasian College of Physicians

- Royal New Zealand College of General Practitioners

- Stroke Society of Australasia

- Te Kaunihera O Nga Neehi Māori O Aotearoa (National Council of Māori Nurses)
- Te Ohu Rata o Aotearoa (Te ORA)
- The New Zealand Rehabilitation Association
- The New Zealand Society of Physiotherapists
- University of Auckland (School of Population Health: Te Kupenga Hauora Māori, Epidemiology & Biostatistics; School of Medical Sciences)
- University of Otago (Health Sciences, Preventive & Social Medicine)
- Whitireia Polytechnic.

There were 35 responses received from 28 organisations in the consultation process. A list of those responding is given in Appendix 1 under acknowledgements. Responders received an acknowledgement at the end of the consultation process.

Questions included in the consultation process about implementation of the guidelines and their use in reducing inequalities drew 22 responses. This input will be taken forward for the implementation phase of the guidelines.

Consumer consultation

A consumer representative was included in the New Zealand Reference Group and had input into the editorial process of all sections of the guidelines.

In collaboration with the SFNZ, NZGG coordinated and facilitated a consumer forum. The aim of this forum was to provide consumer feedback to the New Zealand Reference Group on the consultation draft of the guidelines. The focus of the forum was on 'Rehabilitation and life after hospital discharge'.

The process leading up to the consumer forum involved the following steps:

1. identification of three key informants to advise on the focus of the consumer consultation process.

2. identification by these informants of key aspects of the guidelines most likely to be of interest to consumers.

3. identification by SFNZ field officers of people with stroke, their spouses and support people, for participation in the consumer forum.

4. circulation to consumer forum participants of a pre-reading summary of the guidelines recommendations covering 'rehabilitation and life after hospital discharge', an electronic copy of the consultation draft of the guidelines, and an example of a National Health Service resource for adults who have had a stroke or TIA and their families and carers entitled *Information about NICE clinical guideline 68*.

Consumer forum

The forum was held in Auckland on 24 June 2010, and was well supported with 17 of the 20 invited consumers in attendance. Also present were two SFNZ Field Officers, Dr Jonathan Baskett (SFNZ), and Anne Buckley (NZGG). The forum was facilitated by David Kane (NZGG).

Consultation response integration

Consultation responses were tabulated in spreadsheet form for review and comment prior to consideration by the New Zealand Reference Group in teleconference and email discussion. The report of consumer perspectives was considered indepth via teleconference and email discussion. The Reference Group was led by the Chair/Editor in a consensus decision-making process to integrate consultation feedback.

Completion

The Editor's final draft incorporating consultation feedback and New Zealand Reference Group comments was circulated for final comment and sign off before being submitted for medical editing and final formatting processes. A final review was then carried out by the Editor. The completed guideline was then submitted to the Ministry of Health for acceptance.

Revision of the Guidelines

In Australia, the NHMRC stipulates that guidelines should be reviewed or updated every five years. The plan is to synchronise future revisions of the New Zealand guidelines with Australia, pending Ministry of Health support.

Implementation

Reviewing the evidence and developing evidence-based recommendations for care are only the first steps to ensuring that evidence-based care is available. Following publication of 'New Zealand Clinical Guidelines for Stroke Management', the guidelines should be disseminated to all those who provide care of relevance to stroke care, who may then identify ways in which the guidelines may be taken up at local level.

Strategies by which guidelines may be disseminated and implemented include the following, but will be subject to Ministry of Health support:

- **Distribution of education materials**: for example, mailing of guidelines to stroke clinicians via existing stroke networks should be undertaken. Concise summaries targeted to the majority of disciplines (eg, including general practitioners, nurses and doctors) should also be planned. An electronic link to the guidelines would be available on the SFNZ website and this can be sent to all appropriate universities, colleges, associations, societies and other professional organisations. Appropriate resources may be required in a variety of languages and formats for people with stroke and their carers

- **Educational meetings**: for example, interdisciplinary conferences or internet-based 'webconferences' are being considered by the SFNZ. Resources could be developed to aid workshop facilitators to identify barriers and solutions in the implementation phase

- **Educational outreach visits**: a peer support model, which uses sites viewed as 'champions' in aspects of acute stroke management to support other sites could be used in collaboration with the national audit results.

- **Local opinion leaders**: dissemination of educational resources should utilise key opinion leaders. It will also be appropriate to have local champions facilitate workshops in their local areas

- **Audit and feedback**: data from the national stroke audit will be fundamental to the implementation of these guidelines. A copy of relevant indicators covering organisation of care and clinical care will be available from the SFNZ along with key reports – see Appendix C

- **Reminders**: electronic reminders should be used once local teams have identified key areas of improvement and commenced planned strategies.

A systematic review of studies into the effectiveness of the above dissemination and implementation strategies found that there were difficulties in generalisability due to methodological weaknesses and poor reporting of the study setting. (Grimshaw et al, 2006). However, most of the strategies appear to have modest effectiveness in implementing evidence-based care but it is unclear if single interventions are any better or worse than multiple interventions (Grimshaw et al, 2006).

Consideration of professional and institutional context, and careful analysis of the information and other needs of stakeholders is key to creating awareness, uptake and change.

All of the above strategies may be used where appropriate for implementation of the *New Zealand Clinical Guidelines for Stroke Management 2010*. Specific strategies will also be considered when targeting general practice in line with the RACGP Guidelines for 'Putting prevention into practice' – available at: www.racgp.org.au/guidelines/greenbook.

Appendix 3: National acute stroke services audit 2009

The process of audit and feedback supports informed decision-making directed to improving care delivered to stroke patients. Audit and feedback are a crucial part of guidelines implementation and core components in a cycle of continuous quality improvement. Audit findings may also be used to inform planning at a local, regional or national level to improve outcomes associated with stroke.

The National Acute Stroke Services Audit 2009 (2009 Audit) was an initiative of the Stroke Foundation of New Zealand (SFNZ), in collaboration with the Australian National Stroke Foundation (NSF). The New Zealand Ministry of Health supported the 2009 Audit and contracted the SFNZ to undertake it in district health boards (DHBs).

The 2009 Audit determined what resources are available to support the delivery of evidence-based care and examined conformance of clinical practice with evidence-based best practice recommendations. It was expected that the findings would provide a useful national benchmark in the ongoing development and review of acute stroke care delivery. Ideally the exercise is repeated biennially to provide longitudinal data on clinical performance, and alternates between audit of acute and post-acute services using questions aligned with updated guidelines.

The 2009 Audit aimed to:

1. characterise the nature of acute stroke services in New Zealand

2. identify resources available to support the delivery of evidence-based care

3. identify priority areas where focused strategies linked with resource provision may facilitate evidence-based stroke care

4. monitor how well recommendations in current stroke guidelines available to New Zealand stroke services are being implemented[4]

5. enable DHBs to benchmark against similar DHBs nationally

6. provide data to form the basis of a cycle of ongoing quality improvement

7. foster a culture of audit and feedback.

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[4]   Note that the 2010 Stroke Guideline will replace the outdated 2003 Guideline (*Life after Stroke. New Zealand guideline for management of stroke*). It was considered that the 2007 Australian *National Clinical Guidelines for Acute Stroke Management* – on which the 2009 Audit webtool was based – was amongst more recent international guidelines referenced by clinicians in New Zealand stroke services to ensure best practice and quality of service.

The 2009 Audit comprised two components:

- an **Organisational Survey** of stroke services in DHBs across New Zealand. The survey examines the resources required to deliver evidence-based stroke care such as stroke units, imaging, protocols, processes and pathways, and the interdisciplinary team coordinated care approach. The self-reported data was provided by a nominated member of the DHB auditing team

- a **Clinical Audit** involving retrospective review of up to 40 consecutive cases admitted to participating DHBs during a defined timeframe. The Clinical Audit examines the delivery of processes of care such as diagnostic imaging (CT, MRI and Carotid Doppler), early acute interventions (such as tPA and aspirin) and discharge planning, and the extent to which they conform to best practice.

All 21 DHBs provide acute stroke care, and all participated in the Organisational Survey. The Clinical Audit provided a cohort of 832 records from 20 DHBs, with all but one small DHB participating. The sample was held to be representative of the patient experience of acute stroke care in New Zealand.

Findings in the Organisational Survey and Clinical Audit were integrated in a national report, along with discussion and recommendations. Thus, areas of excellence or need identified in the Clinical Audit were informed by the description of resource organisation and availability obtained from the Organisational Survey. The national report, which gives the 2009 Audit questions in the appendices, is available at: www.stroke.org.nz. In addition to the national report, each DHB was supplied with a confidential report giving their own data alongside national data. The individual DHB reports were designed to support discussion within clinical teams of the implication of findings and key messages for their stroke service.

Glossary and abbreviations

Activities of daily living: the basic elements of personal care such as eating, washing and showering, grooming, walking, standing up from a chair and using the toilet.

Activity: the execution of a task or action by an individual. Activity limitations are difficulties an individual may have in executing activities.

Agnosia: the inability to recognise sounds, smells, objects or body parts (other people's or one's own) despite having no primary sensory deficits.

Aphasia: impairment of language, affecting the production or comprehension of speech, and the ability to read and write.

Apraxia: impaired planning and sequencing of movement that is not due to weakness, uncoordination, or sensory loss.

Atrial fibrillation: rapid, irregular beating of the heart.

Augmentative and alternative communication: non-verbal communication, eg, through gestures or by using computerised devices.

Cochrane review: a comprehensive systematic review and meta-analysis (where possible).

Deep vein thrombosis: thrombosis (a clot of blood) in the deep veins of the leg, arm, or abdomen.

Disability: a defect in performing a normal activity or action (eg, inability to dress or walk).

Dysarthria: impaired ability to produce clear speech due to the impaired function of the speech muscles.

Dysphagia: difficulty swallowing.

Dysphasia: reduced ability to communicate using language (spoken, written or gesture).

Dyspraxia of speech: inability to produce clear speech due to impaired planning and sequencing of movement in the muscles used for speech.

Emotionalism: an increase in emotional behaviour – usually crying, but sometimes laughing that is outside normal control and may be unpredictable as a result of the stroke.

Enteral tube feeding: delivery of nutrients directly into the intestine via a tube.

Executive function: cognitive functions usually associated with the frontal lobes including planning, reasoning, time perception, complex goal-directed behaviour, decision-making and working memory.

Family support/liaison worker: a person who assists people with stroke and their families to achieve improved quality of life by providing psychosocial support and information, referrals to other stroke service providers.

Hyper-acute care: refers to the first 4.5–6 hours from stroke onset during which decisions regarding acute stroke therapies must be made.

Impairment: a problem in the structure of the body (eg, loss of a limb) or the way the body or a body part functions (eg, hemiplegia).

Infarction: death of cells in an organ (eg, the brain or heart) due to lack of blood supply.

Inpatient stroke care coordinator: a person who works with people with stroke and with their carers to construct care plans and discharge plans, and to help coordinate the use of health care services during recovery in hospital.

Interdisciplinary team: the entire rehabilitation team, made up of doctors, nurses, therapists, social workers, psychologists, etc.

International normalised ratio: a measure of blood coagulation.

Ischaemia: an inadequate flow of blood to part of the body due to blockage or constriction of the arteries that supply it.

Modified Rankin Score: a global disability score that records a patient's functional ability with a score that ranges between 0 and 6 (0 = no symptoms, 6 = death).

Neglect: the failure to attend or respond to, or make movements towards one side of the environment.

Participation: involvement in a life situation.

Participation restrictions: problems an individual may experience in involvement in life situations.

Percutaneous endoscopic gastrostomy (PEG): a form of enteral feeding in which nutrition is delivered via a tube that is surgically inserted into the stomach through the skin.

Phonological deficits: language deficits characterised by impaired recognition and/or selection of speech sounds.

Pulmonary embolism: blockage of the pulmonary artery (which carries blood from the heart to the lungs) with a solid material, usually a blood clot or fat, that has travelled there via the circulatory system.

Rehabilitation: restoration of the disabled person to optimal physical and psychological functional independence.

Recovery: term preferred by consumers to describe their experience and journey after stroke.

Risk factor: a characteristic of a person (or people) that is positively associated with a particular disease or condition.

Stroke unit: a section of a hospital dedicated to comprehensive rehabilitation programmes for people with a stroke.

Stroke: sudden and unexpected damage to brain cells that causes symptoms that last for more than 24 hours, in the parts of the body controlled by those cells. It happens when the blood supply to part of the brain is suddenly disrupted, either by blockage of an artery or by bleeding within the brain.

Task-specific training: training that involves repetition of a functional task or part of the task.

Transient ischaemic attack: stroke-like symptoms that last less than 24 hours. While TIA is not actually a stroke, it has the same cause. A TIA may be the precursor of a stroke, and people who have had a TIA require urgent assessment and intervention to prevent stroke.

Abbreviations

AAC: Augmentative and alternative communication

ACEI: Angiotensin converting enzyme inhibitors

ADL: Activities of daily living

AF: Atrial fibrillation

AFO: Ankle foot orthoses

BAO: Basiliar artery occlusion

CCB: Calcium channel blocker

CEA: Carotid endarterectomy

CI: Confidence interval

CILT: Constraint induced language therapy

CPAP: Continuous positive airway pressure

CT: Computed tomography

DALY: Disability adjusted life years

DVT: Deep vein thrombosis

DWI: Magnetic resonance diffusion weighted imaging

ECG: Electrocardiogram

ED: Emergency department

EMG: Electromyographic

ESD: Early supported discharge

FEES: Fiberoptic endoscopic examination of swallowing

FFP: Fresh frozen plasma

GP: General Practitioner

GTN: Glyceryl trinitrate

HR: Hazard ratio

IA: Intra-arterial

ICC: Interrater concordance

ICH: Intracerebral haemorrhage

ICU: Intensive care unit

INR: International normalised ratio

IPC: Intermittent pneumatic compression

IPCS: Inpatient palliative care services

IV: Intravenous

LMWH: Low molecular weight heparin

MAP: Mean arterial blood pressure

MBS: Modified barium swallow

MCA: Middle cerebral artery

MD:	Mean difference
MNA:	Mininutritional assessment
MRI:	Magnetic Resonance Imaging
MRS:	Modified Rankin Score
MST:	Malnutrition screening tool
MUST:	Malnutrition universal screening tool
MWD:	Mean weighted difference
NG:	Nasogastric
NHMRC:	National Health and Medical Research Council
NIHSS:	National Institutes of Health Stroke Scale
NMES:	Neuromuscular electrical stimulation
NNT:	Number needed to treat
NPV:	Negative predictive value
NSF:	National Stroke Foundation of Australia
NZGG:	New Zealand Guidelines Group
OBS:	Observational study
OR:	Odds ratio
OT:	Occupational therapist/Occupational therapy
PBS:	Pharmaceutical Benefit Scheme
PE:	Pulmonary embolism
PEG:	Percutaneous endoscopic gastrostomy
pgSGA:	Patient generated subjective global assessment
PPV:	Positive predictive value
QALYs:	Quality adjusted life years
QI:	Quality improvement
RCT:	Randomised controlled trial
rFVIIa:	recombinant activated factor VII
ROC:	Receiver operating characteristic curve
RRR:	Relative risk reduction
rTMS:	repetitive transcranial magnetic stimulation
SBP:	Systolic blood pressure
SES:	Statistical effect size
SFNZ:	Stroke Foundation of New Zealand
SGA:	Subjective global assessment
SMD:	Standardised mean difference
STAIR:	Stroke transition after inpatient care
TEE:	Transesophageal echocardiography
TIA:	Transient ischaemic attack
tPA:	Recombinant tissue plasminogen activator
TTE:	Transthoracic echocardiography
TTS:	Thermal tactile stimulation
UFH:	Unfractionated heparin

UK: United Kingdom

VMBS: Videofluoroscopic modified barium swallow

VTC: Video-teleconferencing

VTE: Venous thromboembolism

WMD: Weighted mean difference

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