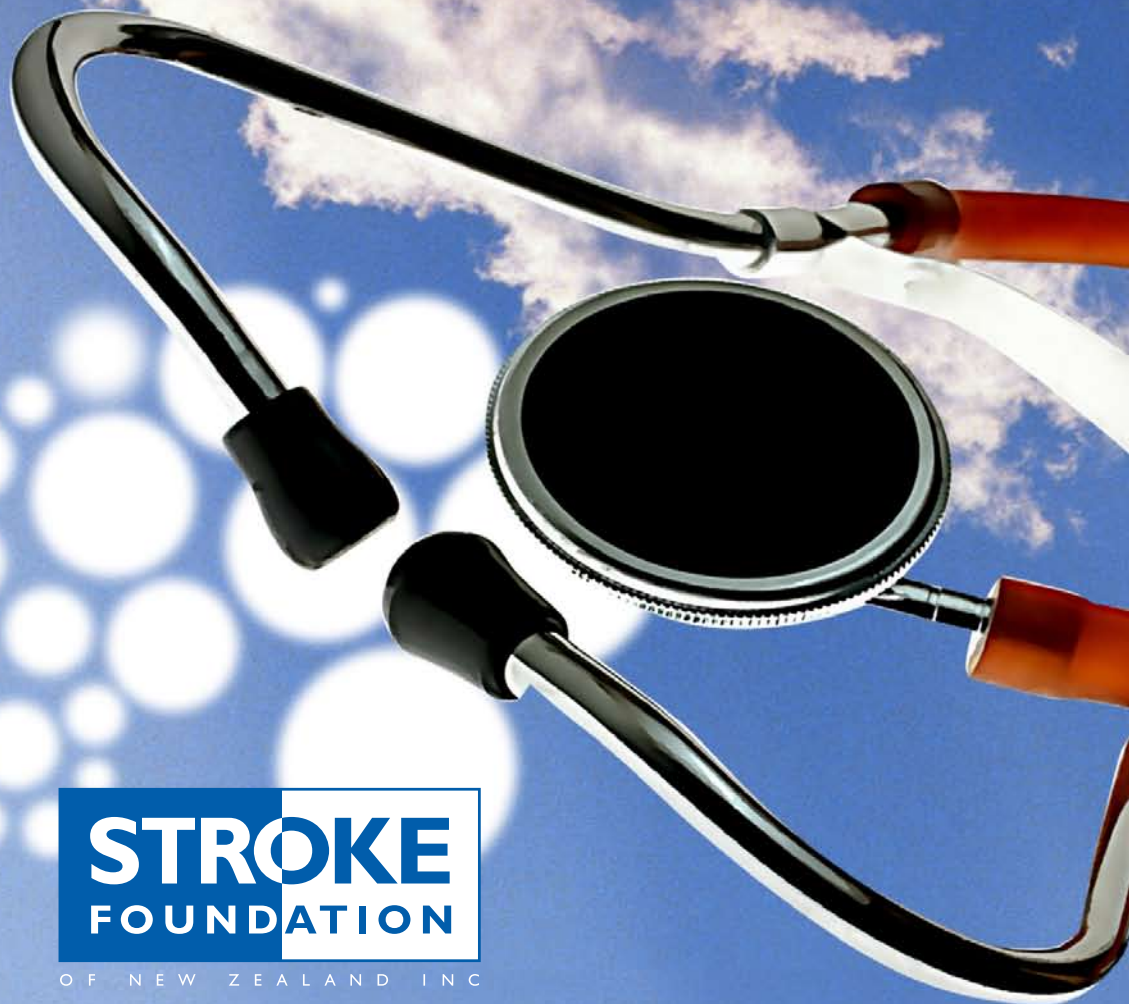


FOR THE ASSESSMENT
AND MANAGEMENT OF
PEOPLE WITH RECENT
TRANSIENT ISCHAEMIC
ATTACK (TIA)



Acknowledgements

The generous voluntary contribution of time and expertise by writers, consumers and commentators in the preparation of this guideline is acknowledged with gratitude.

Disclaimer

This TIA guideline was written to provide general guidance to health professionals and service providers. The information and recommendations contained within this guideline may not be appropriate for use in all situations and healthcare providers will need to use clinical judgment, knowledge and expertise to decide whether or not to apply its recommendations. Any decision must consider the wishes of the patient, the individual patient circumstances, the clinical expertise of the clinician and available resources.

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1 INTRODUCTION

TRANSIENT ISCHAEMIC ATTACK AND STROKE

Stroke is a leading cause of death and the major cause of long term adult disability in New Zealand (**NZ**). Each year approximately 8000 people will suffer a stroke in NZ. The impact on individuals, and their families, whānau and caregivers is substantial. Approximately one third of people with stroke will die within the first 12 months and one third will be reliant on others for assistance with activities of daily living. Stroke is also the second most common cause of dementia, the most frequent cause of epilepsy in older people, and a frequent cause of depression. Demographic changes in NZ are likely to result in an increase in both stroke incidence and prevalence over coming decades.

Transient Ischaemic Attack (**TIA**) is defined as stroke symptoms and signs that resolve within 24 hours. About 25% of people with ischaemic stroke have a preceding or warning TIA. Recent evidence highlights that the risk of stroke following TIA is greatest in the first 48 hours. Thereafter the risk lessens but may be as high as 10% by 30 days and up to 20% by 90 days. Strokes that follow a TIA are not minor; one in five are fatal and a further two thirds are disabling.

PREVENTING STROKES THAT FOLLOW TIA

Reorganisation of services to facilitate prompt assessment of people with TIA and early intervention may reduce the risk of a stroke after TIA by up to 80 percent. Based on a generally accepted figure of \$50,000 per new stroke in direct health costs funded by District Health Boards in NZ, a relatively low number of strokes need to be prevented after TIA to justify intensification of services for people with TIA.

ISSUES TO ADDRESS

The NZ Ministry of Health's Diabetes and Cardiovascular Disease Quality Improvement Plan has identified a number of issues potentially affecting our ability to achieve appropriate early assessment and intervention after TIA, and prevent stroke:

- TIAs are frequently unrecognised by the public and may be misdiagnosed by health practitioners. There is even less recognition of the seriousness of TIAs and need for urgent medical attention.
- TIA risk assessment tools have been developed that allow health practitioners to identify those people who are most at risk of stroke after a TIA. These tools could help determine the urgency of any intervention and facilitate targeting limited resources to those who have the most to gain.
- An up to date NZ TIA guideline is needed.

The Ministry of Health contracted the Stroke Foundation of New Zealand to produce this TIA guideline to help addresses these issues.

2 KEY MESSAGES

TIA IS A MEDICAL EMERGENCY - PEOPLE WITH TIA ARE AT HIGH RISK OF EARLY STROKE!

- This risk can be as high as 12% at 7 days and 20% at 90 days
- About half of these strokes will occur within the first 48 hours after TIA
- Up to 85% of strokes that follow TIA will be fatal or disabling.

This risk is higher than that for chest pain. TIA warrants urgent attention.

The ABCD₂ tool can identify people most at risk of stroke following TIA; usually those with unilateral weakness and/or speech disturbance, especially if symptoms last more than 60 minutes.

Diagnosis of TIA is more likely to be correct if the history confirms;

- Sudden onset of symptoms, with maximal neurological deficit at onset
- Symptoms typical of focal loss of brain function such as unilateral weakness or speech disturbance
- Rapid recovery of symptoms, usually within 30-60 minutes.

URGENT ASSESSMENT AND INTERVENTION REDUCES THE RISK OF STROKE AFTER TIA

- **Aspirin** should be started immediately if fully recovered and no contraindications; 300mg stat if aspirin naïve and 75-150mg daily
- **Risk Assessment.** All people with suspected TIA should be assessed at initial point of health care contact for their risk of stroke, including their ABCD₂ score
- **People at high risk:**
 - Include those with ABCD₂ scores of 4 or more, crescendo TIAs, atrial fibrillation or who are taking anticoagulants
 - Require urgent specialist assessment as soon as possible but definitely within 24 hours
- **People at low risk:**
 - Include those with ABCD₂ scores of less than 4 or those who present more than one week after TIA symptoms
 - Require specialist assessment and investigations within 7 days
 - If treating doctor is confident of diagnosis and initiating treatment, and has ready access to brain and carotid imaging then specialist review may not be required.
- **Secondary prevention.** As soon as the diagnosis is confirmed all people with TIA should have their risk factors addressed and be established on an appropriate individual combination of secondary prevention measures including:
 - Anti-platelet agent(s) – aspirin, aspirin plus dipyridamole or clopidogrel
 - Blood pressure lowering therapy
 - Statin
 - Warfarin – if atrial fibrillation or other cardiac source of emboli
 - Nicotine replacement therapy or other smoking cessation aid.
- **Follow up,** either in primary or secondary care, should occur within one month so that medication and other risk factor modification can be reassessed.

3 DEFINITIONS – Transient Ischaemic Attack and Stroke

STROKE

The World Health Organisation (**WHO**) defines stroke as “a clinical syndrome consisting of rapidly developing clinical signs of focal (or global in case of coma) disturbance of cerebral function lasting more than 24 hours or leading to death with no apparent cause other than a vascular origin”.^[1]

TRANSIENT ISCHAEMIC ATTACK

A Transient Ischaemic Attack (**TIA**) is defined as stroke symptoms and signs that resolve within 24 hours.^[1]

MINOR ISCHAEMIC STROKE

Minor ischaemic stroke refers to that subgroup of people with an ischaemic stroke who either make a full recovery after 24 hours or have minimal residual neurological deficits and are independent in activities of daily living. TIA and minor ischaemic stroke can be considered as part of a continuum where transient symptoms are not infrequently accompanied by brain imaging evidence of “silent” infarction in the relevant vascular territory.

DURATION OF SYMPTOMS – IS STROKE SYMPTOMS RESOLVING “WITHIN 24 HOURS” STILL VALID FOR THE DEFINITION OF TIA?

Before the era of brain imaging, there was consensus that symptom duration of less than 24 hours should be used to distinguish TIA from stroke. However, the majority of TIAs resolve in less than 60 minutes and most within 30 minutes. Less than 15% of people with symptoms of more than one hour duration will fully recover by 24 hours.^[2] Further, a proportion of people with full recovery will have cerebral infarction revealed by brain imaging; up to two thirds in some studies that used magnetic resonance imaging (**MRI**) with diffusion weighted imaging (**DWI**). This proportion increases with longer duration of TIA symptoms.^[3]

This has led to recommendations that the timeframe for the definition of TIA be shortened to one hour with a new definition of TIA as a “brief episode of neurological dysfunction caused by a focal disturbance of brain or retinal ischaemia, with clinical symptoms lasting less than 1 hour, and without evidence of infarction”.^[2] This definition has not yet been adopted by WHO as many countries do not have ready access to brain imaging. This TIA guideline uses the definition of TIA as stroke symptoms lasting less than 24 hours.

Debate about the acceptable duration of TIA symptoms and the significance of cerebral infarction seen on brain imaging in people who make a full recovery highlights the fact that TIA and ischemic stroke are different ends of the same disease spectrum in terms of their causative factors, evaluation, treatment and prognosis for recurrent events. Indeed the European guidelines consider ischemic stroke and TIA to be a single entity.^[4] For the purposes of this TIA guideline, distinguishing one from the other is not critical and the guideline recommendations are also applicable for people who have made a good recovery from minor ischaemic stroke.

4 METHOD

PURPOSE OF THE TIA GUIDELINE

This guideline has two primary aims:

1. To provide guidance for health professionals regarding the assessment and management of people with a recent suspected TIA.
2. To provide guidance for District Health Boards (**DHBs**), which are the regional health authorities in NZ, regarding the provision of services appropriate for the size of their population that facilitate best practice management of patients presenting with recent TIA.

To achieve these aims, this guideline focuses on the issues of:

- Raising public awareness of the symptoms and signs of TIA, and the need to act urgently
- Ensuring accurate diagnosis of TIA by clinicians working in primary care, emergency medical services and hospitals
- Promoting the determination of individual risk of stroke after TIA, particularly use of the ABCD₂ tool
- Ensuring that the urgency of assessment and initial management of people with TIA are based on an individual's estimated stroke risk
- Streamlining the investigation of people with TIA
- Secondary prevention intervention for all people with TIA
- Describing the services required of DHBs to meet the needs of people with TIA.

SCOPE

This guideline is a result of recommendations from the NZ Ministry of Health's Diabetes and Cardiovascular Disease Quality Improvement Plan.^[5] The Ministry of Health contracted the Stroke Foundation of NZ to produce a guideline for the management of people with transient ischaemic attack or minor stroke.

This guideline will be published in two forms;

1. A best practice guideline (**full version**), printed and electronic for uploading to websites so that it is available as a resource.
2. A short implementation manual (**user guide**), printed and electronic, for use by DHBs, Primary Health Organisations (**PHOs**) and health professionals.

WHO SHOULD THIS TIA GUIDELINE APPLY TO?

The recommendations in this guideline are applicable to those people with TIA where accurate diagnosis and stroke prevention are important. The advice in this guideline may not be appropriate if TIA occurs in the setting of terminal illness, severe disability or dementia such as can occur in many older people in hospital-level nursing care.

GUIDELINE DEVELOPMENT PROGRAM

The initial drafts of the TIA guideline document were prepared between March and July 2008 by the authors with input from some members of a NZ TIA Guideline advisory group. The final draft was circulated during August 2008 for comment and peer review to the whole advisory group, NZ colleagues and international peer reviewers.

The NZ advisory group included representatives from people with stroke and TIA, patient support groups, Maori and Pacific people; and health practitioners working in primary care, ambulance services, emergency medicine, and internal medicine.

Others consulted included Pharmac, the NZ government's pharmaceutical funding agency, and DHB NZ, representing DHBs.

Following receipt of feedback, the guideline was then finalised by the authors during September 2008 for publication in October 2008.

ACKNOWLEDGEMENTS

The generous voluntary contribution of time and expertise by writers, consumers and commentators in the preparation of this guideline is acknowledged with gratitude.

SOURCE OF EVIDENCE AND RECOMMENDATIONS

Most of the information and recommendations in this guideline come from key published guidelines. The original papers and meta-analyses behind these recommendations were not individually reviewed unless there was a specific need to significantly alter the recommendation to suit the NZ health environment.

Key Guidelines and References; by date and source

Year	Origin	Title	Ref.
1999	USA	Supplement to the guidelines for the management of transient ischemic attacks	[6]
2003	NZ	Life after stroke: New Zealand guideline for management of stroke	[7]
2003	NZ	The assessment and management of cardiovascular risk	[8]
2004	United Kingdom	National clinical guidelines for stroke	[9]
2005	France	Clinical practice guidelines: diagnosis and immediate management of transient ischemic attacks in adults	[10]
2006	USA	Guidelines for prevention of stroke in patients with ischemic stroke or transient ischemic attacks	[11]
2006	Canada	Canadian stroke strategy: Canadian best practice recommendations for stroke care	[12]
2006	International	National stroke association guidelines for the management of transient ischemic attacks	[13]
2007	England/Wales	National stroke strategy	[14]
2007	Australia	Clinical guidelines for acute stroke management	[3]
2008	USA	Update to the AHA/ASA recommendations for the prevention of stroke in patients with stroke and transient ischemic attack	[15]
2008	NZ	Diabetes and cardiovascular disease quality improvement plan	[5]
2008	Europe	Guidelines for management of ischaemic stroke and transient ischemic attacks	[4]
2008	England/Wales	Stroke: national clinical guideline for diagnosis and initial management of acute stroke and TIA. Royal College of Physicians	[1]

Guidelines are useful for improving care and reducing practice variability, costs and disease burden. However, they are not without limitations including concerns about the quality of methods used, potential for bias and failure to remain up to date. Furthermore, some aspects are only applicable for local use or specific aspects of care. For example, a TIA guideline developed by the National Stroke Foundation (USA) used six editors and 15 international experts from Europe, Australasia and North America to review 137 recommendations identified from a systematic review of 257 unique guideline documents potentially relevant to TIA. [13] Overall 36% of selected recommendations were deemed to be incorrect, not current, impractical, unclear or biased. After redundant versions were also removed only 53 unique recommendations remained. Seven of these final 53 recommendations came directly from NZ guidelines.

LITERATURE SEARCH

In addition a literature search using “MEDLINE with full text” was done on 24 July 2008 for all articles published since 2005 on the topics “transient ischaemic attack” and “TIA” to identify recent evidence that may not have been included in these earlier guidelines.

GRADING OF RECOMMENDATIONS

New Zealand guidelines for management of stroke and for the assessment and management of cardiovascular risk were published in 2003. The 2007 Australian, 2008 European and 2008 Royal College of Physicians (**RCP**) guidelines on stroke and TIA are the most recent guidelines that are relevant to NZ.^[1, 3, 4] Stroke neurologists from NZ were on the Expert Working Group of the Australian guideline and others were consulted during its development. Grading of the recommendations in this guideline uses, unless specified otherwise, the Australian guideline classification and reported levels of evidence, unless specified otherwise. The RCP guideline provided levels of evidence for literature reviewed but did not grade recommendations.

Grading of Recommendations^[3]

- A** 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
- Recommended best practice** based on clinical experience and expert opinion.

Many of the recommendations in this TIA guideline are based on recommendations from published guidelines, with the source and equivalent grade of recommendation identified. Any additional recommendations specific to NZ are identified as “NZ TIA”.

Abbreviations used to identify source of recommendations		Ref.
NZ Stroke	NZ guideline for management of stroke, 2003	[7]
NZ CV Risk	Assessment and management of cardiovascular risk, 2003	[8]
Canadian	Canadian stroke guideline, 2006	[12]
English/Welsh	National stroke strategy, 2006	[14]
Australian	Australian acute stroke guideline, 2007	[3]
NZ QIP	Diabetes and cardiovascular disease quality improvement plan	[5]
European	European acute ischaemic stroke and TIA guideline, 2008	[4]
RCP	National guideline for acute stroke and TIA, 2008	[1]

UPDATING THESE TIA GUIDELINES

Future updates will be incorporated into a planned joint Stroke/TIA guideline relevant to NZ.

DISCLAIMER

This TIA guideline was written to provide general guidance to health professionals and service providers. The information and recommendations contained within this guideline may not be appropriate for use in all situations and healthcare providers will need to use clinical judgment, knowledge and expertise to decide whether or not to apply its recommendations. Any decision must consider the wishes of the patient, the individual patient circumstances, the clinical expertise of the clinician and available resources.

The authors, Stroke Foundation of NZ and Ministry of Health disclaim any responsibility for damages arising out of the use or non-use of these guidelines and the literature used in support of these guidelines.

5 ISSUES FOR MĀORI, AND PACIFIC PEOPLE

Currently, there are significant disparities between Māori and non Māori in the incidence and outcomes for stroke. Similar adverse disparities are becoming more evident for other ethnicities, specifically Pacific and Asian peoples. On average, Māori and Pacific people have their strokes 10 years younger and have worse outcomes than NZ Europeans; with much of the burden falling on whānau (family).^[16] Therefore, Māori and Pacific people have significant potential to gain from strategies designed to reduce the risk of stroke after TIA.

This guideline supports recommendations regarding the rights and needs of Māori and other ethnicities with cerebrovascular disease as documented in previous NZ guidelines.^[5, 7, 8]

Although outside the scope of this document, health services in NZ need to acknowledge and address the broader, contextual issues for Māori and other ethnicities, including structural and system barriers when implementing the actions outlined in this guideline.

SERVICES RESPONSIVE TO MĀORI ^[7, 16]

Māori are not a homogeneous group but share common issues regarding the importance of whānau wellbeing and appropriate communication following TIA. Whānau must be involved in all aspects of TIA management including education, interventions and decision making.

Communication between Māori with TIA, their whānau and health professionals must be appropriate. Information developed by Māori that is specific to the needs of Māori and their whānau is the ideal. The delivery, content and context of information should aim for optimal understanding, encourage ongoing communication and address issues specific for Māori such as premature stroke onset and risk factors. Kanohi ki te kanohi (face to face) discussion is recommended.

Responsiveness of mainstream providers to Māori with TIA, and their whānau will be improved when:

- People with TIA and their whānau are informed and supported in an appropriate manner. Examples include access to a Māori liaison service, increased support to sustain lifestyle changes and to access outpatient services, and whānau involvement in making decisions, including setting goals
- Local Māori providers are consulted regularly
- Barriers to care, including transport and socioeconomic factors, are addressed.

Those seeking more detailed information on this issue are advised to consult Hauora: Māori Standards of Health IV.^[16]

SERVICES RESPONSIVE TO PACIFIC PEOPLES [7]

There is significant national and cultural diversity within the Pacific community that is made up of more than 20 island nations, each with a unique language and culture, and includes island- and New Zealand-born subgroups.

To improve outcomes for Pacific people with TIA it is necessary to:

- Tailor healthcare for the individual person within this diverse grouping
- Appreciate the holistic view of health held by Pacific peoples
- Involve caregivers, family members and other members of the community in the management of TIA
- Consider the implications of difficult socioeconomic circumstances, especially for adherence to therapy, as over two-thirds of Pacific people are in three highest deciles for deprivation
- Acknowledge and be open to the use of traditional healing methods
- Develop and support Pacific health providers and establish partnerships between these and mainstream health services to ensure streamlined care plans.

6 INCIDENCE

The incidence of TIA is difficult to determine due to low public awareness of the significance of TIA symptoms and failure to spontaneously report all events to health professionals. It is commonly stated that 15 to 25% of patients with ischaemic stroke have had an earlier TIA. ^[5, 17]

The most accurate figures available for estimating TIA incidence in NZ come from the Oxford Vascular Study (**OXVASC**).^[18] This study identified an annual rate for definite and probable TIAs of 1.08 (0.95-1.21, 95% CI) per thousand population, standardised for the 2005 United Kingdom population. Of these patients, 50% were first ever TIAs, 27% recurrent TIAs and 24% probable TIAs that were treated with secondary prevention.

If all people with suspected TIA and minor ischaemic stroke events that were referred to OXVASC services are also included then the demand on TIA services rises to 2.98 (2.77-3.2) per thousand population per year.^[18] This number was divided roughly equally between those with definite/probable TIA, minor stroke and those with suspected TIA who were eventually given an alternative diagnosis.

7 PUBLIC AWARENESS OF TIA AND NEED FOR APPROPRIATE ACTION

CURRENT LEVEL OF TIA AWARENESS

Public recognition of stroke symptoms and signs is poor. In a 2007 telephone survey of 1000 people in NZ aged over 15 years, 35% could not correctly name a symptom or sign of stroke and a further 25% could not name more than one symptom or sign. Furthermore, 20% of those who correctly identified a stroke symptom also identified incorrect symptoms not usually associated with stroke such as chest pain. However, when asked what they would do if they thought someone was having a stroke, 81% said they would dial emergency services.^[19]

The ability to recognise and react appropriately to TIA symptoms is worse than stroke as resolution of symptoms is often perceived as a sign that urgent review is unnecessary. In a US telephone survey of over 10,000 people aged 18 years or older only about 8% were able to identify either the correct definition of TIA or at least one common symptom.^[20] In a UK study of 241 patients with TIA only 44% sought medical attention urgently and 27% delayed seeking medical attention for two or more days.^[21] Patients were less likely to seek urgent attention if their TIA occurred over a weekend (41%) than on a weekday (61%). In the EXPRESS and SOS-TIA studies, over 40% of patients did not seek medical attention within the first 24 hours of their event and were substantially less likely to do so on a weekend. ^[22, 23]

IMPROVING PUBLIC AWARENESS

Canadian guidelines recommend that all members of the public should be able to recognise and identify at least two signs and symptoms of stroke, and be aware of the need to seek immediate medical attention.^[12]

An amalgamation of results from community stroke education programs provides evidence that programs using mass media delivered in a periodic, recurring format can change both the public's knowledge of the warning signs of stroke and their behaviour, including the need to seek urgent medical attention.^[24] Further, there is evidence that mass media campaigns have a greater impact on increasing emergency department presentations for TIA than for stroke.^[25]

THE FAST MESSAGE

Many international stroke associations including the Stroke Foundation of NZ promote the simple **FAST** message for public awareness of stroke warning signs. The mnemonic FAST stands for assessments for **F**acial weakness (unilateral), **A**rm weakness (unilateral) and **S**peech disturbance (dysphasia or dysarthria), and advises **T**ime to act and dial emergency services to get to hospital FAST if a person fails any one of these assessments.

Is it a Stroke? Act FAST. Call 111.



Stroke is a medical emergency.

The FAST message has been shown to correctly identify 83% of people who present acutely with stroke and 80% of those who present with TIA.^[26] The FAST message potentially identifies most of those with TIA who are at high risk of early stroke as stroke is more likely to occur following TIAs with weakness and speech disturbance.^[27]

Recommendations – public awareness

- The general public should receive education concerning the importance of early recognition of symptoms and signs of stroke and TIA, and the need to seek emergency medical care. **(European Grade B)**
- All persons should be able to recognise and identify at least two symptoms and signs of stroke and TIA and be aware of the need to seek urgent medical attention. **(Canadian Grade C)**
- The FAST message is appropriate for public awareness campaigns about both TIA and stroke **(NZ TIA ✓)**

8 DIAGNOSIS OF TIA IN PRIMARY CARE AND EMERGENCY DEPARTMENTS

ACCURACY OF TIA DIAGNOSIS

Diagnosis of TIA can be problematic. In primary care and emergency departments it is likely to be only 50 to 80% accurate with frequent over diagnosis.^[18, 23, 28] The Oxford Community Stroke Project reported that less than half of 519 people referred from GPs and emergency departments with suspected TIA actually had a TIA (38% definite TIA and 9% possible TIA).^[28] In a French study, 59% of people referred to an urgent TIA clinic had a final diagnosis of definite TIA, 13% probable TIA, 5% minor stroke and 22% had a non-TIA diagnosis.^[23] Despite best efforts the symptoms sometimes remain unclear and a diagnosis of “possible TIA” is valid if there is insufficient evidence to accept or discard the diagnosis.

An incorrect diagnosis of TIA matters. It may expose a person to unnecessary investigations and interventions; cause anxiety regarding risk of stroke or other cardiovascular events; and impact on a person’s work, driving, travel plans or ability to obtain insurance.

OBTAINING AN ACCURATE DIAGNOSIS OF TIA

As most TIAs resolve within 60 minutes, the diagnosis is almost always based entirely on clinical history and relies on:

- accurate recognition, recollection and communication of symptoms by the patient
- accurate interpretation of the symptoms by the health practitioner
- accurate application of these symptoms to the diagnostic criteria for TIA.

A good history obtained as soon as possible after the event from the person with suspected TIA and/or an observer is the most useful tool in determining whether an event was truly a TIA. A sophisticated knowledge of neurology is not needed to elicit or recognise important features of TIA, especially as most early recurrent strokes occur in the subset of people whose symptoms included unilateral weakness or speech disturbance. The history and examination should assess for symptoms and signs of weakness and sensory loss, dysphasia (eg. ability to name objects, make themselves understood or to understand others) and visual field deficits (one eye, or both affected).

FEATURES THAT SUPPORT A DIAGNOSIS OF TIA

A diagnosis of TIA is more likely to be correct if the history confirms:

- **Sudden onset of symptoms.** Usually people (or observers) can describe what they were doing at the time of symptom onset. TIA is less likely if a person is uncertain when the event started.
- **Maximal neurological deficit occurs at onset.** A progressive onset or a march of symptoms from one part of the body to another is more suggestive of epilepsy (if fast, over seconds to one or two minutes) or migraine (if slow, over several minutes).
- **Focal symptoms consistent with vascular cause.** Disruption of blood supply to a part of the cerebral circulation results in focal symptoms. Symptoms of generalised disturbance of neurological function such as confusion (unless mistaken for dysphasia), faints, generalised numbness, bilateral blurred vision, isolated dizziness and “funny turns” are rarely due to TIA unless also accompanied by focal symptoms (see TIA symptoms table).
- **Loss of function.** Typical symptoms of TIA are “negative” due to loss of focal neurological function eg unilateral loss of movement or sensation, or loss of speech or vision. TIAs rarely cause positive symptoms such as pins & needles, limb shaking or scintillating visual field abnormalities.
- **Rapid recovery** – most TIAs resolve within 60 minutes. If symptoms are still present beyond one hour then assume likely stroke.

TIA Symptoms [28, 29]

Typical Symptoms of TIA

Unilateral weakness:

- face
- arm
- leg

Unilateral altered sensation

Dysphasia

Hemianopia

Monocular Blindness

Not Typical of TIA

(If occur in isolation, without typical symptoms)

Confusion (note - exclude dysphasia)

Impaired consciousness or syncope

Dizziness or light headedness

Generalised weakness or sensory symptoms

Bilateral blurred vision or scintillating scotoma

Incontinence – bladder or bowel

Amnesia

Note – ataxia, vertigo, dysphagia, dysarthria and sensory symptoms to part of one limb or the face may be consistent with TIA if they occur in conjunction with other typical symptoms

Differential diagnosis of TIA [23, 28]

Migraine aura, with or without headache

Hypotension and/or syncope

Transient episodes of non focal symptoms eg confusion

Peripheral vestibular disorders - isolated vertigo and may also have nausea and ataxia

Partial (focal) epileptic seizures

Anxiety and/or hyperventilation

Transient global amnesia

Drop attacks - sudden transient loss of postural tone causing falls

Hypoglycaemia

DIAGNOSIS OF TIA BY EMERGENCY MEDICAL SERVICES

Management of acute stroke and TIA requires good communication and collaboration between general practitioners, emergency medical services (**EMS**), emergency department clinicians, radiologists and physicians, and depends on a five-step chain (**European Grade B**):

- The person's rapid recognition of, and reaction to, symptoms of stroke and TIA
- Immediate contact with EMS and priority EMS dispatch
- Priority transport to hospital with notification of the receiving hospital
- Immediate emergency room triage and evaluation; clinical, laboratory and imaging
- Accurate diagnosis and rapid administration of appropriate treatments and investigations.

Currently in NZ people calling EMS about suspected stroke are asked basic questions in a pre-specified sequence regarding; alertness, abnormal breathing, speech or movement problems, numbness or tingling and stroke history. Depending on the given answers a priority one or two ambulance response is indicated. EMS rules state that "stroke must receive an immediate response that is not subject to delay".

WHO SHOULD BE TRANSPORTED URGENTLY TO HOSPITAL?

The urgency and location of the initial assessment of people with TIA is a matter of some debate.^[33, 34]

In NZ it is not clear who should be transported urgently to hospital for initial assessment. Given the risk of serious adverse outcomes, one possible strategy is that all people with acute TIA should be transported urgently to hospital for assessment. This would be analogous to management of people with chest pain who are usually monitored for between 6 and 24 hours in the emergency department, a chest pain observation unit or an inpatient bed.^[35] However, a policy of admitting all people with suspected TIA is potentially wasteful of limited resources as the numbers presenting to hospital may overwhelm services, thereby delaying assessment of those at higher risk and result in unnecessarily prolonged and inconvenient assessments for those at low risk (see discussion on risk assessment).

Recommendations – location of initial assessment and management

- Most people at high risk of stroke following TIA should be transferred urgently to hospital to facilitate rapid specialist assessment and treatment. **(European Grade B)**
- Most people identified at low risk may initially be managed in the community by a general practitioner and should be referred to a specialist clinic and seen within 7 days. **(NZ TIA ✓)**
- If the treating doctor is confident about the diagnosis, can implement recommended treatments, and has access to brain and carotid imaging within 7 days, then specialist review of people at low risk may not be necessary. **(NZ TIA ✓)**

To improve the accuracy of diagnosis of stroke and TIA in the community and in emergency departments, the European and RCP guidelines recommend use of validated assessment tools in people presenting with sudden onset of neurological symptoms.^[1, 4] However, in most cases of TIA, symptoms and signs will have resolved by the time EMS arrive or the person is assessed in an Emergency Department. Therefore, these tools would need to be applied retrospectively in people presenting with suspected TIA and may not be as effective as in people with stroke.

FAST – THE FACE, ARM AND SPEECH TEST

Use of a validated tool such as FAST by primary care doctors, ambulance paramedics and emergency department doctors has been shown to improve the accuracy of diagnosis of TIA and stroke. ^[1, 4, 36-38]

FACIAL MOVEMENTS

Ask patient to smile or show teeth

- *Look for new lack of symmetry – is there unequal smile or grimace, or obvious facial asymmetry?*
- *Note which side does not move well, and record if this is the patient's left or right.*

ARM MOVEMENTS

Lift the patient's arms together at 90 degrees if sitting or 45 degrees if supine and ask them to hold in position for 5 seconds, then let go

- *Does one arm drift down or fall down rapidly?*
- *If one arm drifts down or falls, record whether it is the patient's left or right arm.*

SPEECH

If the patient attempts conversation

- *Look for new disturbance of speech (check with companion)*
- *Look for slurred speech*
- *Look for word-finding difficulties. This can be confirmed by asking the patient to name commonplace objects that may be nearby, such as a cup, chair, table, keys, pen*
- *If there is a severe visual disturbance, place an object in the patient's hand and ask him/her to name it.*

ROSIER - THE RECOGNITION OF STROKE IN THE EMERGENCY ROOM SCALE

The Recognition of Stroke in the Emergency Room (**ROSIER**) assessment scale is validated for use in the emergency department and is recommended by the European and RCP guidelines.

[1, 4, 39, 40] It is more detailed than the FAST assessment. It includes blood sugar, visual field assessment and documentation of a history of seizures or loss of consciousness and is more accurate at identifying stroke and TIA than other available tools.^[1] The ROSIER scale had a sensitivity of 93% and specificity of 83% but incorrectly diagnoses 10% of people with suspected stroke; about 6% false positive and 4% false negative. ^[1]

THE ROSIER SCALE

If BM glucose < 3.5 mmol/L treat urgently and reassess once blood glucose normal.

- *Has there been loss of consciousness or syncope?* Y = -1
- *Has there been seizure activity?* Y = -1
- *Is there a NEW ACUTE onset (or on awakening from sleep)?*
 - *Asymmetric facial weakness* Y = +1
 - *Asymmetric arm weakness* Y = +1
 - *Asymmetric leg weakness* Y = +1
 - *Speech disturbance* Y = +1
 - *Visual field defect* Y = +1

Total score: _____ (-2 to +5)

Stroke is unlikely but not completely excluded if total scores are < 0

Recommendations – TIA Diagnosis

- General practitioners and emergency medical services should receive education concerning diagnosis of TIA, and the importance of early recognition of stroke and TIA, emphasising these are medical emergencies. **(European Grade B)**
- Emergency medical services should be trained in the use of validated rapid pre-hospital stroke screening tools and incorporate such tools into protocols for all pre-hospital assessment of people with suspected stroke **(Australian Grade B)**
- In people with sudden onset of neurological symptoms, validated tools can facilitate recognition and diagnosis of stroke and TIA. **(RCP, European ✓)**
 - The Face, Arm, Speech Test **(FAST)** is recommended for use in the community
 - The Recognition of Stroke in the Emergency Room **(ROSIER)** scale is recommended for use in Emergency Departments
- Hypoglycaemia must be excluded in all patients with sudden onset of neurological symptoms. **(RCP)**

9 RISK OF STROKE AND OTHER VASCULAR EVENTS FOLLOWING TIA

RISK OF STROKE AFTER TIA

Long term studies show that 20 to 30% of people with TIA will go on to have a stroke with the greatest risk in the first few weeks. A systematic review demonstrated that the reported risk of stroke after TIA varied significantly according to study methodology. In studies that used active outcome ascertainment, the risk of stroke following TIA was 9.9% at two days, 13.4% at

30 days and 17.3% at 90 days. These figures are at least double the rates identified in earlier studies that relied on passive ascertainment methods.^[41]

A Californian study of people attending emergency departments with recent TIA identified an overall stroke risk of 10.5% at 90 days; 50 times higher than that expected of a cohort of similar age.^[42] Furthermore, strokes following TIA were fatal in 21% of patients and disabling in another 64%. The population based Oxford vascular study (**OXVASC**) found even higher rates of stroke following a recent TIA with 8% at 1 week, 11.5% at one month and 18.2% at three months.^[43]

RISK OF OTHER CARDIOVASCULAR EVENTS AFTER TIA

People with TIA are also at increased risk of cardiovascular events. In a meta-analysis of 39 studies involving almost 66,000 people with TIA, the annual risk of myocardial infarction was 2.2% and non-stroke vascular death 2.1%.^[44] Studies that enrolled people in the first days after TIA demonstrate that a significant number of non-stroke cardiovascular events occur within the first 90 days. In the FASTER study, 2% of people with TIA had myocardial infarction (**MI**) or vascular death by 90 days.^[45] In another study 2.6% were hospitalised within 90 days for cardiovascular events such as heart failure, MI, ventricular arrhythmia and unstable angina.^[42]

ASSESSMENT OF AN INDIVIDUAL'S RISK OF STROKE AFTER TIA

Determination of an individual's risk of stroke after TIA may help determine the urgency of any assessments and interventions. This risk varies depending on a number of factors.

The Californian emergency department and OXVASC population studies found that age, diabetes, blood pressure, symptom duration, and particular clinical features all increased an individual's risk of having a stroke following TIA.^[27, 42] In the OXVASC study, all of the strokes that occurred within the first seven days happened in the 51% of people whose TIA involved unilateral weakness and/or speech disturbance. Furthermore, 90% of all strokes that occurred in the first seven days happened in the 30% of people with TIA whose weakness or speech symptoms lasted 60 or more minutes.^[27]

These two groups of researchers collaborated to produce and validate a stroke risk assessment tool that predicts a person's likely risk of early recurrent stroke - the ABCD₂ tool.^[32]

ABCD₂ – prediction of stroke risk after TIA

ABCD₂ items (score: 0 – 7)	Points
A Age: ≥ 60 years	1
B Blood Pressure: ≥ 140/90mm Hg	1
C Clinical features:	
unilateral weakness or	2
speech impairment without weakness	1
D Duration of symptoms:	
≥ 60 minutes or	2
10-59 minutes	1
D Diabetes: on medication/insulin	1

Risk of stroke according to ABCD₂ scores

ABCD ₂ score:	0 – 3	4 – 5	6 – 7
Proportion of all TIAs	34%	45%	21%
Stroke Risk (%) at			
2 days	1.0	4.1	8.1
7 days	1.2	5.9	11.7
90 days	3.1	9.8	17.8

HOW SHOULD ABCD₂ SCORES BE USED TO CATEGORISE HIGH AND LOW STROKE RISK?

Before publication of prediction rules for stroke after TIA, physicians failed to identify the majority of patients at highest risk of stroke.^[46] The ABCD₂ tool researchers recommended three stroke risk groups after TIA; low (scores 1-3), moderate (4&5) and high risk (6&7).^[32] The Australian guideline recommends a simple dichotomised score to differentiate between lower risk (ABCD₂ scores of 4 or less) and higher risk groups (scores of 5 or more), based on the findings of a study of 98 people presenting to an emergency department with TIA that used the earlier six point ABCD version of the tool.^[3, 47] Other guidelines also recommend a dichotomised split but use a score of four or more to identify those at higher risk.^[1, 14] The difference between using a cut off score of four or five to categorise stroke risk has significant implications. In the ABCD₂ study populations a score of four was the single most common result (24% of people with TIA) and using a score of four or more would identify 66% of people with suspected TIA as high risk. However, people with a score of four had a high risk of recurrent stroke; 3.5% at two days and 5% within seven days of their TIA.

The RCP guideline development group discussed with patient representatives the level of risk of stroke that might be acceptable whilst waiting seven days for a clinic appointment. Their view was that any potential risk is a concern and they would want appropriate management without delay. Their consensus was that high-risk patients should be defined as those with a stroke risk greater than 4% over seven days, equivalent to ABCD₂ score of four or more.^[1]

The RCP health economic evidence also suggests that the most cost effective service design would be immediate specialist assessment in all high risk patients including those with an ABCD₂ score of four or more.^[1]

OTHER FACTORS INFLUENCING STROKE RISK AFTER TIA.

It is important that clinicians recognise that the ABCD₂ tool is an aid to, and not a substitute for, clinical decision making in individual patients. Other factors not included in the ABCD₂ tool also contribute to an increased risk of stroke, such as atrial fibrillation, crescendo TIA (two or more TIAs within a week), carotid stenosis of greater than 50 percent, posterior circulation TIA and continued smoking.^[1, 48] People with TIA who have areas of infarction demonstrated on brain imaging are at higher risk of stroke and those with TIAs while on anticoagulation therapy also warrant specialist review.^[1]

Conversely the risk of stroke after a retinal TIA (monocular visual field loss) is less than with cerebral symptoms, and people who present late, with symptoms lasting less than 10 minutes or with isolated sensory symptoms also have a more benign prognosis.^[1, 32, 49, 50]

In the Californian emergency department cohorts, the ABCD₂ score predicted a similar stroke risk in people ethnically identified as white, African-American, Asian-American or Hispanic.^[32] There are currently no data specifically relevant to Māori and Pacific people.

ABCD₂ AIDS DIAGNOSIS OF TIA

The ABCD₂ tool also facilitates accurate diagnosis as it identifies people who are more likely to have a TIA. This is because the discriminating risk factors in the ABCD₂ tool include symptoms and signs commonly seen in definite TIAs such as unilateral weakness and speech disturbance. The focus on neurological symptoms of longer duration will exclude most people with seizures and syncope. Furthermore, older people, and those with high blood pressure and/or diabetes are more likely to have cerebrovascular disease and suffer a TIA.

Recommendations – assessment of stroke risk after TIA

- **All people with suspected TIA** should have an assessment of stroke risk using the ABCD₂ tool at the initial point of health care contact whether first seen in primary or secondary care. **(Australian Grade B, English/Welsh, RCP)**

HIGH risk is indicated by any of the following:

- **Active TIA** – All people who have symptoms at the time of first contact. **(European Grade B)**
- **ABCD₂ score of 4 or more (English/Welsh, RCP)**
- **Other high risk factors** – all people with crescendo TIAs, atrial fibrillation or who are already on anticoagulation, should be managed as high risk regardless of their ABCD₂ scores. **(NZ TIA ✓)**

LOW risk is indicated by any of the following:

- **ABCD₂ score of 3 or less** – these people are at low risk of early stroke, about one in a hundred by one week and one in thirty by 90 days. **(RCP)**
- **People who present late (after one week)** – after their TIA are at lower risk, as two thirds of early strokes will have already occurred by this period. **(RCP)**

10 CLINICAL ASSESSMENT AND INVESTIGATIONS

All people with diagnosis of TIA require clinical assessment of their vascular risk factors and basic investigations to investigate potential causes of their TIA.

VASCULAR RISK FACTOR ASSESSMENTS

All people with TIA should be assessed for the following vascular risk factors at their first assessment

- Hypertension
- Atrial Fibrillation
- Ischaemic Heart Disease and/or Peripheral Vascular Disease
- Diabetes
- Cholesterol
- Smoking History
- Alcohol Consumption

INVESTIGATIONS

Investigations are necessary to exclude other diagnoses and to determine the potential cause of the event. Routine investigations should include; full blood count, electrolytes, renal

function, cholesterol, glucose levels, and electrocardiogram (**ECG**), and in selected patients erythrocyte sedimentation rate (**ESR**) or C-reactive protein (**CRP**).^[3, 4] Further investigations may be warranted if clinical history, imaging and routine investigations do not adequately identify the underlying cause.

BRAIN IMAGING

TIA is a clinical diagnosis and brain imaging is used to exclude stroke mimics. Transient neurological symptoms may arise from widely varying brain pathology and may be difficult to distinguish from TIA. Computerised Tomography (**CT**) brain imaging reliably detects some of these pathologies (eg subdural haematoma, tumours). Other pathologies (eg multiple sclerosis, encephalitis, hypoxic brain damage) are better identified on Magnetic Resonance Imaging (**MRI**). Some stroke mimics (eg epilepsy, acute metabolic disturbances) are not visible on brain imaging at all.

CT imaging is widely available, reliably identifies many diagnoses that mimic TIA and should be undertaken early in all patients.^[4] However, MRI with diffusion weighted imaging (**DWI**) is the imaging strategy of choice and can detect ischaemic changes consistent with infarction in up to two thirds of those with TIA.^[1, 3] The longer imaging time and limited availability of MRI scanners in many centres compared to CT limit the potential application of MRI as a routine strategy.

Patients with severe comorbidities may not be appropriate for scanning if the results would not change management.^[1]

CAROTID IMAGING

The presence of symptomatic carotid artery disease increases the risk of stroke. Appropriate candidates for urgent carotid investigations and revascularisation usually meet the following criteria:

- Carotid circulation symptoms, such as dysphasia, other cortical symptoms, transient monocular blindness and most with unilateral weakness
- Fit for surgery, if this can be performed by a specialist surgeon with low rates of perioperative mortality and morbidity.

Priority for carotid imaging is urgent due to risk of early stroke and proven benefits of early carotid endarterectomy. In higher risk patients carotid ultrasound and surgery should be performed as early as possible, preferably within hours or days.^[14, 51]

A recent systematic review found that non invasive imaging methods such as Doppler ultrasound (**US**), computed tomography angiography (**CTA**), magnetic resonance angiography (**MRA**) and contrast enhanced magnetic resonance angiography (**CEMRA**) provide good accuracy in detecting 70-99% internal carotid artery stenosis (North American Symptomatic Carotid Endarterectomy Trial (**NASCET**) criteria) when compared with conventional intra-arterial angiography.^[52] Of these techniques, CEMRA is the most sensitive and specific non-invasive imaging modality for carotid artery stenosis, closely followed by Doppler US and CTA, with non-contrast MRA being the least reliable.^[52, 53] However, CEMRA is a relatively new test that is not available in all centres whereas Doppler US is widely available and used in most centres. Non invasive measures for symptomatic events were much less accurate for patients with 50-70% stenosis.^[3]

CARDIAC IMAGING

Echocardiography may be considered in selected patients if a potential cardioembolic source is likely or in patients with TIA of unknown origin after standard diagnostic workup.

Recommendation – clinical assessments and investigations

Clinical Assessment and Blood Tests

- In patients with TIA, early clinical evaluation, including physiological parameters and routine blood tests (Full blood count, electrolytes, glucose, lipids and creatinine, and in selected patients CRP or ESR) are recommended **(European Grade A)**

Electrocardiography (ECG)

- All TIA patients should have a 12-lead electrocardiograph **(ECG)**. **(European Grade A)**
- In TIA patients seen after the acute phase, 24-hour Holter ECG monitoring should be performed when arrhythmias are suspected and no other causes of TIA are found **(European Grade A)**

Brain Imaging

- Patients classified as high risk should have an urgent MRI or CT brain ('urgent' is considered as soon as possible, but certainly within 24 hours). **(European Grade A)**
- Patients classified as low risk should have a MRI or CT brain as soon as possible, but certainly within 7 days. **(Australian Grade B)**
- If MRI is used, the inclusion of DWI and T2* weighted gradient echo sequences is recommended **(European Level A)**

Carotid Imaging

- All patients with TIA who are candidates for carotid intervention should have carotid imaging within one week of symptom onset **(RCP)**, and within one working day if at high risk. **(English/Welsh, NZ TIA ✓)**

Cardiac imaging

- Echocardiography is recommended in selected patients **(European Grade B)**

11 BENEFIT OF EARLY ASSESSMENT AND RAPID INTERVENTION FOLLOWING TIA

The high risk of stroke in the first 48 hours after TIA indicates a need for urgent diagnostic workup and early intervention to prevent further events.

Several interventions are of proven effectiveness in preventing stroke and other cardiovascular events after a TIA. To date there are no large randomised trials of urgent intervention or treatments early after TIA. However, there is recent data supporting the beneficial impact of reorganisation of services to facilitate rapid assessment and prompt and more intensive treatment. These studies are discussed in some detail as they give guidance to recommendations for changes in service provision in New Zealand.

A recent systematic review and meta-analysis demonstrated a strong correlation between the degree of urgency of intervention and specialisation of stroke services and the risk of early stroke after TIA. The lowest risks occurred in studies of emergency treatment using specialised stroke services and highest risks occurred in population-based studies that did not involve urgent treatment.^[54]

EXPRESS

The Oxford based Early use of EXisting PREventive Strategies for Stroke (**EXPRESS**) study used a prospective, sequential (before versus after) comparison to report the impact of a change in the process of care of people with TIA and minor ischaemic stroke.^[22] The phase one service provided appointment based clinics on Mondays to Fridays that were associated with inherent delays in receiving referrals and contacting patients. Treatment was not initiated in the clinic; rather, recommendations were made to the referring primary-care physician. Standard secondary prevention measures were recommended with the exception that in addition to aspirin, clopidogrel (75mg daily, to be stopped at 30 days) was recommended for all patients seen within 48 hours or those seen within 7 days and thought to be at high risk. In phase two the service changed to an open-access afternoon clinic at which no appointment was necessary, and at which treatment was initiated immediately after the diagnosis was confirmed. Loading doses of aspirin (300mg) and clopidogrel (300mg) were given at the clinic and other standard secondary prevention measures were introduced.

In phase two of the EXPRESS study, significantly more people were seen early after seeking medical attention for their TIA; 29% within 6 hours (2% before) and 59% within 24 hours (23% before). At one month follow-up more people were on recommended treatments including; dual-therapy with aspirin and a 30 day course of clopidogrel (49% v 10%), a statin (84% v 65%), one or more blood pressure lowering drugs (83% vs 62%) and two or more blood pressure lowering drugs (60% v 34%). The median delay till first prescription of recommended treatments (statin, blood pressure lowering drug, clopidogrel or warfarin) was 1 day in Phase two when treatments were initiated in the clinic compared with 19 days in phase one ($p < 0.0001$). Blood pressures at one month were lower (136/75 mm Hg in phase two and 142/80 mm Hg in phase one). While similar numbers underwent carotid surgery (about 6%), surgery was carried out significantly earlier; 40% within 7 days and 67% within 30 days in phase two compared to 0% and 12% in phase one. These changes in processes of care and interventions were associated with an 80% reduction in the 90 day risk of stroke from 10.3% (32/310) in phase one to 2.1% (6/281) during phase two. This is equivalent to an 8.2% absolute risk reduction or a NNT of 12 to prevent one stroke. The reduction in risk was independent of age and sex.

The EXPRESS study was not a randomised controlled trial. However, the control group was accrued prospectively and the study was nested in the rigorous and well established OXVASC population based study minimising potential selection or referral bias. There was no evidence of confounding i.e. that some other factor changed between phase 1 and phase 2, other than the study intervention. The rate of stroke dropped immediately in the study population after introduction of the new clinic service and there was no change in stroke rates in those TIA patients who were treated elsewhere. These results were obtained within the United Kingdom Health system and there are no data about the potential impact of similar changes to services in New Zealand.

SOS-TIA

The Paris based SOS-TIA study set up a short-stay hospital clinic with 24 hour access via telephone referral and advertised this service to 15,000 primary-care and specialist practitioners.^[23] This clinic was situated within a hospital neurology department that included an acute stroke unit and provided a standardised clinical assessment and investigative work up. Patients with suspected TIA were reviewed by a vascular neurologist within four hours of clinic admission. Over 1000 patients were assessed, 53 percent within 24 hours of symptom onset, and 74 percent were discharged home the same day. All patients with confirmed or possible TIA (78% of those presenting) were immediately started on a secondary prevention program. The referring doctor was telephoned and discharge summaries stated the targets of

preventative therapy; blood pressure of 140/90 mm Hg in non-diabetic patients and, if that was achieved, a further target of 130/70 (the first target for people with diabetes); low-density lipoprotein (**LDL**) level of less than 2.56 mmol/L; and smoking cessation.

In the SOS-TIA study, the 90 day stroke rate was 1.24% (95% CI 0.72-2.12) compared with an ABCD₂ score predicted rate of 5.96%, about an 80% relative risk reduction. This is equivalent to a 4.7% absolute risk reduction or a NNT of 21 to prevent one stroke. The one-year rate of myocardial infarction and vascular death (1.1%) was about half that estimated from meta-analysis.

SOS-TIA study weaknesses included; lack of a historical control population, failure to randomise patients to SOS-TIA clinic care versus usual care and the selective nature of the population treated as they only saw about one in five of all people with TIA in Paris area during the study.

IMPLICATIONS OF EARLY ASSESSMENT AND MORE INTENSIVE INTERVENTION

These studies confirm that it is feasible to reorganise or create services that facilitate urgent assessment and early initiation of secondary preventative therapy, and that by doing so the risk of stroke after TIA may be significantly reduced, possibly by as much as 80 percent. This can be achieved by provision of a daily open-access clinic or an acute 24 hour hospital based service.

12 PROVISION OF TIA SERVICES IN NEW ZEALAND

CURRENT TIA SERVICES

The Ministry of Health produced service specifications in 2003 for components of an organised stroke service in NZ according to District Health Board (**DHB**) size, including neurovascular or outpatient services for people with minor stroke or TIA.^[55]

Organised Stroke Services Key Components (2003)	Large DHB (pop > 180,000)	Medium DHB	Small DHB (pop < 80,000)
Neurovascular or Outpatient Services	Diagnosis and secondary prevention issues in those patients with minor stroke or transient ischaemic attack in the community or not admitted to hospital. Patients should have access to specialist advice, outpatient assessment and investigations within 7-14 days.		
	This assessment should be via a specialised neurovascular clinic or service.	This assessment should ideally be via a specialised neurovascular clinic or service but may occur via other specialist clinics and services.	This assessment could be via a specialised neurovascular clinic but is likely to be provided via other specialist clinics.

The Ministry of Health stroke service specifications also state that each DHB should have “a nominated physician for leadership, planning, implementation, and accountability for best practice management of people with stroke”.

Current services in most DHBs cannot provide rapid initial assessment and investigation as recommended for people with high risk TIA. NZ is not unique in struggling to develop appropriate services for people with TIA. In Australia only 5% of hospitals surveyed in 2007

had a rapid assessment outpatient clinic for people with TIA or minor stroke.^[3] The UK National Sentinel Stroke Audit in 2006 found that 22% of Hospital Trusts treating stroke patients did not offer TIA clinics and 65% were unable to assess TIA patients within 7 days.^[18]

OPTIONS FOR TIA SERVICE DEVELOPMENT

Based on a figure of \$50,000 per new stroke in direct health costs funded by DHBs, a relatively small number of strokes need to be prevented after TIA to justify intensification of services for people with TIA.^[5] Many of the general components required for an effective TIA service already exist in most but not all DHBs. What is required is to address any deficiencies and ensure that the components work together in a timely and seamless fashion.

There are various models suggested for organising services for those with TIA. Such models range from direct hospital admission to a stroke unit, rapid-access outpatient clinics, weekly specialist clinics or management in the community by a general practitioner (**GP**). There is little direct evidence to guide administrators and clinicians in the most appropriate organisation of services for people with TIA. However, it is clear that whichever model is utilised it should be based on local resources and needs, and focus on rapid assessment and early management. Similar to stroke services, development of networks between GPs and stroke centres would enable appropriate use of more resources. Access to services should be determined on the basis of an individual's risk of stroke.

DO ALL PEOPLE WITH SUSPECTED TIA NEED SPECIALIST REVIEW?

The RCP guideline recommends specialist assessment for all people with TIA to ensure:

- accurate diagnosis and exclusion of stroke mimics
- identification of vascular territory and role of carotid imaging
- identification of likely causes
- appropriate investigation and treatment.

If GPs or doctors working in emergency departments have ready access to brain and carotid imaging, and are confident about the diagnosis and implementing recommended treatments, then some people with TIA who are assessed as low risk may not require specialist review.

However, people with TIA make up only one in every thousand consultations with a GP.^[3] Given the infrequent presentation, problems with accurate diagnosis and limited access to brain and carotid imaging in primary care, GPs are best placed to provide risk screening, initiation of recommended therapies, and referral to specialist stroke services for full assessment and early management. Furthermore, GPs are the clinicians primarily responsible for longer term management of cardiovascular risk factors.

WHAT IS THE MOST COST EFFECTIVE STRATEGY?

Health economic modelling performed for the RCP guideline development group found that the most cost effective strategy was immediate specialist assessment for all people with TIA.^[1] Immediate specialist assessment was cost effective compared with weekly specialist assessment even for the lowest ABCD₂ score group. Immediate specialist assessment resulted in the least strokes and most Quality Adjusted Life Years (**QALYs**). GP care was the least costly but resulted in the most strokes and least QALYs. Immediate specialist assessment was cost effective compared with GP care for all groups except those at lowest risk with ABCD₂ scores of 0 and 1. A weekly specialist assessment service was the most costly option.

Despite these findings the RCP guideline development group concluded that immediate specialist assessment was not practical for all TIA patients, as it may result in a larger number of people with non-vascular events being referred with the risk that services become overwhelmed. The RCP guideline development group recommended that the most cost

effective service design would be immediate specialist assessment in all high risk patients including those with an ABCD₂ score of four or more who have a seven day stroke risk of greater than 4%.

DEMAND FOR TIA SERVICES

The OXVASC data provided an annual TIA rate of about one per thousand population for all definite and probable TIAs.^[18] This is the most accurate figure available for estimating actual TIA incidence in NZ.

If all people referred with suspected TIA are also included then the demand on TIA services rises to about 3 referrals per thousand people per year. Of these about one third each will be people with TIA, people with minor stroke and people with neurological symptoms who have a non-TIA diagnosis.

Recommendations - for District Health Boards providing TIA Services

- All District Health Boards must provide organised stroke services. **(NZ Stroke Grade A)**
- Each District Health Board should have a nominated Lead Physician and Manager who are jointly accountable for leadership, planning, and implementation of best practice management of people with stroke and TIA. **(NZ Stroke, NZ TIA ✓)**
- Each DHB should have locally agreed protocols for the assessment and management of people with recent TIA, irrespective of where they are initially seen. **(NZ TIA ✓)**
- Annual TIA incidence of 1 per thousand population and demand for TIA services of 3 per thousand population are appropriate for DHB planning purposes. **(NZ TIA ✓)**
- District Health Boards should provide TIA services that allow urgent specialist assessment, completion of appropriate investigations and initiation of therapy. **(NZ TIA ✓)**
- The degree of urgency for assessment should be based on an individual's risk of stroke, including same day and no later than within 24 hours for most high risk patients (including weekends and public holidays). **(NZ TIA ✓)**
- A TIA service should be provided by an appropriately resourced, open-access daily specialist outpatient clinic, an inpatient short-stay facility or a combination of these services. In smaller District Health Boards with insufficient population to warrant specialised TIA services this should be by general medical services, using agreed protocols. **(NZ TIA ✓)**

UPDATED TIA SERVICE SPECIFICATIONS, ACCORDING TO DHB SIZE

Each DHB should provide TIA services at a level that is appropriate to the population they serve, including same day and no later than within 24 hours access for most high risk patients to recommended specialist assessments, investigations and treatments.

The ABCD₂ data suggest that two thirds of people with TIA will be high risk (ABCD₂ scores of 4 or more).^[32] People with high ABCD₂ scores who present late can be managed as low risk, so the proportion of people referred with suspected TIA who need to be managed as at high risk is likely to be less than two thirds.

Most DHBs will not be able to provide emergency access to specialist TIA services out of hours, on weekends or on public holidays, and many people with acute TIA will need to be assessed in emergency departments and by acute general medical services. Therefore, each DHB should have locally agreed protocols and policies for the assessment and management of people with

recent TIA, irrespective of where they are initially seen.

Larger DHBs serving populations of over 180 000 people should be expected to provide open-access daily Monday to Friday specialist TIA services. Most medium sized (80 - 180 000) and all smaller (less than 80 000) DHBs will need to rely on assessment and initial management by non-stroke specialised clinicians using locally agreed protocols.

Recommendation – TIA service specifications (by risk assessment and DHB size)			
Service Need (population)	Large DHB (180 – 500 000)	Medium DHB (80 – 180 000)	Small DHB (30 – 80 000)
Estimated numbers with TIA (1 per 1000 per year)	180 - 500 per year About 3 - 10 per week	80 to 180 per year About 2 to 3 per week	30 to 80 per year About 1 to 2 per week
High Risk (66%#) (0.6 per 1000 / year)	120 – 330 per year 2 – 6 per week	50 – 120 per year 1 – 2 per week	20 – 50 per year < 1 per week
Who should assess people with high risk of stroke after TIA?	Specialist Stroke Service	Specialist Stroke or Medical Service	Specialist Medical Service.
Where should service be provided?	Open-access Specialist TIA Clinic or Short Stay facility	Ideally open-access Specialist TIA Clinic or Short Stay facility but may occur via Emergency Department or Inpatient Medical Unit.	Emergency Department or Inpatient Medical Unit
How Urgent?	Same day or within 24 hours including weekends and public holidays		
Low Risk (34%) (0.3 per 1000 / year)	60-170 per year 1 – 3 per week	30-60 per year < 2 per week	10-30 per year < 1 per week
Who should assess people with low risk of stroke after TIA?	Specialist Stroke Service or General Practitioner*	Specialist Stroke, Neurology or General Medical Services, or General Practitioner*	Specialist General Medical Services or General Practitioner*
Where should service be provided?	Open-access Specialist TIA Clinic or General Practice*	Open-access Specialist TIA Clinic but may occur via Specialist Clinic or General Practice.*	Specialist Clinic or General Practice*
How Urgent?	As soon as possible but definitely within 7 days		

These figures are for those with probable or definite TIA and need to be doubled if all people with transient neurological symptoms are referred for assessment. This emphasises the importance of correct diagnosis at point of first contact; by GPs, EMS and clinicians in emergency departments. However, these figures also assume all patients with TIA will present to clinicians and be referred for specialist assessment.

* If the treating doctor is confident about the diagnosis of TIA and implementing treatments, and has access to specialist advice and brain and carotid imaging within 7 days then specialist review of low risk TIA patients may not be necessary.

13 SECONDARY PREVENTION MEASURES

BENEFITS OF SECONDARY PREVENTION MEASURES

All people with TIA are at risk of subsequent stroke and cardiovascular events including myocardial infarction and death. Several interventions that have proven effectiveness in preventing these events are well covered by international and NZ guidelines including; dietary modification, exercise, smoking cessation, aspirin, other antiplatelet agents, blood pressure-lowering drugs, statins, improved glycaemic control, anticoagulation for atrial fibrillation and endarterectomy for $\geq 50\%$ symptomatic carotid stenosis.^[56]

Assuming that these effects are independent, use of these interventions in appropriate people following TIA or stroke have been predicted to reduce the long-term group risk of recurrent stroke by up to 80%. Analysis gives an estimated number needed to treat (**NNT**) of about five at five years and three at 10 years.^[56]

There is evidence that initiating secondary stroke prevention therapies in hospital results in high rates of adherence to therapy at follow up.^[8, 57]

ANTITHROMBOTIC THERAPY^[4]

Relative risk reduction (**RRR**), absolute risk reduction (**ARR**) and number needed to treat (**NNT**) to avoid one major vascular event per year in patients with antithrombotic therapy

Disease	Treatment	RRR %	ARR %	NNT
Non-cardioembolic ischaemic stroke or TIA	aspirin / placebo	13	1.0	100
	aspirin + dipyridamole / placebo	28	1.9	53
	aspirin + dipyridamole / aspirin	18	1.0	104
	clopidogrel / placebo	23	1.6	62
	clopidogrel / aspirin	10	0.6	166
Atrial fibrillation (secondary prevention)	warfarin / placebo	67	8.0	13
	aspirin / placebo	21	2.5	40

RISK FACTOR MODIFICATION^[4]

Relative risk reduction (**RRR**), absolute risk reduction (**ARR**) and number needed to treat (**NNT**) to avoid one major vascular event per year in patients with risk factor modifications

Clinical condition	Treatment	RRR %	ARR %	NNT
Post-stroke / TIA with increased blood pressure	Antihypertensive	31	2.20	45
Post-stroke / TIA with normal blood pressure	ACEI \pm diuretic	24	0.85	118
Post-stroke / TIA	Statins	16	0.44	230
	Smoking cessation	33	2.30	43

RECOMMENDATIONS FOR SECONDARY PREVENTION AFTER TIA

This guideline supports the general recommendations of the NZ Ministry of Health's Diabetes and Cardiovascular Disease Quality Improvement Plan.^[5]

Recommendations – initial management

- All people with TIA who attend emergency departments, out-of-hours medical centres or similar providers soon after TIA must be treated and must not be sent home and simply told to see their GP in due course. **(English/Welsh ✓)**
- All people with suspected TIA should receive immediate initiation of antiplatelet therapy with aspirin if fully recovered and no contraindications. **(RCP)**
- Clinicians should establish all people with TIA on measures for secondary prevention as soon as the diagnosis is confirmed, including discussion of individual risk factors. **(RCP)**
This should consist of an appropriate individual combination of:
 - Anti-platelet agent(s) such as aspirin, aspirin plus dipyridamole or clopidogrel
 - Blood pressure lowering therapy
 - Statin
 - Warfarin - if atrial fibrillation or other cardiac source of emboli
 - Nicotine replacement therapy or other smoking cessation aid.
- Treatment must be initiated at first contact. **(RCP, English/Welsh ✓)**

This general advice should be considered for all people after stroke or TIA but treatment decisions must be tailored to the needs of individuals. For example some people may not be able to tolerate all recommended therapies and the long term goal of reducing future cardiovascular events must be balanced against potential immediate hazards of therapies such as bleeding, falls, fractures, delirium and electrolyte disturbances.

Follow up, either in primary or secondary care, should occur within the first month so that medication and other risk factor modification can be reassessed.^[14]

Recommendations – behaviour change

- Every person with TIA should be assessed and informed of their risk factors for stroke and adverse cardiovascular events, 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. **(Australian Grade A)**
 - improving diet: a diet that is low in fat (especially saturated fat) and sodium, but high in fruit and vegetables should be consumed. **(Australian Grade A)**
 - a weight-reducing diet for people with an elevated body mass index. **(European Grade B)**
 - increasing regular exercise **(Australian Grade C)** and physical activity **(European Grade B)**
 - avoiding excessive alcohol. **(Australian Grade C, European Grade B)**
 - Interventions should be individualised and may be delivered using behavioural techniques (such as educational or motivational counselling). **(Australian Grade A)**
 - For Māori and Pacific people, involvement of whānau and culturally appropriate service providers is advised, where these are available. **(NZ TIA ✓)**
 - Information sharing and lifestyle advice should be initiated at first assessment after TIA, whether this occurs in primary or secondary care. **(NZ TIA ✓)**
-

Recommendations – antiplatelet therapy

- Long term antiplatelet therapy should be prescribed to all people with TIA who are not prescribed anticoagulation therapy. **(Australian Grade A)**
 - Antiplatelet therapy should be started immediately in all people with suspected TIA, and not deferred till after brain imaging. **(RCP)**
 - Aspirin, the combination of aspirin plus dipyridamole or clopidogrel are all effective in reducing stroke and vascular events following TIA **(European Grade A)**
 - Aspirin remains the most readily available, cheapest and most widely used anti-platelet agent in people TIA. **(Australian, NZ TIA ✓)**
 - Combination therapy with modified release dipyridamole twice daily plus aspirin is more effective than aspirin alone **(European Grade A)**
 - Clopidogrel is more effective than aspirin **(European Grade A)**
 - The combination of aspirin plus dipyridamole and clopidogrel alone are equally effective in reducing stroke and vascular events **(NZ TIA Grade B)**
 - The combination of aspirin plus clopidogrel is not recommended for long term secondary prevention of cerebrovascular disease in patients who do not have acute coronary disease or recent coronary stent. **(European, Australian Grade A)**
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ASPIRIN BEFORE BRAIN IMAGING

Primary intracerebral haemorrhage (**ICH**) is a rare cause of TIA and 99% of strokes after TIA are due to cerebral infarction.^[32] A Cochrane review of antiplatelet agents for acute ischaemic stroke addressed concerns about patients with ICH treated with aspirin.^[58] A post-hoc subgroup analysis restricted to the subset of 671 participants with ICH inadvertently randomised in the reviewed trials showed that the odds of a poor outcome were lower among those with ICH who were allocated aspirin (OR 0.68, 95% CI 0.49 to 0.94) compared with placebo. Therefore, there is no clear evidence of harm to patients with ICH inadvertently treated with aspirin prior to imaging.

These data support the RCP recommendation for immediate initiation of aspirin in people with suspected TIA, without delay until imaging results are available.^[1] Give Aspirin 300mg stat if aspirin naive followed by 75-150mg daily for first event. These doses are at least as effective as higher doses (NZ CV Risk Grade A).

If already on aspirin, add dipyridamole or change to clopidogrel. Aspirin plus modified release dipyridamole twice daily and clopidogrel alone are more effective than aspirin alone, although the numbers needed to treat (**NNT**) are greater than 100 to obtain benefit above aspirin alone.

DIPYRIDAMOLE

The dipyridamole dose funded by PHARMAC in NZ is 150mg SR twice daily whereas available evidence supports a 200mg modified release dose given twice daily.^[59] There is a significant dropout rate with dipyridamole therapy due largely to headache. Adherence may be improved if people are advised that side effects may resolve after several days therapy or if dose is temporarily reduced and reintroduced gradually, for example using dipyridamole 150mg SR once daily at night for one week before increasing to twice daily.

CLOPIDOGREL

The recommended dose is 300mg stat and 75mg daily. Clopidogrel alone is as effective as combination aspirin plus dipyridamole, and is better tolerated.^[60] At the time of writing, PHARMAC special authority approval is required for funding of clopidogrel. Some people may choose to pay for clopidogrel. A 30 day course of clopidogrel in combination with aspirin following TIA is not proven therapy, but was used in EXPRESS study patients seen within 48 hours of TIA and those seen within seven days who were identified as high risk.^[22] Longer term dual therapy is not recommended due to increased risk of ICH.

Recommendations – anticoagulation therapy

- Anticoagulation therapy for long-term secondary prevention should be used in all people with TIA who have atrial fibrillation, valvular heart disease, or recent myocardial infarction, unless a contraindication exists. **(Australian Grade A)**
- The decision to commence anticoagulation therapy should be made prior to discharge. **(Australian Grade C)**
- Anticoagulation therapy should be started after CT or MRI has excluded intracranial haemorrhage. **(Australian ✓)**
- A target INR of 2.5 (therapeutic range 2-3) is recommended. **(NZ TIA ✓)**
- The potential risks and benefits of anticoagulation therapy should be discussed with the patient and where appropriate their family/whanau, and this discussion and its outcome should be documented. **(NZ TIA ✓)**

Recommendations – blood pressure lowering

- All TIA patients should receive blood-pressure lowering therapy, unless contraindicated by symptomatic hypotension. **(Australian Grade A)**
- The absolute target BP level is uncertain but benefit has been associated with an average reduction of about 10/5 mm Hg, and normal BP levels have been defined as < 120/80 mm Hg. **(European ✓)**
- Individual blood pressure targets should take into account the number and dose of medications as well as co-morbidities and frailty, especially in older people. **(NZ TIA ✓)**
- More than one drug is frequently required to lower blood pressure to optimum levels. **(NZ CV Risk Grade B)**
- An ACE-inhibitor in conjunction with a thiazide diuretic is an appropriate combination. **(NZ CV Risk Grade A)**

Recommendations – cholesterol lowering

- Therapy with a statin should be used for all TIA patients. **(NZ TIA Grade A)**
- Optimal lipid levels include total cholesterol < 4 mmol/L, LDL < 2.5 mmol/L, HDL < 1 mmol/L, TC:HDL ratio < 4.5 and triglycerides < 1.7 mmol/L **(NZ CV Risk ✓)**
- Patients with high cholesterol levels should receive dietary review and counselling by a specialist trained clinician. **(Australian Grade B)**
- For Māori and Pacific people, involvement of whānau and culturally appropriate service providers for dietary counselling and support is advised, where these are available. **(NZ TIA ✓)**

At the time of writing PHARMAC funds simvastatin as initial statin therapy in NZ. Initial dose is simvastatin 40mg although a lower dose (20mg and titrate up) may be more appropriate in older people or those with frailty.

In the Stroke Prevention by Aggressive Reduction in Cholesterol Levels (**SPARCL**) study atorvastatin 80mg reduced stroke recurrence compared with placebo (HR 0.84; 95% CI 0.71-0.99), while in the Heart Protection Study simvastatin 40mg reduced vascular events in patients with prior stroke, and reduced stroke in patients with other vascular disease (RR 0.76).^[4, 61, 62] Neither trial assessed efficacy by stroke subtype, and SPARCL did not include patients with presumed cardioembolic stroke. The risk of haemorrhagic stroke was slightly increased in both trials. The absolute risk reduction achieved with statin therapy over placebo is low with NNT 112-143 for 1 year.^[4] No stroke study has directly compared high intensity therapy with usual dose statin therapy.

Recommendations – diabetes management

- Patients with glucose intolerance or diabetes should be managed in line with national guidelines for diabetes. **(Australian ✓)**

Recommendations – carotid revascularisation

- Carotid endarterectomy should be undertaken in TIA patients with ipsilateral carotid stenosis measured at 70-99% if surgery can be performed by a specialist surgeon with low rates of perioperative mortality/morbidity. **(Australian Grade A)**
 - Carotid endarterectomy should be undertaken in select TIA patients (considering age, gender and comorbidities) with ipsilateral carotid stenosis measured at 50-69% if surgery can be performed by a specialist surgeon with very low rates of perioperative mortality/morbidity. **(Australian Grade A)**
 - People with TIA who have carotid stenosis of < 50% should not receive surgery but best medical treatment **(RCP, Australian Grade A)**
 - People who require carotid endarterectomy should be treated within 2 weeks of TIA **(RCP, Australian Grade A)**
 - Carotid endarterectomy should only be performed by a specialist surgeon at centres where outcomes of carotid surgery are routinely audited. **(Australian Grade B)**
-

BENEFIT OF CAROTID ENDARTERECTOMY (CEA)

The benefit of CEA is substantial for people with 70-99% stenosis of the symptomatic internal carotid artery. The NNT is six to prevent one ipsilateral stroke (95% CI 5-9) or any stroke or surgical death (95% CI 5-10).^[63]

The benefit from CEA is lower in patients with 50-69% stenosis with a NNT 24 to prevent one ipsilateral ischaemic stroke (95% CI 13-50), or 14 to prevent one stroke of any origin, including surgical death (95% CI 9-35).^[63]

The benefit from CEA is highly dependent on time since the presenting symptom. The absolute risk reduction from CEA is reduced by half if surgery is delayed beyond 2 weeks and further reduced by half if it is delayed beyond 4 weeks.^[63] For example, in those with carotid stenosis of > 50%, the NNT is 25 for CEA within 2 weeks of TIA but 625 if CEA is delayed for more than 12 weeks.^[4]

CAROTID ANGIOPLASTY AND STENTING

Carotid angioplasty and stenting may be considered in certain circumstances, that is in patients who meet criteria for carotid endarterectomy but are deemed unfit due to medical comorbidities (eg. significant heart/lung disease, age > 80yrs), or conditions that make them unfit for open surgery (eg high or low carotid bifurcation, carotid re-stenosis, previous neck irradiation).

Recommendations – patent foramen ovale (PFO)

- All patients with TIA and a PFO should receive antiplatelet therapy as first choice. **(Australian Grade C)**
- Anticoagulation may also be considered taking into account other risk factors and the increased risk of harm. **(Australian Grade C)**
- Currently there is insufficient evidence to recommend PFO closure as routine treatment after TIA. **(Australian ✓)**

Recommendations – concordance with medication

- Interventions to promote adherence to medication regimes are often complex and should include one or more of the following:
 - information, reminders, self-monitoring, reinforcement, counselling, family therapy; **(Australian Grade B)**
 - reduction in the number of daily doses; **(Australian Grade B)**
 - multi-compartment medication compliance device; **(Australian Grade C)**
- For Māori and Pacific people, involvement of whānau and culturally appropriate service providers for counselling and support is advised, where these are available. **(NZ TIA ✓)**

14 DRIVING ADVICE AFTER TIA

Given the risk of stroke after TIA, driving must be restricted during the highest risk periods.

SUMMARY OF LAND TRANSPORT NZ RECOMMENDATIONS FOR DRIVING AFTER TIA

Private licence - generally class 1 (private motor vehicles) or class 6 (any motorcycle).

- Single TIA: No driving for minimum one month after a single TIA
- Multiple TIAs: No driving for a minimum three months provided the condition has been adequately investigated and treated.

Vocational licence - generally classes 2-5 (heavy commercial motor vehicles including those towing trailers) and/or a P, V, I or O licence endorsement.

- Single TIA: No driving for a minimum of six months and only if the cause has been identified and satisfactorily treated, including a specialist medical assessment. Note these people may resume private vehicle driving after minimum one month.
- Multiple TIAs: People should not return to vocational driving. However, the Director of Land Transport may consider granting a licence 12 months after the last attack if an appropriate specialist report supports such an application.

Recommendations – driving after TIA

- All people with TIA should have their driving status assessed, be advised about the impact of their TIA on their ability to drive and this advice should be documented **(NZ TIA ✓)**
 - Health practitioners should refer to the Land Transport NZ document “Medical Aspects of Fitness to Drive” available at www.ltsa.govt.nz/licensing/docs/ltsa-medical-aspects.pdf for full advice regarding fitness to drive after a TIA. **(NZ TIA ✓)**
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15 GUIDELINE DEVELOPMENT

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PEER REVIEW AND CONSULTATION

The draft guideline was circulated to over 75 organisations and individuals in New Zealand and overseas for appraisal including:

Australasian College for Emergency Medicine (NZ)

District Health Boards of New Zealand

Internal Medicine Society of Australia and New Zealand (NZ)

New Zealand Medical Association, GP Council

PHARMAC

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THIS TIA GUIDELINE HAS BEEN ENDORSED BY

Internal Medicine Society of Australia and New Zealand
New Zealand Ministry of Health
The Royal New Zealand College of General Practitioners



The Royal New Zealand
College of General Practitioners

16 DISCLOSURES

All three authors are previous members of the Ministry of Health's Stroke Advisory Committee (2002-4) and current honorary medical advisors for the Stroke Foundation of NZ; John Fink (National), Alan Barber (Northern Region) and John Gommans (Central Region).

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