Stroke
FOUNDATION

National Stroke Audit

Acute Services Report 2017

strokefoundation.org.au

About the Stroke Foundation

The Stroke Foundation is a national charity that partners with the community to prevent, treat and beat stroke. We stand alongside stroke survivors and their families, healthcare professionals and researchers. We build community awareness and foster new thinking and innovative treatments. We support survivors on their journey to live the best possible life after stroke.

We are the voice of stroke in Australia and we work to:

› Raise awareness of the risk factors, signs of stroke and promote healthy lifestyles.

› Improve treatment for stroke to save lives and reduce disability.

› Improve life after stroke for survivors.

› Encourage and facilitate stroke research.

› Advocate for initiatives to prevent, treat and beat stroke.

› Raise funds from the community, corporate sector and government to continue our mission.

About the National Stroke Audit

The National Stroke Audit is a Stroke Foundation initiative delivered as part of the organisations' commitment to promoting evidence-based stroke care. The National Stroke Audit provides longitudinal data on clinical performance. The National Stroke Audit first commenced in 2007 and each alternate year the Stroke Foundation switches focus between acute stroke services and inpatient rehabilitation services.

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Acknowledgements

Foreword

On behalf of the Stroke Foundation and our Clinical Council I present the National Stroke Audit Acute Services report for 2017. This national audit of the Australian stroke system and standard of care has been conducted since 2007. The Acute Services Audit report, together with the Rehabilitation Services report produced in alternate years, is the cornerstone of our efforts to drive stroke quality improvement across the healthcare system.

The National Stroke Audit is the only audit of its kind in Australia, it is distinguished by the quality of its data and the large sample size. This year was the most comprehensive yet, encompassing stroke services that accounted for around 87 percent of Australia's acute stroke admissions in 2016, more than 30,000 patients.

The Audit findings demonstrated there was significant disparity in acute stroke care across the country. Targeted investment and coordination of services has resulted in pockets of improved outcomes, but many areas of the community have been left behind.

It was disappointing to see despite significant advancements in the treatment and care for stroke, patients continue to be denied best practice care in Australia. The Audit revealed regional Australians were among those impacted the most. The current divide between the haves and have nots in metropolitan and regional areas is extremely concerning, particularly when we know regional Australians are 19 percent more likely to suffer a stroke than their city counterparts.

Stroke strikes in an instant, attacking the brain – the human control centre. Stroke is a serious medical emergency which requires urgent attention, but with the right treatment at the right time many people are able to recover.

This Audit report provides a foundation for improvements. We must now ensure all Australian patients with stroke have access to the high quality, evidence-based care we know saves lives. The release of the updated Clinical Guidelines for Stroke Management 2017 (in September), means we know what best practice stroke treatment and care looks like.

Improvements can be achieved. Increased availability of clot busting treatment (thrombolysis), clot retrieval (endovascular thrombectomy) and stroke units demonstrates this. Unfortunately, we know that just 36% of patients arrived at hospital in time for clot busting drugs and for those who did arrive in time, just 30% received this emergency treatment within 60 minutes, far behind the UK at 62%. In short, best practice stroke treatment and care is available but not enough patients have access to it.

How do we ensure all Australians have access to best practice care?

We ensure every Australian household has someone who knows the signs of stroke and to call triple zero. We ensure every patient with a stroke has a clear pathway to stroke treatment, whether that be at the regional hospital, utilising telehealth, or transported to the nearest comprehensive stoke service. This means clear processes between ambulances, emergency departments and stroke units enabling patients to be diagnosed and provided with appropriate treatment quickly. The earlier treatment is delivered the better the outcome for patients.

Then, we must ensure patients with stroke and their families are supported to begin their recovery journey, to live well after stroke. Maximising their recovery by staying in a stroke unit and benefiting from specialist stroke teams encompassing doctors, nurses, and allied health professionals. Patients and their families must be provided with the help they need.

It is a travesty time-critical stroke treatment and best practice care is not available to all patients.

Surviving and living well after stroke should not be determined by your post code. Australia has one of the most advanced trauma systems in the world, we need to apply the same thinking to emergency stroke treatment to ensure people living in regional and rural Australia have the best chance of making a meaningful recovery after a stroke.

In summary, improvements have been made in the delivery of acute stroke treatment and care but there is still so much more to be done.

Pockets of high quality stroke care show it can be done and I commend the teams who have demonstrated consistent improvement in performance. If we can encourage success and share the learnings from their improvement then future patients with stroke and their families and carers will be the beneficiaries.

Finally, I want to thank the staff at each of the 127 sites who participated in the 2017 National Stroke Audit for their time and for their commitment to improving acute stroke services in Australia. This is your report and we hope it will help you continue to strive to prevent stroke, save lives and enhance recovery.

I commend this report and its recommendations.

Sharon McGowan

Sharon McGowan
Chief Executive Officer
Stroke Foundation
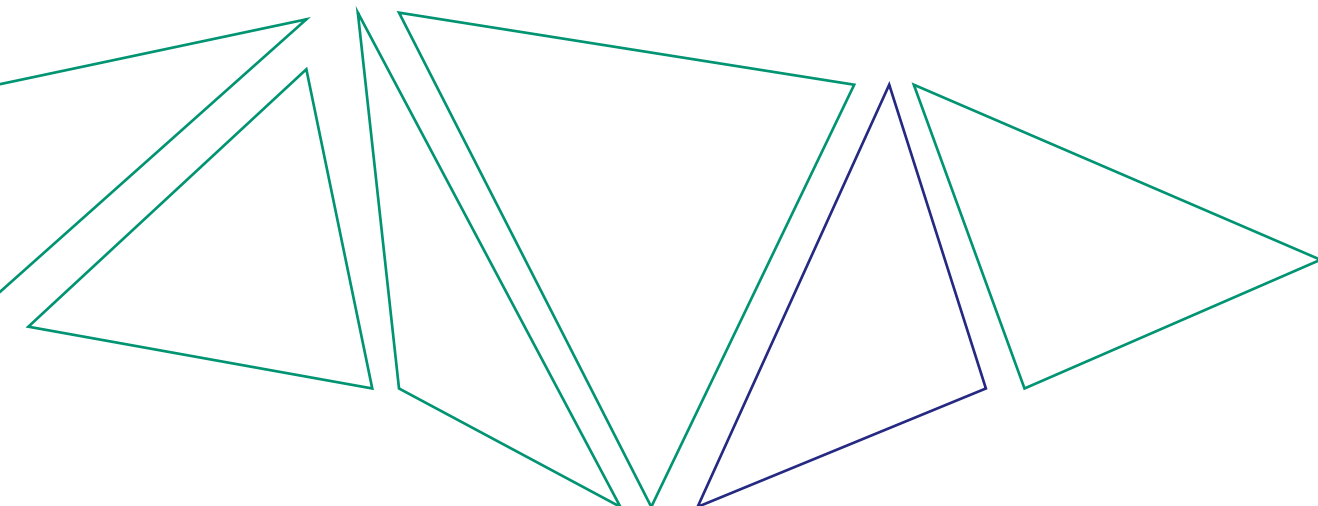
Executive Summary

The 2017 National Stroke Audit provides a robust and representative snapshot of acute stroke care in Australia. The National Report highlights areas where the system for acute stroke treatment and care is working well and reports on where improvement or changes may be needed. It is the only report of its kind in Australia, tracking the performance of Australia's stroke care against evidence-based clinical guidelines, the *Acute Stroke Services Framework 2015* and the Australian Commission on Safety and Quality in Health Care *Acute Stroke Clinical Care Standard 2015*. The report also highlights changes in stroke treatment and care from previous cycles of the National Stroke Audit which commenced in 2007.

Clinicians, healthcare administrators and governments alike utilise the data in this report to review services and clinical care in order to improve the quality of stroke management throughout Australia. The report delivers a solid foundation and baseline for the implementation of the newly released *Clinical Guidelines for Stroke Management* (September 2017).

The Audit collected data in two parts: the first involved a survey of resources, processes and infrastructure completed by 127 hospitals; and the second was a retrospective audit of 4,192 patient case notes (from 117 hospitals). Public and private hospitals that participated, reported admitting more than 30,000 stroke patients in the previous 12 months. Of the 127 participating sites, 82 sites were in metropolitan locations, 45 sites were regional, including one rural. The majority of the participating services admitted between 75 and 499 patients with stroke in the past year.

It is important to note this report maps stroke treatment and care against the *Clinical Guidelines for Stroke Management 2010* which have now been superseded by the 2017 version. Thus, providing an informed baseline for future audits against the updated evidence-based best practice guidelines.

The Audit data revealed inequalities in acute stroke care and services. Advancements in stroke treatment and care mean stroke is no longer a death sentence for many, however too many patients are missing out on best practice care simply because of where they live. There were pockets of the country where targeted investment and coordination of services has resulted in improved outcomes for stroke patients. However, other areas have been left behind; gaps are widening and patients are suffering poorer outcomes as a result.

A metropolitan and regional divide is clearly demonstrated in the Audit results. This is particularly concerning when we know regional Australians are 19% more likely to suffer a stroke than their metropolitan counterparts.

Encouragingly six sites in the Audit were found to meet all the elements of a comprehensive stroke service (increased from one site in 2015), including but not limited to, the provision of hyperacute treatments (endovascular thrombectomy [clot removal] services and intravenous thrombolysis [clot busting] services) and stroke unit care 24 hours a day, 7 days a week. All of these sites were located in metropolitan areas.

'Time is brain' therapies

Stroke is a serious medical emergency requiring urgent attention, but with the right treatment at the right time, many people are able to recover from stroke. Some of the more recent advancements in ischaemic stroke (caused by a clot) treatment are particularly time critical and can only be provided within the first few hours of a stroke (4.5 hours from stroke symptom onset for thrombolysis, and generally within six hours for endovascular thrombectomy). The earlier treatment is delivered, the better the outcome for patients.

Availability of thrombolysis has increased; 72% of participating sites reported offering the treatment, however there was significant

variation across the states and even within states. In the Australian Capital Territory thrombolysis availability was 100%, in Victoria it was 90% but in New South Wales and Tasmania it was just over 60% and in Western Australia it was only 31%. In saying availability to thrombolysis has increased, delivery of the treatment to appropriate patients remains a challenge. Nationally it has increased from 7% in 2015 to 13% in 2017, encouragingly the rate in South Australia was 20%, the Australian Capital Territory 23% and Victoria 19%. In short, thrombolysis is available, but there is inconsistent access across the country.

The Audit also shows that just 36% of patients with stroke reached hospital within the critical 4.5 hour time window for thrombolysis treatment. Recognition of stroke as a medical emergency remains a high priority.

Endovascular thrombectomy services were being delivered at 21 locations nationally, 12 of these 24 hours a day, 7 days a week. No endovascular services were available in the Northern Territory and a 24 hour service was not accessible in the Australian Capital Territory or Tasmania at the time of the Audit. In Queensland three of its services (12%) were delivering the treatment and all were concentrated in the south-east of the state – Brisbane and the Gold Coast. While the appropriate distribution and composition of services is still a matter of discussion, it is vital all Australians have a clear pathway to access this treatment.

Coordinated processes between ambulances, emergency departments and stroke units require integrated triage. Again, there is limited implementation of these care processes. Efficiency of hospital processes is critical to hyperacute care. The Audit shows Australia continues to be well behind indicators of efficiency for patients accessing time critical treatments. Only 30% of appropriate patients accessed thrombolysis within 60 minutes of hospital arrival, compared to the United States of America 59.3% and the United Kingdom 62.3%.[1,2]

Stroke unit care

Building on time critical treatment, access to a stroke unit is proven to save lives and reduce disability caused by stroke. Stroke unit care is characterised by provision of care in one location by an interdisciplinary team including medical, nursing and allied health professionals (occupational therapists, physiotherapists, speech pathologists, social workers and dietitians) with expertise in stroke.

It is encouraging to see access to stroke unit care has again increased to 69%, from 58% in 2013. However, the Audit found that of those who accessed a stroke unit, only half spent enough time on it to maximise their benefit. Again, regional Australians were less likely to have access to these vital services. This suggests bed management systems should be reviewed so hospitals can better prioritise patient movement to an appropriate stroke unit bed.

It is understood that it is not practical to expect all hospitals to have dedicated specialist stroke services. Some may only have a small number of stroke admissions, but all patients need and deserve access to best practice stroke care. The *Framework* recommends all patients with suspected stroke should be transported to a hospital with a stroke unit. Smaller services should have appropriate systems in place to rapidly screen and transfer patients with stroke to the nearest dedicated stroke unit or where access to time critical stroke treatments are available.

Only 57% of services reported routine use of the *Clinical Guidelines for Stroke Management*, care plans and protocols to support access to care for all patients with stroke. Patients are being left with avoidable disability because pathways are not in place to ensure their access to best practice stroke treatment.

In addition, we must ensure hospitals that have regional responsibility for stroke are equipped with the knowledge and resources to deliver best practice stroke care in line with the *Clinical Guidelines for Stroke Management*. A total of 65 acute services reported they had regional responsibility for stroke care, 14 of these services said they had no medical lead with specialist stroke knowledge responsible for ensuring best quality care. Similarly, it was concerning 16 services reported they did not have a stroke coordinator. It was, therefore, unclear what level of outreach and support could be provided in these centres.

Helping patients to live well after stroke

Coordination of care by interdisciplinary teams is critical to patient outcomes. Most hospitals recognised the importance of the coordination of care with rehabilitation services – 94% reported systemised coordination with rehabilitation service providers, 82% reported standardised tools to determine rehabilitation need and 98% reported routine involvement from carers in early rehabilitation processes. However in 2017, just 59% of services provided assessment for ongoing rehabilitation, a decrease from 77% in 2015. Whilst this assessment identified 75% of patients with stroke have ongoing rehabilitation needs, only 46% were referred to rehabilitation services.

Patients who were not treated in a stroke unit were also disadvantaged. They experienced delays in starting their rehabilitation early (within 48 hours from assessment), received less treatment based on their rehabilitation goals, and had fewer assessments for rehabilitation, compared to those who were treated on a stroke unit. Early rehabilitation and appropriate assessment of ongoing needs is a critical component of best practice care and helps patients with stroke to live well after stroke.

The Audit also found patients were not being properly supported to transition out of hospital. Despite this being an area of emphasis of previous Audits, the *Framework* and the *Standard*, 35% of patients did not have a discharge care (personal recovery) plan developed. Around the same number of patients (30%) were not provided with risk factor modification advice. There was much variation around the country in terms of patient education regarding risk factors and behaviour change for modifiable risk factors: a low of 56% in the Northern Territory and Tasmania, compared with a high of 84% in South Australia. Patients were also not prescribed recommended secondary prevention medications. Given one-in-10 stroke survivors are likely to suffer a recurrent stroke within 10 years, these gaps have significant and at times devastating implications for patients, families and the healthcare system. Those not treated on a stroke unit were less likely to receive this crucial advice and medication. We know that around 80% of strokes are preventable and the number of strokes would be practically cut in half (48%) if high blood pressure (hypertension) alone was eliminated.[3]

The opportunity

There are opportunities for improvements in acute stroke treatment and care across the country. We know what best practice stroke care looks like, with the release of the new *Clinical Guidelines for Stroke Management*, we must now ensure all Australian patients with stroke have access to it. This Audit provides a benchmark for clinicians, healthcare administrators and government to improve on. The Australian healthcare system must adapt to support healthcare professionals in the delivery of best practice stroke care and improve how resources are utilised to deliver the best outcomes for all Australians.

1   Xian Y et al. Use of Strategies to Improve Door-to-Needle Times With Tissue-Type Plasminogen Activator in Acute Ischemic Stroke in Clinical Practice Findings from Target: Stroke. Circ Cardiovasc Qual Outcomes. 2017;10:e003227. DOI: 10.1161/CIRCOUTCOMES.116.003227

2   Royal College of Physicians Sentinel Stroke National Audit Programme (SSNAP). Annual Results Portfolio April 2016-March 2017, accessed https://www.strokeaudit.org/results/Clinical-audit/National-Results.aspx

3   O'Donnell, MJ et al. Global and regional effects of potentially modifiable risk factors associated with acute stroke in 32 countries (INTERSTROKE): a case-control study. The Lancet , 2016, 388(10046), 761-775

At a glance

› 127 Hospitals

› 31,952 Acute stroke admissions

Time critical stroke therapy

36%
of patients reached hospital in 4.5 hour time window for thrombolysis

Use of thrombolysis increased
7% 2015
13% 2017

But thrombolysis given in hospital within **60 MINUTES** lags internationally

59%   **62%**   **30%**

Stroke unit care

87 STROKE UNITS 2015

95 STROKE UNITS 2017

77% Metro
Patients who received stroke unit care

47% Regional

Routine use of Clinical Guidelines

66%
in hospital **WITH** stroke unit

28%
in hospital **WITHOUT** stroke unit

More patient care needed

35%
of patients did **not** receive a **DISCHARGE CARE PLAN**

41%
of patients did **not** receive a **REHABILITATION ASSESSMENT**

30%
of patients did **not** receive **RISK FACTOR EDUCATION**
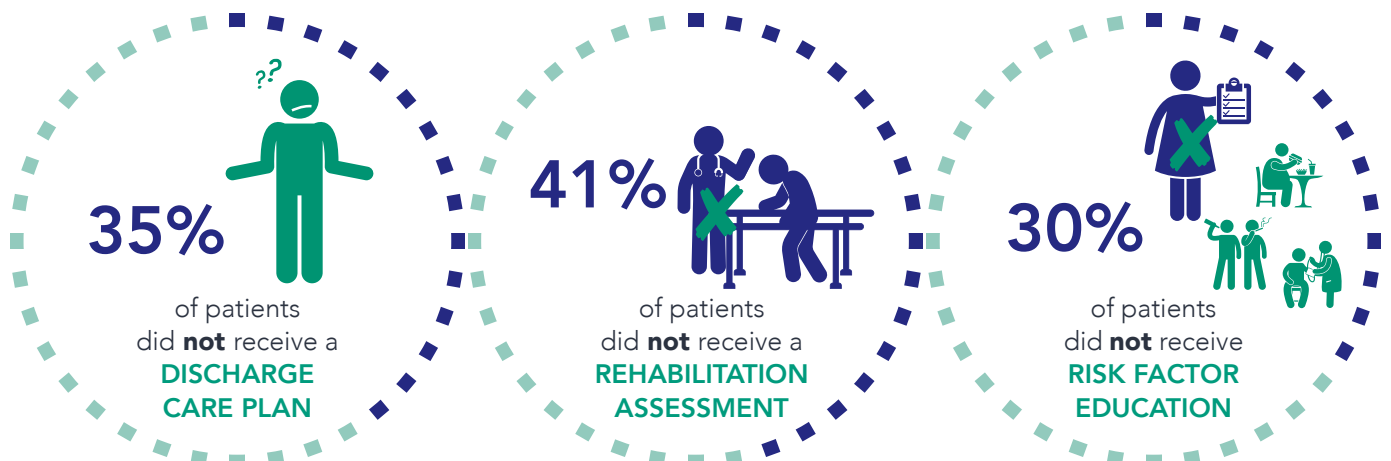
Table 1: 2017 National adherence to the Acute Stroke Clinical Care Standard Indicators

Indicator	Australia n	Australia %
Transport by ambulance to hospital able to provide thrombolysis (N=1,449)	1,035	71
Assessment in the emergency department (N=3,428)	1,578	46
Thrombolysis in ischaemic stroke (with exclusions) (N=2,922)	369	13
Thrombolysis in ischaemic stroke for those who arrived at hospital within 4.5 hours of stroke symptom onset (N=816)	312	38
Thrombolysis within 60 minutes of hospital arrival (N=369)	110	30
Time from stroke symptom onset to thrombolysis (median)	2 hours 36 minutes	
Admission into a stroke unit (N=4,192)	2,913	69
90% of acute hospital admission in a stroke unit (N=4,192)	1,896	45
Assessment by a physiotherapist within 48 hours of hospital admission (N=4,182)	2,813	67
Rehabilitation therapy within 48 hours of initial assessment (N=3,081)	2,654	86
Treatment for a rehabilitation goal commenced during acute hospital admission (N=3,202)	2,882	90
Discharged on antihypertensive medication (intracerebral haemorrhage) (N=154)	123	80
Discharged on statin, antihypertensive and antithrombotic medications (ischaemic stroke) (N=1,676)	1,154	69
Discharged on oral anticoagulants for atrial fibrillation (ischaemic stroke) (N=446)	313	70
Education about behaviour change for modifiable risk factors (N=1,899)	1,333	70
Carer support needs assessment (N=393)	242	62
Carer training (N=381)	217	57
Written care plan (N=2,487)	1,622	65

Recommendations

1 Review stroke service coordination and links, between metropolitan and regional areas, as well as with ambulance services.

2 Increase access to and delivery of time-critical therapy (thrombolysis and endovascular thrombectomy), and ensure that all patients in all parts of Australia have a clear access path to be transferred to receive appropriate stroke therapy.

3 Review bed management and patient flow practices to increase admission rates to a stroke unit and increase length of time patients are treated in a stroke unit.

4 Ensure all patients with stroke are assessed early for rehabilitation and referred as appropriate.

5 Review discharge planning processes to ensure appropriate risk factor education and medication is delivered.

- 127 Hospitals
- 31,952 Acute stroke submissions

Introduction

Stroke is one of Australia's biggest killers and a leading cause of disability. In 2017 alone, it is estimated that Australians will suffer more than 56,000 strokes.[1] In 2012–13, there were approximately 67,900 hospitalisations in Australia with the primary and/or additional diagnosis of stroke, with around 36,390 (7% of all hospitalisations) having stroke as the principal diagnosis.[2] Hospitals with stroke care units significantly improve the health outcomes and recovery of stroke survivors.[2]

Clinical Guidelines and the National Stroke Audit

The Stroke Foundation has coordinated the development of national clinical guidelines for stroke treatment and care since 2003. Clinical guidelines are an important tool empowering clinicians to understand the best evidence-based interventions to help people recover from stroke. The *Clinical Guidelines for Stroke Management 2010*[3] present evidence-based recommendations for clinical stroke care and were approved by the National Health and Medical Research Council (NHMRC). The *Clinical Guidelines for Stroke Management* help to form the basis of the National Stroke Audit, determining what key data is collected.

Clinical guidelines are only useful when they are utilised to inform clinical practice. 'Audit and feedback' is an important strategy to encourage change in clinical practice, and alignment with what is known to be best practice. In the absence of a standardised national data-set in Australia, the National Stroke Audit was designed by the Stroke Foundation to measure adherence to best practice as recommended in the *Clinical Guidelines for Stroke Management*. As well as monitoring stroke care at national and state levels, the National Stroke Audit promotes quality improvement by providing a report back to individual services. These individualised reports enable teams to compare their performance against aggregated averages, achievable benchmarks, and other similar-sized stroke services. The National Stroke Audit commenced in 2007 and provides longitudinal data to track changes over time; allowing services to understand where they have, and have not, improved between each National Stroke Audit cycle.

The new *Clinical Guidelines for Stroke Management 2017*[4] were published in September 2017. The 2017 version of the *Clinical Guidelines* updates and supersedes the 2010 version. Due to the timing of the updated *Clinical Guidelines for Stroke Management* release, this report measures against the 2010 *Clinical Guidelines*. Future National Stroke Audits will measure against the 2017 *Clinical Guidelines for Stroke Management*.
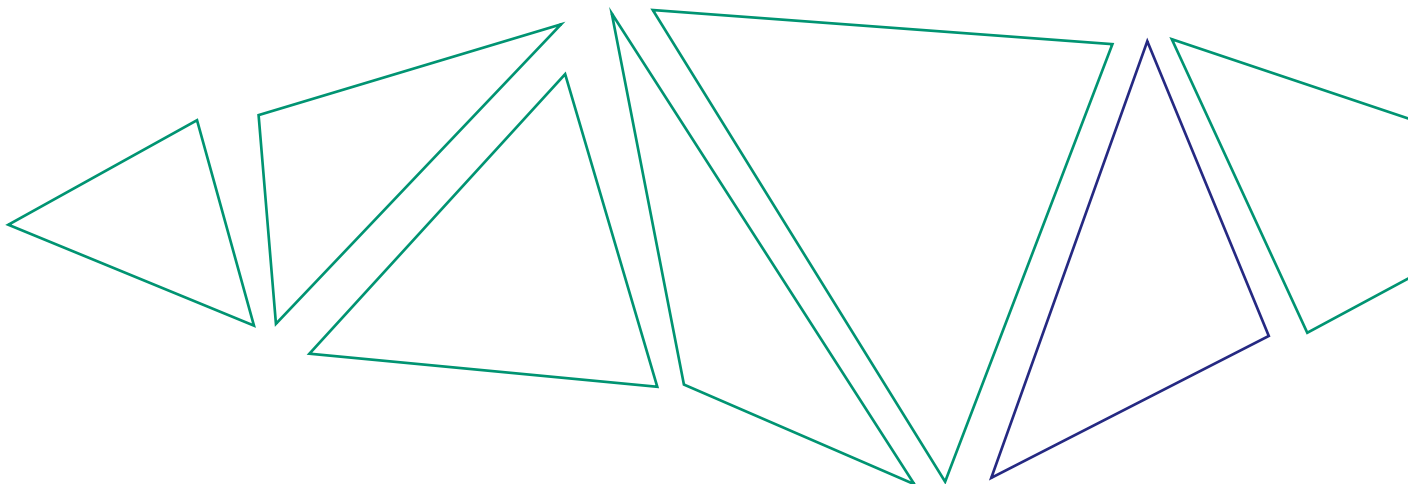
The National Stroke Audit program

The National Stroke Audit Acute Services comprises:

› An Organisational Survey of acute services across Australia. The Organisational Survey assesses the resources required to deliver evidence-based stroke care, such as the availability of stroke units, imaging and interdisciplinary staff. The Organisational Survey questions specifically reflect the *Acute Stroke Services Framework 2015*.[5]

The Stroke Foundation developed the *Acute Stroke Services Framework* to guide service planning, monitoring and improvement of appropriate acute stroke services to support the delivery of best practice care as outlined by the *Clinical Guidelines for Stroke Management 2010*. The document outlines where stroke services should be developed, provides a basis for measuring adequacy of current structures and resources, guides decisions about resource requirements and provides an outline for monitoring of quality of acute stroke care.

› A Clinical Audit involving the retrospective review of up to 40 consecutive patients admitted to participating acute services during a defined time frame. The Clinical Audit measures the delivery of, and adherence to, evidence-based processes of care outlined in the *Clinical Guidelines for Stroke Management 2010* and the *Acute Stroke Clinical Care Standard*. These processes of care include timely[6] assessment, diagnostic procedures, early interventions, interdisciplinary care and discharge planning. Timing of the delivery of various aspects of care and discharge outcomes were also measured.

The National Stroke Audit Acute Services is conducted biennially to provide cross-sectional data on clinical performance. Each alternate year, the Stroke Foundation undertakes an audit of inpatient rehabilitation services for patients with stroke.

Structure of the report

For this report 'acute care' refers to care provided in hospital from arrival at hospital to discharge from hospital, or transfer to inpatient rehabilitation.

The Organisational Survey and Clinical Audit were developed in tandem and the results are presented collectively. This is because areas of excellence and areas of need identified in the Clinical Audit may be better understood in association with information about the available resources obtained from the Organisational Survey.

This report outlines the adherence to the Australian Commission of Safety and Quality in Health Care (ACSQHC) *Acute Stroke Clinical Care Standard*[6] and the *Clinical Guidelines for Stroke Management 2010* in hospital services providing inpatient acute care for patients with stroke. It reports resources available within these acute services and the quality of care provided. It also outlines resources and structures available at these acute services mapped to the *Acute Stroke Services Framework 2015*.

› CHAPTER 2 includes details of the methodology used to undertake the National Stroke Audit.

› CHAPTER 3 includes details of the participating acute services.

› CHAPTER 4 includes the responses to the Organisational Survey.

› CHAPTER 5 provides results of the Clinical Audit, which reflects individual patient care.

› CHAPTER 6 includes data changes noted since 2011.

› CHAPTER 7 includes discussion and recommendations regarding the data from this year's National Stroke Audit.

36%
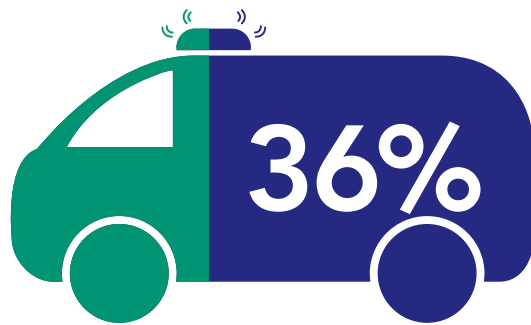
of patients reached hospital
in 4.5 hour time window
for thrombolysis

Methodology

Development of the National Stroke Audit questions

The National Stroke Audit was first developed under the guidance of a National Advisory Committee including national representation from medical, nursing, allied health and clinical research groups.[7]

Some items contained in the National Stroke Audit have been refined over time based on feedback from previous years and changes in national reporting standards. However, the majority of items have remained consistent from year to year to allow comparisons over time. Data collected include:

> Demographic characteristics.

> History of risk factors.

> Stroke severity measures.

> 30+ evidence-based processes of care.

> In-hospital outcomes.

Organisational Survey

Data collected through the Organisational Survey enables reporting of services against each required element outlined in the *Acute Stroke Services Framework 2015*. The Organisational Survey questions were reviewed based on the *Acute Stroke Services Framework 2015* and comments received from previous National Stroke Audits. All feedback was discussed and changes approved by the Stroke Foundation Clinical Council.

Clinical Audit

The Clinical Audit involves a systematic process of abstracting data from patient medical records. The data collected through the Clinical Audit is designed to report on adherence to recommendations outlined in the *Clinical*

Guidelines for Stroke Management 2010. The Clinical Audit questions were reviewed in line with the *Clinical Guidelines for Stroke Management 2010* and comments received from previous National Stroke Audits. All feedback was discussed and changes approved by the Stroke Foundation Clinical Council.

The indicators reported against are based on the Australian Stroke Coalitions' agreed *National Stroke Data* and *Quality Framework*[8], the Australian Council on Healthcare Standards' Clinical Indicator Set for stroke, and the ACSQHC *Acute Stroke Clinical Care Standard* with associated indicators[9].

To ensure standardised data collection and reporting in Australia the National Stroke Data Dictionary (NSDD)[10] is utilised for the National Stroke Audit. The NSDD is regularly reviewed and updated in accordance with the Australian Stroke Data Tool (AuSDaT) National Stroke Data Dictionary Operational Policy[11]. The ACSQHC indicators were reported using the definitions included in the ACSQHC Standard.

Feedback from participants in previous years requested a way of reducing the amount of data collected. This year participating services that collect data for the Australian Stroke Clinical Registry (AuSCR) were able to utilise data entered in AuSCR for the National Stroke Audit. Western Australia also created an in-house data collection system that allowed for relevant data to be imported for use in the National Stroke Audit. Both systems reduced the burden of data entry for services participating in the National Stroke Audit.

Definitions of the indicators reported (including numerators and denominators, and exclusion criteria) are available in the report supplement at informme.org.au/stroke-data

The basis of the Organisational Survey and Clinical Audit is represented in Figure 1.

Figure 1: Components of acute care reflected in this report

Acute Stroke Services Framework	Acute Stroke Clinical Care Standard and Clinical Guidelines for Stroke Management 2010
▼	▼
Outlines recommended resources in acute stroke	Outlines recommended clinical care in acute stroke
▼	▼
Measured by the Organisational Survey	Measured by the Clinical Audit
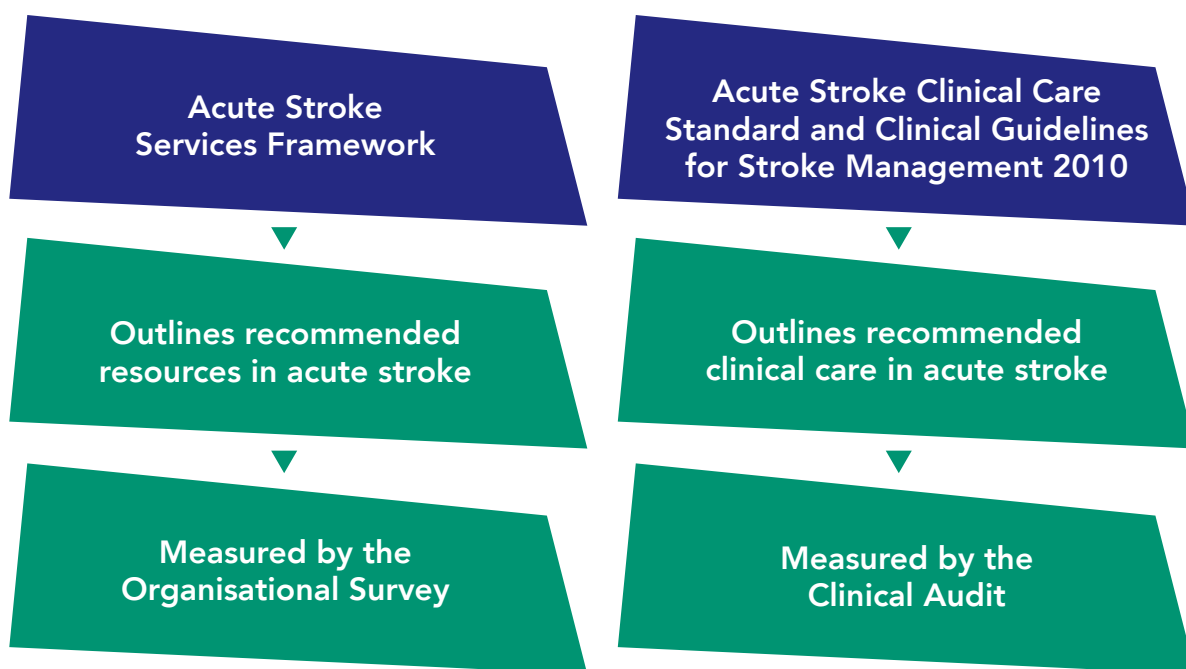
Recruitment

To be eligible for participation in the National Stroke Audit Acute Services 2017, hospitals were required to provide an inpatient acute service and have admitted at least 5 patients with stroke for acute care in 2016. Eligible services were identified through previous participation in the National Stroke Audit, partnerships with state-based clinical networks and relationships with key healthcare providers.

Acute services were recruited between December 2016 and February 2017, where Chief Executives and the main contacts from both public and private acute services were sent a letter of invitation. Services were asked to complete and return a consent form to confirm participation. Services were also requested to give permission for the Stroke Foundation to share summarised data with relevant state-based clinical networks or departments of health, to promote transparency and facilitate support for quality improvement. Each participating service nominated a coordinator to receive all correspondence during the National Stroke Audit period. This coordinator was responsible for data completion and data quality at their site.

Any acute service admitting at least 5 patients with acute stroke was eligible to participate in the Organisational Survey component.

Services admitting 45 or more patients with stroke per year were invited to participate in the Clinical Audit. Smaller services were able to participate in the Clinical Audit, but were not actively recruited.

Training

The Australian Stroke Data Tool (AuSDaT) was utilised for the National Stroke Audit Acute Services. This is a purpose designed integrated, web-based data collection and management platform. The National Stroke Audit program transitioned from the Stroke Foundation to AuSDaT in 2015. AuSDaT was designed to reduce the data entry burden and time for data collection. All auditors were required to complete standardised training in AuSDaT and the NSDD was made available, providing a rationale for each question as well as definitions and help notes. In addition, the Stroke Foundation Project Team was available to assist prior to and throughout the data collection period.

Data collection

All participants completed the Organisational Survey via AuSDaT between 1 March and 30 March 2017. The full list of Organisational Survey questions is presented online in the report supplement informme.org.au/stroke-data

Between 1 March and 31 May 2017, those sites participating in the Clinical Audit component completed a retrospective case note audit of up to 40 consecutive stroke admissions to their service. To minimise selection bias, data were extracted for the first 40 consecutive acute stroke admissions over a pre-defined time period. For the vast majority of these cases, admission and discharge dates had to fall between 1 July and 31 December 2016.

Patients with an ICD-10 code of I61.0-I61.9 (intracerebral haemorrhage), I63.0-I63.9 (cerebral infarction), I64 (stroke not specified as haemorrhagic or infarction) and I62.9 (intracerebral haemorrhage unspecified) were eligible for inclusion. The specificity for diagnosing stroke (any type) using these ICD-10 codes is >95%.[12] The full list of Clinical Audit questions is presented online in the report supplement informme.org.au/stroke-data

Auditors at participating services were required to log in to access the AuSDaT and enter data. Security and confidentiality were maintained by each auditor having an individual account, with email and password specific to them, in order to enter and access data in the AuSDaT. No patient-identifying data were collected by the Stroke Foundation. However, to facilitate data checking and quality as part of verification processes, services were asked to keep a list of the cases they entered into AuSDaT.

Data quality checks

AuSDaT contains pre-defined data fields with inbuilt programmed logic checks. Manual reliability checks were also performed via re-auditing of 3-5 cases by another auditor. This helps identify whether a case note audited independently by two people provides the same responses to ensure data are being reliably collected. A total of 511 reliability records were completed. Coordinators were also asked to confirm site data at completion of the data collection period to maximise the accuracy of the data and minimise missing items. The results of this data quality procedure were not reported here; however, information gathered will assist in refining future National Stroke Audit cycles.

Data verification

Participants were able to change their entered data up until 31 May 2017, when all data were locked. Programmed logic checks of the data were then conducted and used to validate data from the Organisational Survey and the Clinical Audit. Queries were sent to Coordinators where assumptions about true values could not be made. Where data appeared incorrect, further changes were permitted. The final, cleaned data were then used for analysis.

Data analysis

Staff from the Translational Public Health and Evaluation Division, Monash University, independently analysed the anonymised data. Names of services were excluded from the data submitted to Monash University; only the site identification number was provided.

The data were analysed using computer programs including Intercooled STATA 12.0 for Windows (Stata Corp, College Station, TX) and Excel (Microsoft Excel 2013). The data were exported from the web-based data entry terminal as an Excel spreadsheet and transferred into STATA.

All Organisational Survey and Clinical Audit data were aggregated to provide national estimates. Subcategories for analyses included breakdown by state, metropolitan/regional status, public/private status, stroke admission volume and presence of a stroke unit. Patients recorded as transient ischaemic attack (TIA) within AuSDaT were considered as ischaemic stroke as these patients are often clinically managed in a comparative manner to patients with ischaemic stroke.

For medical history and impairment data, only valid responses (i.e. Yes/No) were included in the analysis. 'Not documented' responses to these questions have been reported in a separate column, but were excluded from the denominator. For data relating to processes of care, i.e. received advice about risk factor modification, 'not documented' and 'unknown' responses have been assumed to be negative (i.e. a care process not provided) and were included in the denominator.

Adherence to processes of care were generally calculated on the entire sample. When reporting adherence to care, 'Known N' refers to all eligible patients. In some

instances, eligibility criteria for processes of care were specified. For example, adherence to the process of care relating to the use of antithrombotics on discharge was calculated only for patients presenting with ischaemic stroke who were discharged.

To minimise data being excluded, cases with known dates but unknown times for processes of care were assumed a time of 00:00. For patients suffering an in-hospital stroke, stroke onset date and time were used for date and time of emergency department presentation. Derived variables relating to outcomes of care, such as length of stay, were calculated based on admission and discharge dates.

The median (50th percentile) and first (Q1) and third (Q3) quartiles (25th percentile and 75th percentile) were reported for skewed (i.e. data that is not normally distributed) continuous data from questions such as the number of stroke admissions each year.

The Achievable Benchmark of Care (ABC™) methodology was used to create benchmarks for several nationally relevant indicators based on the average performance of the top 15% of hospitals for each indicator.[13]

Supplementary data

In addition to this report, a supplement containing details of questions from the Organisational Survey and Clinical Audit is available. This also contains further detail regarding the indicators of clinical care and is available at informme.org.au/stroke-data

Site specific feedback

Feedback to participants is an essential component of the National Stroke Audit, considering the evidence that audit and feedback can influence and change clinical practice.[14] Each participating acute service receives a site-specific report highlighting performance to inform decisions to improve patient care and outcomes. In addition, all participating services have access to their own results at informme.org.au. Sites can also benchmark their 2017 performance against similar acute services across Australia for continuous quality improvement purposes.

Use of
thrombolysis
increased

7%
2015

13%
2017
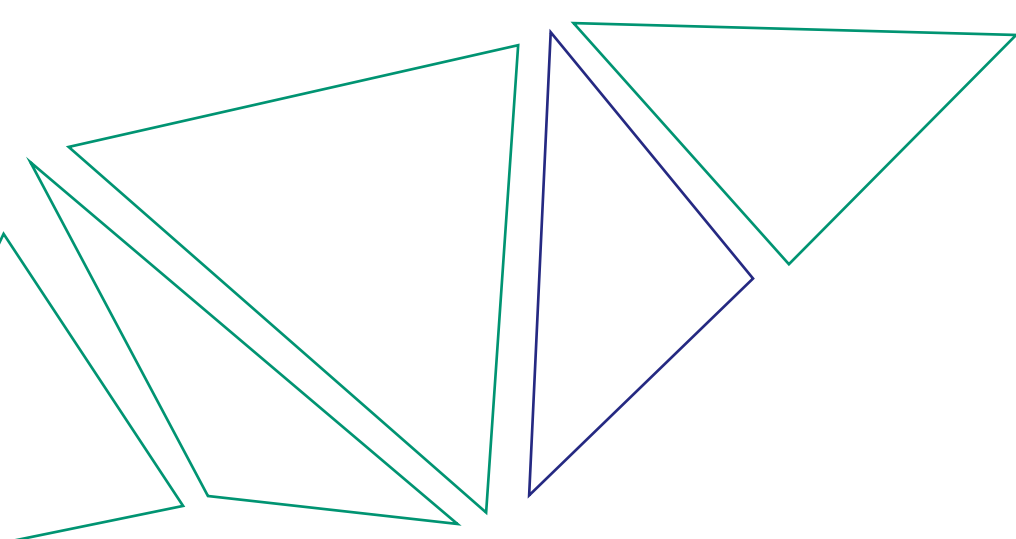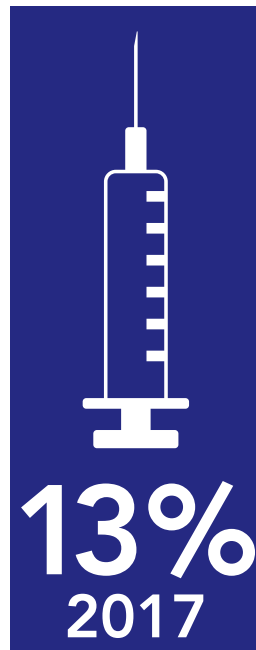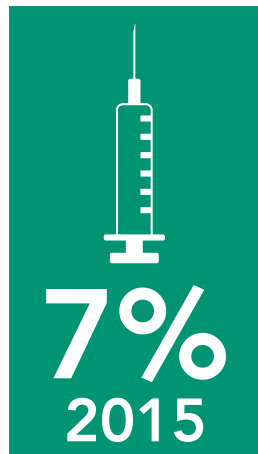
Participating acute services

Response rates and characteristics of participating acute services

Public versus Private

A total of 151 acute services were identified as potentially eligible to participate in the National Stroke Audit Acute Services 2017, with 139 public services deemed eligible. The number of eligible private services was unknown; however, based on previous participation and partnerships with state-based clinical networks, 10 private services were identified as eligible. All eligible services were targeted with active recruitment procedures that included phone calls and emails.

In total, 121 public services and six private services participated in the Organisational Survey and among these, 112 public services and five private services participated in the Clinical Audit.

A total of 18 eligible public services elected not to participate. Among these, six were from New South Wales (NSW), six were from Queensland (QLD), three were from Victoria (VIC), two were from South Australia (SA), and one was from Tasmania (TAS).

Metropolitan versus Regional

Classification of participating acute services as metropolitan or regional/rural was based on the Modified Monash Model (MMM). The MMM is a classification system that categorises metropolitan, regional, rural and remote areas according to both geographical remoteness and town size. It is based on work by Humphreys and McGrail from Monash University using Australian Statistical Geography Standard Remoteness areas, but then further subdividing regional Australia into four categories based on the size of the local town or city. The MMM is a consistent and well-understood system supported by the best available evidence.[15]

There are seven MMM categories. For classification and reporting purposes for the National Stroke Audit Acute Services 2017:

> Participating acute services in MMM Category 1 and 2 have been classified as 'metropolitan'.

> Participating acute services in MMM Category 3, 4 and 5 have been classified as 'regional'.

> Participating acute services in MMM Category 6 have been classified as 'rural'.

> No MMM Category 7 were identified.

Of the 127 participating acute services, 82 services have been classified as metropolitan (67 MMM Category 1 and 15 MMM Category 2) and 45 services have been classified as regional (30 MMM Category 3, 12 MMM Category 4, 2 MMM Category 5, and 1 MMM Category 6). One service was classified as rural (MMM Category 6); however, for data reporting this acute service has been included in the regional grouping.

Table 2: Participating acute services by location and region

	Organisational Survey			Clinical Audit		
	Total	Public	Private	Total	Public	Private
Australia	127	121	6	117	112	5
ACT	2	2	0	2	2	0
NSW	44	43	1	44	43	1
NT	2	2	0	1	1	0
QLD	26	23	3	23	21	2
SA	7	7	0	4	4	0
TAS	3	3	0	3	3	0
VIC	30	28	2	29	27	2
WA	13	13	0	11	11	0
Region						
Metropolitan	82	76	6	81	76	5
Regional	45	45	0	36	36	0

Stroke service size

The 127 services that completed the Organisational Survey reported a total of 31,952 admissions for patients requiring inpatient acute stroke services over the past 12 months. Services that reported fewer than 75 annual acute stroke admissions (N=32) accounted for 1,473 (5%) of all reported stroke admissions. Services that reported admitting 500 or more patients with acute stroke (N=22) accounted for 14,884 (47%) stroke admissions. The 117 services that participated in the Clinical Audit accounted for a total of 31,631 stroke admissions or 99% of the reported caseload.

The Australian Capital Territory (ACT) reported the largest acute services, while SA reported the smallest (Table 3). The number of patients with stroke admitted to the 127 acute services ranged from 5 to 1005 (median: 190; Q1: 70; Q3: 311). Over half the sites (58%) reported having between 75 and 499 acute stroke admissions.

Acute Stroke Unit beds

Ninety-five acute services (75%) reported having co-located stroke beds within a geographically defined unit, or an 'acute stroke unit'. These 95 services admitted a total of 29,723 patients with acute stroke in the past year (93% of all patients). Participants were asked to report on the number of beds in their acute stroke unit. An acute stroke unit differs from other wards. Stroke units 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 (e.g. family conferences).

› Active encouragement of stroke survivors and their carers/families to be involved in the rehabilitation process.[4]

Table 3: Participating acute services by location, region and setting, number of acute beds and annual stroke admissions

	Median number of acute beds (Q1, Q3)	Median number of annual stroke admissions (Q1, Q3)	Reported annual stroke admissions		
			<75	75-499	≥500
Location					
Australia (N=127)	237 (114, 450)	190 (70, 311)	32 (25%)	73 (58%)	22 (17%)
ACT (N=2)	427 (254, 600)	276 (242, 310)	0	2	0
NSW (N=44)	220 (122, 437)	220 (87, 305)	9	29	6
NT (N=2)	263 (180, 345)	108 (50, 165)	1	1	0
QLD (N=26)	222 (140, 531)	203 (115, 276)	5	19	2
SA (N=7)	81 (71, 486)	40 (19, 595)	4	1	2
TAS (N=3)	264 (102, 384)	270 (129, 550)	0	2	1
VIC (N=30)	254 (115, 508)	150 (80, 500)	7	15	8
WA (N=13)	182 (85, 450)	120 (60, 283)	6	4	3
Region					
Metro (N=82)	374 (220, 560)	265 (157, 506)	8	52	22
Regional (N=45)	90 (68, 140)	70 (40, 130)	24	21	0
Setting					
Public (N=121)	220 (110, 437)	190 (70, 326)	31	68	22
Private (N=6)	429 (250, 540)	170 (132, 200)	1	5	0

Q1: 1st quartile; Q3: 3rd quartile

Participants reported a total of 676 dedicated acute stroke unit beds in the 127 participating acute services (median: 5; Q1: 4; Q3: 8). On the day of completion of the Organisational Survey, 644 patients with acute stroke were admitted to an acute service. Among these, 444 (69%) patients were being cared for in a dedicated acute stroke unit.

But thrombolysis given in hospital within
60 MINUTES lags internationally
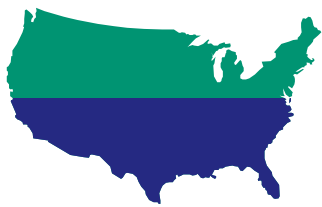
59% 62% 30%

Organisational Survey and adherence to the Acute Stroke Services Framework

Capacity to plan, deliver and evaluate high quality acute stroke services is essential for improvement of healthcare delivery and patient outcomes. The *Acute Stroke Services Framework* aims to improve the quality of Australian acute stroke services by outlining the recommended structures, networks, settings and criteria for monitoring. This section of the report describes the current resources available in Australia to support best practice stroke care and is based on data from the Organisational Survey.

Aims of the *Framework*

The intended use of the *Framework* is to:

> Outline where stroke services should be developed and what such services should include in order to assist planning of stroke services.

> Provide a basis for measuring adequacy of current structures and resources for best practice stroke care.

> Make information available to be used to advocate for improved services where gaps are identified.

> Guide decisions about resource requirements (including minimum stroke unit bed numbers in comprehensive stroke services (CSS)).

> Provide an outline for monitoring quality of care delivered by stroke services.

The *Framework* comprises 24 elements, of which CSS's should have all elements, and primary stroke services (PSS's) should have the majority of elements and where they do not, they should have processes in place to access CSS's.

Changes over time, 2015 to 2017:

Acute services nationally are meeting a median of 18 of the 24 elements that comprise the *Framework*, with 6 acute services meeting all 24 elements. Only one acute service achieved 24 elements in the 2015 National Stroke Audit.

Aside from increased access to onsite telehealth facilities, there has been little change to resources between 2015 and 2017. Whilst access to ongoing inpatient and outpatient rehabilitation and 24/7 thrombolysis services is positive, there remains room for improvement for other important elements required to support stroke care. These areas need to be examined within states and local health services to determine how resources can be made available in order to achieve best practice stroke management.

Table 4: Comparison of Organisational Survey results 2015-2017

	Australia 2015 %	Australia 2017 %
Acute stroke unit	76	75
Onsite telehealth facility, which has been utilised for clinical decision making within the last 6 months	44	53
Thrombolysis for eligible stroke patients available	73	72
If thrombolysis available, offered 24/7	91	90
Onsite endovascular thrombectomy*	16	17
If endovascular thrombectomy available, offered 24/7	58	57
Access to a rapid access transient ischaemic attack (TIA) clinic (assessed within 48 hours) for TIA patients not admitted to hospital	28	29
Access to ongoing inpatient rehabilitation	91	94
Access to outpatient rehabilitation	92	92
Access to day hospital	35	35
Access to community-based rehabilitation in the home	86	83
Access to stroke specialist Early Supported Discharge	8	11
Program for the continuing education of staff relating to the management of stroke	84	82

*2015: Question was in two parts – "Does your hospital have access to endovascular stroke therapy?" and "if yes, is it onsite?"
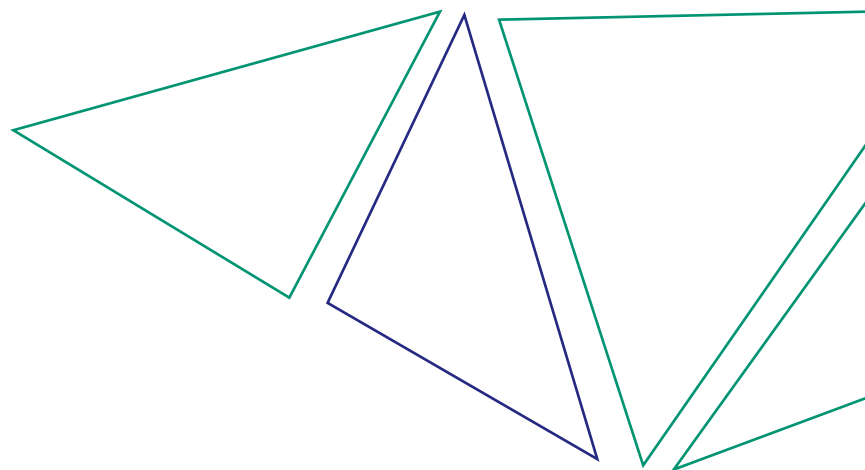
Individual elements of the *Framework*

Table 5. Adherence to the individual elements of the *Framework* by location

Elements of the *Framework*	Australia (N=127) n (%)	ACT (N=2) n (%)	NSW (N=44) n (%)	NT (N=2) n (%)	QLD (N=26) n (%)	SA (N=7) n (%)	TAS (N=3) n (%)	VIC (N=30) n (%)	WA (N=13) n (%)
Organised pre-hospital services (includes use of validated screening tools by paramedics, appropriate pre-notification systems)	74 (58%)	0	26 (59%)	0	17 (65%)	5 (71%)	0	21 (70%)	5 (38%)
Coordinated regional stroke systems (includes protocols for hospital bypass, transfer from non-stroke hospital to PSS or CSS, and between a PSS and CSS)	88 (69%)	0	31 (70%)	0	20 (77%)	5 (71%)	0	25 (83%)	7 (54%)
Coordinated ED systems (includes use of validated screening tools; agreed triage categories; protocols for thrombolysis intervention e.g. "Code Stroke"; pathways to facilitate urgent access to imaging etc)	117 (92%)	2 (100%)	41 (93%)	0	24 (92%)	7 (100%)	1 (33%)	30 (100%)	12 (92%)
Stroke unit	95 (75%)	2 (100%)	34 (77%)	1 (50%)	23 (88%)	3 (43%)	2 (67%)	25 (83%)	5 (38%)
Onsite CT brain (24/7) including CT angiography	123 (97%)	2 (100%)	42 (95%)	2 (100%)	26 (100%)	5 (71%)	3 (100%)	30 (100%)	13 (100%)
Carotid imaging	114 (90%)	2 (100%)	37 (84%)	2 (100%)	24 (92%)	7 (100%)	3 (100%)	28 (93%)	11 (85%)
Advanced imaging capability (e.g. MRI/MRA, catheter angiography)	109 (86%)	2 (100%)	36 (82%)	2 (100%)	23 (88%)	4 (57%)	3 (100%)	29 (97%)	10 (77%)
On-site endovascular thrombectomy (24/7)	12 (9%)	0	2 (5%)	0	3 (12%)	1 (14%)	0	5 (17%)	1 (8%)
On-site neurosurgical services (e.g. for hemicraniectomy due to large middle cerebral artery infarcts)	32 (25%)	1 (50%)	12 (27%)	1 (50%)	6 (23%)	2 (29%)	1 (33%)	7 (23%)	2 (15%)
Delivery thrombolysis	92 (72%)	2 (100%)	29 (66%)	1 (50%)	22 (85%)	5 (71%)	2 (67%)	27 (90%)	4 (31%)
Ability to provide acute monitoring (telemetry and other physiological monitoring) for at least 72 hours	121 (95%)	2 (100%)	43 (98%)	2 (100%)	25 (96%)	7 (100%)	3 (100%)	29 (97%)	10 (77%)
Acute stroke team	111 (87%)	2 (100%)	36 (82%)	1 (50%)	26 (100%)	6 (86%)	3 (100%)	27 (90%)	10 (77%)

(Continued)

Table 5. Adherence to the individual elements of the *Framework* by location (continued)

Elements of the *Framework*	Australia (N=127) n (%)	ACT (N=2) n (%)	NSW (N=44) n (%)	NT (N=2) n (%)	QLD (N=26) n (%)	SA (N=7) n (%)	TAS (N=3) n (%)	VIC (N=30) n (%)	WA (N=13) n (%)
Dedicated stroke coordinator position	72 (57%)	2 (100%)	21 (48%)	0	17 (65%)	3 (43%)	0	22 (73%)	7 (54%)
Dedicated medical lead	86 (68%)	2 (100%)	31 (70%)	1 (50%)	20 (77%)	4 (57%)	2 (67%)	19 (63%)	7 (54%)
Access to HDU / ICU (for complex patients)	116 (91%)	2 (100%)	43 (98%)	2 (100%)	24 (92%)	4 (57%)	3 (100%)	28 (93%)	10 (77%)
Rapid (within 48 hours) TIA assessment clinics/services	49 (39%)	0	21 (48%)	1 (50%)	8 (31%)	5 (71%)	1 (33%)	8 (27%)	5 (38%)
Provision of telehealth services for acute assessment and treatment	63 (53%)	1 (50%)	16 (36%)	2 (100%)	14 (54%)	4 (57%)	1 (33%)	20 (67%)	9 (69%)
Coordination with rehabilitation service providers (including a standardised process, and/or a person, used to assess suitability for further rehabilitation)	119 (94%)	1 (50%)	42 (95%)	2 (100%)	26 (100%)	6 (86%)	3 (100%)	29 (97%)	10 (77%)
Early assessment using standardised tools to determine individual rehabilitation needs and goals (ideally within 24-48 hours)	104 (82%)	0	37 (84%)	2 (100%)	23 (88%)	6 (86%)	2 (67%)	26 (87%)	8 (62%)
Routine involvement of carers in the rehabilitation process	125 (98%)	2 (100%)	43 (98%)	2 (100%)	26 (100%)	7 (100%)	3 (100%)	30 (100%)	12 (92%)
Routine use of guidelines, care plans and protocols	72 (57%)	1 (50%)	33 (75%)	0	13 (50%)	2 (29%)	1 (33%)	18 (60%)	4 (31%)
Regular data collection and stroke specific quality improvement activities	111 (87%)	2 (100%)	38 (86%)	1 (50%)	22 (85%)	5 (71%)	3 (100%)	29 (97%)	11 (85%)
Access and collaboration with other specialist services (cardiology, palliative care, vascular)	81 (64%)	2 (100%)	29 (66%)	2 (100%)	19 (73%)	3 (43%)	2 (67%)	18 (60%)	6 (46%)
Regional responsibility (e.g. coordination across a local health district)	65 (51%)	2 (100%)	25 (57%)	1 (50%)	11 (42%)	4 (57%)	0	16 (53%)	6 (46%)
Total number of elements met (Q1, Q3)	18 (15,20)	Min 17, Max 17	18 (15,20)	Min 12, Max 16	18 (16,21)	16 (10,21)	13	18 (15,21)	14 (9,19)

Q1: 1st quartile; Q3: 3rd quartile, PSS: primary stroke service, CSS: comprehensive stroke service, ED: emergency department,
CT: computed tomography, MRI: magnetic resonance imaging, MRA: magnetic resonance angiography, HDU: high dependency unit,
ICU: intensive care unit, TIA: transient ischaemic attack, Min: minimum, Max: maximum

Overall adherence to the *Framework*

Among the 127 acute services that completed the Organisational Survey the median number of *Framework* elements met nationally was 18.

› 6 services (5%) were found to meet all 24 elements.

› 2 services (2%) met 23 elements.

› 5 services (4%) met 22 elements.

› 11 services (9%) met 21 elements.

› 18 services (14%) met 20 elements.

The largest proportion of services (18 services, 14%) met 20 elements.

The median number of elements met increased slightly with:

› Metropolitan location (metropolitan median: 18 elements, regional median: 15 elements).

› Acute services with a stroke unit (with a stroke unit median: 19 elements, without a stroke unit median: 12 elements).

› Services with a larger volume of patients with stroke admitted (500+ stroke admissions median: 21 elements, <75 stroke admissions per annum median: 13 elements).

While the number has increased, it is a concern that only 6 hospitals among the 22 hospitals admitting 500+ patients with stroke in the past year were found to meet all 24 elements of the *Framework*, allowing classification as a Comprehensive Stroke Service (CSS)[5]. There were no CSS's identified in the ACT, Northern Territory (NT), QLD, TAS or Western Australia (WA).

CSS's have highly specialised resources and personnel available (24 hours a day, 365 days a year). They see high volumes of patients with stroke, including the most complex presentations. They have a dedicated stroke unit, established well-organised systems to link emergency services and hyperacute care, and coordinated processes for ongoing inpatient rehabilitation, secondary prevention, and community reintegration. CSS's have timely neurovascular imaging and expert interpretation (including advanced imaging capability) and offer thrombolysis and endovascular thrombectomy (24/7), along with links to other specialist services. They also have a leadership role in establishing partnerships with other local hospitals for supporting stroke care.

Another concern is that 20 services (16%) met less than half the *Framework* elements (≤12 elements).

› 42 services (33%) met 20+ elements.

› 76 services (60%) met 10-19 elements.

› 9 services (7%) met <10 elements.

Figure 2 below shows the progress in Australia's aggregated adherence to the 24 individual elements of the *Framework* since the 2015 National Stroke Audit.

Please note: 118 acute services participated in the 2015 Organisational Survey and 127 acute services participated in the 2017 Organisational Survey. The 2015 Organisational Survey results only include acute services with 50+ acute stroke admissions; different to 2017, which includes all acute services regardless of acute stroke admission numbers. Only 6 acute services had <50 acute stroke admissions in 2017.

Figure 2. Australia's aggregated adherence to the 24 elements of the *Framework*, 2015 and 2017

Element	2015	2017
Organised pre-hospital services	59%	58%
Coordinated regional stroke systems	67%	69%
Coordinated emergency department systems	86%	92%
Stroke unit	76%	75%
Onsite CT brain (24/7) including CT angiography	95%	97%
Carotid imaging	86%	90%
Advanced imaging capability	83%	86%
On-site endovascular thrombectomy (24/7)	9%	9%
On-site neurosurgical services	25%	25%
Delivery of thrombolysis	73%	72%
Ability to provide acute monitoring for at least 72 hours	92%	95%
Acute stroke team	86%	87%
Dedicated stroke coordinator position	52%	57%
Dedicated medical lead	64%	68%
Access to HDU/ICU (for complex patients)	92%	91%
Rapid TIA assessment clinics/services	36%	39%
Provision of telehealth services	44%	53%
Coordination with rehabilitation service providers	87%	94%
Early assessment of rehabilitation needs and goals	76%	82%
Routine involvement of carers	97%	98%
Routine use of guidelines, care plans and protocols	43%	57%
Regular data collection and QI activities	80%	87%
Access and collaboration with other specialist services	62%	64%
Regional responsibility	55%	51%

Table 6. Median number of *Framework* elements by region and stroke volume

	Australia (N=127)	Region		Reported annual stroke admissions				
		Metro (N=82)	Regional (N=45)	<75 (N=32)	75-199 (N=35)	200-349 (N=33)	350-499 (N=5)	500+ (N=22)
Total number of stroke admissions in past 12 months	31,952	27,588	4,364	1,473	4,866	8,748	1,981	14,884
Median number of *Framework* elements met (Q1, Q3)	18 (15,20)	18 (16,21)	15 (11,18)	13 (10,15)	17 (14,18)	18 (17,20)	22 (21,22)	21 (20,24)

Q1: 1st quartile; Q3: 3rd quartile

Adherence to specific aspects of the *Framework*

Rapid transfer, assessment and investigations

Services for stroke management need to cover aspects of rapid assessment including pre-hospital services, emergency department (ED) processes and critical investigations, such as brain imaging. These systems and processes are designed to ensure prompt transfer to hospitals equipped to deliver appropriate care and ensure swift diagnosis and intervention.

Results

Early recognition of stroke symptoms, as well as the timing and method by which people are transferred to hospital are critical to ensuring optimal outcomes for patients. In this hyperacute phase of care, organised pre-hospital services and coordinated regional stroke systems are vital to appropriate patient transfer and stroke management. Data from the 2017 National Stroke Audit shows that only 58% of services reported arrangements with local ambulance services to facilitate early notification to the receiving hospital, and only 69% of services had protocols in place for bypass and transfer to facilitate coordinated regional stroke systems (Table 7).

Positively, once a person with suspected stroke presents to hospital, 92% of services reported access to coordinated ED systems that allow for urgent assessment and interventions, as well as early imaging: CT brain (97%), carotid (90%), and advanced imaging (86%). Metropolitan services were noted to have more coordinated local stroke systems (74%) compared with regional services (60%), and improved access to advanced imaging (96%) compared with regional services (67%). However, the difference between metropolitan and regional services on the other pre-hospital, ED and imaging elements were minor.

Hospital services that admit low stroke patient volumes each year were asked if they had established protocols for ED assessment and transfer of patients with suspected stroke. Among the 32 hospitals admitting fewer than 75 patients a year, 28 hospitals (88%) had ED protocols for rapid triage for patients presenting with acute stroke; 30 hospitals (94%) had protocols for transferring patients to other hospitals, but only 5 hospitals (16%) had an agreement in place with the local ambulance service to bypass the hospital for another stroke specific service.

Table 7. Adherence to recommended pre-hospital, ED and imaging services by region and stroke volume

	Australia (N=127) n (%)	Region		Reported annual stroke admissions				
		Metro (N=82) n (%)	Regional (N=45) n (%)	<75 (N=32) n (%)	75-199 (N=35) n (%)	200-349 (N=33) n (%)	350-499 (N=5) n (%)	500+ (N=22) n (%)
Element of service: pre-hospital and ED								
Organised pre-hospital services	74 (58)	49 (60)	25 (56)	12 (38)	17 (49)	19 (58)	5 (100)	21 (95)
Coordinated regional stroke systems	88 (69)	61 (74)	27 (60)	17 (53)	22 (63)	23 (70)	5 (100)	21 (95)
Coordinated ED systems	117 (92)	77 (94)	40 (89)	28 (88)	32 (91)	30 (91)	5 (100)	22 (100)
Element of service: imaging								
Onsite CT brain (24/7) including CT angiography	123 (97)	81 (99)	42 (93)	29 (91)	35 (100)	32 (97)	5 (100)	22 (100)
Carotid imaging within 24 hours	114 (90)	79 (96)	35 (78)	24 (75)	32 (91)	32 (97)	5 (100)	21 (95)
Advanced imaging capability (e.g. MRI/ MRA, catheter angiography)	109 (86)	79 (96)	30 (67)	16 (50)	33 (94)	33 (100)	5 (100)	22 (100)

ED: emergency department, CT: computed tomography, MRI: magnetic resonance imaging, MRA: magnetic resonance angiography

Reperfusion services

Acute stroke services should provide access (onsite or by transfer) to recommended reperfusion therapy including thrombolysis (clot busting) and endovascular thrombectomy (clot retrieval). Reperfusion therapies are time dependent and are provided within the first few hours after stroke onset. Prompt treatment with clot-dissolving (thrombolytic) drugs can restore blood flow before major brain damage has occurred and assist people to make a good recovery from their stroke.[15]

Overall, access to thrombolysis remains relatively poor in Australia. The failure to fully implement stroke thrombolysis is an international problem, but there is evidence from numerous studies that treatment of up to 20% of all patients with ischaemic stroke is achievable in well organised regions.[4]

Although thrombolysis reduces disabillity and improves functional outcomes when administered as early as possible after onset of ischaemic stroke, its use is limited by the narrow therapeutic time window, important contraindications, and limited efficacy in patients with proximal large arterial occlusions.[16] This has led to recent substantial interest in endovascular therapies for acute ischaemic stroke.

Endovascular thrombectomy is a highly effective treatment with evidence of benefit in selected patients with large vessel occlusion. Treatment may occur either following thrombolysis or as initial treatment in patients with thrombolysis exclusions. Systems of care need to be redesigned to offer this treatment to eligible patients with ischaemic stroke, and all reperfusion therapy requires a high degree of ongoing monitoring during and after the treatment.

Table 8. Adherence to recommended reperfusion services by region and stroke volume

	Australia (N=127) n (%)	Region		Reported annual stroke admissions				
		Metro (N=82) n (%)	Regional (N=45) n (%)	<75 (N=32) n (%)	75-199 (N=35) n (%)	200-349 (N=33) n (%)	350-499 (N=5) n (%)	500+ (N=22) n (%)
Element of service: reperfusion therapies								
Delivery of thrombolysis (24/7)	83 (65)	68 (83)	24 (53)	13 (41)	24 (69)	28 (85)	5 (100)	22 (100)
On-site endovascular thrombectomy (24/7)	12 (9)	12 (15)	0	0	0	1 (3)	2 (40)	9 (41)
Onsite neurosurgical services (e.g. for hemicraniectomy due to large MCA infarcts)	32 (25)	32 (39)	0	1 (3)	4 (11)	8 (24)	4 (80)	15 (68)
Ability to provide acute monitoring (telemetry and other physiological monitoring) for at least 72 hours	121 (95)	79 (96)	42 (93)	29 (91)	35 (100)	32 (97)	5 (100)	20 (91)
Access to HDU / ICU (for complex patients)	116 (91)	82 (100)	34 (76)	21 (66)	35 (100)	33 (100)	5 (100)	22 (100)

MCA: middle cerebral artery, HDU: high dependency unit, ICU: intensive care unit

Results

Ninety-two acute services (72%) reported offering thrombolysis and 83 of these acute services provided thrombolysis 24/7. These acute services reported thrombolysing 2,459 patients with stroke in the past 12 months, with a median of 16 patients per service. Twenty-five services reported thrombolysing fewer than 8 patients in the past 12 months, including 3 services that reported having a thrombolysis service available but had not thrombolysed any patients in the last 12 months.

Table 9. Thrombolysis numbers and proportion by region, setting and presence of stroke unit

	Australia (N=127)	Region		Setting		Stroke Unit	
		Metro (N=82)	Regional (N=45)	Public (N=121)	Private (N=6)	Stroke Unit (N=95)	No Stroke Unit (N=32)
Median (Q1,Q3) number of patients who received thrombolysis	16 (7,34)	23 (9,44)	9 (5,14)	17 (9,37)	3 (0,7)	16 (9,38)	2 (1,5)
Total number of patients who received thrombolysis	2,459	2,231	228	2,440	19	2,404	55

Q1: 1st quartile; Q3: 3rd quartile

Table 10. Thrombolysis numbers by stroke volume

	Australia (N=127)	Reported annual stroke admissions				
		<75 (N=32)	75-199 (N=35)	200-349 (N=33)	350-499 (N=5)	500+ (N=22)
Median (Q1, Q3) number of patients who received thrombolysis	16 (7,34)	2 (1,7)	9 (4,16)	14 (9,26)	34 (32,50)	54 (58,100)
Total number of patients who received thrombolysis	2,459	67	255	492	180	1,465

Q1: 1st quartile; Q3: 3rd quartile

Table 11. Thrombolysis numbers by location

	Australia (N=127)	ACT (N=2)	NSW (N=44)	NT (N=2)	QLD (N=26)	SA (N=7)	TAS (N=3)	VIC (N=30)	WA (N=13)
Median (Q1, Q3) number of patients who received thrombolysis	16 (7,34)	20 (12,28)	15 (9,33)	9 (9,9)	10 (2,20)	25 (5,78)	15 (11,19)	20 (8,52)	25 (10,71)
Total number of patients who received thrombolysis	2,459	40	680	9	325	255	30	959	161

Q1: 1st quartile; Q3: 3rd quartile

Table 12. Access to onsite endovascular thrombectomy by location

	Australia (N=127)	ACT (N=2)	NSW (N=44)	NT (N=2)	QLD (N=26)	SA (N=7)	TAS (N=3)	VIC (N=30)	WA (N=13)
Hospitals with onsite endovascular thrombectomy services – n (%)	21 (17)	1 (50)	6 (14)	0	3 (12)	2 (29)	1 (33)	5 (17)	3 (23)
24/7 access – n (% of endovascular thrombectomy services)	12 (57)	0	2 (33)	0	3 (100)	1 (50)	0	5 (100)	1 (33)

Time to reperfusion stroke therapies is important for patient outcomes and is discussed with the Clinical Audit results in Chapter 5.

Regional thrombolysis rates, based on reported stroke admissions in the 24 acute services offering thrombolysis, were 5% (228 patients thrombolysed from a total of 4,364 patients with stroke admitted to a regional service); a median of 9 patients (Q1: 5, Q3:14) were thrombolysed in the last 12 months, with 10 out of the 24 regional acute services reporting admissions of fewer than 75 patients with stroke per year.

Private hospital thrombolysis rates, based on reported stroke admissions in the 6 private hospitals offering thrombolysis, was 2% (19 patients thrombolysed from a total of 918 patients); a median of 3 patients (Q1:0, Q3:7) were thrombolysed in the last 12 months, with 5 of the 6 private hospitals reporting admissions of between 132 to 205 patients with stroke last year.

Twenty-one acute services (17%) reported providing endovascular thrombectomy to 872 patients in the past 12 months. These services were all provided in metropolitan areas; no regional stroke services reported providing endovascular thrombectomy. While the *Framework* recommends endovascular thrombectomy be available 24/7, 9 acute services did not provide 24/7 access; 5 of these acute services admitted more than 500 patients with stroke in the past 12 months, 1 acute service admitted 350-499 patients with stroke and 3 acute services admitted 200-349 patients with stroke.

No regional acute services reported onsite neurosurgical services, and acute services with fewer than 350 stroke admissions had less access to onsite neurosurgical services: 0-4 acute services with stroke admissions <350 in the past 12 months had onsite neurosurgical services, compared with 3-14 acute services with 350+ stroke admissions. High dependency units (HDU's) and intensive care units (ICU's) were also present in fewer regional acute services (76% in regional areas, compared with 100% in metropolitan) and acute services that admitted fewer than 75 patients with stroke in the past 12 months (66% compared with 100% in acute services that admitted more than 75 patients with stroke).

Table 13. Adherence to organised services by stroke volume

	Reported annual stroke admissions					
	Australia (N=127) n (%)	<75 (N=32) n (%)	75-199 (N=35) n (%)	200-349 (N=33) n (%)	350-499 (N=5) n (%)	500+ (N=22) n (%)
Element of service: reperfusion therapies						
Stroke unit	95 (75)	10 (31)	27 (77)	31 (94)	5 (100)	22 (100)
Acute stroke team	111 (87)	20 (63)	32 (91)	32 (97)	5 (100)	22 (100)
Dedicated medical lead	86 (68)	14 (44)	16 (46)	29 (88)	5 (100)	22 (100)
Stroke coordinator	72 (57)	9 (28)	25 (71)	19 (58)	4 (80)	15 (68)
Routine use of guidelines, care plans and protocols	72 (57)	13 (41)	19 (54)	21 (64)	5 (100)	14 (64)
Access and collaboration with other specialist services (cardiology, palliative care, vascular)	81 (64)	8 (25)	18 (51)	28 (85)	5 (100)	22 (100)

Stroke unit care

The *Framework* recommends that all patients with suspected stroke should be transported to a hospital with a stroke unit. Stroke units are not recommended for small sites where stroke numbers are insufficient to justify dedicated resources. Instead, it is recommended these smaller hospital services have appropriate systems in place to rapidly screen and transfer patients with stroke to the nearest dedicated stroke service, a service where access to reperfusion therapy and stroke unit services are available.

Organisation of acute stroke services with dedicated personnel and processes is fundamental to maximise patient outcomes. Stroke unit care is the cornerstone of stroke management. It is characterised by provision of care in one location/ward and an interdisciplinary team with expertise in stroke care who meet regularly to plan patient care and develop expert knowledge through ongoing professional development specific to stroke.

Results

Thirty-two acute services reported not having a stroke unit. Of these, 8 services (25%) reported admitting between 75-199 patients in the last year and 2 services (6%) reported admitting between 200-349 patients with stroke in the last year.

Of the 95 acute services reporting the presence of a stroke unit, 13 acute services did not fulfil all of the minimum stroke unit requirements as specified in the *Framework*:

> Co-located beds within a geographically defined unit.

> Dedicated, interprofessional team with members who have a special interest in stroke and/or rehabilitation (the minimum team would consist of medical, nursing and allied health).

> Interprofessional team meet at least once per week to discuss patient care.

> Regular programs of staff education and training relating to stroke.

Among those serivces that did not meet the criteria, 7 acute services reported not having interprofessional team meetings at least once a week to discuss patient care, and 6 acute services reported not having regular programs of staff education and training related to stroke available.

Stroke unit capacity at a single point in time was established by analysing the number of patients with stroke in hospital on the day the Organisational Survey was completed, compared to the number of dedicated stroke unit beds across the state (all hospitals) and in stroke unit hospitals (Table 14). On the day the Organisational Survey was completed, 159 patients with stroke (26%) in stroke unit hospitals were not in a stroke unit bed, despite the availability of 232 stroke beds. This suggests that bed management systems should be reviewed, enabling hospitals to better prioritise patient movement into stroke unit beds.

Routine admission directly to a stroke unit from the ED was reported in only 74 sites (58%), with general medical ward (23%), other ward (8%), medical assessment unit (5%) and neurology ward (4%) the next commonly reported wards for patient admission.
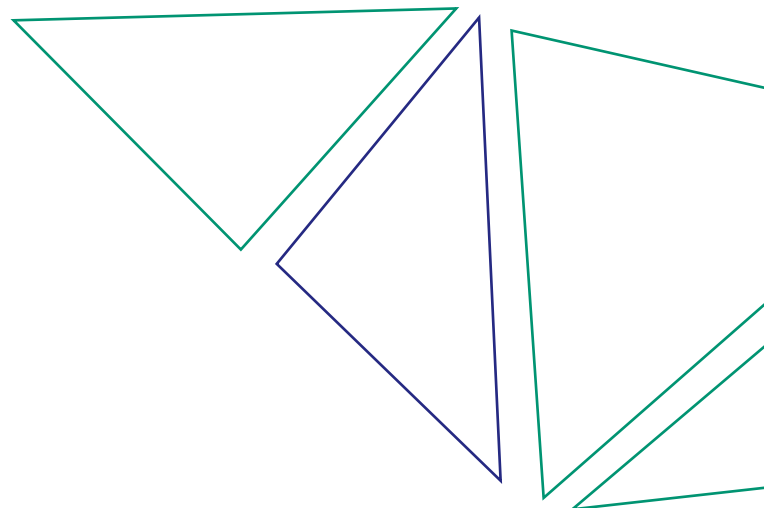
Table 14. Stroke unit information from the Organisational Survey

	Stroke unit beds in all hospitals (N=127) – total	Dedicated stroke unit beds per hospital (N=127) – median (Q1, Q3)	Patients with acute stroke in all hospitals (N=127) – total	Stroke patient to stroke unit bed ratio in all hospitals (N=127)	Patients with acute stroke in hospitals with stroke unit (N=95)	Stroke patient to stroke unit bed ratio in hospitals with stroke unit (N=95)
Australia	676	5 (4,8)	644	0.95	603	0.89
Location						
ACT^	8	4	14	1.75	14	1.75
NSW	201	5 (4,8)	216	1.07	203	1.01
NT*	4	4	19	4.75	18	4.5
QLD	153	5 (4,7)	103	0.67	102	0.67
SA+	56	16 (16,24)	46	0.82	44	0.79
TAS^	19	10 (8,11)	18	0.95	14	0.74
VIC	189	4 (2,12)	153	0.81	146	0.77
WA	46	6 (6,12)	75	1.63	62	1.35
Reported annual stroke admissions						
<75	38	4 (4,4)	34	0.89	18	0.47
75-199	102	4 (3,4)	111	1.09	93	0.91
200-349	242	5 (4,9)	184	0.76	177	0.73
350-499	34	6 (6,8)	33	0.97	33	0.97
500+	260	12 (8,15)	282	1.08	282	1.08

*One stroke unit, ^Two stroke units, +Three stroke units

Acute stroke team

An important component of acute stroke care is a specialised interdisciplinary team of healthcare professionals providing a coordinated program. This program includes individual assessment, treatment, discharge planning and follow-up. The acute stroke team may include many disciplines combining and coordinating the use of medical, nursing and allied health skills. The *Framework* specifies that the minimum criterion is a "dedicated, interprofessional team with members who have a special interest in stroke and/or rehabilitation". The minimum team would consist of medical, nursing and allied health, including occupational therapy, physiotherapy, speech pathology, social work and dietetics.

Results

Eighty-six acute services (68%) reported a consultant physician with specialist knowledge of stroke was formally recognised as having principal responsibility for stroke management at their hospital. For 71 acute services (56%) the medical leadership for stroke was a neurologist. A general physician (86 services, 68%), geriatrician (76 services, 60%) and a general practitioner (31 services, 24%) were also recognised as being actively involved with the management of stroke. It is important to note that those recognised as being actively

involved in stroke management were not mutually exclusive; more often than not there was more than one physician involved with stroke management. All of the acute services with large annual admission-groupings (350+ stroke admissions) reported a neurologist actively involved with stroke management; however, only 16% of acute services with <75 stroke admissions in the past 12 months reported neurologist involvement with stroke management. Neurologists were less prominent outside metropolitan locations (actively involved with stroke management at 18% of regional acute services, compared with 77% in metropolitan acute services).

Allied health staff were well represented in specialised interdisciplinary teams, with 100% of acute services reporting access to physiotherapists, occupational therapists, speech pathologists and dietitians, and 97% of acute services reporting access to social workers. Clinical psychologists and neuropsychologists were actively involved in the management of patients with stroke at less than one third of acute services, 22% and 27% respectively. The majority of the psychology professionals were based in metropolitan locations (30% clinical psychologists, 39% neuropsychologists), with a lower representation in regional areas (7% clinical psychologists, 4% neuropsychologists).

Team communication

Regular communication among the interdisciplinary team is vital to address key issues that may arise during a patient's hospital admission. Case conferences and team meetings facilitate communication, coordination of care and discharge care planning. The *Framework* specifies that the "interprofessional team meet at least once per week to discuss patient care".

Results

Just over half of the acute services (72 services, 57%) reported having a dedicated stroke coordinator available to liaise and coordinate care between emergency, acute, rehabilitation and/or other services. A stroke/neurology team was reported to manage patients with stroke at 43 acute services (34%) and a general medical team was reported to manage patients with stroke at 58 acute services (46%). Regular team meetings (case conferences) occurred at 115 acute services (91%). Of these, the median frequency of meetings was 4 per month, or the equivalent of 1 meeting per week.

A total of 107 services (84%) reported having a clinical care pathway in place for managing stroke, with protocols for referral to physiotherapy, speech pathology and occupational therapy reported at 98% of the acute services, dietetics at 95% of the acute services, social work at 91% of the acute services, and psychology at only 42% of the acute services.

Routine use of guidelines, care plans and protocols were reported at more acute services with stroke units (66%) than acute services without a stroke unit (28%). Metropolitan services (79%) and services with a stroke unit (76%) reported increased access and collaboration with other specialist services (cardiology, palliative care, and vascular specialties) compared with regional services (36%) and services without a stroke unit (28%).
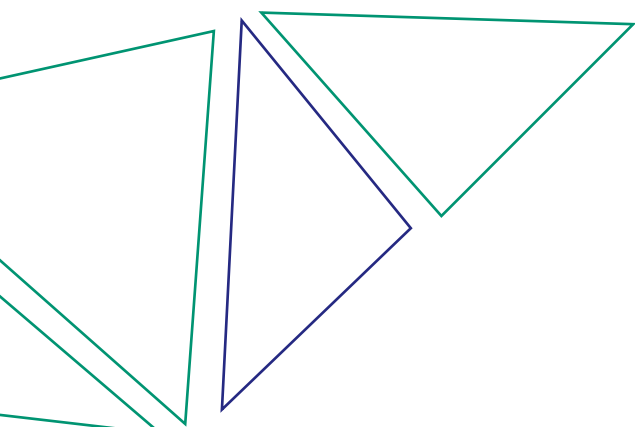
Table 15. Adherence to recommended rehabilitation services by stroke volume

	Reported annual stroke admissions					
	Australia (N=127) n (%)	<75 (N=32) n (%)	75-199 (N=35) n (%)	200-349 (N=33) n (%)	350-499 (N=5) n (%)	500+ (N=22) n (%)
Element of service: rehabilitation						
Coordination with rehabilitation service providers	119 (94)	29 (91)	34 (97)	32 (97)	4 (80)	20 (91)
Early assessment using standardised tools to determine individual rehabilitation needs and goals	104 (82)	25 (78)	27 (77)	28 (85)	4 (80)	20 (91)
Routine involvement of carers in the rehabilitation process	125 (98)	31 (97)	34 (97)	33 (100)	5 (100)	22 (100)

Rehabilitation

Acute services must coordinate with rehabilitation services to facilitate seamless transfer of care for people with stroke. Rehabilitation is a holistic process that should begin early after stroke with the aim of maximising the participation of the person with stroke in the community.[4]

Results

Ninety-five services (75%) reported a rehabilitation physician actively involved in the management of stroke at their acute service. More metropolitan acute services (84%) reported involvement of a rehabilitation physician compared with regional acute services (58%), as did services with a stroke unit (84%) compared with services without a stroke unit (47%).

Regarding assessing suitability for rehabilitation, most acute services (92%) reported that the acute interdisciplinary team were responsible for referring patients with stroke to rehabilitation, followed by acute physician (76%) and a joint decision from both the acute and rehabilitation team members (72%). Overall, 104 acute services (82%) reported a standardised process regarding assessing suitability for further rehabilitation at their service.

A total of 119 acute services (94%) reported access to ongoing inpatient rehabilitation, 117 services (92%) reported access to outpatient rehabilitation, and 105 services (83%) reported access to community-based rehabilitation provided in the home. Very

few sites reported access to day hospital rehabilitation (35%) or stroke specialist Early Supported Discharge (ESD) (11%). ESD services allow patients to return home from hospital earlier than usual and receive rehabilitation in the familiar environment of their own home.

Quality improvement activities

Embedding a culture of evidence-based practice is facilitated by providing targeted education and collaborative involvement in data collection and quality improvement. Access to regular stroke-specific education is a core component of effective and efficient stroke care. The *Framework* specifies clinicians have access to "regular programs of staff education and training relating to stroke (e.g. dedicated stroke inservice program and/or access to annual national or regional stroke conference)".

Results

A total of 104 acute services (82%) reported access to a program of continuing education for staff related to the management of stroke. There was variability, ranging from 57% in SA to 100% in the ACT and NT, and staff in metropolitan locations and larger acute services were more likely to have opportunities for professional development (94% metropolitan versus 60% regional; 96% 350+ stroke admissions versus 53% <75 stroke admissions).

Table 16. Quality improvement activities by region and stroke volume

	Australia (N=127) n (%)	Region		Reported annual stroke admissions				
		Metro (N=82) n (%)	Regional (N=45) n (%)	<75 (N=32) n (%)	75-199 (N=35) n (%)	200-349 (N=33) n (%)	350-499 (N=5) n (%)	500+ (N=22) n (%)
Element of service: reperfusion therapies								
Over the last 2 years stroke team involved in quality improvement activities (collecting and reviewing local stroke data and agreeing on strategies to improve care)	111 (87%)	74 (90%)	37 (82%)	21 (66%)	34 (97%)	30 (91%)	5 (100%)	21 (95%)

Services for patients with transient ischaemic attack (TIA)

Acute services should also ensure there are services that allow rapid assessment and management for people with suspected transient ischaemic attack (TIA) to prevent stroke. Diagnostic work-up and implementation of optimal therapy for patients with suspected TIA should be completed within 24-28 hours. It is highly recommended that all services develop a local TIA pathway involving primary care, emergency department, and stroke specialist teams to ensure patients are managed as rapidly and comprehensively as possible, matching locally available resources.[4]

Results
One hundred and five services (83%) reported a defined and documented process, policy or clinical pathway for assessing TIA patients. Thirty-seven acute services (29%) reported admitting all TIA patients, and 90 acute services (71%) reported admitting only selected TIA patients. Twenty-six acute services (29%) reported access to a rapid access TIA clinic for patients not admitted to hospital, however whilst the recommendation was for assessment within 48 hours, the average waiting time for an appointment at a TIA clinic was 4 days (Q1:2 days, Q3:10 days).

Telehealth and regional responsibility

Acute services may also have links to regional or 'spoke' sites (in a hub and spoke referral system) to support acute clinical care and provide education to non-specialist staff.

Results
There were 65 acute services (51%) reporting they had regional responsibility for specialist stroke care and supporting smaller services. However, medical leads were absent in 14 of these services (22%), stroke coordinators were absent in 16 services (25%) and 2 services (3%) reported not having a dedicated, interdisciplinary team with members who had a special interest in stroke. A further 7 acute services reported they had regional responsibility but did not report a stroke unit, and 3 of these 7 reported admitting fewer than 75 patients with stroke.

Table 17. Adherence to recommended TIA services by region and stroke volume

	Reported annual stroke admissions							
	Australia (N=127) n (%)	Metro (N=82) n (%)	Regional (N=45) n (%)	<75 (N=32) n (%)	75-199 (N=35) n (%)	200-349 (N=33) n (%)	350-499 (N=5) n (%)	500+ (N=22) n (%)
Element of service: TIA services								
Rapid (within 48 hours) TIA assessment clinics/services	49 (39)	12 (38)	9 (26)	12 (36)	1 (20)	15 (68)	5 (100%)	21 (95%)

Table 18. Adherence to telehealth and regional responsibility by stroke volume

	Reported annual stroke admissions					
	Australia (N=127) n (%)	<75 (N=32) n (%)	75-199 (N=35) n (%)	200-349 (N=33) n (%)	350-499 (N=5) n (%)	500+ (N=22) n (%)
Element of service: telehealth and regional responsibility						
Provision of telehealth services for acute assessment and treatment	67 (53)	20 (63)	18 (51)	13 (39)	2 (40)	14 (64)
Regional responsibility (e.g. coordination across a local health district)	65 (51)	6 (19)	19 (54)	16 (48)	4 (80)	20 (91)

87
STROKE
UNITS
2015

95
STROKE
UNITS
2017

77%
Metro

Patients who received stroke unit care

47%
Regional
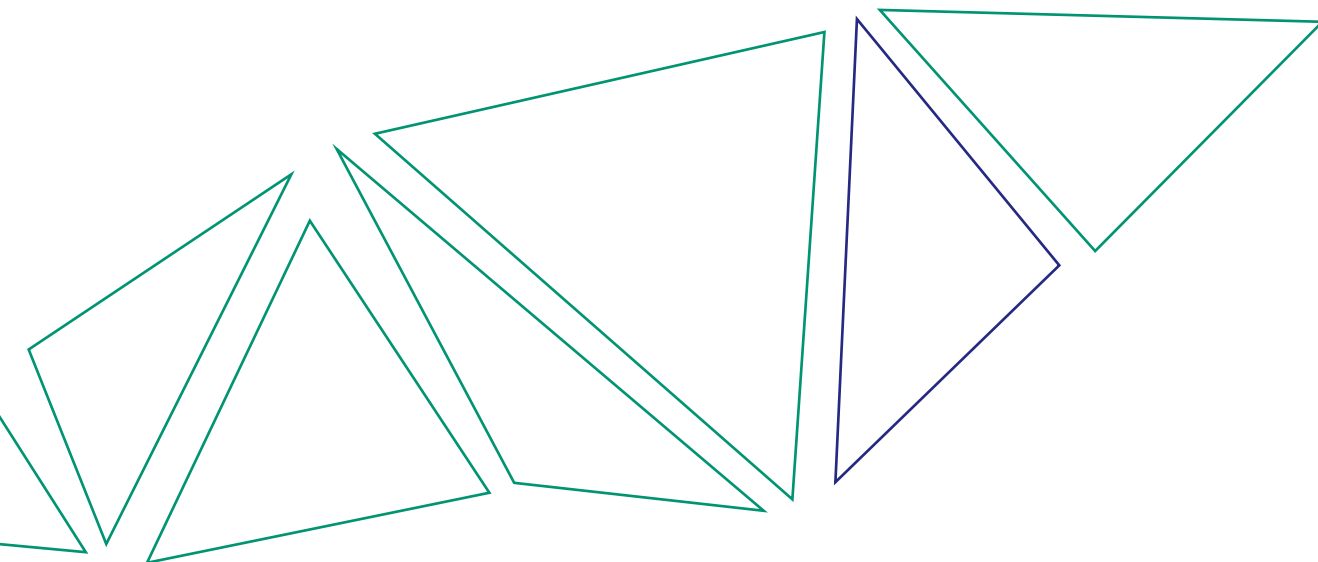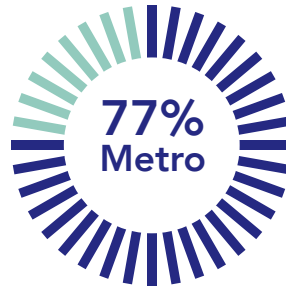
Clinical Audit and performance against the Acute Stroke Clinical Care Standard Indicators

The *Acute Stroke Clinical Care Standard*, released in June 2015 by the Australian Commission for Safety and Quality in Health Care (ACSQHC) builds on the *Clinical Guidelines for Stroke Management*, which set out best practice stroke treatment.

The *Standard* guides clinicians and health services to provide high-quality care, and support stroke survivors, their families and carers from the onset of symptoms to the start of rehabilitation. It sets out 19 suggested process indicators covering 7 quality statements for stroke care. This section of the report provides data related to the indicators, based on data from the Clinical Audit component.

Key findings 2015 to 2017

Positive performance was noted on a number of *Acute Stroke Clinical Care Standard* indicators, including:

› Transport to appropriate hospitals for access to thrombolysis (66% in 2015, 71% in 2017).

› Thrombolysis delivery (7% in 2015, 13% in 2017).

› Early commencement of rehabilitation during acute hospital admission (82% in 2015, 86% in 2017).

› Education about behaviour change and risk factors (56% in 2015, 70% in 2017).

› Being discharged on an antihypertensive for patients with intracerebral haemorrhage (66% in 2015, 80% in 2017).

Whilst multiple *Acute Stroke Care Standard* indicators have improved since the 2015 Audit, there remains room for improvement:

› Use of a stroke screen in emergency departments (38% in 2015, 46% in 2017).

› Thrombolysis occurring within 60 minutes of hospital arrival (26% in 2015, 30% in 2017).

› Stroke unit care (67% in 2015, 69% in 2017).

› Carer training (48% in 2015, 57% in 2017) and carer support needs assessment (59% in 2015, 62% in 2017).

› Discharge on secondary prevention medication (64% in 2015, 69% in 2017).

› Care plan development with the team and patient/family (56% in 2015, 65% in 2017).

Characteristics of patients from the Clinical Audit

A total of 4,192 patient case notes were audited. The majority of these patients were managed in metropolitan acute services: 3,121 metropolitan cases (74%) compared with 1,071 cases from regional locations (26%).

The median age of patients was 75 years, 45% of patients were female, only 2% of patients were identified as being of Aboriginal and/or Torres Strait Islander background and 7% required an interpreter.

Table 19. Patient demographics

Patient demographics	Australia (N=4,192) n (%)	Metropolitan (N=3,121) n (%)	Regional (N=1,071) n (%)
Age – median (Q1,Q3)	75 (65,84)	75 (65,83)	76 (66,84)
Sex – female	1,887 (45%)	1,411 (45%)	476 (44%)
Patient identifying as Aboriginal and/or Torres Strait Islander background	98 (2%)	54 (2%)	44 (4%)
Patient requiring interpreter	278 (7%)	267 (9%)	11 (1%)
Stroke type			
Ischaemic stroke	3,433 (82%)	2,615 (84%)	818 (76%)
Intracerebral haemorrhage	517 (12%)	376 (12%)	141 (13%)
Undetermined stroke type	242 (6%)	130 (4%)	112 (10%)
Pre-stroke information			
Independence prior to admission (mRS 0-2)	3,373 (80%)	2,499 (80%)	874 (82%)
Risk factors prior to admission			
Atrial fibrillation (irregular heart beat)	1,039 (27%)	736 (26%)	303 (30%)
Previous stroke	897 (23%)	655 (23%)	242 (24%)
Previous TIA	492 (13%)	357 (13%)	135 (14%)
Diabetes mellitus	1,010 (26%)	750 (26%)	260 (26%)
Hypercholesterolaemia (high cholesterol)	1,611 (42%)	1,183 (42%)	428 (44%
Hypertension (high blood pressure)	2,762 (69%)	2,029 (68%)	733 (72%)
Ischaemic heart disease	973 (26%)	712 (25%)	261 (27%)
High alcohol consumption	342 (10%)	246 (10%)	96 (11%)
Current smoker	574 (16%)	414 (16%)	160 (18%)
Past smoker	1,030 (33%)	742 (31%)	288 (38%)
Dementia	333 (9%)	252 (9%)	81 (9%)

Q1: 1st quartile, Q3: 3rd quartile, mRS: modified rankin scale, TIA: transient ischaemic attack

The majority of patients (82%) had an ischaemic stroke (caused by a clot), compared with intracerebral haemorrhage (bleed) (12%). The top 3 risk factors reported included: high blood pressure (hypertension) (69%), high cholesterol (hypercholesterolaemia) (42%) and being an ex-smoker (33%).

Eighty percent of patients had a modified Rankin Score[17] (a commonly used scale for measuring the degree of disability or dependence in the daily activities of people) of 0-2 prior to their stroke, indicating they had no disabilities or minor disabilities. Most patients lived at home with others (67%) or lived alone (24%).

National Performance on the Acute Stroke Clinical Care Standard indicators

The ACSQHC provides a set of suggested indicators to assist with local implementation of the *Acute Stroke Clinical Care Standard. Clinicians* and healthcare services can use the indicators to monitor the implementation of the quality statements and support improvement as needed. Definitions of the indicators reported (including numerators and denominators, and exclusion criteria) are available in the report supplement at informme.org.au/stroke-data

Seventeen of the 19 national indicators are reported in Figure 3 below. The indicator regarding assessment by ambulance services is not able to be reported as the National Stroke Audit examines information from the point of presentation to hospital.

Tables 20 and 21 detail the adherence to select clinical recommendations with results split by hospital location and annual hospital acute stroke admissions. The national benchmarks included in Table 20 are based on a modified version of the Achievable Benchmark of Care (ABC™) methodology[13] (refer to Chapter 2).

Figure 3. 2017 National adherence to the Acute Stroke Clinical Care Standard indicators

Indicator

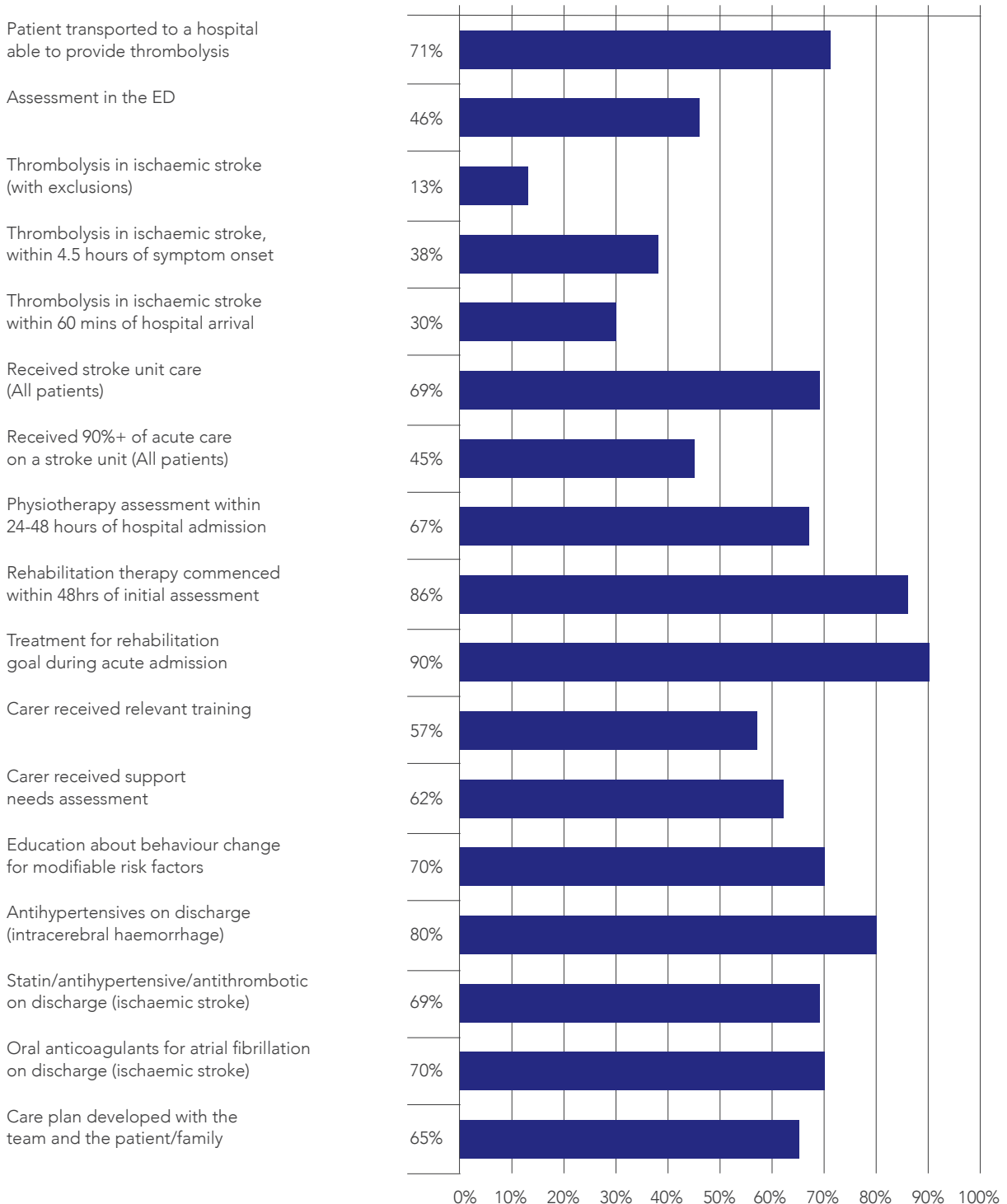| Indicator	Value
Patient transported to a hospital able to provide thrombolysis	71%
Assessment in the ED	46%
Thrombolysis in ischaemic stroke (with exclusions)	13%
Thrombolysis in ischaemic stroke, within 4.5 hours of symptom onset	38%
Thrombolysis in ischaemic stroke within 60 mins of hospital arrival	30%
Received stroke unit care (All patients)	69%
Received 90%+ of acute care on a stroke unit (All patients)	45%
Physiotherapy assessment within 24-48 hours of hospital admission	67%
Rehabilitation therapy commenced within 48hrs of initial assessment	86%
Treatment for rehabilitation goal during acute admission	90%
Carer received relevant training	57%
Carer received support needs assessment	62%
Education about behaviour change for modifiable risk factors	70%
Antihypertensives on discharge (intracerebral haemorrhage)	80%
Statin/antihypertensive/antithrombotic on discharge (ischaemic stroke)	69%
Oral anticoagulants for atrial fibrillation on discharge (ischaemic stroke)	70%
Care plan developed with the team and the patient/family	65%

Table 20. Performance on selected Acute Stroke Clinical Care Standard indicators by location

	Australia (N=117) %	National Benchmark %	ACT (N=2) %	NSW (N=44) %	NT (N=1) %	QLD (N=23) %	SA (N=4) %	TAS (N=3) %	VIC (N=29) %	WA (N=11) %
Assessment in the emergency department˜	46	89	79	54	0	39	67	33	45	30
Thrombolysis in ischaemic patients with stroke (with exclusions)‡	13	20*	23	11	4	9	20	8	19	4
Thrombolysis in ischaemic patients with stroke who arrive within 4.5 hours of symptom onset‡	38	-	52	38	0	27	58	23	54	13
Thrombolysis within 60 minutes of hospital arrival	30	61	31	29	0	20	47	25	34	20
Admission into a stroke unit	69	96	83	67	87	79	85	56	73	41
90% of acute hospital care in a stroke unit§	45	81	41	37	26	51	67	25	58	30
Assessment by a physiotherapist within 48 hours of hospital admission‖	67	86	35	67	76	73	77	64	67	62
Discharged on antihypertensive medication (intracerebral haemorrhage)#	80	82	40	83	75	87	67	83	72	86
Discharged on statin, antihypertensive and antithrombotic medications (ischaemic stroke)#	69	89	51	65	55	79	49	67	69	74
Education about behaviour change for modifiable risk factors	70	95	83	76	56	76	84	56	61	60
Carer support needs assessment‖	62	86	64	75	60	53	50	29	57	39
Written care plan‖	65	95	72	73	85	61	61	17	64	58

*International benchmark, ˜Excludes in-hospital stroke, inter-hospital transfer, unconscious patients, ‡Excludes patients with premorbid functional impairment, recent stroke surgery, major comorbidity, warfarin with INR>1.7, (international normalised ratio), rapidly improving, imaging showing spontaneous reperfusion, other contraindication, §Known times, ‖Excludes patients declining involvement, #Excludes those contraindicated to treatment, futile, or refused (antihypertensive medications only contraindicated)

The National median time from onset of stroke symptoms to thrombolysis was 2 hours and 36 minutes (Q1: 2 hours; Q3: 3 hours and 24 minutes).

Table 21. Performance on selected Acute Stroke Clinical Care Standard indicators by stroke volume

	Reported annual stroke admissions					
	Australia (N=117) %	<75 (N=23) %	75-199 (N=35) %	200-349 (N=32) %	350-499 (N=5) %	500+ (N=22) %
Assessment in the emergency department*	46	38	38	47	31	63
Thrombolysis in ischaemic patients with stroke (with exclusions)~	13	8	8	12	19	22
Thrombolysis in ischaemic patients with stroke who arrive within 4.5 hours of symptom onset~	38	23	28	37	51	54
Thrombolysis within 60 minutes of hospital arrival	30	21	27	27	22	36
Admission into a stroke unit	69	37	60	79	85	84
90% of acute hospital care in a stroke unit‡	45	25	42	47	46	58
Assessment by a physiotherapist within 48 hours of hospital admission§	67	56	72	67	73	67
Discharged on antihypertensive medication (haemorrhagic stroke)‖	80	79	78	87	89	68
Discharged on statin, antihypertensive and antithrombotic medications (ischaemic stroke)‖	69	67	71	69	78	65
Education about behaviour change for modifiable risk factors	70	66	69	73	82	67
Carer support needs assessment§	62	65	57	63	91	59
Written care plan§	65	59	60	69	47	72

*Excludes in-hospital stroke, inter-hospital transfer, unconscious patients, ~Excludes patients with premorbid functional impairment, recent stroke surgery, major comorbidity, warfarin with INR>1.7 (international normalised ratio), rapidly improving, imaging showing spontaneous reperfusion, other contraindication, ‡Known times, §Excludes patients declining involvement, ‖Excludes those contraindicated to treatment, futile, or refused (antihypertensive medications only contraindicated)

Adherence to specific aspects of the Acute Stroke Clinical Care Standard indicators

Time-critical therapy

Access to appropriate screening, assessment, imaging, investigation and treatment is essential for positive patient outcomes.

Participants were asked to record data regarding stroke management and reperfusion treatment based on hyperacute therapy recommendations in the *Clinical Guidelines for Stroke Management 2010*.

The table below summarises access to appropriate stroke therapies and the provision of thrombolysis treatment.

Results

Seventy-six percent of patients arrived at hospital by ambulance and 15% were transferred from another hospital. The median time from stroke onset to arrival in the ED was 3.6 hours. Twenty-nine percent of patients arrived at hospital within 3 hours and 36% arrived within 4.5 hours of stroke symptom onset. 71% of patients were outside the time window (4.5 hours) for thrombolysis treatment.

Ninety-nine percent of patients received a brain scan following their stroke with 91% occurring within hospital, 35% of these scans were performed within 1 hour of arrival to hospital and 90% were performed within 24 hours of arrival to hospital. The majority (81%) of the brain scans were a CT scan.

Seventy-one percent of patients were transported by ambulance to a hospital able to provide thrombolysis, however only 45% of all patients who presented to hospital were screened for thrombolysis eligibility. Consequently, only 13% of all patients received thrombolysis.

Table 22. Early access and thrombolysis indicators, by region

Indicator	Australia (N=4,192)	Metro (N=3,121)	Regional (N=1,071)
Patient transported to a hospital able to provide thrombolysis*	71%	77%	57%
Assessment in the emergency department	46%	46%	47%
Thrombolysis in ischaemic stroke (with exclusions)˜	13%	13%	10%
Thrombolysis in ischaemic stroke for those who arrive within 4.5 hours of symptom onset˜	38%	40%	32%
Thrombolysis in ischaemic stroke within 60 mins of hospital arrival	30%	31%	23%
Median time from stroke onset to thrombolysis (hours:minutes) (Q1,Q3)	2:36 (2:00, 3:24)	2:30 (1:54, 3:24)	3:06 (2:24, 3:38)

Q1: 1st quartile, Q3: 3rd quartile, *Excludes in-hospital stroke, arrivals >4.5 hours from stroke onset, ˜Excludes patients with premorbid functional impairment, recent stroke surgery, major comorbidity, warfarin with INR>1.7, (international normalised ratio), rapidly improving, imaging showing spontaneous reperfusion, other contraindication

Table 23. Thrombolysis indicators (ischaemic stroke)

Patient fully worked up within 4.5 hours but thrombolysis unable to be given for following reasons (N=476)*:	Australia n (%)
Clinical trial patient	1 (<1%)
Major premorbid functional impairment (level of disability)	55 (12%)
Recent surgery	23 (5%)
Major co-morbidity	53 (11%)
Warfarin with INR>1.7	41 (9%)
Rapidly improving	195 (41%)
Spontaneous reperfusion based on brain imaging	11 (2%)
Other contraindication	204 (43%)

*More than one option could be selected, INR: international normalised ratio

Of those patients who were screened and eligible to receive thrombolysis, 38% received thrombolysis and, of these, 30% received thrombolysis within 60 minutes of hospital arrival.

Median time from arrival at hospital to brain scan (door to scan) was 27 minutes (Q1:25, Q3:45 minutes), and median time from arrival at hospital to receiving thrombolysis (door to needle) was 72 minutes (Q1:54, Q3:102 minutes).

The table above summarises the decision making processes of hospitals providing thrombolysis. Of the patients who did not receive thrombolysis, 41% were rapidly improving and 43% had other contraindications.

Stroke unit care

The organisation of hospital services to provide stroke unit care will significantly improve patient outcomes. The benefit of patient access to a stroke unit is shown in the analysis below which supports the configuration of services to ensure patients with stroke receive interdisciplinary stroke care in a stroke unit.

Results

Fifty-four percent of patients were admitted directly to a stroke unit on admission to hospital, with 24% of patients admitted to a medical ward on admission and 8% of patients admitted directly to ICU. The median time from hospital arrival to admission to a stroke unit was 7.4 hours. Alarmingly, 41% of stroke patients were not cared for in a stroke unit during their acute admission, and of those who did receive care in a stroke unit, only 45% spent at least 90% of their acute hospital stay in a stroke unit.

All acute stroke services should implement standardised protocols to manage fever, glucose and swallowing difficulties in patients with stroke.[18]

Table 24. Stroke unit care, by location and region

Indicator	Australia (N= 4,192) %	Metro (N= 3,121) %	Regional (N= 1,071) %	ACT (N= 83) %	NSW N= 1,495) %	NT (N= 39) %	QLD (N= 864) %	SA (N= 123) %	TAS (N= 124) %	VIC (N= 1,099) %	WA (N= 365) %
Received stroke unit care	69	77	47	83	67	87	79	85	56	73	41
Received 90% of acute care in a stroke unit	45	50	33	41	37	26	51	67	25	58	30

Of those patients who developed a temperature within the first 72 hours of admission, patients treated in a stroke unit had a slightly higher treatment rate than those patients not in a stroke unit (59% compared with 51%). Reasons paracetamol was not administered included the fact that regular paracetamol had already been given (12%) or that it was contraindicated (2%).

Whilst rates of elevated glucose levels were present in similar percentages in both stroke unit and non-stroke unit patients, just under 2 in 5 of these patients were appropriately managed with insulin administration.

Patients treated in a stroke unit received more swallow screening or assessment than patients not treated in a stroke unit. More patients in a stroke unit were screened within 24 hours of admission and screened/assessed before oral intake, than those patients who were not treated in a stroke unit.

Table 25. Fever, sugar, swallow processes by stroke unit access

	Australia (N=4 192) %	Treated in a stroke unit (N=2,913) %	Not treated in a stroke unit (N=1,279) %
Fever			
Patient developed fever ≥ 37.5°C within first 72 hours	11	11	12
Paracetamol for the first elevated temperature administered within 1 hour*	56	59	51
Glucose			
Hyperglycaemia (first 48 hours of admission)	18	17	20
Insulin administered within 1 hour of the first elevated finger-prick glucose (>=10 mmol/L)	38	38	39
Swallow			
Formal swallow screen performed	57	63	42
Swallow screened within 24 hours	49	56	34
Swallow assessment by speech pathologist	75	81	61
Swallow screened or assessed	84	92	67
Swallow screen or assessment performed before given oral intake (medications, food or fluids)	63	71	46

*Excludes those already receiving regular paracetamol or where contraindicated

Table 26. Impairments on admission

Impairments present on admission	Australia (N=4,192) %
Sensory deficit	36
Cognitive deficit	33
Visual deficit	30
Perceptual deficit	20
Speech/communication impairment	57
Hydration problems	15
Nutrition problems	16
Arm deficit	60
Lower limb deficit	53
Dysphagia	33
Continence	26
Balance	49
Other impairment	11

Early interdisciplinary assessment and intervention

It is important that a formal assessment for rehabilitation is performed for all patients following a stroke.

The table above provides information on the type and rates of impairments patients with stroke presented with on admission to hospital. More than half of patients had upper limb deficits and speech/communication impairments, and just under half had balance issues. Around one third of patients had sensory deficits, cognitive issues, visual deficits and dysphagia (difficulty swallowing).

Results

Compared to patients who did not receive stroke unit care, a higher proportion of patients treated in a stroke unit received malnutrition screening (71% vs 50%), an incontinence management plan (19% vs 15%), and had their mood assessed (28% vs 11%) han those patients not treated in a stroke unit.

The *Clinical Guidelines* recommend a patient's rehabilitation needs and goals are to be assessed by staff trained in rehabilitation within 24-48 hours of admission and rehabilitation started as soon as possible.[4]

One component of stroke unit care and rehabilitation is early mobilisation. "Mobilisation" is defined as out-of-bed activities and can include sitting out of bed, standing and walking.[19]

Table 27. Mobilisation, by stroke unit access

Mobilisation	Australia (N=4,192) %	Treated in a stroke unit (N=2,913) %	Not treated in a stroke unit (N=1,279) %
Mobilisation during acute admission	86	93	73
Mobilisation during acute admission if unable to walk independently on day admitted to hospital	78	87	58
Mobilisation on same day or day after arrival to ED	79	78	79
Mobilisation on same day or day after arrival to ED if unable to walk independently on day admitted to hospital	70	70	70
Mobilisation within 2 days of arrival to ED	91	91	90
Mobilisation within 2 days of arrival to ED if unable to walk independently on day admitted to hospital	86	86	86

ED: emergency department

Table 28. In-hospital communication, by region and stroke unit access

Indicator	Australia (N=4,192) %	Metro (N=3,121) %	Regional (N=1,071) %	Treated in a stroke unit (N=2,913) %	Not treated on a stroke unit (N=1,279) %
Team met with patient to discuss management	82	83	78	85	74
Goals set with input from team and patient	77	79	69	84	58
Patient and/or family received information covering stroke, hospital management, secondary prevention and recovery	58	58	57	68	35

Patients treated in a stroke unit were more likely to be mobilised during admission and more likely to be mobilised if they were unable to walk independently on the day they were admitted to hospital, than those patients not treated in a stroke unit. However there were no differences noted between patients treated in a stroke unit and those not treated in a stroke unit in terms of how soon mobilisation occurred – on the same day, the day after or within 2 days of arrival at hospital – regardless of level of independence with mobility.

Patient goal setting should take into consideration that the needs of each individual will vary depending on the type of stroke, symptoms and the individual's psychosocial circumstances. Goal setting helps direct rehabilitation efforts throughout the various stages of recovery and a 'patient' or 'person-centred' approach is required to establish rehabilitation goals that are relevant to an individual's needs.[20] Goals developed in team meetings should be documented and agreed to by the stroke survivor and/or family/carer. The table above details the reported communication between treating teams and patients/families.

Acute services in metropolitan locations and those services with stroke units involved patients more in their post-stroke management plans. Patients treated in a stroke unit were more likely to receive information about stroke, post-stroke management and recovery, and prevention of further stroke.

Participants were asked to provide information regarding assessment by members of the interdisciplinary team, and the time to assessment was analysed from the data provided. Reporting of assessments by dietitians and psychologists took into account the presence of nutrition complications and mood impairment.

Whilst most patients with stroke were assessed by a physiotherapist, occupational therapist and speech pathologist during their hospital admission, fewer patients were assessed by a dietitian or a social worker, and very few patients were assessed by a psychologist. Patients in regional areas had minimal access to psychology services.

Early rehabilitation

Rehabilitation should commence early after stroke and tailored interventions that focus on impairment, activity and participation levels must considered. The table below provides details on rehabilitation indicators.

Results

Patients not treated in a stroke unit were less likely to commence rehabilitation within 48 hours of initial assessment, receive treatment based on identified rehabilitation goals, or have an assessment for rehabilitation.

Assessment for rehabilitation was primarily undertaken by the multidisciplinary team (58%), followed by the rehabilitation specialist (16%), or rehabilitation registrar (9%). Less than half of all patients (46%) were referred for ongoing rehabilitation, even though three-quarters (75%) of those who had an assessment for rehabilitation had an identified need for ongoing rehabilitation identified.

Table 29. Interdisciplinary assessment, by region and stroke unit access

	Australia (N=4,192)	Metro (N=3,121)	Regional (N=1,071)	Treated in a stroke unit (N=2,913)	Not treated in a stroke unit (N=1,279)
Physiotherapy					
Assessed*	88%	89%	84%	94%	73%
Assessed within 48 hours	67%	67%	67%	74%	53%
Occupational Therapy					
Assessed¯	87%	89%	82%	94%	70%
Assessed within 48 hours	54%	55%	52%	59%	41%
Speech Pathology					
Assessed¯	87%	88%	85%	92%	74%
Assessed within 48 hours	69%	70%	66%	75%	56%
Dietetics					
Assessed†‡	69%	70%	68%	75%	57%
Median time to assessment (days) (Q1,Q3)	2 (1,3)	2 (1,3)	2 (1,3)	2 (1,4)	2 (1,3)
Social Work					
Assessed	60%	62%	54%	66%	45%
Median time to assessment (days) (Q1,Q3)	2 (1,4)	2 (1,3)	2 (1,3)	2 (1,4)	2 (1,4)
Psychology					
Assessed§†	13%	18%	0%	15%	3%
Median time to assessment (days) (Q1,Q3)	5 (4,9)	5 (4,9)	-	5 (4,9)	-

Q1: 1st quartile, Q3: 3rd quartile; *Excludes where patient declined: ¯Excludes where not required; ‡If nutrition or hydration problems on admission or if failed swallow screen; §If mood impairment identified on admission

Table 30. Rehabilitation indicators, by region and stroke unit access

	Australia (N=4,192)	Metro (N=3,121)	Regional (N=1,071)	Treated in a stroke unit (N=2,913)	Not treated in a stroke unit (N=1,279)
Rehabilitation therapy commenced within 48 hours of initial assessment*	86	89	79	91	72
Treatment based on patient's identified rehabilitation goals undertaken during acute admission¯	69	72	60	76	52
Assessment for rehabilitation performed	59	62	50	67	40
Assessment identified need for ongoing rehab‖	75	73	80	74	76
Referral made for ongoing rehabilitation§	46	46	43	51	34

*Excludes patients declining involvement; ¯Excludes if patient declined, had returned to pre-morbid level, was unresponsive, or treatment was futile; ‡Of those who had assessment; §Includes all patients; ‖If assessment performed

Minimising risk of another stroke

The *Clinical Guidelines for Stroke Management 2010* recommend the use of blood pressure-lowering, cholesterol-lowering and antiplatelet or anticoagulation pharmacotherapy to prevent secondary stroke. All patients should also be assessed for, and educated on, lifestyle risk factor modification in order to prevent further stroke.

Results

At the point of discharge from the acute service:

› 30% of patients had not received advice about risk factor modification.

› 20% of patients with intracerebral haemorrhage were not prescribed antihypertensives.

› 30% of patients with ischaemic stroke with atrial fibrillation were not prescribed anticoagulants.

› 31% of patients with ischaemic stroke were not prescribed triple prevention therapy: statin, antihypertensive and antithrombotic medications.

In terms of patient education regarding risk factors and behaviour change for modifiable risk factors, there was much variability across the country: as few as 56% of patients were receiving this education in some states (NT and TAS), compared with a maximum of 84% found elsewhere in the country (SA). Patients discharged on appropriate medications for secondary stroke prevention also varied around the country and was inconsistent by type of stroke: ischaemic and intracerebral haemorrhage.

Transition from hospital care

A range of physical, psychosocial, social and financial consequences challenge stroke survivor's adjustment to life in the community following discharge. Effective discharge planning facilitates the transfer of the stroke survivor to the community by maximising independence, minimising social isolation and ensuring the needs of the patient and carer are addressed.

The carer of a stroke survivor should receive practical training and support to enable them to provide care, support and assistance to the stroke survivor. The information provided to stroke survivors and carers regarding preparation for life in the community is vital. Carers often report difficulties coping in the community due to inadequate training and lack of support.

Table 31. Secondary prevention indicators, by region and stroke unit access

Indicator	Australia (N=4,192) %	National benchmark %	Metro (N=3,121) %	Regional (N=1,071) %	Treated in a stroke unit (N=2,913) %	Not treated in a stroke unit (N=1,279) %
Education on behaviour change for modifiable risk factors	70	95	69	73	74	59
Discharged on antihypertensives (intracerebral haemorrhage)*	80	82	82	73	85	71
Discharged on statin, antihypertensive and antithrombotic medications (ischaemic stroke)*	69	89	68	71	69	67
Discharged on oral anticoagulants for atrial fibrillation (ischaemic stroke)*	70	86	70	70	73	59

*Excludes those contraindicated to treatment, futile, or refused (antihypertensive: only contraindicated)

Table 32. Secondary prevention indicators, by location

Indicator	ACT (N=83) %	NSW (N=1,495) %	NT (N=39) %	QLD (N=864) %	SA (N=123) %	TAS (N=124) %	VIC (N=1,099) %	WA (N=365) %
Education on behaviour change for modifiable risk factors	83	76	56	76	84	56	61	60
Discharged on antihypertensives (intracerebral haemorrhage)*	40	83	75	87	67	83	72	86
Discharged on statin, antihypertensive and antithrombotic medications (ischaemic stroke)*	51	65	55	79	49	67	69	74
Discharged on oral anticoagulants for atrial fibrillation (ischaemic stroke)*	86	69	100	58	100	62	75	69

*Excludes those contraindicated to treatment, futile, or refused (antihypertensive: only contraindicated)

Table 33. Discharge planning processes, by region and stroke unit access

Indicator	Australia (N=4,192) %	Metro (N=3,121) %	Regional (N=1,071) %	Treated in a stroke unit (N=2,913) %	Not treated in a stroke unit (N=1,279) %
Care plan developed with the team and patient (or family)*	65	66	62	70	52
Patient involvement in care plan~	92	92	92	93	88
Family involvement in care plan~	69	69	66	68	71
Copy of discharge summary sent to general practitioner and/or community providers‡	95	96	95	96	94
Patient or family received contact details of someone in hospital for post-discharge questions‡	61	62	59	66	51

*Excludes death, if transferred to inpatient rehabilitation, acute care or refused plan, or where not applicable
~If had care plan, ‡Excludes deaths

Results

The Clinical Audit showed 29% of patients were reported to have a carer, however only 57% of these carers received relevant training, and only 62% of carers received a support needs assessment.

Over one-third (35%) of patients did not have a care plan developed, and 39% of patients did not receive contact details of someone in the hospital for post-discharge questions. Of those patients not treated in a stroke unit only half received a care plan (52%) or contact details of someone in the hospital for post-discharge questions (51%).

Routine use of Clinical Guidelines

66%

in hospital **WITH** stroke unit

28%
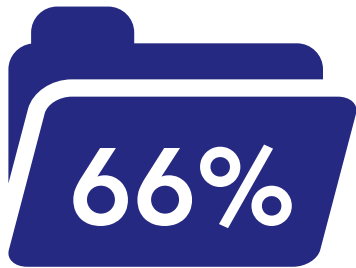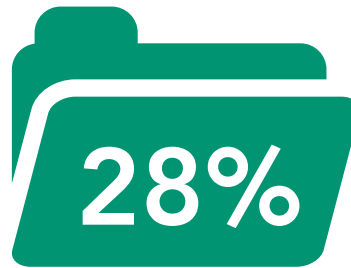
in hospital **WITHOUT** stroke unit

CHAPTER 6
Changes over time

Changes in key performance indicators over time provide a useful comparator to assess improvements or otherwise in clinical practice.

The following table details selected recommended care indicators for 2011, 2013, 2015 and 2017. Care must be taken in directly comparing the results for certain indicators as question wording and response options have changed, particularly between the 2013 and 2015 audit cycles.

Some indicators have improved slightly, such as stroke unit care and swallow screening/

assessment, and other indicators have shown more encouraging improvements: thrombolysis treatment, behaviour change education for modifiable risk factors, provision of a care plan and carer training.

Alarmingly, a number of indicators remain relatively unchanged, such as brain imaging within 24 hours, allied health assessment within 48 hours (physiotherapy, occupational therapy, speech pathology), mood assessment, continence management plans and discharge on appropriate medications.

Table 33. Comparison of National adherence to selected indicators of care since 2011 (clinical audit data only)

Recommended care	2011 %	2013 %	2015 %	2017 %
Received stroke unit care*	58	58	67	69
Swallow screened or assessed before food or drink, or oral medication˜	57	52	56	63
Brain imaging within 24 hours#	91	93	90	90
Thrombolysis in ischaemic stroke (with exclusions) *§	7	7	7	13
Received thrombolysis (all ischaemic stroke arrived within 3 hours)*§	20	15	29	45
Aspirin within 48 hours if ischaemic stroke*‡	65	67	70	71
Assessed by physiotherapy within 48 hours*‡	63	70	68	67
Assessed by occupational therapy within 48 hours*‡	41	49	53	54
Assessed by speech pathologist within 48 hours*‡	63	66	68	69
Mood assessed during admission*	-	17	22	22
Incontinent patients with continence management plan*	25	23	35	33
Discharged on antihypertensives (all stroke)*#	82	78	76	77
Discharged on antithrombotics (ischaemic stroke)*#	97	96	97	98
Discharged on lipid-lowering (ischaemic stroke)*#	82	81	83	86
Received education about behaviour change for modifiable risk factors*‖	50	51	65	70
Care plan developed with the team and the patient (or family)*‖	50	50	56	65
Carer received relevant training*‖	45	41	48	57

*2013: excludes palliative care; ˜2011: question was worded differently; ‡2011, 2013: processes of care with time dependent variables are not directly comparable with earlier reports due to inclusion of in-hospital stroke onset as emergency department arrival; §No exclusions in 2011/2013; #2011, 2013: Not directly comparable with earlier reports due to different exclusions; ‖Response options have changed over time therefore care must be taken when comparing 2011 and 2013 to 2015 and 2017

35%

of patients
did **not** receive a
**DISCHARGE
CARE PLAN**
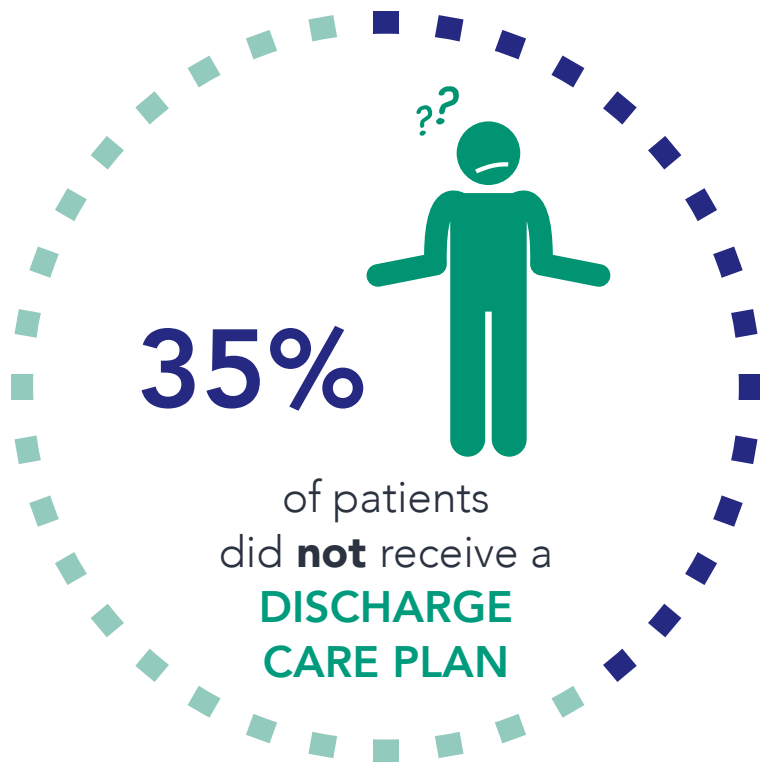
Discussion and recommendations

The National Stroke Audit Acute Services Report 2017 provides the largest snapshot to date of current inpatient acute services for stroke in Australia. Importantly, the results are presented according to the *Clinical Guidelines for Stroke Management 2010* and the *Acute Stroke Clinical Care Standards* and progress since the last National Stroke Audit is able to be described.

The information provided in this report will inform areas for quality improvement activity and improve patient outcomes. Acute services are encouraged to assess their stroke services' performance by comparing themselves to the national, state and annual admission-specific averages presented.

Strengths of the data

The National Stroke Audit Acute Services provides an excellent cross-sectional overview of acute stroke services in Australia. The quality of the data analysis was assured by:

› Minimising potential reporting biases through a process of standardised training and ongoing education of participants.

› A comprehensive data dictionary was provided as an aid for both the Organisational Survey and Clinical Audit to increase inter-rater reliability. Each site also conducted a reliability check in which data from 3-5 cases was entered by two separate auditors.

› Programmed logic checks were built into the AuSDaT to verify data at the point of entry and all participants received their data for verification.

› The National Stroke Audit Project Team monitored data entry including pro-actively investigating missing data or anomalies.

› Data was analysed independently.

The total patient cohort for this year's National Stroke Audit was the largest ever submitted for an acute stroke cycle:

› 31,952 stroke admissions reported in 2017 compared with 29,712 stroke admissions reported in 2015.

› 4,192 episodes audited for this year's Clinical Audit, compared with 4,087 patient case notes entered in the 2015 Clinical Audit.

› More acute stroke services participated in at least one of the National Stroke Audit components than in any previous acute cycle (127 compared with 118).

This sizeable sample ensures recommendations are robust and meaningful.

Limitations of the data

The National Stroke Audit Acute Services provides Australia's largest snap shot of inpatient acute services for stroke in Australia. The data does have some limitations. Readers are advised to use caution as:

> Participation in the National Stroke Audit is voluntary and the data are self-reported and may be subject to reporting bias, or misinterpretation of the question (response bias).

> Documentation issues should be considered; recording of data for the Clinical Audit assumes that, if a process was not documented, it was not performed, which may not always be the case. This is highlighted when data from the Organisational Survey and Clinical Audit provide conflicting information. However, as documentation of care is a medico-legal responsibility and proof that care was delivered, care could not be assumed in the absence of documentation. Better documentation will provide the ability to gather more robust data for monitoring stroke care and should be factored into quality improvement activities.

> Accuracy of responses may be dependent on the respondent's knowledge of their hospital's stroke services.

> The National Stroke Audit is undertaken once every two years and the patient cohort sample size was relatively small in several of the participating services. Application of exclusion criteria and missing data further reduced the sample size for some indicator level analyses.

Conclusions

## Mismatch: resources versus delivery of care

The Organisational Survey examines the resources required to deliver evidence-based stroke treatment and care. Responses reported this year showed the largest proportion of services met 20 of the 24 *Framework* elements, and nationally were achieving an average of 18 elements. These results indicate acute services have access to appropriate resources required for stroke care delivery. However, the Clinical Audit, which measures the delivery of, and adherence to, evidence-based processes of care, highlights issues with implementation and clinical practice.

This suggests that whilst the resources are available they are not being utilised appropriately to deliver necessary stroke care.

Improve adherence to the *Framework*

The *Framework* aims to improve the quality of Australian acute stroke services by outlining where strokes services should be developed, providing a basis for measuring adequacy of current structures and resources. It guides decisions about resource requirements and provides an outline for monitoring the quality of acute stroke care. Delivering optimal stroke services equitably across Australia remains a challenge with the variable access to best practice stroke services. Of concern is the number of acute services meeting *Framework* elements. Only 6 hospitals among the 21 hospitals admitting 500 or more patients with stroke over the past 12 months were found to have all 24 elements of the *Framework*, and overall, there were 12 acute services that met 10 or fewer *Framework* elements.

All efforts should be made to improve patient access to evidence-based acute stroke care in Australia. Capacity to deliver quality acute stroke services is essential for improvement of healthcare delivery and patient outcomes. Acute services need to use the *Framework* to identify gaps in their service provision for stroke and take the opportunity to examine ways of implementing change to achieve both *Framework* adherence and recommended evidence-based service provision.
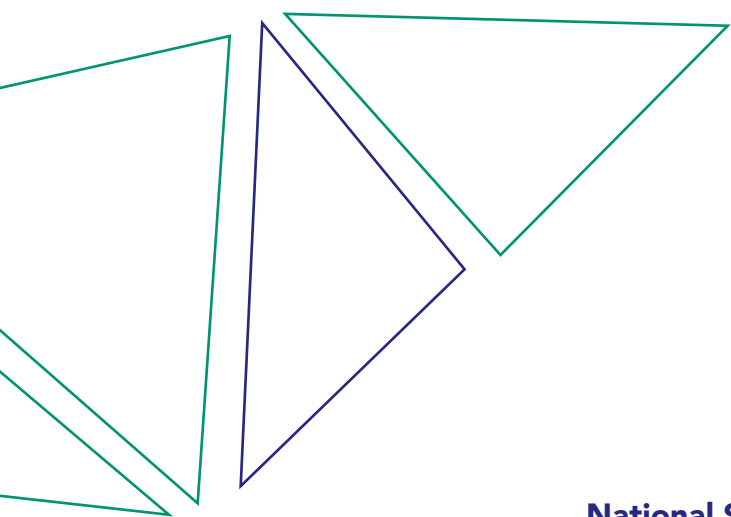
Examine regional stroke coordination

About half (51%) of the acute services reported they had regional responsibility for specialist stroke care and support smaller services. However, medical leads were absent in 14 (22%) of these services, stroke coordinators were absent in 16 (25%) services and 2 (3%) services reported not having a dedicated, interdisciplinary team with members who have a special interest in stroke. Particularly concerning, 7 acute services that reported they had regional responsibility did not have a stroke unit.

Where an acute service has regional responsibility, additional resources should be allocated to coordinate care and include:

> Coordinated regional stroke planning, transfer protocols and key stroke treatment delivery.

> Capacity for specialist clinical support and education (outreach or via telemedicine links).

> Dedicated stroke coordinator positions to coordinate care in and between sites.

Organise pre-hospital services

Early recognition of stroke symptoms and the timing and method by which suspected patients with stroke are transferred to appropriate acute services are critical to ensuring optimal outcomes. In this hyperacute phase of care, ambulance services have a central coordinating role as 76% of patients with stroke arrived at hospital by ambulance. However, only 58% of acute services reported arrangements with local ambulance services to facilitate early notification and only 69% of acute services had protocols in place for bypass and transfer to enable coordinated regional stroke systems. Ambulance services and acute services need to establish systems that facilitate early notification to the receiving hospital and ensure that a hospital with a stroke unit is selected, where possible, for patient transport.

Time-critical therapy access

Acute stroke services should provide access to time-critical therapies, such as reperfusion therapy including thrombolysis and endovascular thrombectomy. Positively,

72% of acute services reported offering thrombolysis, and the national thrombolysis rate has risen from 7% in 2015 to now 13%. But acute services providing thrombolysis varied widely across the states: from 100% of services in the ACT to only 31% in WA; as well as in terms of thrombolysis rates: 25 services reported thrombolysing fewer than 8 patients in the past 12 months and another 3 services reported having not thrombolysed any patient in the last 12 months. Only 45% of patients were screened for thrombolysis eligibility, and of those patients who were screened and eligible to receive thrombolysis, 38% of these patients received thrombolysis. Door-to-needle time remains a challenge with only 30% of those who received thrombolysis being treated within 60 minutes of hospital arrival.

While the appropriate distribution and composition of endovascular thrombectomy services is still a matter of discussion, it is imperative that all patients in all regions in Australia have a clear access path to be transferred to receive endovascular thrombectomy if clinically indicated.

All acute services that reported providing endovascular thrombectomy, were in metropolitan areas; no regional stroke services reported providing endovascular thrombectomy. The *Framework* recommends endovascular thrombectomy be available 24/7, however 43% of the acute services that reported providing thrombectomy services did not provide 24/7 access.

State access to thrombectomy services also varied: the NT has no thrombectomy services. The earlier treatment is delivered the better the outcomes for patients with stroke. All stroke patients need and deserve access to time-critical stroke treatment.

Stroke unit access and care

One-quarter of acute services reported not having a stroke unit, and routine admission directly to a stroke unit from the ED was reported in only 58% of services, as a result 54% of patients were admitted directly to a stroke unit on admission to hospital. Stroke unit availability across the country varies from 38% in WA to 100% in the ACT, as well as from 93% in metropolitan areas to only 42% in regional areas. The median time from hospital arrival to admission to a stroke unit was 7.4 hours and only 69% of those patients admitted to hospital received care during their acute

admission in a stroke unit. Of these patients only 45% received at least 90% of their care in a stroke unit.

Increasing admission rates to a stroke unit is the factor likely to have the single biggest impact on stroke morbidity, due to the many facets of coordinated and improved care that result.

Routine use of guidelines, care plans and protocols were in place at more acute services with stroke units (66%) than acute services without a stroke unit (28%). Patients admitted to a stroke unit received better treatment rates for key issues such as fever (59% compared with 51%), swallow screening and/or assessment (more patients in a stroke unit were screened within 24 hours of admission), malnutrition screening (71% compared with 50%), an incontinence management plan (19% compared with 15%), and having their mood assessed (28% compared with 11%). Patients treated in a stroke unit were also more likely to be mobilised during admission than those patients not treated in a stroke unit.

Access to rehabilitation

Assessment for rehabilitation was primarily undertaken by the multidisciplinary team, but only in 58% of patients. Of these, 75% of patients who had an assessment for rehabilitation had a need for ongoing rehabilitation identified, yet only 46% of these patients were referred for ongoing rehabilitation.

Patients not treated in a stroke unit were less likely to commence rehabilitation within 48 hours of initial assessment, receive treatment based on identified rehabilitation goals, or have an assessment for rehabilitation.

Early rehabilitation and appropriate assessment of ongoing rehabilitation needs is a critical component of best practice stroke care. Acute services must also coordinate with rehabilitation services to facilitate seamless transfer of care for people with stroke. A greater focus on identifying and addressing patient rehabilitation needs is required.

Secondary prevention

At the point of discharge from the acute service, 30% of patients did not receive advice about risk factor modification, 20% of patients with intracerebral haemorrhage were not prescribed antihypertensives, 30% of ischaemic stroke patients with atrial fibrillation were not prescribed anticoagulants, and 31% of ischaemic stroke patients were not prescribed triple therapy: statin, antihypertensive and antithrombotic medications. There is much variability across the country in terms of patient education regarding risk factors and behaviour change for modifiable risk factors. A low of 56% of patients were receiving this education in the NT and TAS, compared with a high of 84% in SA. Patients discharged on appropriate medications for secondary stroke prevention also varied around the country and was inconsistent for stroke type: ischaemic, and haemorrhagic. Given the proven effects of secondary prevention strategies in reducing recurrent stroke risk, these gaps in care have significant implications for individuals and the healthcare system. Review of processes to ensure appropriate risk factor education and medication prescription is warranted.

Support for transition from hospital

Stroke survivors and their carers/families report the transition from hospital after stroke is a critical point in their recovery and comprehensive planning to facilitate this is important. Despite this, only 57% of carers received relevant training, and only 62% of carers received a support needs assessment. No care plan was developed for 35% of patients and 39% of patients did not receive contact details of someone in the hospital for post-discharge questions. Of those patients not treated in a stroke unit only half received a care plan or contact details of someone in the hospital for post-discharge questions. Given the complexity of stroke, care plans provide an essential service and are recommended for all patients.

Quality improvement and data collection

Whilst 82% of the acute services reported access to a program of continuing education for staff relating to the management of stroke, there was variability ranging from 57% in SA to 100% in the ACT and NT. Staff in metropolitan locations were more likely to have opportunities for professional development (94%) than those staff located in regional areas (60%).

The National Stroke Audit promotes the delivery of evidence-based stroke care by providing longitudinal data on resources and clinical performance, with national and state comparative data, as well as metropolitan/regional, public/private, stroke unit/no stroke unit, and admission volume breakdowns. The National Stroke Audit provides a strong impetus to improve stroke systems of care and increase individual patient care. Ideally all acute services need to participate for continuous assessment and benchmarking.

Recommendations

› Review stroke service coordination and links, between metropolitan and regional areas, as well as with ambulance services.

› Increase access to and delivery of time-critical therapy (thrombolysis and endovascular thrombectomy), and ensure that all patients in all parts of Australia have a clear access path to be transferred to receive appropriate stroke therapy.

› Review bed management and patient flow practices to increase admission rates to a stroke unit and increase length of time patients are treated in a stroke unit.

› Ensure all patients with stroke are assessed early for rehabilitation and referred as appropriate.

› Review discharge planning processes to ensure appropriate risk factor education and medication is delivered.

› Recruit all acute services to participate in the National Stroke Audit for continuous assessment and benchmarking.

41%
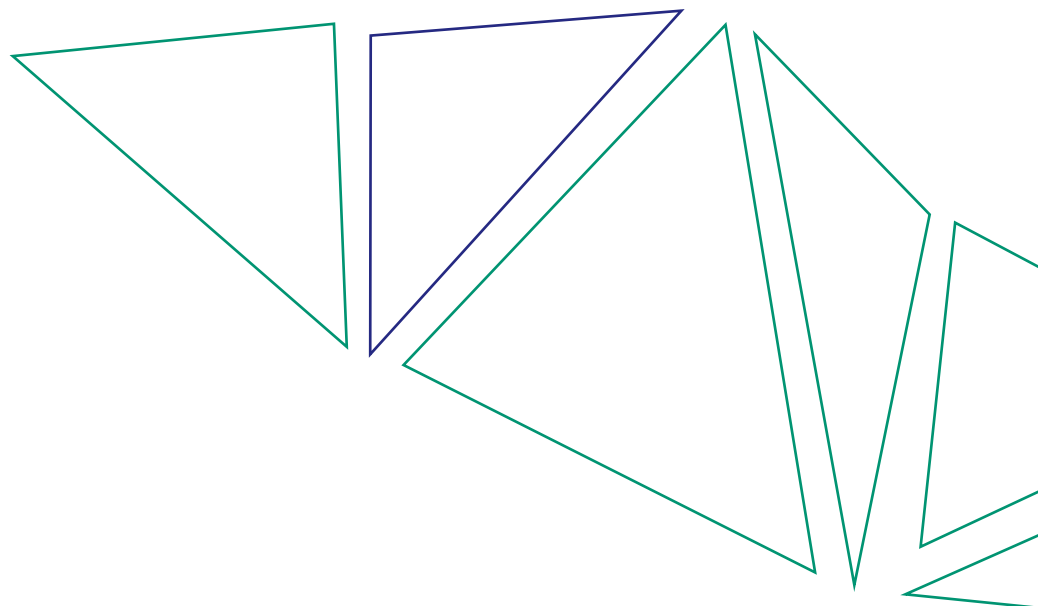
of patients
did **not** receive a
**REHABILITATION
ASSESSMENT**

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30%

of patients
did **not** receive
RISK FACTOR
EDUCATION

Participating services in Australia

We would like to thank everyone involved at all participating acute services for their support and hard work on the National Stroke Audit Acute Services 2017.

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Stroke
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💡 **Leave a lasting legacy** – include a gift in your Will.

➕ **Know your numbers** – check your health regularly.

📶 **Stay informed** – keep up-to-date and share our message.