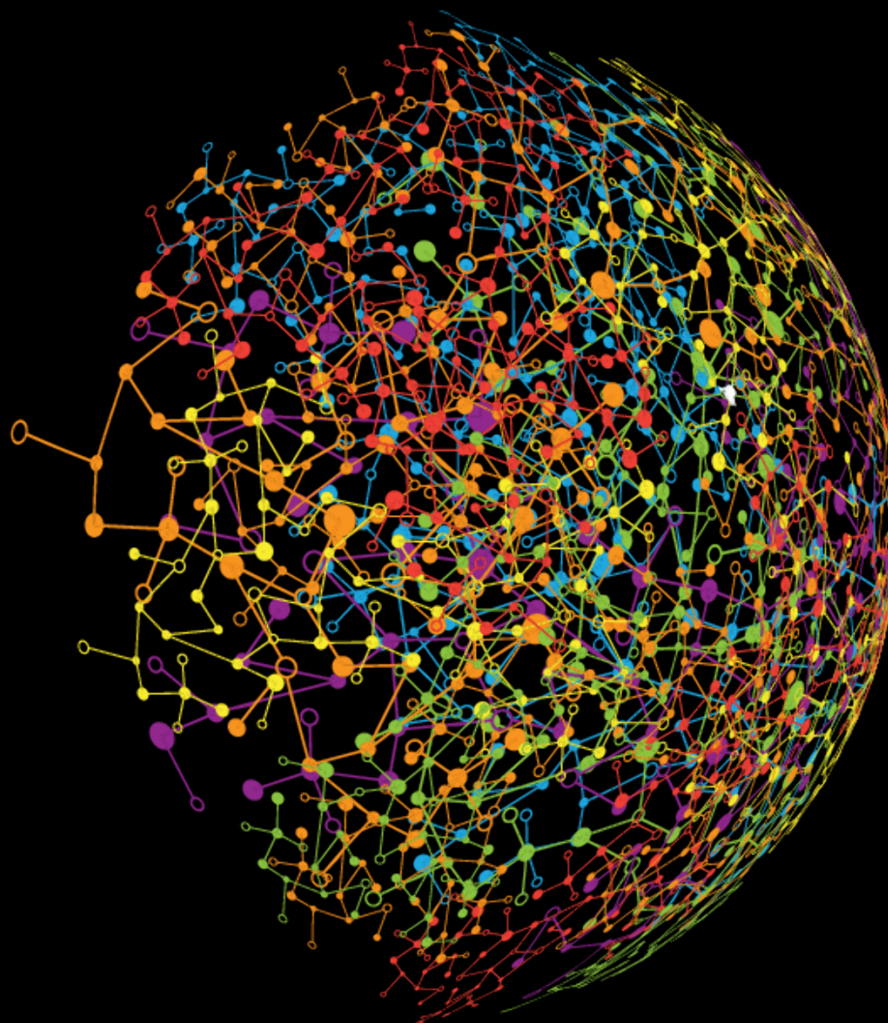


Deloitte.



**No Postcode Untouched
Stroke in Australia 2020**

Stroke Foundation

November 2020

Deloitte
Access **Economics**

Foreword

No community across Australia has been left untouched by stroke. Yet, stroke can be prevented, and it can be treated.

As the No Postcode Untouched (the Report) demonstrates, stroke is a major health issue in Australia. In 2020, an estimated 27,428 new strokes will be experienced by Australians, with 445,087 stroke survivors living across the country.

Without action, it is estimated these figures will almost double by 2050 – increasing to 50,600 annual strokes, and a total of 819,000 Australians living with the impact of this debilitating disease.

This is unacceptable and can be avoided.

As well as demonstrating the scale of stroke's impact, the Report highlights opportunities to address stroke risk factors, improve access to stroke treatment and care, and reduce the burden of this devastating disease on our communities.

The Report maps stroke by Federal Electoral Division, showing stroke hotspots (areas with the greatest number of stroke events) today and into the future. It highlights where those who have survived stroke live, as well as areas with the highest rates of preventable risk factors for stroke. The Report provides a road map for focused investment in proven interventions to stop this disease.

Australia's regional and rural communities are those most impacted by stroke. The Report shows Australians living in these areas were 17 percent more likely to experience a stroke than their metropolitan counterparts.

Alarmingly, the Report also provides evidence of increased incidence of stroke among Australians of working age. International trends in recent years had been pointing to more people having stroke at a younger age,¹ now we see this trend reflected in Australian data for the first time.

Increased risk associated with lifestyle factors connects an overrepresentation of stroke in our regional, rural and remote areas and among younger people. We know more than 80 percent of strokes can be prevented.² We must increase our efforts and recognise the value in preventing stroke and chronic disease.

Further, we must ensure equity of access for all Australians to best-practice stroke treatment and care.

Building on the data in the report, The economic impact of stroke in Australia, 2020 found that this year alone, the estimated cost of stroke was a shocking \$6.2 billion in direct financial impact and a further \$26.0 billion in mortality and lost wellbeing. It found, improving access to stroke care and reducing high blood pressure in 2020 has the potential to save \$2.6 billion over 5 years in economic and wellbeing costs.³

Advancements in stroke treatment mean stroke is no longer a death sentence for many. However, there is still more to be done to ensure regional and rural Australians have access to these life-saving breakthroughs. Most stroke specialists, hyper-acute treatments and dedicated stroke units are in metropolitan areas limiting access to those outside of our cities. The gradual roll out of telehealth systems for stroke is improving access and pathways of care for regional Australians but there is still a way to go.

This Report is not just a series of numbers, behind these figures are real people. Our families, friends, colleagues or even ourselves.

Stroke strikes in an instant. It attacks the brain – the human control-centre, often changing the life of the individual who experiences stroke and their loved ones forever. Stroke’s impact extends well beyond the immediate medical emergency. As a leading cause of disability in this country, its impact can be felt for decades.

This is the third update of the No Postcode Untouched Report commissioned by Stroke Foundation since its original publication in 2014.⁴ As well as decreases in mortality, encouragingly, estimated incidents of stroke have declined, due, in part, to efforts to reduce high blood pressure, smoking and high cholesterol. It demonstrates we could meaningfully reduce stroke incidence and its impact on the community.

The National Strategic Action Plan for Heart Disease and Stroke (the Action Plan) provides evidence-based interventions to address stroke’s impact. The Action Plan was developed by Stroke Foundation in partnership with the National Heart Foundation and funded by the Australian Government. It sets out evidence-based actions to change the course of stroke in Australia and we look forward to working in partnership with governments.

It is important to note the potential impact of the coronavirus (COVID-19) pandemic on the findings of this report. While the data contained in this Report has been delivered independent of the pandemic, COVID-19 will undoubtedly affect its future estimates, as emerging evidence demonstrates both unintended and direct consequences of COVID-19 on stroke.

Australians are not visiting their general practitioner to have health checks or manage chronic conditions, calls to triple zero (000) have decreased causing avoidable delays in emergency stroke treatment. Our lifestyles in 2020 have been even more sedentary, and those who have experienced a stroke during this period are not being connected to rehabilitation or being provided with the secondary prevention information they need to recover well. Continuity of care has been a major challenge. There is also some early evidence from the United States and Europe suggesting a link between COVID-19 and a cluster of stroke among younger people.⁵

The 2050 scenario described in this report could be avoided if we act now to implement the interventions that we know could change the state of stroke in Australia for generations to come.



Sharon McGowan
Chief Executive Officer
Stroke Foundation



Acknowledgement

Deloitte Access Economics acknowledges and thanks Stroke Foundation for commissioning the report. We would like to recognise the time and important contributions from the many clinicians and stroke experts who have contributed to the report.

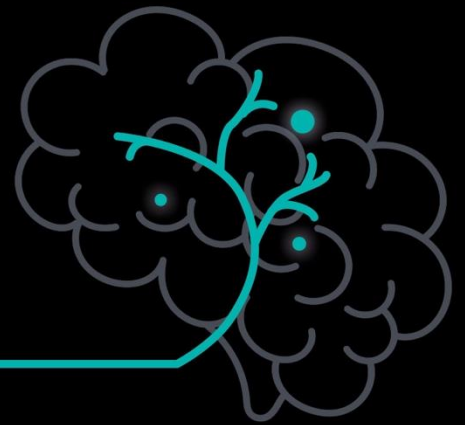
Special thanks to Stroke Foundation Non-Executive Director representing interests of Clinicians and Chair of Clinical Council Professor Bruce Campbell MBBS (Hons), BMedSc, PhD, FRACP, FAHMS; Non-Executive Director representing the interests of Research and Chair of Research Advisory Committee Professor Amanda Thrift BSc (Hons), PhD, PGDipBiostat; Research Advisory Member Dr Nadine Andrew; and Associate Professor Seana Gall BSc (Hons), PhD, Chair of the Health Promotion Advisory Subcommittee.

We would also like to thank the many people who volunteered to have their stories included in this report, to demonstrate the real impact of stroke on everyday Australians.

This report was made possible by sponsorship provided to the Stroke Foundation by Bayer Australia and Boehringer Ingelheim.



Key insights



In 2020...

An estimated

27,428

Australians will experience stroke for the first time in their lives

One stroke occurs every

19 minutes



14% 24%

2012

2020

Share of new strokes among people **54 years** and under has increased



Regional Australians are

17%

more likely to suffer a stroke than those in metropolitan areas

South Australia and **Tasmania** had the highest number of people experiencing stroke for the first time on a per capita basis

Australia's stroke hotspot is **Cowper, New South Wales**

This is followed by **Barker and Adelaide** in South Australia

The number of strokes and Australians living with stroke is expected to grow...

	2020	2050
Australians living with stroke	445,087	819,900
First-ever strokes each year	27,428	50,600



1 Introduction

Every 19 minutes someone in Australia will suffer a new stroke. By 2050, without action, this number will increase to one new stroke every 10 minutes. An estimated 27,428 Australians experienced a stroke for the first time in their lives in 2020. Many of these were experienced by people living in regional Australia. In fact, regional Australians are 17 percent more likely to suffer a stroke than those living in a metropolitan area.

This report provides evidence of increasing incidence among younger working age Australians. It was estimated that stroke incidence rates have increased over time in Australians aged 35 to 54. This trend is well documented internationally but this is the first time it has been demonstrated within Australia. In 2020, it was estimated 10,670 strokes – approximately 29 strokes a day - were experienced by Australians of working age. Projections assume incidence rates remain constant through to 2050, potentially underestimating the future impact of stroke on Australia’s working age population.

"We now have evidence that demonstrates stroke incidence in younger Australians is rising, which is very concerning. The impact of this for us as a society is significant, with increasing losses in years of life and productivity. We need to act to stem this tide." - Stroke Foundation Research Advisory Committee Chair Professor Mandy Thrift

Increased incidence of stroke among younger people can be attributed in part to Australians leading a sedentary lifestyle. The impact of the coronavirus (COVID-19) has the potential to compound this issue, as restrictions have limited movement and exercise.ⁱ

There have been significant advancements in access to and delivery of stroke treatment and care. As a result, stroke mortality has declined significantly in recent decades – between 1980 and 2016, overall deaths rates for stroke in Australia fell by three quarters – and this trend is set to continue.⁶

However, in 2020 it is estimated 445,087 Australians were living with the effects of stroke.

No Postcode Untouched, Stroke in Australia 2020 demonstrates the impact of stroke on millions of lives in cities and towns across the nation now and into the future. It highlights the significant burden of stroke on regional and rural Australia, which presents an ongoing challenge to our health system.

In this latest report, Deloitte Access Economics has provided analysis of stroke statistics and estimates by Federal Electoral Division. This includes, the incidence of stroke, the number of Australians living with stroke living in the community and the leading risk factors for preventable stroke. Risk factors include high blood pressure, atrial fibrillation, high cholesterol, physical inactivityⁱⁱ, smoking and obesity.

Using demographic population projections, Deloitte Access Economics has also estimated the number of new strokes in Australia over the next 30 years. These projections have been prepared to demonstrate what might occur if we do not continue to see improvements in stroke prevention and treatment.

ⁱ The economic impact of stroke in Australia, 2020 report was done independent of the coronavirus (COVID-19) pandemic. It is important to note the pandemic may have an impact on the data included in this report. Emerging evidence indicates chronic disease, including stroke, diagnosis and management may be impacted by the pandemic. There have also been reported delays in people accessing emergency stroke treatment and links between COVID-19 and stroke in younger people from the United States of America.

ⁱⁱ In this report, physical inactivity has been based on people who report no physical activity in the past week.

Key methodological revisions between reports

In Deloitte Access Economics' 2013 report, *The economic impact of stroke in Australia*, incidence of stroke was calculated by applying the rates reported by Thrift et al (2009) to 2012 Australian demographic data. At the time, the incidence rates were conservatively adjusted to reflect the annual decline in stroke hospitalisations noted by Thrift et al (2012) in the ten years between 1996-97 and 2005-06. The rates derived in the 2013 report were also used to estimate stroke prevalence and incidence in Stroke Foundation's 2017 report, *No postcode untouched: Stroke in Australia 2017*, which provided estimates of stroke incidence nationally and for each Federal electoral division in Australia. Similarly, the prevalence and mortality rates from the 2013 report were also used to inform estimates of stroke deaths and the number of Australians living with stroke in 2017.

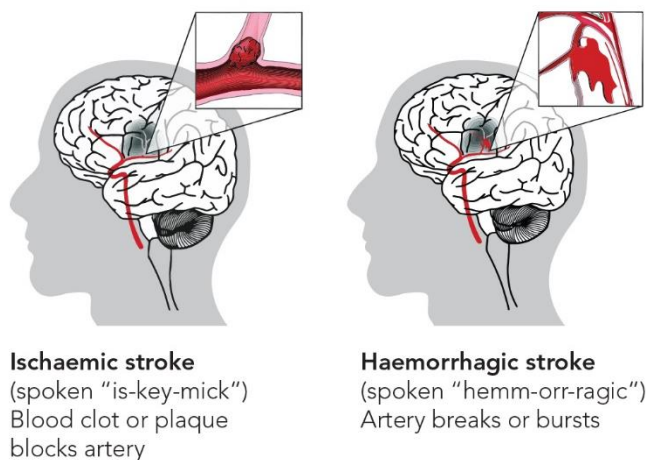
Stroke incidence and mortality have continued to decline since 2013, and there is emerging evidence that the number of Australians living with stroke may be declining based on self-reported data published in the Australian Bureau of Statistics' *Survey of Disability, Ageing and Carers*. In this report, current estimates of incidence were calculated using a population-based study undertaken by Leyden et al (2010) in Adelaide, South Australia. As the latest available incidence data were reported for 2010, the rates were further adjusted to reflect the continued decline in stroke incidence using trend data reported by Sarink et al (2018), who provided trends specific to each age and gender in Western Australia. The estimated rates were then applied to 2020 Australian demographic data. At the same time, the mortality and prevalence estimates in this report also reflect the latest and best available data sources on stroke from Australia, coupled with Deloitte Access Economics' demographic projections.

The estimated stroke incidence, mortality and prevalence have declined since 2017 due to these methodological revisions. However, it is important to note the true incidence, prevalence and mortality from stroke may differ to the figures estimated here. Recent advances in data linkage capability in Australia may make it possible to estimate this data with greater certainty in the future.

1.1 What is stroke?

When blood supply to the brain is blocked, brain cells begin to die at a rate of 1.9 million a minute.⁷ Every stroke is different depending on where in the brain it strikes and how severe it is. What is common is the devastation it can cause the survivor, their carer and family.

Figure 1.1: There are two types of stroke



Source: Used with permission from the Stroke Foundation

1.2 The impact of stroke

Stroke is a leading cause of disability in Australia. The impact of stroke on survivors and carers is significant with stroke survivors more likely to have profound limitations relating to self-care, movement and communication than other people with disability.⁸ Two years after a stroke, most survivors have reduced quality of life, with many stroke survivors rating their quality of life as poor.⁹ Depression and anxiety are common after stroke,¹⁰ with 50 percent of survivors report feeling overwhelmed after hospital discharge.¹¹ Australian stroke survivors and their carers consistently report difficulty reintegrating into the community and general dissatisfaction with services and follow up after stroke.¹²

Recovery from stroke is a journey that can continue for decades. Stroke can impact anyone at any age and can leave its mark on every aspect of life. Financially, the cost of ongoing care, rehabilitation and equipment, the emotional impact, the lost earnings and the social impact can be overwhelming. In addition, survivors and their families and carers often live with the fear of recurrent stroke.

The Economic Impact of Stroke Report states the economic cost of stroke exceeded \$6.2 billion, with a further \$26.0 billion in lost wellbeing - due to short and long-term disability, and premature death.¹³

1.3 Acting to prevent and treat stroke

Stroke can be prevented, and it can be treated.

1.3.1 Stroke prevention

More than 80 percent of strokes can be prevented. In fact, if high blood pressure (hypertension) alone was eliminated the number of strokes would be practically cut in half (48%).¹⁴ Australians must be empowered to be aware of their stroke risk and how to manage it. This includes:

- Helping Australians know their blood pressure and understand that it is a key risk factor for stroke.
- Increasing community awareness and management of atrial fibrillation or irregular heartbeat. Atrial fibrillation is associated with one in four strokes.
- Raising awareness of all stroke risk factors and help Australians make healthy choices to reduce and manage their stroke risk.

1.3.2 Think F.A.S.T. act FAST

When a stroke does occur, the best outcomes are achieved when treatment is received quickly.

The first step in accessing treatment is recognising the signs of stroke and calling triple zero (000). The majority of strokes exhibit at least one of the F.A.S.T. (Face. Arms. Speech. Time.) signs of stroke.

Figure 1.2: Symptoms of stroke



Source: Used with permission from the Stroke Foundation.

1.4 Stroke treatment

For strokes caused by a blocked blood vessel (85 percent of strokes¹⁵), treatment options include:

- 'Clot-dissolving' thrombolysis – a medication given into a vein within 4.5 hours of stroke onset. Selected patients with favourable brain imaging may be eligible for thrombolysis between 4.5 and 9 hours, or if they wake with stroke symptoms, BUT the proportion of patients with the required favourable imaging drops rapidly, so 'time is brain' remains true. Currently, only 35 percent of all Australian patients with acute stroke reach hospital within the critical 4.5-hour time window for thrombolysis treatment.¹⁶
- Clot retrieval (endovascular thrombectomy) – a small tube is fed from a leg artery up into the brain to physically remove the clot blocking blood supply to the brain. Patients with blockage in large arteries may be suitable up to 24 hours after stroke onset.

For the approximately 15 percent of strokes¹⁷ caused by a weakened blood vessel that ruptures and bleeds into the surrounding brain, treatment options include:

- Emergency measures – This may include drugs or transfusions of blood products to counteract the effects of blood thinners (for those on them), or drugs to lower blood pressure or spasms of the blood vessels to prevent seizures.
- Surgery – If the area of bleeding is large, surgery may be performed to remove the blood and relieve pressure on the brain. Surgery may also be used to repair blood vessel problems, such as aneurysms or arteriovenous malformations (AVM) if they caused the stroke.

Building on time critical treatments, access to stroke unit care is proven to deliver improved outcomes for patients.¹⁸ Stroke unit care is characterised by provision of care in one location by an interdisciplinary team including medical, nursing and allied health professionals with expertise in stroke.

1.4.1 Access to stroke treatment

Access to emergency stroke treatment and stroke unit care is limited outside of metropolitan areas.¹⁹ All Australians need and deserve access to best-practice stroke treatment and care. Where specialist stroke services cannot be provided locally, clear diagnosis and treatment pathways must be in place to ensure access.

Table 1.1 Stroke treatment facilities by regional location

	Major cities	Inner regional	Outer regional
Stroke unit	61 services	25 services	5 services
Clot dissolving treatment	54(49 accessible 24/7)	33(31 accessible 24/7)	11(all accessible 24/7)
Clot retrieval treatment	19(13 accessible 24/7)	0	0
Education on preventing recurrent stroke	75%	69%	66%

Source: supplied by Stroke Foundation.

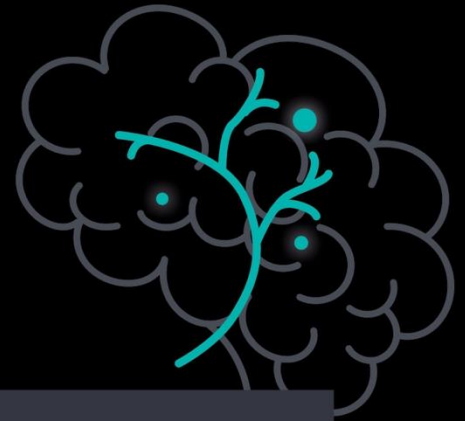
Telehealth

Historically, regional hospital emergency departments have been unable to provide time critical therapies. Patients with stroke need detailed assessment by a stroke specialist to ensure a patient is suitable for treatment. Telehealth boosts the capacity of our regional clinicians and hospitals, delivering people living in rural and regional areas the opportunity to quickly access stroke specialists.²⁰ This ensures correct diagnosis of stroke and helps to support clinicians on the ground to administer time critical thrombolysis treatment or arrange transfer to a comprehensive stroke centre for clot retrieval treatment.

Telehealth services are now operating in limited areas, but more investment is required to develop a nationally coordinated stroke telehealth network.

Further, there is potential to expand the benefits of telehealth services for stroke beyond the emergency room. In response to the coronavirus (COVID-19) pandemic the use of telehealth services was expanded to deliver rehabilitation, including physiotherapy, occupational therapy, speech and mental health support. We have an opportunity to take lessons from this pandemic and expand them beyond. Improving access to rehabilitation and boosting the capacity of local health services.

"We have made enormous gains in treating stroke in the past two decades, however this disease continues to place a heavy burden on Australia. The challenge is to ensure all Australians can access life-changing treatment when they need it. At the moment they are not." - Stroke Foundation Clinical Council Chair Professor Bruce Campbell.



Bill and Denise Vernon

Regional Western Australian, Bill Vernon suffered a stroke at 1:30am on Dec 5, 2013. Bill's wife, Denise, believed he was having a stroke and called triple zero (000) immediately. Bill was very scared. He arrived at the local regional hospital by ambulance within 20 minutes. When they arrived, Denise asked if the young doctor thought Bill had a stroke. The doctor made a call to Perth.

The doctor said he thought it was a stroke but could not determine if the stroke was caused by a clot or a bleed so was unable to provide treatment.

Bill was paralysed and in very poor shape. Bill was placed in a dark room to wait for the morning and a possible transfer to a larger hospital. Denise and their children were advised to say their goodbyes: when Bill got to his local hospital, they didn't think he was going to make it through the night.

In the morning, Bill's condition had not improved. Bill was transferred to Bunbury where he was assessed and scanned and then transferred to a Perth hospital.

Bill was 53 years old when he had a stroke. Doctors said Bill would never be able to walk or talk again. Bill and Denise were forced to move to Perth for a year so he could access the rehabilitation he needed.

Bill was determined to recover and worked incredibly hard in his rehabilitation. Bill can now walk, but he has trouble with his memory and finding words. Bill will never be able to return to work.

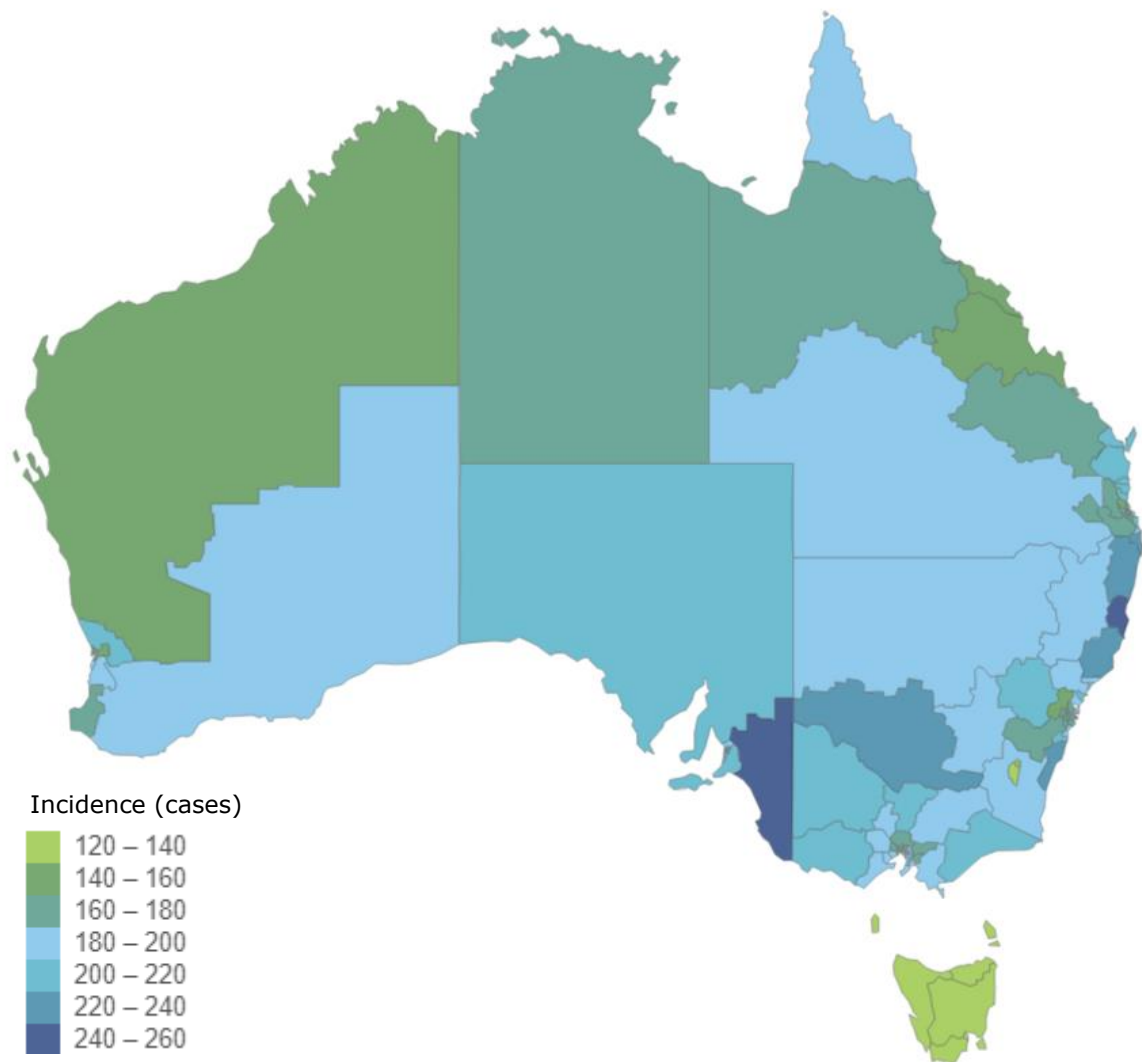
"It shouldn't be this way. City people are benefitting from amazing breakthroughs in stroke treatment but us country people are being left behind. If and how you live after stroke should not be determined by where you live. We all deserve the chance to survive and live well after stroke", Denise said

2 The national picture of stroke in Australia

Table 2.1: The national picture of stroke in Australia

	Total Aus	NSW	VIC	QLD	WA	SA	TAS	ACT	NT
Incidence	27,428	8,926	7,051	5,371	2,706	2,137	665	401	172
Prevalence	445,087	145,066	113,339	87,676	43,634	35,273	11,242	6,313	2,545
Mortality	8,703	2,901	2,256	1,634	816	732	217	115	32

Chart 2.1: Stroke incidence, 2020



3 Over-representation of stroke

Stroke impacts sections of the Australian population differently. The following sections discuss differences in regional Australia and for Aboriginal and Torres Strait Islander people.

3.1 Over-representation of stroke in regional Australia

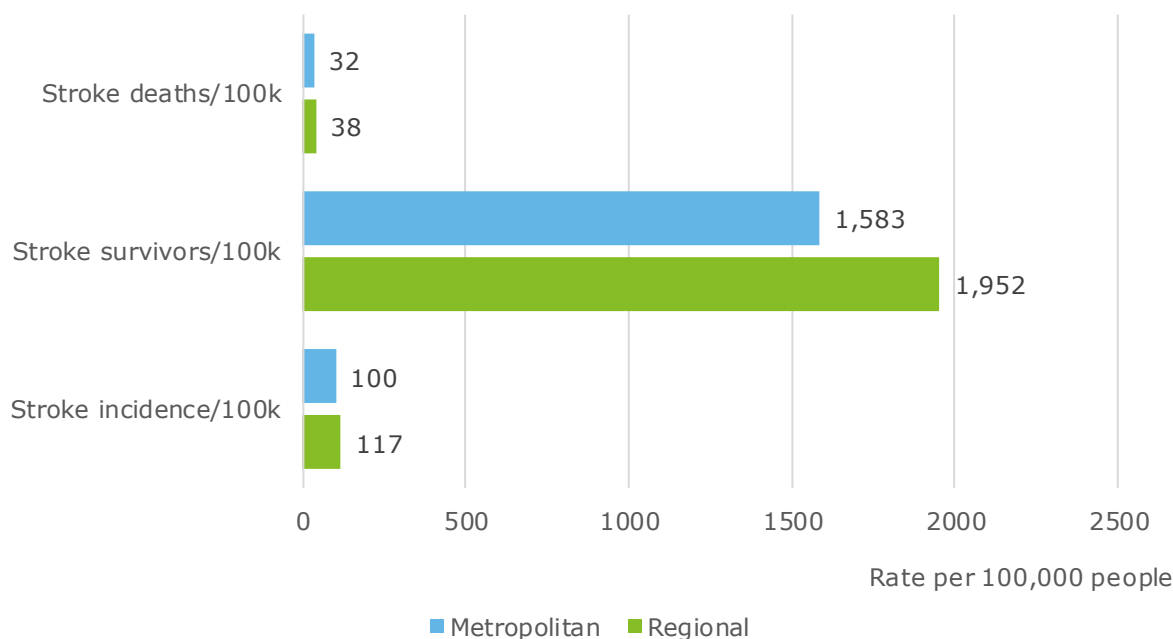
Deloitte Access Economics’ demographics modelling indicates around 43% of Australians living with stroke live in Federal electoral divisions that are classed as regional areas. This is despite these regional areas making up only 38% of the total Australian population. The drivers of this over-representation are twofold. Regional Australians are older on average, which is a non-modifiable risk factor increasing the likelihood of stroke. More importantly, statistics have shown the further people live from major Australian cities, the poorer their health and lower their life expectancy.²¹ The results from this analysis highlight the significant health disparity between regional and metropolitan areas of Australia.

There is limited access to best-practice stroke treatment and care, which compounds the impact of increased stroke incidence in regional Australia. Hospitals with specialist staff and stroke units are proven to deliver improved outcomes for survivors, but due to the small numbers of patients treated for stroke, many rural hospitals do not have stroke units or specialist treatment and care teams.²²

Many stroke specialists, who play an essential role in diagnosing and treating stroke, work predominantly in metropolitan areas.

All Australians should have access to stroke diagnosis, treatment and care pathways we know save lives and improve health outcomes.

Chart 3.1: Stroke incidence, Australians living with stroke and deaths per 100,000 people (metropolitan versus regional)



3.2 Stroke in Aboriginal and Torres Strait Islander people

In 2018, the Australian Institute of Health and Welfare (AIHW) reported Aboriginal and Torres Strait Islander people were more than 1.7 times more likely to be hospitalised for stroke than all non-Aboriginal and Torres Strait Islander people.²³

Correlated with these findings are the prevalence rates of health risk factors in the Aboriginal and Torres Strait Islander population. Recognised disadvantage sees Aboriginal and Torres Strait Islander people have high rates of obesity, smoking and physical inactivity – all known risk factors of stroke considered in this report – compared to non-Aboriginal and Torres Strait Islander Australians.²⁴ Similarly, Aboriginal and Torres Strait Islander people also have increased dietary risks and higher levels of alcohol consumption (both stroke risk factors not included within this report) placing them at greater risk of stroke compared to all Australians.

Though stroke incidence has not been estimated for each population subgroup, it is understood that Aboriginal and Torres Strait Islander people are at a much greater risk of stroke. For example, Dos Santos et al found age-standardised incidence to be three times higher in Aboriginal and Torres Strait Islander people compared to Non-Aboriginal and Torres Strait Islander Australians.²⁵ Similar results were reported by Katzenellenbogen et al where the age-standardised stroke incidence rate ratio was 2.6 for men and 3.0 for women.²⁶

Similarly, the AIHW reported that Aboriginal and Torres Strait Islander people have a 1.3 times greater risk of dying from stroke compared to non-Aboriginal and Torres Strait Islander people.²⁷



Charlotte Porter

Charlotte is a proud Wiradjuri woman and mother of four and was working a double shift on the day of her stroke in 2018. Charlotte had a pounding headache, extreme fatigue and then noticed that her arm felt heavy and she could not lift it. She went to her local health clinic who called for an ambulance immediately.

Stroke changed Charlotte's life in an instant. She went from being a busy working mum who enjoyed exercise to being unable to move from a chair or a bed by herself for 15 weeks. It was confronting and incredibly challenging for Charlotte and her whole family.

Once she left hospital, Charlotte did not know where to turn to for advice or support. She and her husband had to work it out on their own. Living in a small rural community where people don't talk about stroke much also added to the isolation she was feeling.

Charlotte has continued to set herself goals in her recovery and has even become a power lifter.

"I am passionate about raising awareness of stroke and its risk factors in the Indigenous community and making sure other working age people with stroke do not feel alone and confused like I did," Charlotte said.

4 Young people and stroke

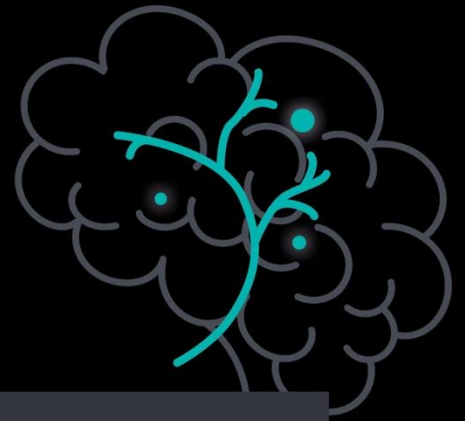
Stroke incidence rates in young people of working age have increased over time. In 2020, it was estimated 10,670 strokes – approximately 29 strokes a day - were experienced by Australians of working age. Approximately 24% of all strokes in 2020 occurred in people under 54 years of age. If trends continue this is set to increase.

This finding highlights the need to prioritise the prevention of stroke and of stroke risk factors in the young working age population. In particular, this cohort has the highest rates of daily smoking (more than 20% of males aged 40-44 smoke daily), significant overweight and obesity rates and elevated levels of physical inactivity.²⁸

Sarink et al were the first Australian authors to identify an increase in incidence of stroke in people aged 35 to 54 in Western Australia.²⁹ The study was conducted from 1995 to 2010. A number of international sources were relied upon to conclude that this trend has continued through to 2020.

When considering international evidence, one study from the Netherlands reported significant increases in incidence from 1998 to 2010 for people aged 18-49.³⁰ However, this increase was non-significant for people aged less than 35. A study from the United States reported an increase in the incidence of ischaemic stroke in individuals aged 20 to 44,³¹ while a French population-based study found a rise in the incidence of ischaemic stroke in individuals aged less than 55.³² Similarly, a study in Denmark reported hospitalisation rates for new strokes in people aged 15 to 30 increased by 40% between 1994 and 2012.³³ However, this increase occurred between 1994 and 2006, with no further increases to age-standardised incidence occurring between 2006 and 2012.

The literature were also compared to hospitalisation data for stroke. Stroke hospitalisation rates have increased over time in NSW. For example, the age-standardised rate for males aged 50-54 increased from 99.9 per 100,000 people in 2000-01 to 139.1 in 2018-19. The NSW hospitalisations data also suggests that the increase in hospitalisation rates has been sustained over this period, suggesting that rates may continue to trend upwards beyond 2020. It is important to note the present analysis assumed that incidence rates remain constant over time when projections to 2050 were made. This may mean that the estimated 6,800 incident cases of stroke for people aged 35 to 54 in 2050 is conservative.



Kate Comer

Regional Victorian, Kate Comer had a stroke at the age of 34.

A radiographer, Kate had been at work when she got a call to pick up her son from day-care. On arrival, Kate collapsed and was unable to use her right side or talk.

The day-care staff called triple zero (000) immediately and Kate was taken to the local hospital - where she works. Stroke protocols kicked in and Kate was taken straight for a CT brain scan. A telehealth consultation was held with a metropoli-

tan-based stroke specialist, and the decision was made to transfer Kate to Melbourne by helicopter.

The stroke happened at 9:30am and Kate arrived in a Melbourne hospital at 2:10pm. Kate was wheeled into the operating room and intubated before clot retrieval was performed. At 5:30pm, Kate woke up and could speak and move again. Kate spent three nights in hospital before going home. She required no rehabilitation and had no residual deficits.

"I am more grateful for life than I have ever been before and so thankful for our medical care here in Victoria, Australia. If I lived anywhere else in regional Australia, the outcome from my stroke could have been so different", Kate said

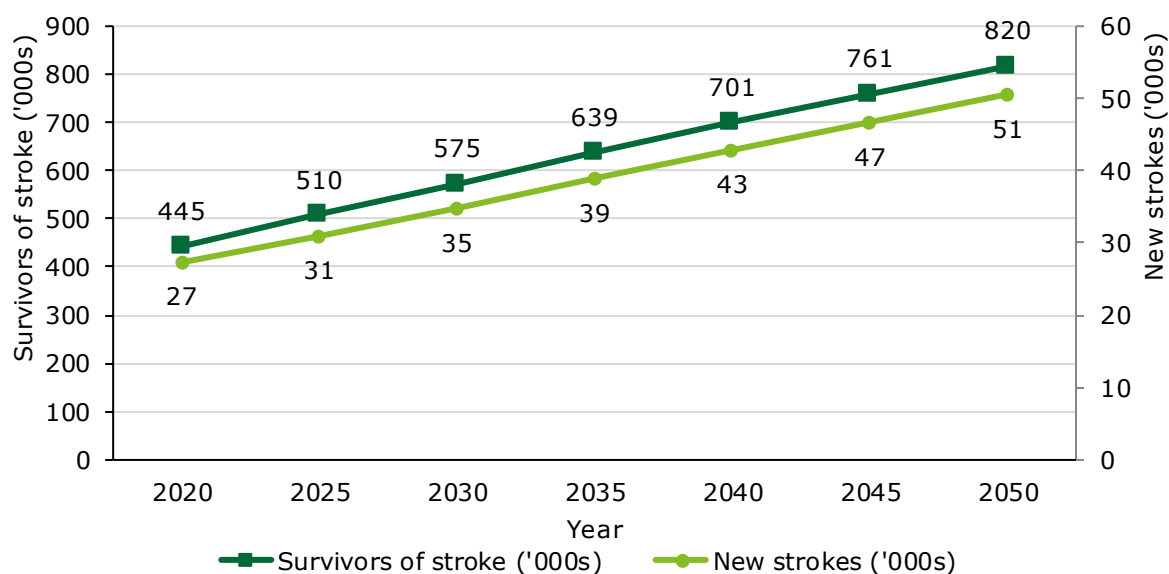
5 National stroke forecast

Stroke - and broader cardiovascular disease - is well recognised as the costliest disease group, placing a significant burden on the community and health system.³⁴ Stroke is a complex medical condition attacking the brain.

Australia’s population growth is forecast to continue. By 2050, Deloitte Access Economics’ demographic modelling (DAE-DEM) shows that Australia will have approximately 36 million people. The demographic profile of our population continues to shift towards an elderly population. If no further action is taken to improve treatment and prevention of stroke, it is estimated there will be 819,900 Australians living with stroke in 2050. This represents more than 374,000 additional Australians living with stroke compared to today, highlighting the scale of the issue at hand.

Investment in stroke prevention and intervention are needed to reduce the overall number of strokes that occur and improve the quality of life for these Australians living with stroke. Without further action to prevent stroke, the number of new strokes occurring annually is expected to grow to more than 50,000 by 2050. This is an increase of around 23,000 cases per year compared to today.

Chart 5.1: Survivors of stroke and new strokes, '000s of people, 2020-2050



The **National Strategic Action Plan for Heart and Stroke** identifies and prioritises achievable actions to reduce the impact of stroke and heart disease and stroke in the community. While new strokes and deaths from stroke are estimated to have declined since 2017, the economic impact has increased since 2012. It is critical these actions be implemented.

The Action Plan was funded by the Australian Government and developed by Stroke Foundation and the National Heart Foundation.

Table 5.2: Predicted top 20 electorates for Australians living with stroke in 2050

Rank	State	Electorate	Location	Prevalence (cases 2050)
1	VIC	Melbourne	Metropolitan	7,738
2	VIC	Lalor	Metropolitan	7,431
3	QLD	Fadden	Metropolitan	7,427
4	QLD	Longman	Regional	7,192
5	QLD	Fairfax	Regional	7,117
6	QLD	Moncrieff	Regional	7,098
7	QLD	Fisher	Regional	7,039
8	VIC	Gorton	Metropolitan	6,865
9	WA	Pearce	Metropolitan	6,855
10	VIC	Calwell	Metropolitan	6,636
11	NSW	Sydney	Metropolitan	6,563
12	QLD	Petrie	Metropolitan	6,553
13	VIC	Gellibrand	Metropolitan	6,486
14	NSW	Cowper	Regional	6,442
15	QLD	Mcperson	Regional	6,440
16	VIC	Holt	Metropolitan	6,400
17	NSW	Richmond	Regional	6,399
18	VIC	Macnamara	Metropolitan	6,399
19	VIC	Corio	Regional	6,390
20	QLD	Blair	Regional	6,389

Note: Blue represents metropolitan, Green represents regional.

Table 5.3: Predicted top 20 electorates for stroke incidence in 2050

Rank	State	Electorate	Location	Incidence (cases 2050)
1	VIC	Melbourne	Metropolitan	492
2	VIC	Lalor	Metropolitan	462
3	QLD	Fadden	Metropolitan	454
4	QLD	Longman	Regional	435
5	QLD	Moncrieff	Regional	434
6	QLD	Fairfax	Regional	430
7	VIC	Gorton	Metropolitan	427
8	QLD	Fisher	Regional	425
9	NSW	Sydney	Metropolitan	424
10	WA	Pearce	Metropolitan	420
11	VIC	Calwell	Metropolitan	416
12	VIC	Macnamara	Metropolitan	406
13	VIC	Holt	Metropolitan	404
14	VIC	Gellibrand	Metropolitan	403
15	QLD	Petrie	Metropolitan	399
16	NSW	Bennelong	Metropolitan	398
17	VIC	Corio	Regional	396
18	QLD	Blair	Regional	396
19	QLD	Mcpherson	Regional	394
20	WA	Brand	Metropolitan	392

Note: Blue represents metropolitan, Green represents regional.



Felix Schibeci

It was the day after Valentine's Day 2018 when Felix Schibeci, 72, almost lost his life.

Felix was at his home in Melbourne, on his knees with a hammer in his hand when he screamed out to his wife, Ina.

Paralysed down on side, Felix couldn't speak. He tried to mouth the word 'stroke', but Ina had already called an ambulance.

The Stroke Ambulance (Mobile Stroke Unit) moved Felix into the ambulance. Onboard scanning allowed the type of stroke to be diagnosed immediately. Clot busting treatment was given in his driveway, possibly saving his life.

In hospital, Felix went straight into surgery to remove the clot in his brain. Five hours later, the father of six and grandfather of 11 was awake and in recovery.

Since his stroke, Felix doesn't rush around anymore. His joy is family, cooking, gardening - and telling the tale of his stroke survival.

"I consider myself very lucky. I have known other who have had strokes, and I know the damage they can do, but my recovery had been remarkable", Felix said.

The Stroke Ambulance is a next generation stroke treatment solution that is being trialled in Melbourne. As Australia's only ambulance of this type, it is fitted with a CT brain scanner which is able to deliver time-critical stroke diagnosis and treatment to the patient.

The research trial is being delivered by Stroke Foundation, the Victorian Government, Ambulance Victoria, Melbourne Health, the Florey Institute of Neuroscience and Mental Health, and The University of Melbourne.



5.1 Stroke hotspots

Stroke impacts all areas of Australia, though this chapter demonstrates that the effect varies across Federal electoral divisions. The data presented below highlight Australia's stroke hotspots, communities where stroke has the greatest impact now and potential impact into the future. The data will aid decision making and actions moving forward.

5.1.1 Australians living with stroke

Recovery can be long and difficult for people surviving a stroke. Their needs for health and social support also change over time. In 2020, it was estimated that 445,087 Australians had experienced a stroke some time in their lives, of which 56% were male.

Number of Australians living with stroke in Australia today: 445,087

Proportion of top 20 stroke survivor electorates found in regional areas: 80%

Table 5.4: Top 20 electorates by number of Australians living with stroke, 2020

Rank	State	Electorate	Location	Australians living with stroke (cases 2020)	Number of Australians living with stroke per 100,000 people
1	NSW	Cowper	Regional	4,430	2,635
2	SA	Barker	Regional	4,260	2,449
3	NSW	Lyne	Regional	4,014	2,600
4	NSW	Page	Regional	3,960	2,401
5	NSW	Richmond	Regional	3,953	2,395
6	NSW	Gilmore	Regional	3,882	2,409
7	SA	Adelaide	Metropolitan	3,790	1,947
8	NSW	Farrer	Regional	3,736	2,174
9	SA	Grey	Regional	3,714	2,145
10	QLD	Hinkler	Regional	3,711	2,466
11	QLD	Fairfax	Regional	3,669	2,185
12	SA	Mayo	Regional	3,653	2,155
13	QLD	Fisher	Regional	3,629	2,185
14	QLD	Wide Bay	Regional	3,583	2,356
15	SA	Sturt	Metropolitan	3,575	1,938
16	QLD	Longman	Regional	3,569	1,974
17	NSW	Dobell	Regional	3,539	2,170
18	SA	Boothby	Metropolitan	3,531	2,017
19	WA	Pearce	Metropolitan	3,516	1,675
20	VIC	Mallee	Regional	3,500	2,243

Note: Blue represents metropolitan, Green represents regional.

5.1.2 Stroke incidence

The incidence of stroke has been declining in Australia, largely due to efforts to manage some key risk factors that are known to cause stroke, such as high blood pressure and smoking. However, it must be noted there has been an increase in Australians having strokes at younger ages, particularly among those aged 35 to 54 years. There were 27,428 Australians who experienced stroke for the first time in 2020 or one new stroke every 19 minutes. This is expected to increase by 85% by 2050 if current rates continue, with one new stroke occurring every 10 minutes.



Table 5.5 Top 20 electorates by stroke incidence, 2020

Rank	State	Electorate	Location	Stroke incidence (cases 2020)	Number of incident cases per 100,000 people
1	NSW	Cowper	Regional	255	152
2	SA	Barker	Regional	247	142
3	SA	Adelaide	Metropolitan	233	120
4	NSW	Richmond	Regional	232	141
5	NSW	Page	Regional	231	140
6	NSW	Lyne	Regional	231	150
7	NSW	Gilmore	Regional	225	139
8	NSW	Farrer	Regional	221	129
9	SA	Grey	Regional	220	127
10	SA	Sturt	Metropolitan	219	119
11	SA	Mayo	Regional	219	129
12	WA	Pearce	Metropolitan	217	103
13	QLD	Fairfax	Regional	217	129
14	QLD	Fisher	Regional	214	129
15	SA	Boothby	Metropolitan	214	122
16	SA	Hindmarsh	Metropolitan	214	125
17	QLD	Longman	Regional	212	117
18	NSW	Dobell	Regional	212	130
19	QLD	Fadden	Metropolitan	210	109
20	QLD	Hinkler	Regional	210	140

Note: Blue represents metropolitan, Green represents regional.



Jim Cartwright

South Australian, Jim 'Jimbo' Cartwright suffered a stroke in November 2005 at the age of 52.

Jim, who was a heavy smoker and drinker, was asleep on the couch after a big night out. He woke up around midday to the sound of someone at the front door and fell over as he got up to answer it.

At the door was a friend who was also a nurse. As soon as Jim opened the door, she saw his facial droop and knew it was a stroke. The nurse quickly called triple zero (000).

Jim was taken to hospital for treatment and then spent the next six months in rehab, learning how to walk and talk again.

Today, Jim's recovery is continuing. He is back driving and has returned to work part-time. Jim has not touched a cigarette or alcoholic drink since his stroke and says he has never felt healthier.

Jim is also committed to helping others avoid stroke. A Stroke Foundation volunteer StrokeSafe speaker, Jim shares his story, empowering others to avoid stroke and call triple zero (000) at the first sign.

"I love giving StrokeSafe talks in the community to raise stroke awareness. It's never too late to change", Jim said.

5.2 Stroke risk factors by state

High blood pressure, atrial fibrillation (irregular heartbeat), high cholesterol, physical activity, obesity and smoking are all modifiable risk factors for stroke.³⁵ Non-modifiable risk factors include age, gender and family history of stroke.

The table below shows a significant proportion of the Australian population is living at risk of stroke. Many of these people live without awareness of their risk limiting their ability to take control of their health.

A reduction in modifiable risk factors will help prevent stroke, reducing the incidence and impact of the disease.

Supporting the Australian community to identify and manage their health risks must be addressed at multiple levels and sustained over time.

Table 5.6: The national picture of stroke, 2020

	Total Aus	NSW	VIC	QLD	WA	SA	TAS	ACT	NT
High blood pressure (000s)	4,728.1	1,472.7	1,283.9	897.5	494.2	368.9	116.1	63.7	31.1
Estimated % of total population [^]	23%	7%	6%	4%	2%	2%	1%	0%	0%
Atrial fibrillation (000s)	384.4	126.5	97.8	74.9	36.9	31.5	10.0	5.2	1.7
Estimated % of total population [^]	2%	1%	0%	0%	0%	0%	0%	0%	0%
High cholesterol (000s)	2,472.0	805.5	751.1	422.3	182.8	191.5	51.0	53.4	14.4
Estimated % of total population [^]	12%	4%	4%	2%	1%	1%	0%	0%	0%
Physical inactivity (000s)*	3,127.9	955.8	705.9	796.7	284.0	236.1	80.7	31.8	36.9
Estimated % of total population [^]	15%	5%	3%	4%	1%	1%	0%	0%	0%
Daily smoking (000s)	2,790.8	926.8	714.0	586.5	250.0	177.7	67.6	31.5	36.6
Estimated % of total population [^]	13%	4%	3%	3%	1%	1%	0%	0%	0%
Overweight and obesity (000s)	13,775.0	4,331.3	3,688.6	2,689.6	1,422.8	987.9	306.1	226.6	122.2
Estimated % of total population [^]	66%	21%	18%	13%	7%	5%	1%	1%	1%

Sources: Australian Bureau of Statistics National Health Survey 2017-18, Ball et al (2015), Deloitte Access Economics demographic estimates. Note: Age-standardised rate ratios for each state/territory were used where data was available (see Chapter 6 for a full description). * physical inactivity has been based on people who reported no physical activity within the last week. [^] Percentages are with respect to the total Australian population aged 15 years and over.

5.2.1 High blood pressure

Around 4.7 million Australians have high blood pressure (Table 5.6). High blood pressure is a leading risk factor for stroke. The World Health Organisation and the National Heart Foundation of Australia defines 'high' blood pressure as systolic pressure at or above 140mmHg.^{36 37}

Major contributors to high blood pressure include poor diet (especially high salt intake), being overweight, excessive alcohol consumption and insufficient physical activity.

Research suggests that 48% of strokes could be prevented if high blood pressure was eliminated. Lowering blood pressure has been conclusively shown to prevent both ischaemic and haemorrhagic strokes, and it is equally important in secondary prevention.³⁸

Table 5.7: Top 20 electorates for high blood pressure, 2020

Rank	State	Electorate	Location	Estimated number of people with high blood pressure	Estimated proportion of population >15 years with high blood pressure
1	VIC	Melbourne	Metropolitan	41,700	19%
2	SA	Barker	Regional	40,727	28%
3	SA	Adelaide	Metropolitan	40,020	25%
4	WA	Pearce	Metropolitan	39,642	23%
5	SA	Grey	Regional	38,078	27%
6	SA	Sturt	Metropolitan	37,811	25%
7	NSW	Sydney	Metropolitan	37,748	17%
8	VIC	Lalor	Metropolitan	37,605	21%
9	NSW	Cowper	Regional	37,067	27%
10	SA	Mayo	Regional	36,818	26%
11	SA	Boothby	Metropolitan	36,801	25%
12	VIC	Holt	Metropolitan	36,550	22%
13	VIC	Chisholm	Metropolitan	36,292	23%
14	VIC	Hotham	Metropolitan	35,960	23%
15	SA	Hindmarsh	Metropolitan	35,837	25%
16	VIC	Calwell	Metropolitan	35,799	23%
17	NSW	Reid	Metropolitan	35,519	20%
18	VIC	Macnamara	Metropolitan	35,454	20%
19	VIC	Dunkley	Metropolitan	35,142	26%
20	NSW	Richmond	Regional	35,002	26%

Sources: Australian Bureau of Statistics National Health Survey 2017-18, Deloitte Access Economics demographic estimates.

Note: Blue represents metropolitan, Green represents regional. Age-standardised rate ratios for each state/territory were used where data were available (see Chapter 6 for a full description).

5.2.2 Atrial fibrillation

Almost 385,000 Australians have an irregular heartbeat known as atrial fibrillation (Table 5.6). The prevalence of atrial fibrillation increases with age, affecting around 1 in 5 people aged 85 years or older. Atrial fibrillation is associated with one in four strokes.³⁹

Like high blood pressure, many people are unaware they suffer from atrial fibrillation and how serious the condition is. As a consequence, too few people are accessing life-saving treatments to control atrial fibrillation.

Table 5.8: Top 20 electorates for atrial fibrillation, 2020

Rank	State	Electorate	Location	Estimated number of people with atrial fibrillation	Estimated proportion of population >15 years with atrial fibrillation
1	NSW	Cowper	Regional	4,142	3.0%
2	SA	Barker	Regional	3,919	2.7%
3	NSW	Lyne	Regional	3,755	2.9%
4	NSW	Page	Regional	3,627	2.7%
5	NSW	Richmond	Regional	3,617	2.6%
6	NSW	Gilmore	Regional	3,574	2.7%
7	QLD	Hinkler	Regional	3,400	2.7%
8	NSW	Farrer	Regional	3,398	2.4%
9	SA	Adelaide	Metropolitan	3,380	2.1%
10	SA	Grey	Regional	3,316	2.3%
11	SA	Mayo	Regional	3,312	2.3%
12	QLD	Fairfax	Regional	3,296	2.4%
13	QLD	Wide Bay	Regional	3,262	2.6%
14	QLD	Fisher	Regional	3,259	2.4%
15	NSW	Dobell	Regional	3,232	2.4%
16	VIC	Mallee	Regional	3,192	2.5%
17	SA	Sturt	Metropolitan	3,184	2.1%
18	SA	Boothby	Metropolitan	3,163	2.2%
19	QLD	Longman	Regional	3,158	2.2%
20	VIC	Gippsland	Regional	3,155	2.5%

Sources: Ball et al (2015), Deloitte Access Economics demographic estimates. Note: Blue represents metropolitan, Green represents regional. Estimates have been based on national age-gender specific rates, which were then multiplied by the demographics of the population in each Federal electoral division (see Chapter 6 for a full description).

5.2.3 High cholesterol

Almost 2.5 million Australians live with high cholesterol (Table 5.6). High cholesterol is defined as total cholesterol greater than or equal to 5.5 mmol/L.⁴⁰ High cholesterol contributes to blood vessel disease, which often leads to stroke. High-density lipoprotein ('good') cholesterol helps to reduce cardiovascular disease risk, while low-density lipoprotein ('bad') cholesterol can increase risk.

Cholesterol comes from two sources – the food we eat (of which only 50 percent of the cholesterol may be absorbed) as well as that synthesised and metabolised in the body. High cholesterol levels have been associated with ischaemic stroke – those caused by clots. Statins (a group of medicines that can help lower the level of bad cholesterol in the blood) are demonstrated to reduce the risk of stroke by about 20 percent.

Table 5.9: Top 20 electorates for high cholesterol, 2020

Rank	State	Electorate	Location	Estimated number of people with high cholesterol	Estimated proportion of population >15 years with high cholesterol
1	VIC	Melbourne	Metropolitan	22,278	10%
2	SA	Barker	Regional	22,166	15%
3	NSW	Cowper	Regional	22,137	16%
4	VIC	Gippsland	Regional	21,688	17%
5	VIC	Dunkley	Metropolitan	21,630	16%
6	VIC	Wannon	Regional	21,428	17%
7	VIC	Mallee	Regional	21,313	17%
8	VIC	Monash	Regional	21,301	17%
9	VIC	Chisholm	Metropolitan	21,132	14%
10	VIC	Indi	Regional	21,128	17%
11	VIC	Nicholls	Regional	21,024	17%
12	VIC	Lalor	Metropolitan	20,785	12%
13	VIC	Holt	Metropolitan	20,715	13%
14	VIC	Hotham	Metropolitan	20,525	13%
15	NSW	Richmond	Regional	20,500	15%
16	NSW	Page	Regional	20,499	15%
17	SA	Adelaide	Metropolitan	20,481	13%
18	VIC	Calwell	Metropolitan	20,427	13%
19	VIC	Bendigo	Regional	20,361	16%
20	SA	Grey	Regional	20,268	14%

Sources: Australian Bureau of Statistics National Health Survey 2017-18, Deloitte Access Economics demographic estimates.

Note: Blue represents metropolitan, Green represents regional. Age-standardised rate ratios for each state/territory were used where data was available (see Chapter 6 for a full description).

5.2.4 Physical inactivity

Over 3.1 million Australians, or around 12% of the Australian population report no physical activity within the past week (Table 5.6).⁴¹ There are also many more Australians who do not meet the National Physical Activity Guidelines which recommend 2.5-5 hours of moderate physical activity or 1.25-2.5 hours of vigorous physical activity each week, with an aim to be active on most days of the week.⁴²

Insufficient physical activity may be linked to stroke, as well as other risk factors considered in this report such as being overweight or obese, high blood pressure and high cholesterol.

Table 5.10: Top 20 electorates for physical inactivity, 2020

Rank	State	Electorate	Location	Estimated number of people with physical inactivity	Estimated proportion of population >15 years with physical inactivity
1	NT	Northern Territory	Regional	36,876	19%
2	QLD	Fadden	Metropolitan	30,688	19%
3	QLD	Longman	Regional	29,621	20%
4	QLD	Moncrieff	Regional	29,326	19%
5	QLD	Petrie	Metropolitan	29,173	20%
6	QLD	Fairfax	Regional	29,061	21%
7	QLD	Fisher	Regional	28,737	21%
8	QLD	Forde	Metropolitan	27,648	19%
9	QLD	Leichhardt	Regional	27,619	19%
10	QLD	Rankin	Metropolitan	27,531	18%
11	QLD	Hinkler	Regional	27,404	22%
12	QLD	Brisbane	Metropolitan	27,393	17%
13	QLD	Wide Bay	Regional	27,154	22%
14	QLD	Oxley	Metropolitan	26,875	18%
15	QLD	Mcperson	Regional	26,608	19%
16	QLD	Wright	Regional	26,478	19%
17	QLD	Blair	Regional	26,448	18%
18	QLD	Moreton	Metropolitan	26,009	18%
19	NSW	Sydney	Metropolitan	25,966	12%
20	QLD	Lilley	Metropolitan	25,898	19%

Sources: Australian Bureau of Statistics National Health Survey 2017-18, Deloitte Access Economics demographic estimates.

Note: Blue represents metropolitan, Green represents regional. Physical inactivity has been based on people who report no physical activity within the past week. Age-standardised rate ratios for each state/territory were used where data was available (see Chapter 6 for a full description).

5.2.5 Daily smoking

Around 2.8 million Australians smoke on a daily basis (Table 5.6). Smoking is a significant risk factor of stroke, with the Australian Burden of Disease estimating that smoking is attributable to 11% of the total burden of stroke.⁴³ Smoking increases the likelihood of dying as a result of stroke, while a 'pack a day' smoker is more than six times as likely to have a stroke compared to a non-smoker.⁴⁴

Smoking has several effects on the body, including thickening the blood, increasing the risk of blood clots and thinning the arteries. Smoking also limits the amount of oxygen in the blood.

Table 5.11: Top 20 electorates for daily smoking, 2020

Rank	State	Electorate	Location	Estimated number of people with daily smoking	Estimated proportion of population >15 years with daily smoking
1	NT	Northern Territory	Regional	36,582	19%
2	NSW	Sydney	Metropolitan	32,735	15%
3	VIC	Melbourne	Metropolitan	29,387	14%
4	NSW	Reid	Metropolitan	25,129	14%
5	NSW	Kingsford Smith	Metropolitan	24,983	14%
6	NSW	Parramatta	Metropolitan	24,834	15%
7	QLD	Brisbane	Metropolitan	24,350	15%
8	VIC	Lalor	Metropolitan	23,760	14%
9	VIC	Macnamara	Metropolitan	23,703	14%
10	NSW	Barton	Metropolitan	23,019	14%
11	NSW	Bennelong	Metropolitan	22,842	14%
12	NSW	Blaxland	Metropolitan	22,767	14%
13	NSW	Watson	Metropolitan	22,369	14%
14	QLD	Fadden	Metropolitan	22,212	14%
15	VIC	Gorton	Metropolitan	21,946	14%
16	NSW	Greenway	Metropolitan	21,919	14%
17	VIC	Holt	Metropolitan	21,852	13%
18	QLD	Rankin	Metropolitan	21,833	14%
19	QLD	Griffith	Metropolitan	21,815	15%
20	NSW	Werriwa	Metropolitan	21,633	14%

Sources: Australian Bureau of Statistics National Health Survey 2017-18 , Deloitte Access Economics demographic estimates.

Note: Blue represents metropolitan, Green represents regional. Age-standardised rate ratios for each state/territory were used where data was available (see Chapter 6 for a full description).

5.2.6 Overweight and obesity

More than 1 in 2 Australians are overweight or obese, with an estimated 13.8 million overweight or obese Australians in 2020 (Table 5.6). Overweight and obese Australians were defined by a body mass index of >25 (with a score of >30 representing obese Australians). Overweight and obesity are prevalent across all ages, though the likelihood peaks at around 60 years of age. At this age, more than 80% of men and 70% of women were overweight or obese.⁴⁵

Obesity or being overweight can contribute to other risk factors including high blood pressure and high cholesterol which heighten the risk of stroke.

Table 5.12: Top 15 electorates for overweight and obesity, 2020

Rank	State	Electorate	Location	Estimated number of people with overweight and obesity	Estimated proportion of population >15 years with overweight and obesity
1	VIC	Melbourne	Metropolitan	139,934	65%
2	NSW	Sydney	Metropolitan	136,330	63%
3	NT	Northern Territory	Regional	122,169	63%
4	VIC	Lalor	Metropolitan	117,013	67%
5	VIC	Macnamara	Metropolitan	114,783	65%
6	WA	Pearce	Metropolitan	113,007	67%
7	NSW	Reid	Metropolitan	112,243	64%
8	VIC	Holt	Metropolitan	109,723	67%
9	NSW	Kingsford Smith	Metropolitan	109,572	64%
10	NSW	Parramatta	Metropolitan	109,525	64%
11	SA	Adelaide	Metropolitan	109,353	68%
12	VIC	Gorton	Metropolitan	108,119	67%
13	VIC	Hotham	Metropolitan	106,609	67%
14	VIC	Calwell	Metropolitan	105,908	67%
15	VIC	Bruce	Metropolitan	105,062	67%
16	VIC	Chisholm	Metropolitan	104,445	67%
17	NSW	Barton	Metropolitan	103,761	64%
18	NSW	Bennelong	Metropolitan	103,635	64%
19	SA	Sturt	Metropolitan	103,117	67%
20	QLD	Fadden	Metropolitan	102,549	65%

Sources: Australian Bureau of Statistics National Health Survey 2017-18, Deloitte Access Economics demographic estimates.

Note: Blue represents metropolitan, Green represents regional. Age-standardised rate ratios for each state/territory were used where data was available (see Chapter 6 for a full description).

6 About this report

Deloitte Access Economics was commissioned by the Stroke Foundation to undertake analyses of stroke statistics and provide estimates of the incidence, prevalence and mortality of stroke in Australia. This report follows the 2020 paper, *The economic impact of stroke in Australia, 2020*, which estimated that stroke costs the Australian economy \$6.2 billion per year, including \$3.6 billion in lost productivity.⁴⁶ Estimates of the impact of stroke by Federal electoral division for 2020 are also available.

The rates (or proportions) for incidence, prevalence and mortality have been updated using the latest available evidence. Full details of the methodology used to derive stroke prevalence, mortality and incidence rates are available in the Deloitte Access Economics' 2020 report on the *Economic impact of stroke in Australia*.⁴⁷ Incidence reflects new stroke cases in a given year, whereas prevalence refers to the number of people living after a stroke at a point in time.

Prevalence rates were taken from the survey of Disability Ageing and Carers conducted by the Australian Bureau of Statistics.⁴⁸ The survey provides detailed information on the self-reported prevalence of stroke by age and gender.

Mortality rates were derived from the Australian Institute of Health and Welfare,⁴⁹ whereby for each age-gender cohort, the estimated number of deaths due to stroke in 2018 were adjusted for demographic changes to reflect the deaths in 2020.

Incidence rates were derived from the Leyden et al Adelaide stroke incidence study.⁵⁰ This was the most recent population-based stroke incidence study presenting stroke incidence data for 2009-10. To account for changes in incidence over the last 10 years, an incidence trend was applied based on the hospitalisation-based stroke study Sarink et al.⁵¹

In Deloitte Access Economics' 2013 report, *The economic impact of stroke in Australia*, incidence of stroke was calculated by applying the rates reported by Thrift et al (2009) to 2012 Australian demographic data. At the time, the incidence rates were conservatively adjusted to reflect the annual decline in stroke hospitalisations noted by Thrift et al (2012) in the ten years between 1996-97 and 2005-06. The rates derived in the 2013 report were also used to estimate stroke prevalence and incidence in Stroke Foundation's 2017 report, *No postcode untouched: Stroke in Australia 2017*, which provided estimates of stroke incidence nationally and for each Federal electoral division in Australia. Similarly, the prevalence and mortality rates from the 2013 report – which were based on latest available evidence from the National Mortality Database and the Australian Bureau of Statistics' 2009 Survey of Disability, Ageing and Carers (the latest available at the time of analysis), were also used to inform estimates of stroke deaths and the number of Australians living with stroke in 2017.

Noting the change to sources mentioned above and in Chapter 1, there is evidence stroke incidence and mortality have continued to decline since 2013. There is also emerging evidence that the number of Australians living with stroke may be declining based on self-reported data published in the Australian Bureau of Statistics' *Survey of Disability, Ageing and Carers*. The mortality and prevalence estimates in this report also reflect the latest and best available data sources on stroke from Australia, coupled with Deloitte Access Economics' demographic projections. The methodological revisions between reports mean the stroke incidence, mortality and prevalence have declined since 2017 due to these methodological revisions. However, it is important to note the true incidence, prevalence and mortality from stroke may differ to the figures estimated here. As noted in Chapter 1, recent advances in data linkage capability in Australia may make it possible to estimate this data with greater certainty in the future. Furthermore, it is also important to note events which were previously classified as transient ischaemic attack have recently been reclassified as stroke. The reclassification may mean the incidence rates of stroke, particularly mild stroke, are higher than estimated here. This is because

the incidence data used to estimate these figures were collected prior to this change in classification.

Stroke risk factor data was obtained from the Australian Health Survey, 2017-18,⁵² except for atrial fibrillation, which was based on data available in Ball et al.⁵³ The risk factor rates by age and gender were calculated at a national level for Australians aged 15 years and over. State and Territory rates were estimated by adjusting the national rates using age-standardised rate ratios between States and Territories rates and the National rates by age and gender to account for state and territory-based variations in the prevalence of risk factors. For example, the prevalence of smoking is much higher in the Northern Territory compared to the National average, so the National rates were multiplied by a rate ratio of 1.33 to estimate prevalence of smoking in the Northern Territory. These rate ratios were derived from the underlying rates reported in the Australian Health Survey. Rate ratios were used instead of the specific age and gender rates for each state and territory due to small cell sampling errors within each state (e.g. some states report no prevalence of risk factors in certain age groups).

For the purpose of the report, Australian Electoral Commission geographic classifications of provincial and rural electorates have been combined under a regional banner. Inner metropolitan and outer metropolitan electorate classifications have been combined under a metropolitan banner. The Modified Monash Model is used by the Stroke Foundation to define metropolitan/regional splits for hospitals as part of national stroke audits.

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