Best for the Bush

IN FOCUS
HEART, STROKE AND VASCULAR DISEASE

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Royal Flying Doctor Service

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About the Royal Flying Doctor Service (RFDS)

The RFDS is a national, charitable health organisation delivering primary health care and 24-hour emergency services for those who live in rural and remote Australia. Long known as one of the largest aeromedical organisations in the world, the RFDS delivers health care where mainstream health services are not available, using the latest in aviation, medical and communications technology, and a broad-reaching ground-service fleet.

Our Commitment to Reconciliation

The RFDS respects and acknowledges Aboriginal and Torres Strait Islander peoples as the First Australians, recognising the significant and ongoing impacts of colonisation and dispossession. Our vision for reconciliation is a culture that strives for unity, equity and respect between Aboriginal and Torres Strait Islander peoples and other Australians. The RFDS is committed to improved health outcomes and access to health services for all Aboriginal and Torres Strait Islander peoples. Our Reconciliation Action Plan outlines our intentions to use research and policy to drive improvement:

https://www.flyingdoctor.org.au/download-document/RAP22-24/

RFDS research and policy reports include Aboriginal and Torres Strait Islander peoples' data as part of a broader effort to improve health outcomes and access to health services and as a contribution to the 'Close the Gap' campaign. This report contributes to the aims of our Reconciliation Action Plan and the RFDS will continue to work with and be guided by Aboriginal and Torres Strait Islander peoples in determining how best to address their needs and priorities. Through our strong and committed partnerships with Aboriginal and Torres Strait Islander peoples and communities, we will focus on building local, community-led solutions, recognising that self-determination for Aboriginal and Torres Strait Islander peoples is fundamental to improving health outcomes.

Use of the term 'Indigenous'

The term 'Aboriginal and Torres Strait Islander peoples' is preferred in RFDS publications when referring to the separate Indigenous peoples of Australia. However, the term 'Indigenous peoples' is used interchangeably with 'Aboriginal and Torres Strait Islander peoples' to assist readability. Throughout this publication, the term 'Indigenous peoples' refers to all persons who identify as being Aboriginal, Torres Strait Islander, or both Aboriginal and Torres Strait Islander.

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Executive summary

The RFDS provides around 35,000 aeromedical retrievals every year, on behalf of the Commonwealth and our state retrieval partners, transporting those living, working and travelling in rural and remote Australia to the urgent hospital care they need. The most common reason for the RFDS to provide an aeromedical retrieval is in response to heart, stroke and vascular disease, consistently accounting for almost a quarter of all RFDS retrievals.[1]

Given this finding, this first *Best for the Bush: In Focus* report is focused on heart, stroke and vascular disease, and seeks to document prevalence in rural and remote areas as compared to other parts of Australia, highlight specific gaps in service access, and identify needs in order to contribute to an evidence-informed response to address these issues.

Heart, stroke and vascular disease is a significant issue in Australia – more than 1.2 million people are living with one or more of these diseases, which contribute to a quarter of all deaths.[2] Ischaemic heart disease, also known as coronary heart disease, is currently the leading cause of death in Australia[3] and costs the Australian health system almost $12 billion a year.

Socioeconomic factors and the ability to access comprehensive health services significantly affect the prevalence and impact of these diseases. In 2016–2020, deaths from ischaemic heart disease were up to 10 times higher in some rural and remote communities, compared to the national average.[4] In 2020–21, hospitalisation rates for heart, stroke and vascular disease were 1.4 times higher for remote and very remote populations, compared to people in major cities.[2] Similarly, in 2017–19, people living in remote and very remote areas were 1.4 times as likely to die from heart, stroke and vascular disease as people in major cities.[2] Indeed, the RFDS finds that in some of the most remote and isolated places of our country, such as parts of the Northern Territory and Western Australia, people were between four and 10 times more likely to die from ischaemic heart disease than the national average.

Further, Indigenous peoples, more than half of whom live outside major cities, experience heart, stroke and vascular disease at higher rates and at younger ages. In 2020–21, Indigenous peoples were 1.8 times as likely to be hospitalised and in 2017–19 were 1.8 times as likely to die from heart, stroke and vascular disease as non-Indigenous Australians.[2]

In this report, the RFDS provides an in-depth analysis of over 31,000 aeromedical retrievals conducted in the five years between January 2017 and December 2021 that were for heart, stroke and vascular disease – around 118 per week. We found that over the five-year period, the RFDS provided aeromedical retrievals for heart, stroke and vascular disease from 522 unique locations across Australia, with the largest proportion being undertaken in Queensland, followed by Western Australia, South Australia, the Northern Territory and New South Wales. Of these retrievals, 16.8% or 5,106 were for Indigenous peoples, most frequently in the 40–59-year age group, as compared to the 60–79-year age group for non-Indigenous Australians. And while almost double the number of retrievals were provided for heart, stroke and vascular disease among non-Indigenous males compared to females, retrieval rates of Indigenous males and females were similar.

To fully understand the prevalence and burden of heart, stroke and vascular diseases, this report considers, in detail, the specific sub-types that necessitated an RFDS retrieval, as well as geographic and demographic information.

Consistent with the reasons for hospitalisation across Australia, the main heart, stroke or vascular disease resulting in an RFDS aeromedical retrieval was ischaemic heart disease. This accounted for over 60 RFDS retrievals every week, from 424 unique locations during the study period. Acute myocardial infarction, or heart attack, accounted for more than three-quarters of these retrievals by the RFDS, with our data further aligning with national data, demonstrating that Indigenous peoples retrieved for a heart attack were much younger than non-Indigenous Australians. Indigenous peoples accounted for 17.6% of these retrievals and were younger, with the most patient retrievals occurring between 30 and 50 years compared to 60 to 80 years for non-Indigenous Australians.

Previous research has demonstrated that Indigenous peoples were three times as likely as non-Indigenous Australians to have a heart attack, and more than twice as likely to die from ischemic heart disease, though they were half as likely to get angiography, angioplasty or stents.[5] There is strong evidence that acute heart, stroke and vascular disease events are largely preventable, especially with early diagnosis and treatment.[6]

As identified in the *Best for the Bush: Rural and Remote Health Base Line 2022*[1] report, primary healthcare is at the forefront for the delivery of services to identify, prevent, and manage heart, stroke and vascular disease risk.[7] Modifiable risk factors associated with heart, stroke and vascular disease, which can be managed in the primary healthcare setting, include blood pressure, cholesterol, diet, physical activity, weight, smoking status and alcohol intake.[8]

A team supporting someone who has had a heart attack could include a cardiothoracic surgeon, cardiologist, general practitioner, physiotherapist, occupational therapist, cardiac nurse, dietician and access to a cardiac rehabilitation program.[2] Cardiac rehabilitation programs provide access to these specialists and improve outcomes. However, in areas where primary healthcare is limited, access to consistent, comprehensive and multidisciplinary care is more difficult.

We know that access to adequate or comprehensive primary health care is poor in many parts of rural, and particularly remote, Australia. According to the RFDS Service Planning and Operational Tool, which maps services in rural and remote areas against population, 22,003 people in remote and very remote Australia in 2023 do not have any access to a primary healthcare service within a 60-minute drive time, that being just one requirement for reasonable access to care.[1] It is also the case that even a 60-minute drive time is a significant undertaking in many places throughout rural and remote areas owing to factors such as difficult terrain, weather conditions, poor phone and internet connectivity in case of emergency, the poor condition of roads and a person's ability to access transport. Similarly, affordability, cultural appropriateness, availability and frequency or mode of delivery of a service impacts access to care.[1]

Unsurprisingly, the RFDS found that, with the exception of nurses, the distribution of the primary healthcare workforce (per 100,000 head of population) is significantly lacking in rural and remote areas.[1]

There is no doubt this impacts the prevention and management of heart, stroke and vascular disease for people living in these areas. Heart, stroke and vascular disease rates worsen by remoteness and socioeconomic status. RFDS retrieval data reflects the Australian Institute of Health and Welfare data and demonstrates that areas that have the highest prevalence of heart, stroke and vascular disease are more remote and have lower socioeconomic status. The RFDS Service Planning and Operational Tool shows that remote communities and low socioeconomic areas have less access to healthcare services. Indeed, most aeromedical retrievals for heart, stroke, and vascular disease came from areas without healthcare service provision, including lack of cardiac services and chronic disease management. For stroke care, only 3% of Australians who live in rural and remote areas received care in a specialist stroke unit in 2021, compared to 77% of people who live in major cities.[9]

The COVID-19 pandemic impacted chronic disease management due to isolation caused by lockdowns.[1] Although lockdowns may have reduced the impact of COVID-19 on populations, they also disrupted the delivery of primary healthcare services. Like many service providers, RFDS primary healthcare teams were unable to deliver services to rural and remote communities, or across state borders. The World Health Organization has identified that backlogs and delays in non-emergency health care caused by the COVID-19 pandemic have impacted populations across the world.[10] Primary health care has been affected, leading to late diagnosis of chronic diseases, as well as inadequate screening, follow-up and inconsistent public health control measures of patients.[10]

Through the analysis of RFDS retrieval data as related to specific heart, stroke and vascular disease across rural and remote Australia, this report shines a light on where cardiac services are most needed, and based on this analysis, the RFDS makes the following recommendations and is committed to working with governments, communities, partners and other services to ensure the following:

1. Equitable access to comprehensive primary healthcare services in rural and remote areas, including specific cardiac care.

As identified in the RFDS *Best for the Bush: Rural and Remote Health Base Line 2022*[1] report, there must be equitable access to services, equitable use of services and equitable health outcomes for those in rural and remote areas as compared to other parts of Australia. This includes around cardiac care, noting in particular the increased risk factors, burden and impacts of heart, stroke and vascular diseases for rural and remote Australians, and the absence of services in many locations. Ultimately, prevention is key, while early detection and effective management of those with heart, stroke and vascular disease will save lives and reduce the need for emergency aeromedical retrievals and hospital admissions. Given the significantly higher rates across rural and remote Australia, particular attention must be given to preventing coronary heart disease and effective management to reduce the rates of heart attack. Those in rural and remote Australia must also have timely access to the best care possible; for example, ensuring those who suffer a stroke receive specialised care, as do those in metropolitan areas.

Ensuring adequate cardiac care in rural and remote Australia must include:

Primary prevention

Rural and remote populations have higher rates of modifiable risk factors contributing to heart, stroke and vascular disease. Primary healthcare providers can have a positive impact on patients making changes through counselling and advice, health checks and care plans, and programs such as smoking cessation and support to access dental services. People living in rural and remote areas should have equitable access to these services. For this to succeed, we need to raise the awareness of health checks among health professionals and the community, and provide rural health professionals with the resources, including funding and training, to support this activity – particularly as it relates to coronary heart disease. This is pertinent given we know that 64% of eligible patients between 45 and 74 years have not had a Heart Health Check.

Secondary prevention

Those who have had an acute episode, or are living with a chronic heart, stroke and vascular disease require access to secondary prevention measures such as rehabilitation and chronic disease management. These services are often based in major city areas of Australia and are inaccessible to rural and remote Australians. Increased services should be delivered in rural and remote locations, and innovative outreach models of care, such as remote monitoring, hospital in the home, and phone-based, home-based and online cardiac rehabilitation

services, should be supported to ensure accessibility. Further integration and efficiencies can be achieved by combining primary and secondary measures with community programs, which will allow services to target larger populations, increasing the benefits and making them cost effective.

Targeted prevention and management plans for the most at-risk populations and locations

The RFDS repeats the recommendation of the *Best for the Bush: Rural and Remote Health Base Line 2022*[1] report that comprehensive primary healthcare plans be developed for the most at-risk populations and locations. This should include for heart, stroke and vascular disease with initiatives based on evidence of the most effective prevention activities and interventions, paired with comprehensive monitoring and tracking. This should particularly include both Indigenous and non-Indigenous males. Findings in this report show that non-Indigenous Australians aged over 45 years and Indigenous peoples aged over 30 years in rural and remote Australia should receive additional intervention, information and prevention services addressing risk factors for heart, stroke and vascular diseases.

2. Supporting fit-for-purpose funding models and models of care for the prevention and management of heart, stroke and vascular diseases in rural and remote Australia.

To achieve access to comprehensive cardiac care in rural and remote Australia, additional resources are required to support targeted, innovative and fit-for-purpose services for rural and remote Australians. This report shows that innovative programs, such as the Integrated Cardiovascular Clinical Network and Australian Stroke Alliance, are available and successful. Supporting additional and expanded services models must include:

- Increased access to multidisciplinary teams that is relevant and appropriate to the needs of individual communities, through co-designed models of care that are culturally appropriate;
- Adequate resourcing, education and training of general practitioners in cardiac prevention and treatment, particularly where they lead primary healthcare teams;
- The use of telehealth, remote monitoring and digital approaches to supplement face-to-face services and increase access levels;
- Adequate and sustainable long-term funding models for the rural and remote context, which may include blended payments (e.g. Medicare Benefits Schedule, My Medicare), incentive payments and targeted initiatives;
- Coordinated service planning across different elements of the health system, and between the Commonwealth and state and territory governments, to ensure duplication and inefficiencies are avoided; and
- Additional and sustainable support for research and evaluation to ensure impact and effectiveness of interventions to ensure evidence-based outcomes that takes into account social and economic wellbeing.

3. Better data collection and integration.

Work must be undertaken to better collect and coordinate data related to the incidence, treatment and outcomes associated with heart, stroke and vascular diseases in rural, and particularly remote Australia. This should include:

- Linkage of 'time-to-treatment' data, with a focus on heart disease and stroke through development of a national approach to collection and monitoring;
- Improvements in hospital transition of rural and remote patients back to community, including the provision of clear and culturally appropriate discharge plans, with a focus on post-discharge support planning;
- Improvements in discharge summary quality, provision of discharge summaries to rural and remote healthcare providers, and the sharing of patient medical records across professionals essential for rehabilitation and management;
- Costing avoidable hospitalisations for heart, stroke and vascular disease as a result of preventative primary healthcare services, to identify system savings through investment in primary healthcare services; and
- Expanding clinical databases to improve data collection from rural and remote areas; for example, Australian Stroke Clinical Registry and cardiac rehabilitation registries.

The RFDS is committed to ensuring only the best for the bush, achieved through adequate, appropriate, timely and comprehensive care that ensures the highest standards of health and wellbeing, no matter where in Australia you live.

Chapter 1: About heart, stroke and vascular disease

1.1 Introduction

Almost 30 years ago, the RFDS produced a Best for the Bush strategy document,[11] focused on improving health service delivery to rural and remote Australians. The RFDS continues to pursue this, and the objective of improved health outcomes in rural and remote areas, embarking on an annual report series. In 2023, the RFDS presented the latest data on the health of rural and remote Australians, alongside RFDS aeromedical retrieval data and evidence on service gaps, which identified current health issues that most urgently need attention from service providers, funders and policy makers.[1]

The Best for the Bush: Rural and Remote Health Base Line 2022[1] report demonstrated that diseases of the circulatory system were the main reason for an aeromedical retrieval in 2021–22, accounting for more than one in five (22%) RFDS aeromedical retrievals.[1] Diseases of the circulatory system[a] are more commonly referred to as cardiovascular disease, heart disease, or heart, stroke and vascular disease.

Heart, stroke and vascular disease is a broad term that encompasses a range of diseases and conditions that affect the heart and blood vessels, including, for example, angina, heart attack and stroke.[2] Heart, stroke and vascular disease is often associated with a build-up of fatty deposits inside the arteries (atherosclerosis) and an increased risk of blood clots.[12] Heart, stroke and vascular disease can be systemic and widespread, and can affect multiple organs, including the heart, brain, kidneys and eyes.[12]

This in-focus report provides an in-depth analysis of heart, stroke and vascular disease in rural and remote Australia. The report:

- Compares the prevalence of heart, stroke and vascular disease in rural and remote Australia with major cities;
- Presents comprehensive RFDS data on heart, stroke and vascular disease within its service footprint, including a multi-year analysis of aeromedical retrieval data;
- Identifies specific gaps in access to services for heart, stroke and vascular disease for people in rural and remote Australia in order to contribute to an evidence-informed response to address these issues;
- Describes the role of primary healthcare, including RFDS primary healthcare services, in supporting improved heart, stroke and vascular health;
- Provides examples of models of care that address sub-types of heart, stroke and vascular disease; and
- Presents a series of recommendations to support improved heart, stroke and vascular health for people in rural and remote Australia.

a The terms ‘diseases of the circulatory system’, ‘cardiovascular disease’, ‘heart disease’, and ‘heart, stroke and vascular disease’ are used interchangeably in this report.

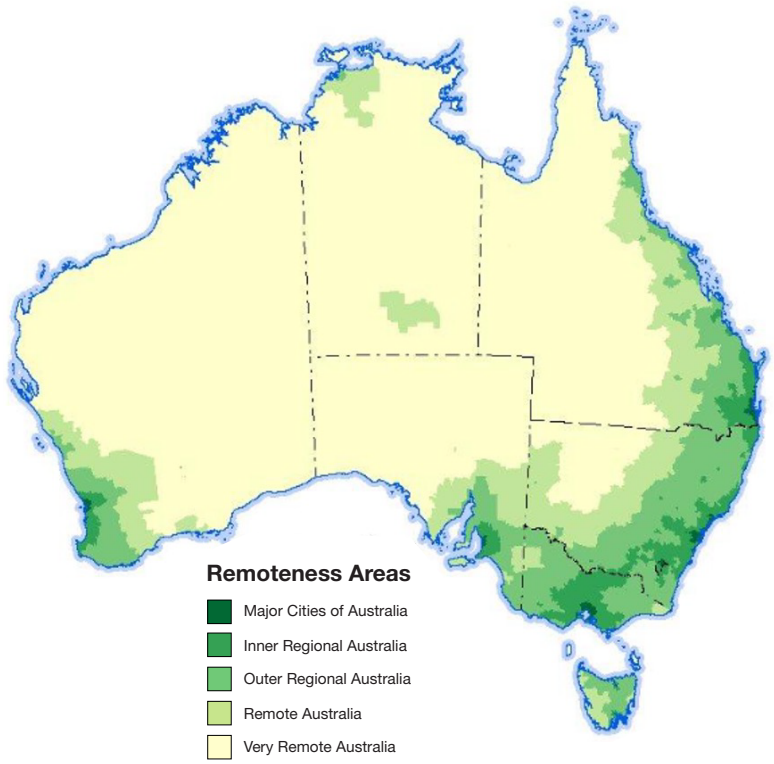
1.2 Defining rural and remote Australia

Australia is a vast continent, spanning 7.69 million square kilometres and is the world's sixth largest country by total area.[13]

The Australian Statistical Geography Standard Remoteness Structure defines remoteness areas in five classes of relative remoteness: major cities, inner regional, outer regional, remote, and very remote (Figure 1.1). These remoteness areas are centred on the Accessibility Remoteness Index of Australia, which is based on the road distances people have to travel for services.[14]

This report uses the term 'rural and remote' to cover any area outside of Australia's major cities.[15]

Figure 1.1 Remoteness areas of Australia



Source: Australian Bureau of Statistics (2021).[20]

1.3 Australian population by remoteness

Major cities comprise only 0.3% of Australia's land mass,[16] yet the majority of Australians live in these areas. Of Australia's estimated resident population of 25,688,079 in June 2021, just over seven million people lived in rural and remote Australia with around half a million living in remote or very remote Australia (Table 1.1).[17] The remaining population is not evenly distributed throughout the country – 18.2% live in inner regional areas, 8.2% in outer regional areas, 1.1% in remote areas, and 0.8% in very remote areas.[17]

Table 1.1. Australia's population by remoteness areas, 2021

Remoteness area	Number (N)	Per cent (%)
Major cities	18,414,552	71.7%
Inner regional	4,683,923	18.2%
Outer regional	2,096,218	8.2%
Remote	297,990	1.1%
Very remote	195,396	0.8%
Total population	**25,688,079**	**100%**

Source: Australian Bureau of Statistics (2021).[22]

1.3.1 Aboriginal and Torres Strait Islander peoples

As at 30 June 2021, 896,265 people identified as Indigenous, representing 3.5% of the total Australian population.[18] The proportion of the total population who identify as Indigenous increased with remoteness.[18]

Among Australia's Indigenous peoples, 38.5% live in major cities, 44.2% live in inner and outer regional areas, and 17.3% live in remote and very remote areas combined (Table 1.2).[18] Of the total population in remote and very remote areas (combined), 31.5% is Indigenous.[18] It is estimated that by the year 2031, there will be around 1.1 million Indigenous peoples.[18,19]

Table 1.2 Australia's Indigenous population by remoteness areas, 2021

Remoteness area	N	%	Proportion of total population that is Indigenous (%)
Major cities	344,765	38.5%	1.9%
Inner and outer regional	395,946	44.2%	5.8%
Remote and very remote	155,554	17.3%	31.5%
Total	**896,265**	**100%**	**3.5%**

Source: Australian Institute of Health and Welfare (2021).[6]

1.4 Health of rural and remote Australians

Despite higher levels of life satisfaction,[20] rural and remote Australians have poorer access to health care, travel greater distances to receive medical services, experience higher rates of ill health and potentially preventable hospitalisations, and demonstrate higher levels of mortality, morbidity and health and disease risk factors.[1,21,22]

1.4.1 Health risk factors

Health risk factors are attributes, characteristics or exposures that increase the likelihood of a person developing a disease or health problem.[22] Many health problems can be prevented by reducing exposure to modifiable risk factors.[22]

The most common modifiable risk factors impacting rural and remote Australians include smoking, overweight and obesity, poor diet, alcohol and drug misuse, insufficient physical activity and high blood pressure.[22] All these risk factors can play a role in the development of heart, stroke and vascular disease.

- In 2019, people in remote and very remote areas were almost two times as likely as those in major cities to smoke daily (19.2% compared with 9.8%).[23] Smoking increases the risk of heart disease and stroke.[24]
- In 2018, more people in inner regional (71.0%) and outer regional and remote (70.3%) areas were overweight or obese, compared with major cities (65.1%).[22] Obesity is linked to the development of many chronic conditions, including heart, stroke and vascular disease.[25]
- The 2020–21 National Health Survey demonstrated that 15.5% of respondents in outer regional and remote areas did not engage in any physical activity on a regular basis (zero minutes) and 71.5% did not meet current Australian activity guidelines.[26] Low levels of physical activity are a major risk factor for several chronic conditions.[27] Without sufficient physical activity, people are at increased risk of heart, stroke and vascular disease, overweight and obesity, high blood pressure and high blood cholesterol.[27]

The 2017–18 National Health Survey found that rates of high blood pressure were similar across all remoteness areas and ranged from 21.5% in major cities to 23.5% in outer regional and remote areas.[22] High blood pressure is associated with increased risk of heart attack, stroke, heart failure and kidney disease.[28]

Additional risk factors for heart, stroke and vascular disease include a family history of heart, stroke or vascular disease; diabetes; high cholesterol; being Indigenous; being male; and being over 50 years of age.[12]

1.4.2 Social determinants of health

The health outcomes of rural and remote Australians are also impacted by the social determinants of health, which include social, economic, environmental, political, behavioural and biological factors, and cultural perceptions.[29]

Recent research found that greater social adversity, defined by adverse social determinants of health, was linked to higher burden of heart, stroke and vascular disease risk factors and poorer health outcomes, including increased likelihood of stroke, heart attack, ischaemic heart disease (a sub-type of heart, stroke and vascular disease), heart failure and mortality.[30] In contrast, favourable social conditions had protective effects on heart, stroke and vascular disease.[30,31]

In general, people in rural and remote areas experience lower levels of education; lower levels of employment and lower household incomes; higher occupational risks and hazards, including physical risks and workplace pressures and stressors associated with farming and mining; the need for more long-distance travel; poorer access to fresh foods; and poorer access to health services.[16] Rural and remote Australians are also more likely to be of lower socioeconomic status, to experience greater health risk factors,[16] to experience greater social isolation, and have poorer health literacy than people living in major cities.[32]

Indigenous peoples, who comprise a large proportion of rural and remote Australians, are further disadvantaged compared to their non-Indigenous counterparts, experiencing higher rates of illnesses, injuries, deaths and hospitalisations than non-Indigenous Australians, and these increase with the extent of remoteness.[1,33] The RFDS is acutely aware the disparity in health outcomes for Indigenous peoples is also impacted by social determinants of Indigenous health, including the significant, long-lasting and ongoing impacts of dispossession; colonisation; loss of language and connection to the land; environmental deprivation; spiritual, emotional and mental disconnectedness; a lack of cultural respect; lack of opportunities for self-determination; poor educational attainment; reduced opportunities for employment; poor housing; negative interactions with government systems; and systemic discrimination and intergenerational trauma, including through the Stolen Generations.[1,34,35]

1.4.3 Access to health services

The health of rural and remote Australians, including their heart, stroke and vascular health, is also impacted by lack of access to appropriate health services, especially primary healthcare services, such as general practitioner and nursing services.[1,36] These services are important for reducing hospital admissions as well as morbidity and mortality, and a lack of primary health care is a major contributing factor to higher rates of preventable hospitalisations and emergency situations in rural and remote Australia.[37,38]

There are many factors that contribute to those in rural and remote Australia being able to access appropriate and effective services, and the very first is ensuring they are available. As one measure to inform improved planning, the Australian Institute of Health and Welfare proposed that to ensure reasonable access to primary health care, people should have access to, at a minimum, a general practitioner, nursing, oral health, mental health and Indigenous health services within a 60-minute drive time.[36,39]

Through the RFDS Service Planning and Operational Tool, which maps service data and overlays this with population data, the RFDS has been able to identify where this is not the case. We found that in 2023, 22,003 people in remote and very remote Australia had no access to any type of primary healthcare service within a 60-minute drive time of their place of residence.[1]

It is also noted that apart from the simple measure of a 60-minute drive time, there are many other barriers to access that must be addressed in work to develop a more comprehensive definition of reasonable access that is agreed by the rural health sector, funders and policy makers alike.

This needs to take into account affordability, cultural appropriateness, availability, and frequency or mode of delivery. Further, it does not account for a patient's ability to access transport; for example, a private motor vehicle or public transport, or the costs of doing so. It is also the case that even a 60-minute drive time is a significant undertaking in many places throughout rural and remote areas owing to factors such as difficult terrain, weather conditions or the poor condition of roads.[1]

Prevention, early detection and effective management of people with heart, stroke and vascular disease can only be achieved by ensuring appropriate access to health services for people in rural and remote Australia.

1.5 Heart, stroke and vascular disease prevalence, mortality and morbidity

Heart, stroke, and vascular disease is a leading cause of mortality and morbidity worldwide.[40] In 2019, an estimated 17.9 million people died from heart stroke and vascular disease, representing 32% of global deaths.[40]

1.5.1 Prevalence

In 2017–18 in Australia, almost 1.2 million people (6.2% of the adult population) self-reported one or more conditions related to heart, stroke and vascular disease.[2] The prevalence of self-reported heart, stroke and vascular disease among persons 18 and over in 2017–18 was similar across remoteness areas.[2] Age-standardised data demonstrated that 5.6% of people in major cities had heart, stroke and vascular disease, compared to 6.0% of people in inner regional areas and 5.1% of people in outer regional and remote areas.[2]

1.5.2 Hospitalisations

In 2020–21, 600,217 people were hospitalised for heart, stroke and vascular disease in Australia.[2] This represented 5.1% of all hospitalisations in Australia.[2] Males (2,160 per 100,000 population) were 1.6 times as likely as females (1,356 per 100,000 population) to be hospitalised for heart, stroke and vascular disease in Australia in 2020–21.[2]

People in remote and very remote Australia (2,553 per 100,000 population) were 1.4 times as likely as people in major cities (1,861 per 100,000 population) to be hospitalised for heart, stroke and vascular disease in Australia in 2020–21.[2] Males in remote and very remote Australia (2,841 per 100,000 population) were 1.2 times as likely as males (2,326 per 100,000 population) in major cities to be hospitalised, and females in remote and very remote Australia (2,233 per 100,000 population) were 1.5 times as likely as females (1,448 per 100,000 population) in major cities to be hospitalised for heart, stroke and vascular disease in Australia in 2020–21.[2]

In 2020–21, 17,275 Indigenous peoples were hospitalised with heart, stroke and vascular disease.[2] The age-standardised rate of hospitalisation of Indigenous peoples (3,318 per 100,000 population) was 1.8 times higher than the non-Indigenous rate (1,845 per 100,000 population).[2]

Higher hospitalisation rates in remote and very remote areas were most likely influenced by the higher proportion of Indigenous peoples living in these areas, who have higher rates of heart, stroke and vascular disease than other Australians.[2]

1.5.3 Deaths

Almost 25% (N=42,686) of all deaths in 2021 were attributed to heart, stroke and vascular disease – equivalent to 117 deaths per day.[41]

In 2017–19, people living in remote and very remote areas (172 deaths per 100,000 population) were 1.4 times as likely to die from heart, stroke and vascular disease as people in major cities (124 deaths per 100,000 population).[2]

Between 2017 and 2019, 2,100 Indigenous peoples died from heart, stroke and vascular disease – the rate of death for Indigenous peoples (238 deaths per 100,000 population) was 1.8 times as high as for non-Indigenous Australians (130 deaths per 100,000).[2]

From 2016–20, premature deaths from heart, stroke and vascular disease, for people aged 0–74 years, were high in many rural and remote communities throughout Australia. Analysis of data from the Public Health Information Development Unit demonstrated that the standardised death ratio for heart, stroke and vascular disease was higher than the national average in some areas (Table 1.3).[4] For example, in Halls Creek/Kununurra (Western Australia) the standardised death rate was 4.32 times higher than the national average.[4] This means, for example, if you lived in Halls Creek/Kununurra in 2016–20, relative to all of Australia, you were 4.32 times more likely to die from heart, stroke and vascular disease.[4]

Table 1.3. Rural and remote Statistical Area Level 3 regions in each Australian state/territory that had the highest standardised death ratios for heart, stroke and vascular disease, for people aged 0–74 years, 2016–20

State or Territory	Region: Statistical Area Level 3	Standardised death ratio
Western Australia	Halls Creek/Kununurra	4.32
	Leinster–Leonora	3.64
	South Hedland	3.54
	Derby–West Kimberley/Roebuck	3.18
Northern Territory	Anindilyakwa/East Arnhem/Nhulunbuy	5.39
	Barkley/Tennant Creek	4.44
	Elsey/Gulf/Victoria Rover	4.29
	Alice Springs–Remote	3.80
South Australia	Aṉangu Pitjantjatjara Yankunytjatjara (APY) Lands	3.92
	Ceduna/West Coast (SA)/Western	2.28
	Coober Pedy/Outback	1.92
	Port Augusta/Quorn–Lake Gilles	1.80
Victoria	Bendigo	2.27
	Moe–Newborough/Morwell	2.08
	Heathcote	1.91
	Robinvale	1.90
Queensland	Mount Isa	2.92
	Carpentaria/Mount Isa Surrounds	2.39
	Far North (Queensland)	1.75
	Charleville/Far Central West/Far South West	1.90
New South Wales	Bourke–Brewarrina/Walgett–Lightning Ridge	2.96
	Wellington	2.44
	Moree	2.28
	Cobar/Coonamble/Nyngan–Warren	1.97
Tasmania*	Acton–Upper Burnie/Burnie–Wivenhoe	2.11
	Parklands–Camdale/ Somerset/Wynyard	1.90
	Longford/Northern Midlands	1.88
	West Ulverstone	1.70

Note: *Excludes Greater Hobart and Launceston.
Source: Derived from Public Health Information Development Unit data (2023).[4]

Between 2016 and 2020, ischaemic heart disease was the leading cause of death across all remoteness areas in Australia.[3] During the same period, the age-standardised death rate from ischaemic heart disease in very remote Australia (90 deaths per 100,000) was 1.7 times the rate in major cities (53 deaths per 100,000).[3]

Specifically, in 2021, ischaemic heart disease was the leading cause of death in Australia and accounted for 17,331 (50 deaths per 100,000 population) deaths, equivalent to 10.1% of all deaths and 40.6% of heart, stroke and vascular disease deaths.[41] This was followed by dementia and Alzheimer's disease (N=15,940, 9.3%), and cerebrovascular disease[b] (a sub-type of heart, stroke and vascular disease) (N=9,800, 5.7%).[41]

1.5.4 Burden of disease

Burden of disease is a measure of years of healthy life lost because of injury, illness or premature deaths in the population.[42] Heart, stroke and vascular disease is a major contributor to the overall burden of disease in Australia and accounted for almost 13% of the total burden of disease in 2018.[2,42] In 2018, Australians lost an estimated 646,000 years of healthy life (Disability Adjusted Life Years) due to heart, stroke and vascular disease.[2] The following selected risk factors contributed the most to the total burden of disease for heart, stroke and vascular disease in Australia: high blood pressure, dietary risks, overweight and obesity, high cholesterol, and tobacco use.[42]

Between 2016 and 2020, total burden of disease rates of ischaemic heart disease were 2.2 times as high in remote and very remote parts of Australia compared to major cities.[3]

1.5.5 Other

More than 107 million prescriptions for cardiovascular medicines were dispensed in Australia in 2019–20, comprising 35% of total Pharmaceutical Benefits Scheme prescriptions.[2] However, previous research found that prescription rates for medications such as beta blockers, ACE inhibitors, statins and warfarin, which are critical for treating heart, stroke and vascular diseases, were lower in rural and remote areas.[43]

In 2018–19, 8.7% of total expenditure in the Australian health system ($11.8 billion) was attributed to heart, stroke and vascular disease.[2]

b The terms 'cerebrovascular disease' and 'stroke' are used interchangeably in this report.

Chapter 2: RFDS aeromedical retrievals for heart, stroke and vascular disease

The RFDS is perhaps best known for its aeromedical retrieval service, which provides a mantle of safety across rural and remote areas. RFDS aeromedical retrievals are available throughout our service footprint 24-hours a day, seven days a week (24/7), supported by a 24/7 telehealth system to patients who are beyond reasonable access to health care and experience a medical emergency that requires transportation to hospital care. Aeromedical retrievals are made up of:

- Primary evacuations, that being an emergency medical service and retrieval for those beyond normal medical infrastructure;[44]
- Inter-hospital transfers, that being transfer between hospitals;[44] and
- Repatriations, transporting patients back to their communities.

Beyond our aeromedical retrieval service, the RFDS delivers a comprehensive suite of primary healthcare services, including GP, nursing, dental and mental health clinics throughout rural and remote areas of Tasmania, Victoria, South Australia, the Northern Territory, New South Wales, Queensland and Western Australia.[1] These are discussed further in Chapter four and described in detail in the *Best for the Bush: Rural and Remote Health Base Line 2022* report.

The Best for the Bush: Rural and Remote Health Base Line 2022[1] report also demonstrated that heart, stroke and vascular disease was the main reason for an aeromedical retrieval in 2021–22, comprising 21% of aeromedical retrievals.[1] Based on this finding, the RFDS sought to conduct a more comprehensive analysis of data to determine whether heart, stroke and vascular disease was consistently the leading reason for an aeromedical retrieval. This data is presented in the current chapter.

Comprehensive analyses into the sub-types of heart, stroke and vascular disease that comprised RFDS aeromedical retrievals is presented in Chapter three.

2.1 Methodology

To achieve this, the RFDS conducted an analysis of RFDS aeromedical retrieval data from primary evacuations and inter-hospital transfers that was collected during the five-year period from 1 January 2017 to 31 December 2021.

The methodology for this analysis is included at Appendix 1.

The RFDS uses the tenth edition of the International Classification of Diseases and Related Health Conditions (ICD-10) Australian Modification (AM) (ICD-10-AM) to code and classify health. Heart, stroke and vascular disease is classified under Chapter IX of the ICD-10-AM – diseases of the circulatory system. Diseases were further classified by ICD-10-AM sub-chapters (see Appendix 1).

2.2 Results

2.2.1 Types of RFDS retrievals

The RFDS provides primary evacuations, inter-hospital transfers and repatriation flights, which combined form our aeromedical retrieval services. More on these services are as follows:

- Primary evacuation – the provision of emergency medical services to victims of illness or accident who are in a serious or potentially life threatening condition who are beyond the normal medical infrastructure, that is they are not in reasonable proximity to a hospital or health facility, and who require transport and/or medical and nursing care during transport to the nearest suitable hospital (including all fixed-wing air transport services directly related to these emergency medical services). A primary evacuation could be necessary, for example, from the roadside, a large property, or small community without other services and is often for urgent, high acuity cases;
- Inter-hospital transfer – the transfer of patients between one hospital to another hospital often in pursuit of more comprehensive or higher levels of care than is available at the initial facility, often following initial treatment, for example to get specialist treatment, further diagnostic testing or life-saving surgery. These retrievals form the bulk of RFDS retrieval activity, and while tasking arrangements vary state by state, this could include transporting patients from small rural hospitals or health facilities to metropolitan hospitals, or from metropolitan areas to other, larger metropolitan areas;
- Repatriation – the transportation of patients from tertiary hospitals back to their communities.

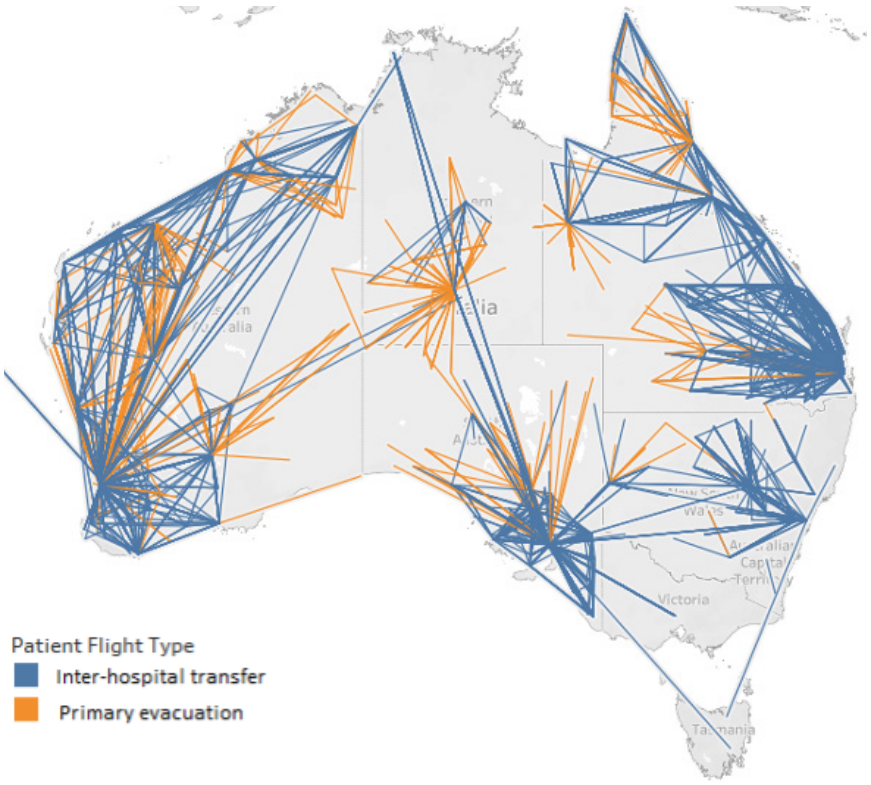
2.2.2 Summary data

Between 1 January 2017 and 31 December 2021, the RFDS retrieved more than 140,000 people from across Australia for a range of medical conditions. The highest number of retrievals were for heart, stroke and vascular disease, which accounted for 31,511 (22%) aeromedical retrievals, equivalent to more than 17 aeromedical retrievals per day.

These retrievals comprised 28,007 (91%) inter-hospital transfers and 2,788 (9%) primary evacuations. The remaining 716 aeromedical retrievals were repatriations and are excluded from further analyses, consistent with prior RFDS poublications.[1]

Figure 2.1 shows the flight paths for inter-hospital transfers and primary evacuations for all patients who underwent an aeromedical retrieval for heart, stroke and vascular disease by the RFDS between 1 January 2017 and 31 December 2021.

Figure 2.1 Flight path for RFDS aeromedical retrievals of patients with heart, stroke and vascular disease, by flight type, 1 January 2017 to 31 December 2021



2.2.3 Patient characteristics

Figures 2.2 and 2.3 demonstrate the number of patients who underwent an aeromedical retrieval for heart, stroke and vascular disease, by five-year age group and Indigenous status, and gender and Indigenous status (respectively). The following was observed for RFDS aeromedical retrievals for heart, stroke and vascular disease between 1 January 2017 and 31 December 2021:

- Patients retrieved were between the ages of 0 and 85+ years;
- Non-Indigenous Australians accounted for 22,955 (75.6%) retrievals, Indigenous peoples accounted for 5,106 (16.8%) retrievals, and people who did not specify their Indigenous status accounted for 2,309 (7.6%) retrievals;
- Non-Indigenous Australians and people who did not specify their Indigenous status were most frequently between the ages of 60 and 79 years; and
- Indigenous peoples were most frequently between the ages of 40 and 59 years.

Figure 2.2 Number of patients who underwent an aeromedical retrieval for heart, stroke and vascular disease, by five-year age group and Indigenous status, 1 January 2017 to 31 December 2021

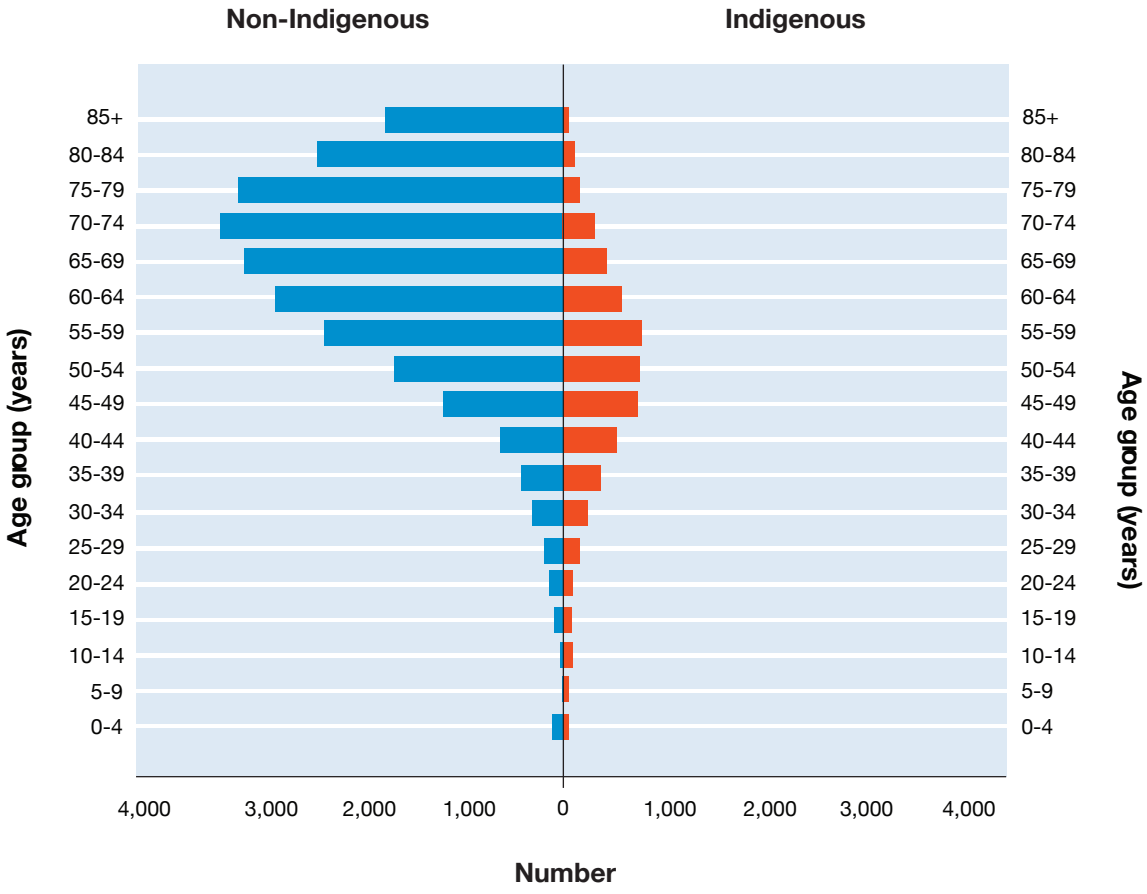
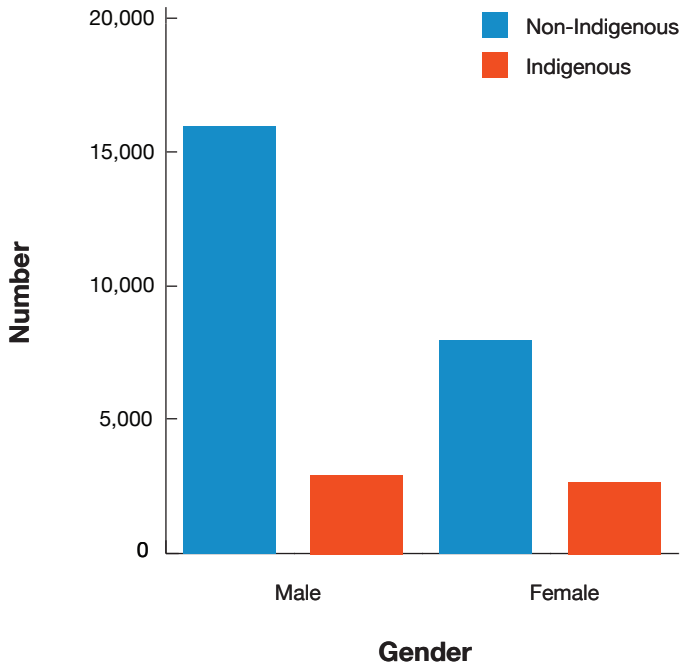


Figure 2.3 Number of patients who underwent an aeromedical retrieval for heart, stroke and vascular disease, by gender and Indigenous status, 1 January 2017 to 31 December 2021



Additional analyses demonstrated that between 1 January 2017 and 31 December 2021:

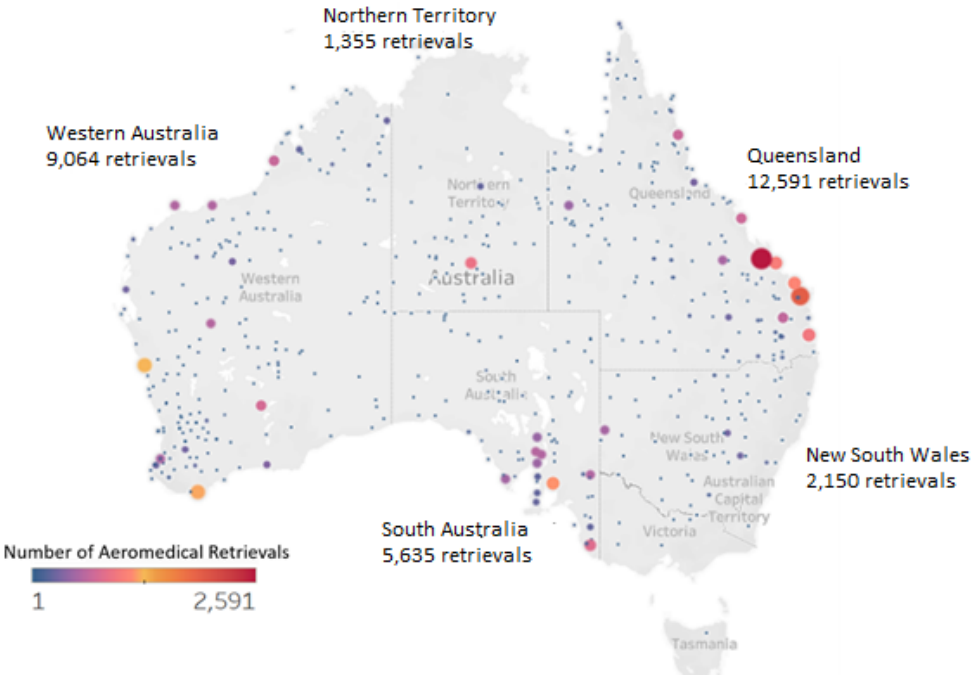
- Non-Indigenous males (66.7%) were 2.0 times as likely as non-Indigenous females (33.3%) to undergo an aeromedical retrieval for heart stroke and vascular disease; and
- Aeromedical retrieval rates for Indigenous males (51.5%) were similar to rates of Indigenous females (48.5%).

2.2.4 Aeromedical retrieval pick-up and drop-off locations

Data regarding the location from which a patient was retrieved (pick-up location) and transported to (drop-off location) was collected and is reported.

RFDS conducted aeromedical retrievals for heart, stroke and vascular disease from 522 unique locations across Australia. This comprised 12,591 retrievals in Queensland, 9,064 in Western Australia, 5,635 in South Australia, 1,355 in the Northern Territory, and 2,150 in New South Wales (Figure 2.4).

Figure 2.4. RFDS aeromedical retrieval pick-up locations for heart, stroke and vascular disease by Australian state and territory, 1 January 2017 to 31 December 2021

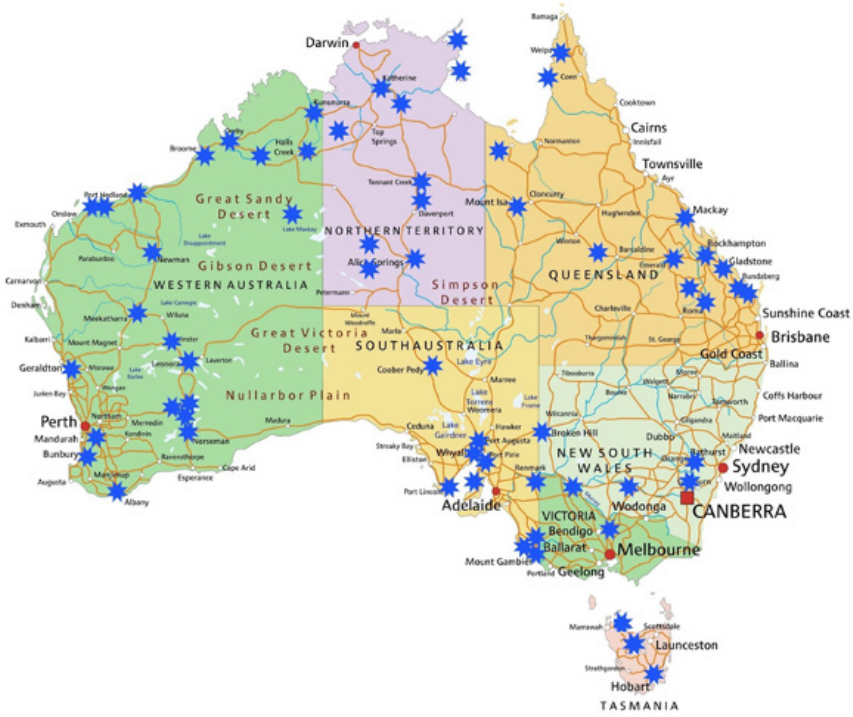


The majority of patients (n=24,326, 79%) were transferred to a major city for definitive care. This included 7,738 patients taken to a facility in Perth (Western Australia), 7,181 to a facility in Adelaide (South Australia), 533 to a facility in Sydney (New South Wales), 8,162 to a facility in Brisbane (Queensland) and 748 to a facility in Alice Springs (Northern Territory).

2.3 Heart Stroke and vascular disease hotspots

In addition to analysing RFDS aeromedical retrieval data, the RFDS examined internal data from its Service Planning and Operational Tool, and external data from the Primary Health Information Development Unit, to identify areas in rural and remote Australia that were most impacted by heart, stroke and vascular disease in terms of access to services and standardised death ratios for these conditions (Figure 2.5). These locations were determined from internal RFDS data, including the RFDS Service Planning and Operational Tool and aeromedical retrieval data; and external sources, including the Primary Health Information Development Unit, which incorporates data from multiple sources, including, for example, the Australian Bureau of Statistics and Mortality Over Regions and Time (MORT) books. Multiple communities were identified throughout rural and remote Australia.

Figure Figure 2.5. Rural and remote Australian communities worst affected by heart, stroke and vascular disease*,^



*Blue stars denote communities with the highest rates of heart, stroke and vascular disease.
^Locations were determined from internal RFDS data, including the RFDS Service Planning and Operational Tool and aeromedical retrieval data; and external sources, including the Primary Health Information Development Unit (2023).[4]
Source: Bardocz (2023).[45]

2.4 Discussion

The RFDS provides aeromedical retrievals to people from rural and remote areas who require urgent care in a tertiary hospital. Not all components of care provided to people who are transported via an aeromedical retrieval by the RFDS are reported in national statistics. Analysis of aeromedical retrievals for heart, stroke and vascular disease, conducted between 1 January 2017 and 31 December 2021, demonstrated that heart, stroke and vascular diseases were a significant issue for people within the RFDS service footprint, comprising 22% of aeromedical retrievals.

Heart, stroke and vascular disease was a significant issue for both males and females. However, males comprised almost twice as many aeromedical retrievals for heart, stroke and vascular disease, suggesting that males in rural and remote Australia are likely to have increased numbers of risk factors for heart, stroke and vascular disease. This data is supported by national hospitalisation data, which demonstrated high rates of hospitalisation for males in remote and very remote Australia (2,841 per 100,000 population) for heart, stroke and vascular disease in Australia in 2020–21.[2]

The composition of RFDS aeromedical retrievals for heart, stroke and vascular disease by Indigenous status aligns with the proportion of the population in rural Australia. The data demonstrated that Indigenous peoples who underwent an RFDS aeromedical retrieval for heart, stroke and vascular disease were around 20 years younger than non-Indigenous Australians. A previous review of RFDS aeromedical data collected between 1 July 2019 and 30 October 2020 identified that, compared to non-Indigenous Australians, Indigenous peoples who underwent an aeromedical retrieval for heart, stroke and vascular disease had higher prevalence rates (229.0 per 1,000 (Indigenous) versus 152.0 per 1000 (non-Indigenous)) and were younger (48 years versus 55.6 years).[46] When adjusted for heart, stroke and vascular disease prevalence, remote Indigenous peoples were 1.6 times as likely to be hospitalised as non-remote Indigenous Australians and 1.2 times as likely as remote non-Indigenous Australians to be hospitalised.[46] It should be noted this analysis was conducted during COVID-19, which could have contributed to higher Indigenous hospitalisation rates for heart, stroke, and vascular disease. This was due to many of these patients being considered high risk for COVID-19.

Particularly looking at primary evacuations, where patients were retrieved from (pick-up location), and taken to (drop-off location), provides insight into the medical infrastructure across Australia. The areas where primary evacuations were highest often coincided with a lack of medical infrastructure and medical services. This is further explored in chapters three and four.

It should be noted that some capital cities (e.g. Brisbane and Adelaide) were identified as RFDS aeromedical retrieval pick-up locations, on occasion with high activity. These often represent inter-hospital transfers of patients from high acuity care (such as a dedicated stroke or cardiac unit) to lower acuity care, such as to a large regional or other metropolitan hospitals. These patients who underwent an inter-hospital transfer from a major city hospital may have still required comprehensive medical treatment, but no longer needed the high acuity services provided by specialist units.

Chapter 3. RFDS aeromedical retrievals for heart, stroke and vascular disease sub-types

3.1 Introduction

The RFDS sought to determine the sub-types of heart, stroke and vascular disease impacting rural and remote Australians, which necessitated an aeromedical retrieval to a tertiary hospital to receive escalation in care.

Some of these aeromedical retrievals may be preventable and occur because there is a lack of access to primary healthcare services as well as other preventative and chronic disease management services. For example, a previous review of RFDS aeromedical retrievals, which compared the acuity of aeromedical retrievals pre-COVID-19 (1 July 2018 to 31 December 2019) and post-COVID-19 (1 July 2020 to 31 December 2021) demonstrated a 25% increase in priority one retrievals (the most acute and time sensitive) post-COVID-19.[1] This suggests that the RFDS retrieved patients who were sicker after lockdowns.[1] Reduced access to primary health care during the pandemic may have contributed to the increase in priority one retrievals.[1]

The information on heart, stroke and vascular disease sub-types is presented in order to recommend the types of services required to improve health outcomes for rural and remote Australians with heart, stroke and vascular disease, and determine where these services should be located.

3.2 Heart, stroke and vascular disease sub-types

There are several heart, stroke and vascular disease sub-types that impact Australians. Sub-types include:

- Ischaemic heart disease[c] (also known as coronary heart disease) – caused when the heart does not receive sufficient oxygen due to reduced blood supply.[2] It is most commonly caused by the build-up of plaque on the walls of arteries (atherosclerosis) near the heart.[2] It includes heart attack (myocardial infarction) and chest pain (angina);[2]
- Stroke[d] (also known as cerebrovascular disease) – occurs when a blood vessel supplying blood to the brain either suddenly becomes blocked (ischaemic stroke) or ruptures and begins to bleed (haemorrhagic stroke);[2]
- Heart failure and cardiomyopathy (often occur together) – heart failure occurs when the heart becomes less effective at pumping blood around the body; cardiomyopathy occurs when the entire heart muscle, or a large part of it, is weakened;[2]
- Atrial fibrillation – an abnormal heart rhythm due to a disturbance in the electrical rhythm of the heart.[2] Atrial fibrillation increases the risk of a stroke;[2]
- Peripheral arterial disease[e] (also known as peripheral vascular disease) – occurs when blood circulation to a body part outside of the heart or brain is reduced.[2]
- Acute rheumatic fever and rheumatic heart disease – acute rheumatic fever is an autoimmune response to an infection of the upper respiratory tract by group A streptococcus bacteria, causing potential inflammation in the heart and brain.[2] Rheumatic heart disease occurs when there is permanent damage to the heart as a result of acute rheumatic fever.[2]
- Congenital heart disease – describes a defect of the heart, heart valves or central blood vessels that is present at birth. [2]

3.2.1 Hospitalisations by sub-type

In 2020–21, more than 600,000 people were hospitalised for heart, stroke and vascular disease in Australia.[2] The principal sub-types of heart, stroke and vascular disease that resulted in hospitalisation in Australia 2020–21 included:

- Ischaemic heart disease (22%);
- Atrial fibrillation (13%);
- Heart failure and cardiomyopathy (12%);
- Cerebrovascular disease (11%);
- Peripheral arterial disease (5.5%);
- Hypertensive disease (2.7%); and
- Rheumatic heart disease (0.8%).[2]

c The terms ‘coronary heart disease’ and ‘ischaemic heart disease’ are used interchangeably in this report.
d The terms ‘cerebrovascular disease’ and ‘stroke’ are used interchangeably in this report.
e The terms ’peripheral artery disease’ and ‘peripheral vascular disease’ are used interchangeably in this report.

3.3 Methodology

Chapter two and Appendix 1 described the methodology for analysis of aeromedical retrieval data collected between 1 January 2017 and 31 December 2021.

The analysis demonstrated there were 28,007 (91%) inter-hospital transfers and 2,788 (9%) primary evacuations for heart, stroke and vascular disease during the five-year study period.

These aeromedical retrieval data were then classified into ICD-10-AM sub-chapters, to enable the data to be further analysed by heart, stroke and vascular disease sub-type. The results of the sub-type analysis are now presented.

Comprehensive data analysis was conducted for several sub-types of heart, stroke and vascular disease, as these accounted for the highest number of RFDS aeromedical retrievals for heart, stroke and vascular disease, or were notable for their impact on specific communities (e.g. Indigenous peoples were disproportionately affected by acute rheumatic fever and rheumatic heart disease). Data on the following sub-types are presented:

- Ischaemic heart disease (ICD-10-AM code I20-I25), with specific emphasis on acute myocardial infarction (I21);
- Heart failure (I50);
- Cerebrovascular disease (I60-I69); and
- Acute rheumatic fever and rheumatic heart disease (I00-I09).

3.4 Results

Analysis of RFDS aeromedical retrieval data for heart, stroke and vascular disease, collected between 1 January 2017 and 31 December 2021, demonstrated that retrievals were highest for the following heart, stroke and disease sub-types:

- Ischaemic heart disease (N=15,503, 49.2%), particularly acute myocardial infarction;
- Other forms of heart disease (N=7,181, 22.8%), particularly heart failure; and
- Cerebrovascular disease (N=4,548, 14.4%).

The remaining sub-types accounted for 4,279 (13.6%) aeromedical retrievals.

3.5 Ischaemic heart disease

In 2020–21, an estimated 571,000 Australians aged 18 and over (2.9% of the adult population) were living with ischaemic heart disease.[47]

Between 2016 and 2020, ischaemic heart disease was the leading cause of death across all remoteness areas in Australia.[3] During the same period, the age-standardised death rate from ischaemic heart disease in very remote Australia (90 deaths per 100,000) was 1.7 times the rate in major cities (53 deaths per 100,000).[3]

In 2021, ischaemic heart disease was the leading cause of death in Australia and accounted for 17,331 deaths (50 deaths per 100,000 population), equivalent to 10.1% of all deaths and 40.6% of heart, stroke and vascular disease deaths.[41]

Furthermore, ischaemic heart disease was the leading cause of death in Australia for Indigenous peoples in 2021.[41] Research in 2006 demonstrated that, compared to other Australians, Indigenous peoples had three times the rate of heart attack and 1.4 times the out-of-hospital death rate.[5] When in hospital, Indigenous peoples were more than twice as likely to die from ischaemic heart disease, half as likely to get angiography, angioplasty or stent, and 20% less likely to receive coronary bypass surgery.[5]

In 2020–21, there were 160,000 hospitalisations for ischaemic heart disease, equivalent to 1.4% of all hospitalisations, and 27% of all hospitalisations for heart, stroke and vascular disease in Australia.[2] The rate of hospitalisation among Indigenous peoples (1,038 per 100,000 population) was 2.1 times as high as for non-Indigenous Australians (483 per 100,000 population).[2] People living in remote and very remote areas (745 per 100,000 population) were 1.5 times as likely as people in major cities (486 per 100,000 population) to be hospitalised for ischaemic heart disease in 2020–21.[2]

From 2016–20, premature deaths from ischaemic heart disease were highest in the Northern Territory and Western Australia, with a standardised death ratio 4 to 10 times higher than the national average[4] (Table 3.1).

Table 3.1 Rural and remote Statistical Area Level 3 regions in each Australian state/territory that had the highest standardised death ratios for ischaemic heart disease, for people aged 0–74 years, 2016–20*

State or Territory	Region: Statistical Area Level 3	Standardised death ratio
Western Australia	Leinster–Leonora	7.47
	Halls Creek/Kununurra	5.07
	Meekatharra	4.21
	South Hedland	4.14
Northern Territory	Barkley/Tennant Creek	9.76
	Anindilyakwa/East Arnhem/Nhulunbuy	7.57
	Elsey/Gulf/Victoria Rover	6.76
	Daly–Tiwi–West Arnhem	6.31
South Australia	Whyalla/Whyalla North	2.25
	Wallaroo	1.99
	Coober Pedy/Outback	1.97
	Barmera/Berri	1.93
Victoria	Heathcote	2.94
	Robinvale	2.30
	Moe–Newborough/Morwell	2.24
	Corio–Lovely Banks/Norlane	2.15
Queensland	Mount Isa	3.48
	Berserker/Lakes Creek/Rockhampton City	2.77
	Carpentaria/Mount Isa Surrounds	2.73
	Charleville/Far Central West/Far South West	2.39
New South Wales	Bourke–Brewarrina/Walgett–Lightning Ridge	3.08
	Cobar/Coonamble/Nyngan–Warren	2.08
	Moree	1.97
	Glen Innes/Tenterfield	1.94
Tasmania^	West Coast (Tasmania)/Wilderness	2.42
	Longford/Northern Midlands	2.41
	Acton–Upper Burnie/Burnie–Wivenhoe	2.02
	Ulverstone	1.86

*Notes: *Data not published on regions where there were small numbers of people impacted by an illness, to protect privacy (e.g. APY Lands).
^Excludes Greater Hobart and Launceston.
Source: Derived from Public Health Information Development Unit data (2023).[4]

3.5.1 RFDS aeromedical retrievals for ischaemic heart disease

Ischaemic heart disease was the main reason for an RFDS aeromedical retrieval for heart, stroke and vascular disease between 1 January 2017 and 31 December 2021 and accounted for 15,503 retrievals, equivalent to 60 retrievals per week.

3.5.2 Patient characteristics

Figures 3.1 and 3.2 demonstrate the number of patients who underwent an aeromedical retrieval for ischaemic heart disease, by five-year age group and Indigenous status, and gender and Indigenous status (respectively). The following was observed for RFDS aeromedical retrievals for ischaemic heart disease between 1 January 2017 and 31 December 2021:

- Indigenous peoples accounted for 2,479 (17.6%) retrievals;
- Males (N=9,554, 67.5%) were 2.1 times as likely to undergo an aeromedical retrieval as females (N=4,608; 32.5%);
  - Non-Indigenous males (N=7,787, 70.4%) were 2.4 times as likely to be retrieved as non-Indigenous females (N=3,276, 29.6%);
  - Indigenous males (N=1,767, 57.0%) were 1.3 times as likely to be retrieved as Indigenous females (N=1,332, 43.0%);
- Patients retrieved were between the ages of 0 and 85+ years;
- Indigenous peoples were younger than non-Indigenous Australians when retrieved;
  - Most retrievals of Indigenous peoples were for people aged 30–50 years; and
  - Most retrievals of non-Indigenous Australians were for people aged 60–80 years.

Figure 3.1 Number of patients who underwent an aeromedical retrieval for ischaemic heart disease, by five-year age group and Indigenous status, 1 January 2017 to 31 December 2021

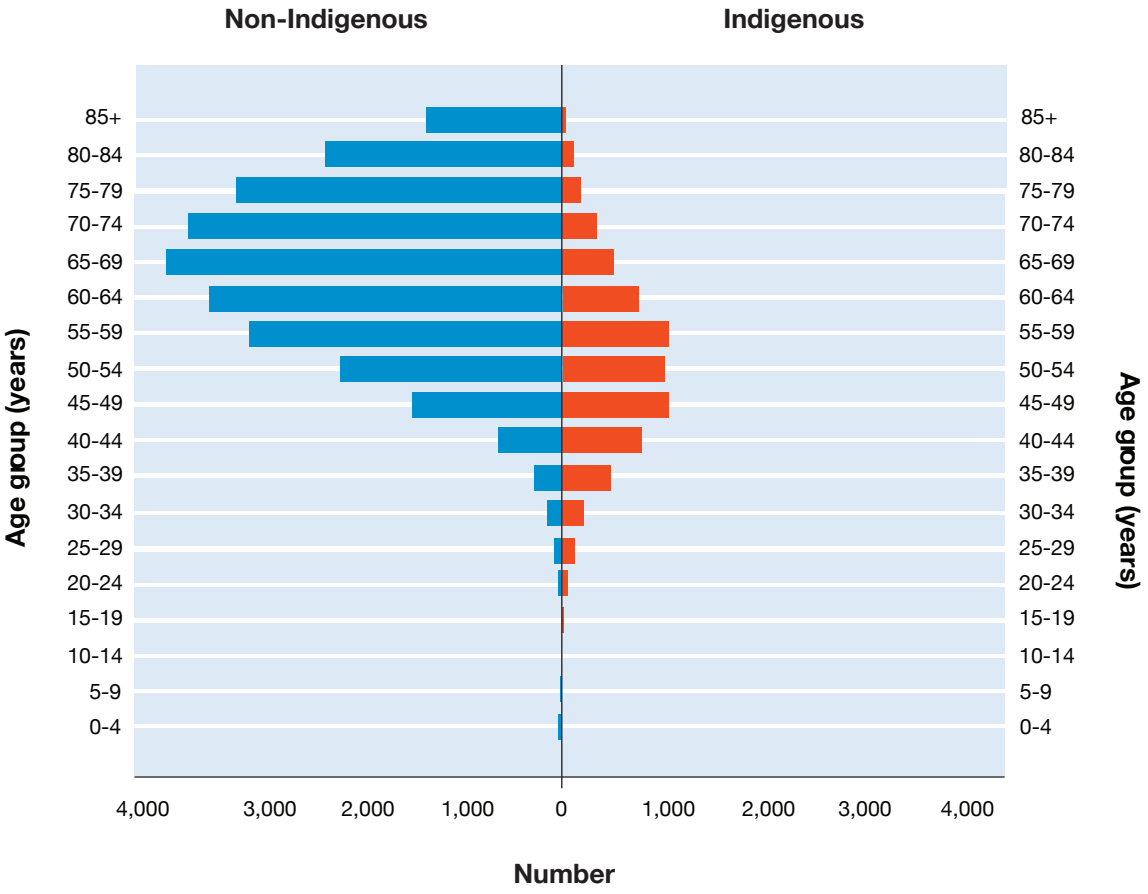
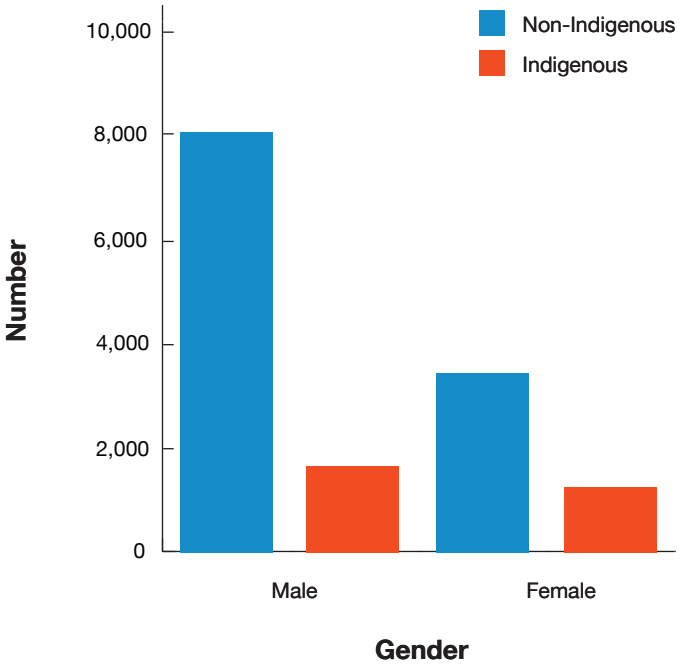


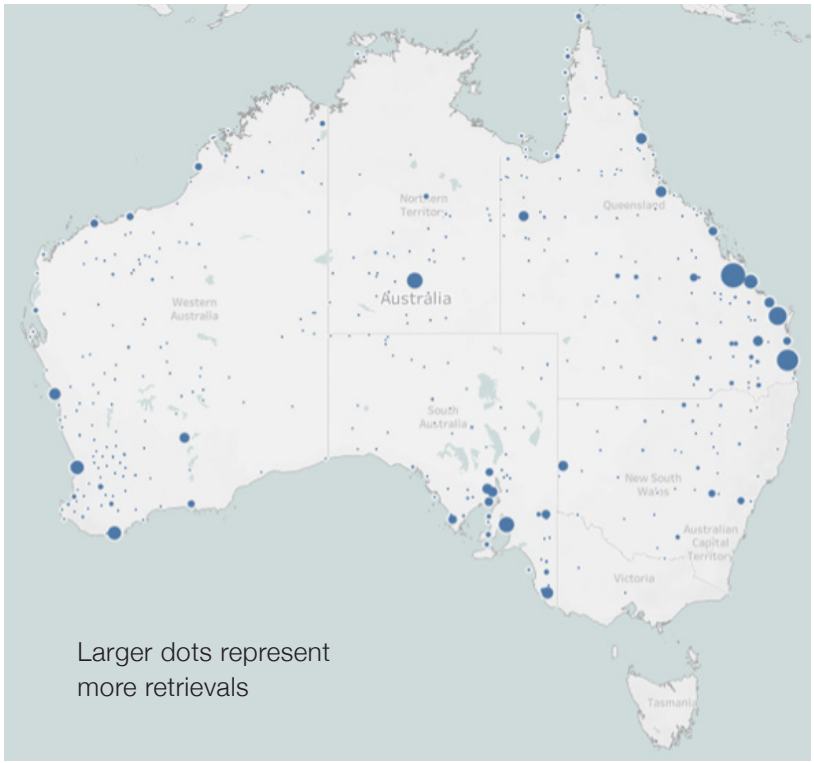
Figure 3.2 Number of patients who underwent an aeromedical retrieval for ischaemic heart disease, by gender and Indigenous status, 1 January 2017 to 31 December 2021



3.5.3 Aeromedical retrieval pick-up and drop-off locations

Patients with ischaemic heart disease were retrieved from 424 unique Australian airstrip locations and taken to one of 112 locations to receive treatment. Patients were retrieved from towns of various sizes, including from large regional areas to small, very remote communities, particularly in primary evacuations, including the Kiwirrkurra Community (Northern Territory), which is the most remote community in Australia (Figure 3.3). There were 3,643 retrievals from South Australia and the Northern Territory, 5,963 from Queensland, 966 from New South Wales and 3,432 from Western Australia.

Figure 3.3 Aeromedical retrieval pick-up locations for ischaemic heart disease, 1 January 2017 to 31 December 2021



Most inter-hospital transfers following initial treatment were from larger facilities in Rockhampton and Hervey Bay (Queensland); Alice Springs (Northern Territory); Mount Gambier (South Australia); and Broken Hill (New South Wales).

The facilities that received the most patients (drop-off locations) were in the state capitals and included Royal Adelaide Hospital and Flinders Medical Centre (South Australia); Fiona Stanley Hospital and Sir Charles Gardiner Hospital (Western Australia); The Prince Charles Hospital, Royal Brisbane Hospital and Royal Women's Hospital (Queensland); and Dubbo Base Hospital and The Royal Prince Alfred (New South Wales). Most retrievals from Far West New South Wales were received by the Royal Adelaide Hospital as it was the closest facility.

3.6 Acute myocardial infarction

Acute myocardial infarction, commonly known as heart attack, is a type of ischaemic heart disease and was responsible for a large proportion of RFDS aeromedical retrievals for ischaemic heart disease.

3.6.1 RFDS aeromedical retrievals for acute myocardial infarction

Acute myocardial infarction accounted for almost three-quarters (N=10,380, 74%) of RFDS aeromedical retrievals coded under ischaemic heart disease.

Between 1 January 2017 and 31 December 2021, the RFDS retrieved 10,220 patients for acute myocardial infarction, which equates to 39 patients a week. Acute myocardial infarction accounted for 11% of all aeromedical retrievals and 19% of primary evacuations, which was more than double the average number of primary evacuations for other heart, stroke and vascular diseases.

3.6.2 Patient characteristics

Figures 3.4 and 3.5 demonstrate the number of patients who underwent an aeromedical retrieval for acute myocardial infarction, by five-year age group and Indigenous status, and gender and Indigenous status (respectively). Between 1 January 2017 and 31 December 2021:

- Non-Indigenous Australians accounted for 7,781 (81.8%) retrievals and Indigenous peoples accounted for 1,735 (18.2%) retrievals;
- Males (N=8,163, 67.5%) were 1.8 times as likely to undergo an aeromedical retrieval as females (N=4,608; 32.5%);
  - Non-Indigenous males (N=6,999, 70.4%) were 2.2 times as likely to be retrieved as non-Indigenous females (N=3,381, 32.6%);
  - Indigenous males (N=1,164, 56.9%) were 1.3 times as likely to be retrieved as Indigenous females (N=883, 43.1%);
- Patients retrieved were between the ages of 0–85+ years;
- Indigenous peoples were younger than non-Indigenous Australians when retrieved;
  - 1.9% of Indigenous peoples retrieved for acute myocardial infarction were aged 25–29 years compared to 0.3% of non-Indigenous Australians;
  - 6.5% of Indigenous peoples retrieved for acute myocardial infarction were aged 35–39 years compared to 1.2% of non-Indigenous Australians; and
  - 11.3% of Indigenous peoples retrieved for acute myocardial infarction were aged 40–44 years compared to 2.5% of non-Indigenous Australians.

Figure 3.4 Number of patients who underwent an aeromedical retrieval for acute myocardial infarction, by five-year age group and Indigenous status, 1 January 2017 to 31 December 2021

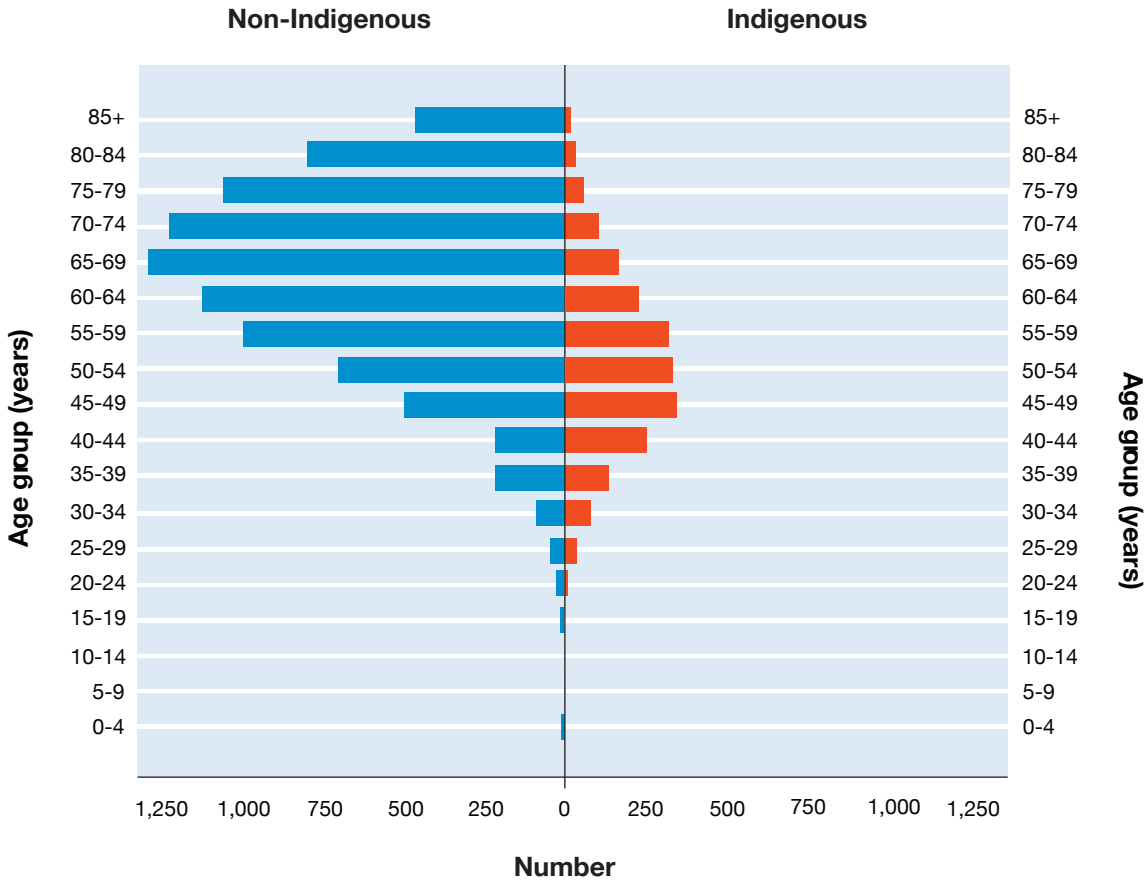
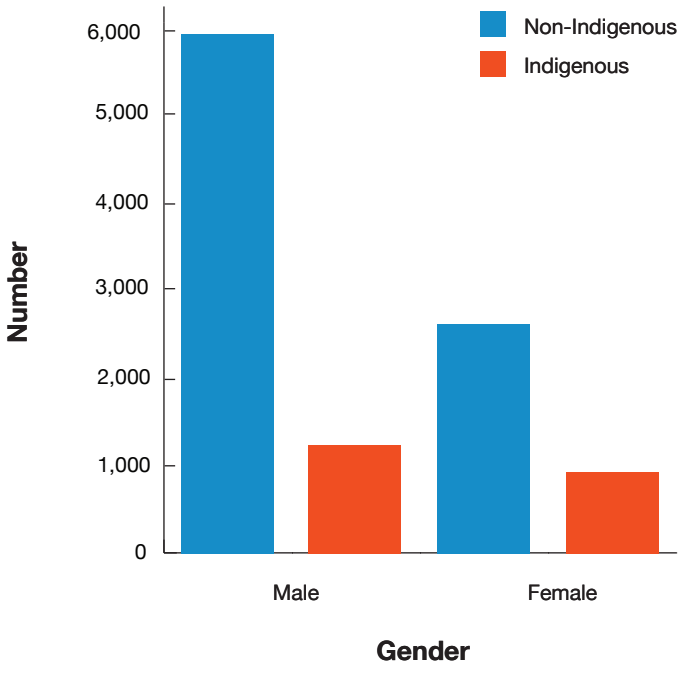


Figure 3.5 Number of patients who underwent an aeromedical retrieval for acute myocardial infarction, by gender and Indigenous status, 1 January 2017 to 31 December 2021

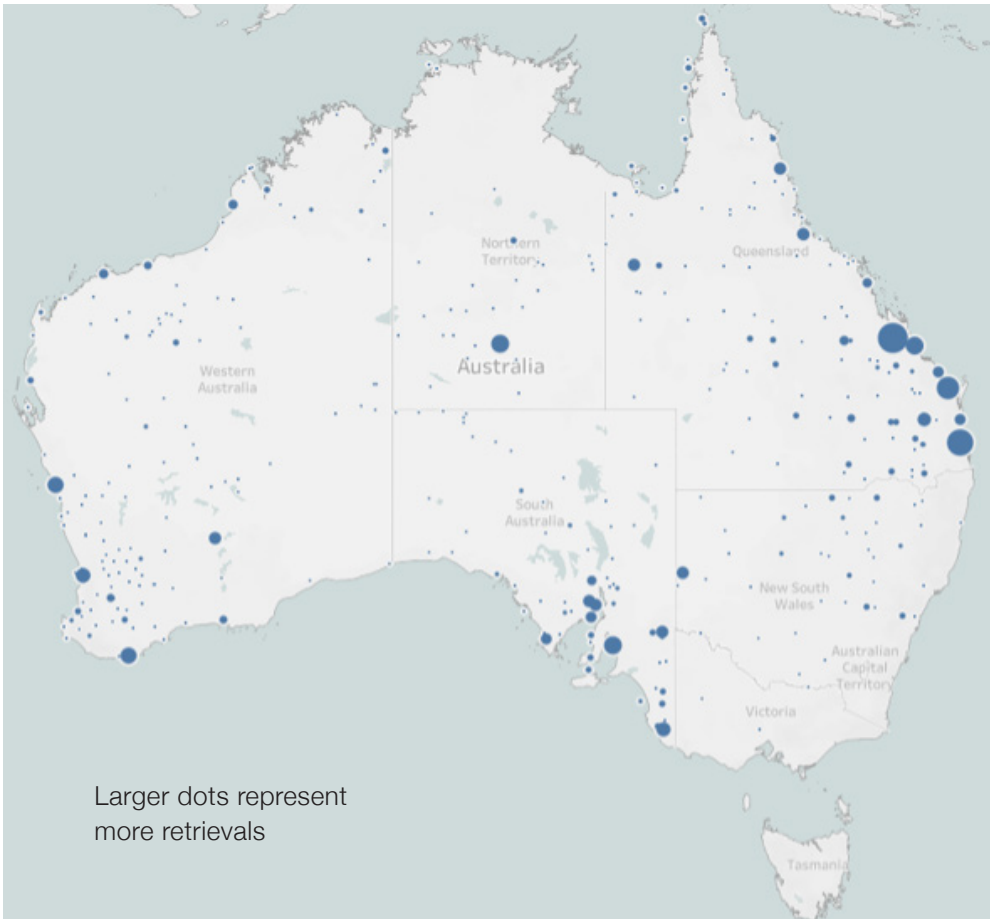


3.6.3 Aeromedical retrieval pick-up and drop-off locations

Figure 3.6. shows aeromedical retrieval pick-up locations for acute myocardial infarction.

RFDS primary evacuation locations for myocardial infarction show retrievals for patients from some of the most remote Australian communities, including Kowanyama, Aurukun, and Pormpuraaw (Queensland); Jurien Bay, Mount Magnet, and Meekathara (Western Australia); and Uluru, Yuendumu and Yalata Mission (Northern Territory and South Australia). The highest number of inter-hospital transfers were from Rockhampton, Hervey Bay and Gladstone (Queensland); Alice Springs (Northern Territory); Albany (Western Australia) Port Lincoln, Port Pirie and Kadina (South Australia); and Broken Hill (New South Wales).

Figure 3.6 Aeromedical retrieval pick-up locations for acute myocardial infarction, 1 January 2017 to 31 December 2021



3.7 Heart failure

Self-reported data from the National Health Survey demonstrated that 102,000 adults had heart failure in 2017–18.[2] Heart failure is costly (economically and socially) because it accounts for a large number of hospitalisations, with many people having multiple hospital visits.[48] Heart failure is progressive and 50–75% of people die within five years of diagnosis.[48]

In 2020–21, there were 178,563 hospitalisations where heart failure or cardiomyopathy was recorded as the principal and/or additional diagnosis – it was the principal diagnosis in 41% (N=73,293) of these hospitalisations.[2] The age-standardised hospitalisation rate for heart failure and cardiomyopathy in remote and very remote areas (903 per 100,000 population) was 1.8 times as high as for major cities (516 per 100,000 population).[2]

In 2017–19, the age-standardised death rate of Indigenous peoples (140 per 100,000 population) was 2.0 times as high as for non-Indigenous Australians (70 per 100,000 population).[2]

3.7.1 RFDS aeromedical retrievals for heart failure

Between 1 January 2017 and 31 December 2021, the RFDS retrieved 1,198 patients for heart failure, which equates to almost five patients a week. Primary evacuations accounted for 147 (12.3%) retrievals and inter-hospital transfers accounted for 1,051 (87.7%) retrievals.

3.7.2 Patient characteristics

The following was observed for RFDS aeromedical retrievals for heart failure between 1 January 2017 and 31 December 2021 (Figures 3.7 and 3.8):

- Patients retrieved were between the ages of 0–85+ years;
- Most of the primary evacuations (79.0%) and one-third (31%) of inter-hospital transfers for heart failure were for Indigenous peoples; and
- Indigenous peoples were younger than non-Indigenous Australians when retrieved – the majority of Indigenous peoples were younger than 65 years and the majority of non-Indigenous Australians were 65 years of age or older.

Figure 3.7 Number of patients who underwent an aeromedical retrieval for heart failure, by five-year age group and Indigenous status, 1 January 2017 to 31 December 2021

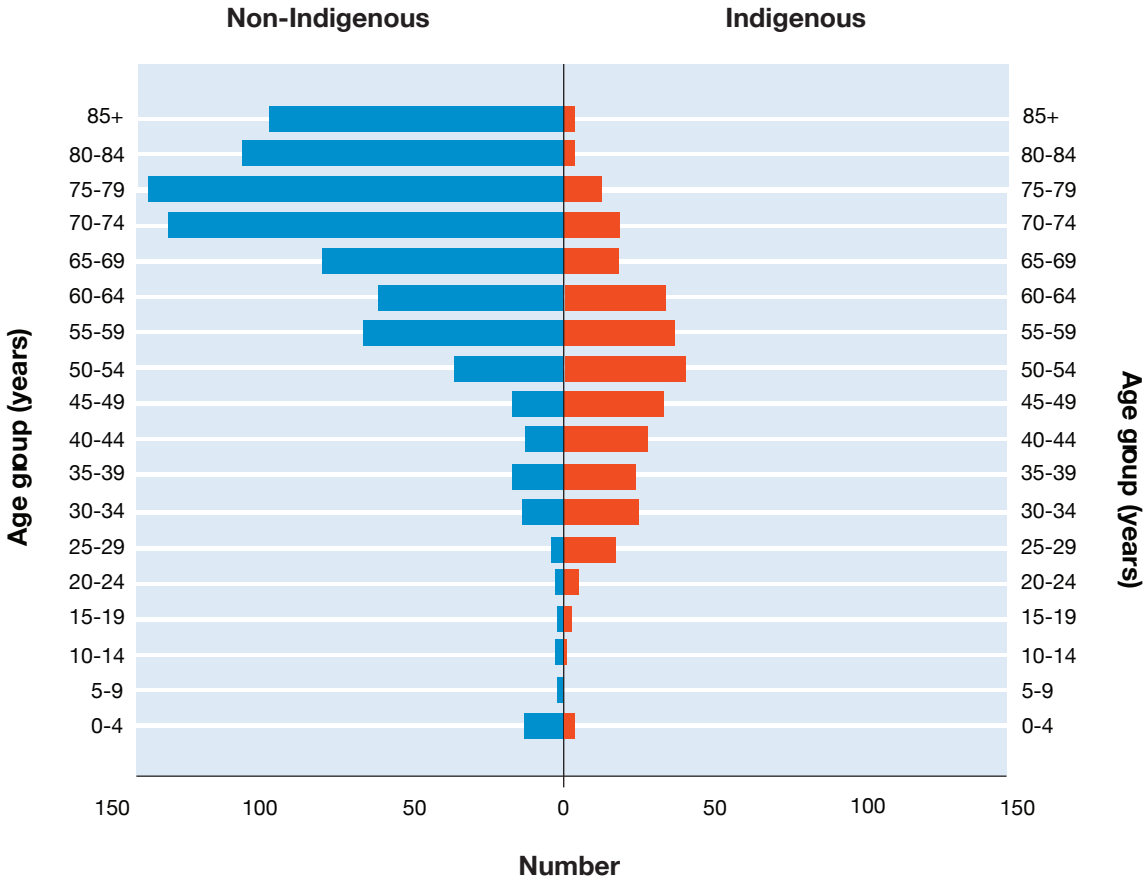
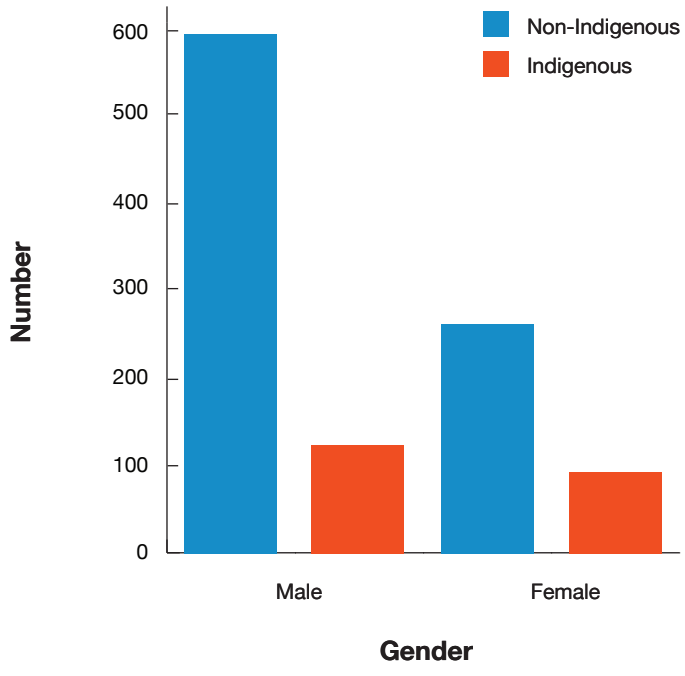


Figure 3.8 Number of patients who underwent an aeromedical retrieval for heart failure, by gender and Indigenous status, 1 January 2017 to 31 December 2021

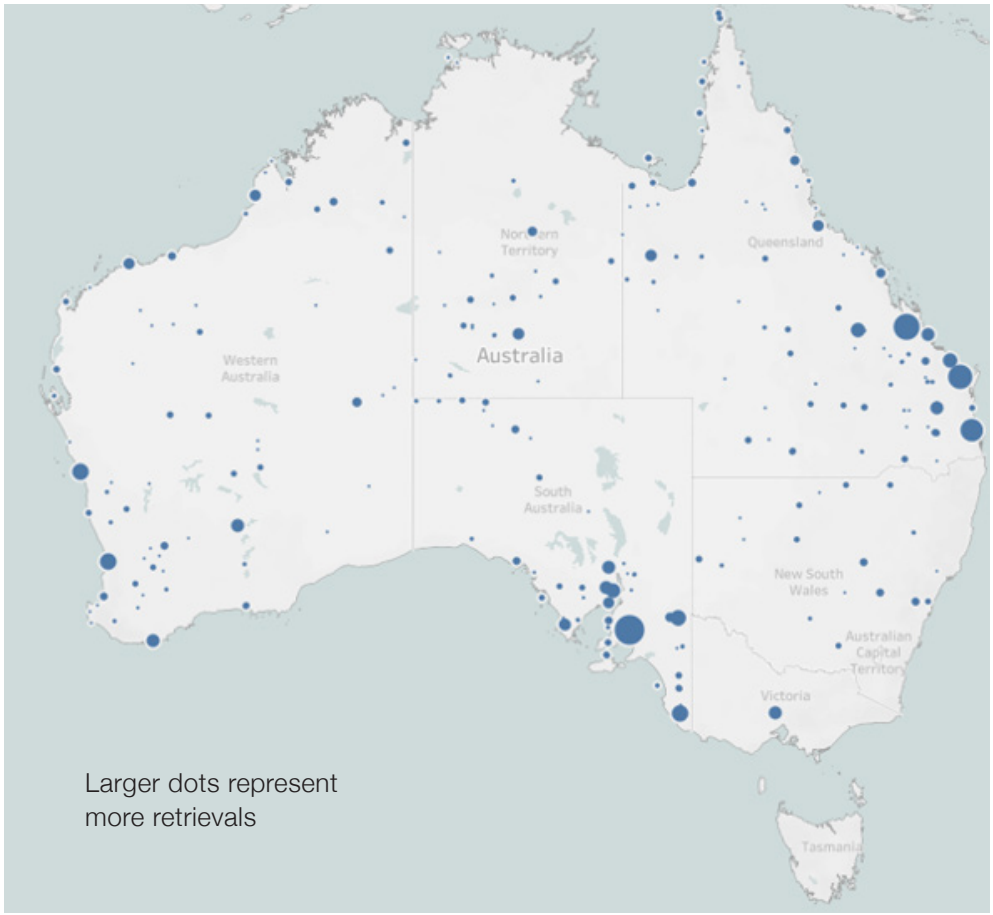


3.7.3 Aeromedical retrieval pick-up and drop-off locations

Figure 3.9 shows aeromedical retrieval pick-up locations for heart failure. RFDS primary evacuation locations for heart failure show retrievals for patients from some of the most remote locations in Australia including Warburton Ranges and Balgo Hills (Western Australia); Thargomindah (Queensland); Marla (South Australia); and Yuendumu (Northern Territory). The highest number of inter-hospital transfers included in Rockhampton and Hervey Bay (Queensland); Geraldton (Western Australia), as well as the movement of patients from Adelaide (South Australia) and Brisbane (Queensland), often for de-escalation of care following initial treatment.

Patients retrieved for heart failure were mostly taken to large inner-city facilities, such as the Royal Adelaide Hospital (South Australia), Fiona Stanley Hospital (Western Australia), Alice Springs Hospital (Northern Territory) and The Prince Charles Hospital (Queensland), for treatment.

Figure 3.9 Aeromedical retrieval pick-up locations for heart failure, 1 January 2017 to 31 December 2021



3.8 Cerebrovascular disease

Data from the 2018 Survey of Disability, Ageing and Carers demonstrated that around 387,000 Australians aged over 15 years had experienced a stroke at some point during their lives.[2] The age-standardised prevalence of stroke demonstrated that there was no difference across remoteness areas.[2]

In 2020, there were around 39,500 stroke events in Australia, equivalent to 100 per day (154 events per 100,000 population).[2] Males (144 per 100,000 population) were 1.4 times as likely as females (105 per 100,000 population) to experience a stroke in 2020, and the likelihood of stroke increased with age.[2]

Age-standardised hospitalisation rates for stroke were 1.4 times as high for males (255 per 100,000 population) as females (176 per 100,000 population) in 2020–21.[2] Hospitalisation rates for stroke among Indigenous Australians (352 per 100,000 population) were 1.7 times as high as for non-Indigenous Australians (206 per 100,000 population) in 2020–21.[2] Similarly, age-standardised stroke hospitalisation rates for people living in remote and very remote areas (270 per 100,000 population) were 1.2 times as high as for people living in major cities (216 per 100,000 population).

Research conducted in 2021 highlighted that only 3% of Australians living in rural and remote areas received care in a specialist stroke unit, compared to 77% of people who live in the city.[9]

From 2016–20, premature deaths from cerebrovascular disease were highest in Western Australia and the Northern Territory with a standardised death ratio up to six times higher than the national average[4] (Table 3.2).

Table 3.2 Rural and remote Statistical Area Level 3 regions in each Australian state/territory that had the highest standardised death ratios for cerebrovascular disease, for people aged 0–74 years, 2016–20*

State or Territory	Region: Statistical Area Level 3	Standardised death ratio
Western Australia	Halls Creek/Kununurra	5.58
	East Pilbara	2.98
	Derby–West Kimberley/Roebuck	2.31
	Geraldton/Geraldton–East	1.84
Northern Territory	Anindilyakwa/East Arnhem/Nhulunbuy	3.04
	Katherine	2.32
	Daly–Tiwi–West Arnhem	2.21
	Alice Springs–Town	1.00
South Australia	Port Augusta/Quorn–Lake Gilles	1.63
	Peterborough–Mount Remarkable	1.58
	Port Pirie	1.45
	Barossa–Angaston/Lyndoch	1.42
Victoria	Bendigo	2.65
	Colac	2.14
	Nhill Region/West Wimmera/Yarriambiack	2.06
	Moe–Newborough/Morwell	2.00
Queensland	Mount Isa	2.53
	Daintree/Port Douglas	2.34
	Berserker/Lakes Creek/Rockhampton City	2.33
	Rockhampton Central	2.14
New South Wales	Macksville/Scotts Head/Nambucca Heads	2.91
	Mayfield–Warabrook/Waratah–North Lambton	2.89
	Bolton Point–Teralba	2.60
	Muswellbrook	2.49
Tasmania^	West Ulverstone	2.37
	Parklands–Camdale/Somerset/Wynyard	2.27
	New Town	2.15
	Acton–Upper Burnie/Burnie–Wivenhoe	2.06

Notes: *Data not published on regions where there were small numbers of people impacted by an illness, to protect privacy (e.g. APY Lands).
^Excludes Greater Hobart and Launceston.
Source: Derived from Public Health Information Development Unit data (2023).[4]

3.8.1 RFDS aeromedical retrievals for cerebrovascular disease

Stroke was the third most common reason for an RFDS aeromedical retrieval for heart, stroke and vascular disease between 1 January 2017 and 31 December 2021, and accounted for 4,318 retrievals across Australia, including Queensland (N=1,799, 41.7%), Western Australia (N=1,098, 25.4%), South Australia and the Northern Territory (N=1,079, 25%), and New South Wales (N=342, 7.9%).

Inter-hospital transfers for stroke accounted for the majority (94.5%) of aeromedical retrievals.

3.8.2 Patient characteristics

Figures 3.10 and 3.11 demonstrate the number of patients who underwent an aeromedical retrieval for cerebrovascular disease, by five-year age group and Indigenous status, and gender and Indigenous status (respectively). Between 1 January 2017 and 31 December 2021:

- Non-Indigenous Australians accounted for 3,245 (81.3%) retrievals and Indigenous peoples accounted for 745 (18.7%) retrievals;
- Males (N=2,334, 58.5%) were 1.4 times as likely to undergo an aeromedical retrieval as females (N=1,656, 41.5%);
  - Non-Indigenous males (N=1,970, 60.1%) were 1.5 times as likely to be retrieved as non-Indigenous females (N=1,275, 39.9%);
  - Indigenous males (N=364, 48.9%) and Indigenous females (N=381, 51.1%) demonstrated similar rates of aeromedical retrieval for stroke;
- Patients retrieved were between the ages of 0–85+ years;
- Indigenous peoples were younger than non-Indigenous Australians when retrieved;
  - Mean age at retrieval for non-Indigenous Australians was 65.6 years (Standard Deviation (SD) 16.1 years); and
  - Mean age at retrieval for Indigenous peoples was age 54.7 years (SD 14.1 years).

Figure 3.10 Number of patients who underwent an aeromedical retrieval for cerebrovascular disease, by five-year age group and Indigenous status, 1 January 2017 to 31 December 2021

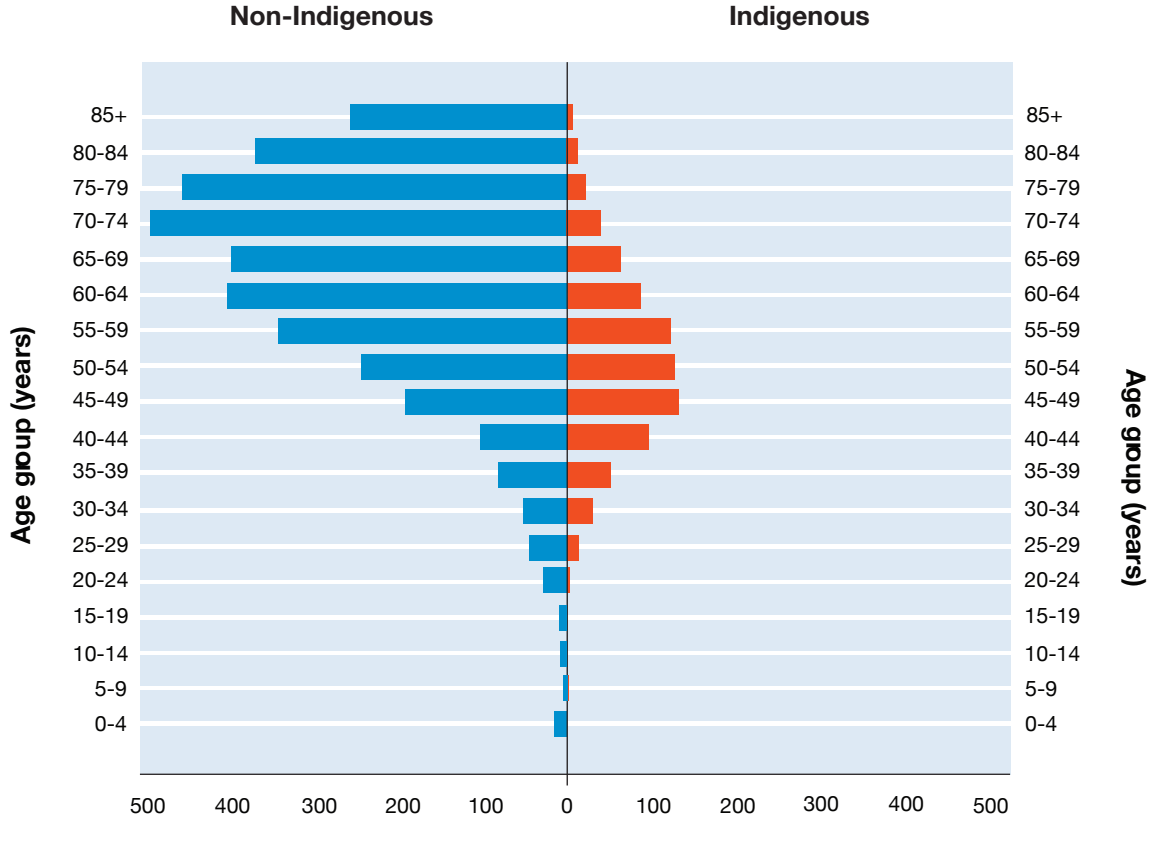
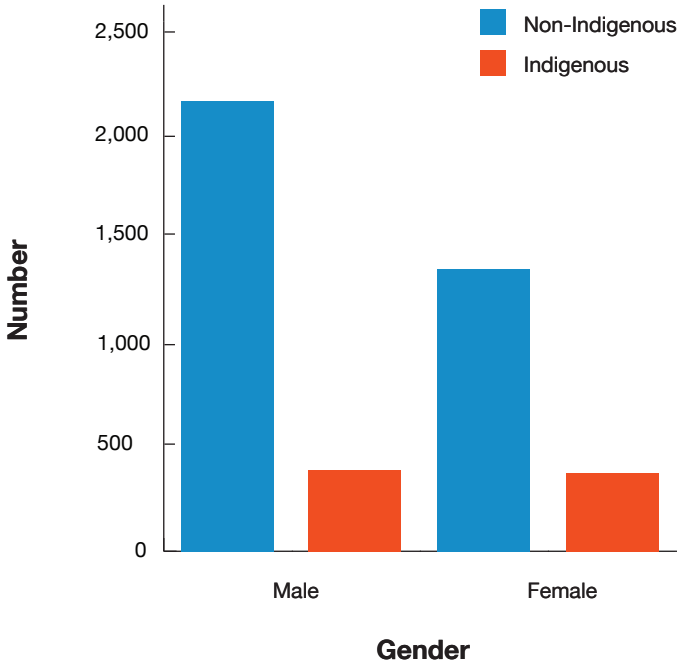


Figure 3.11 Number of patients who underwent an aeromedical retrieval for cerebrovascular disease, by gender and Indigenous status, 1 January 2017 to 31 December 2021

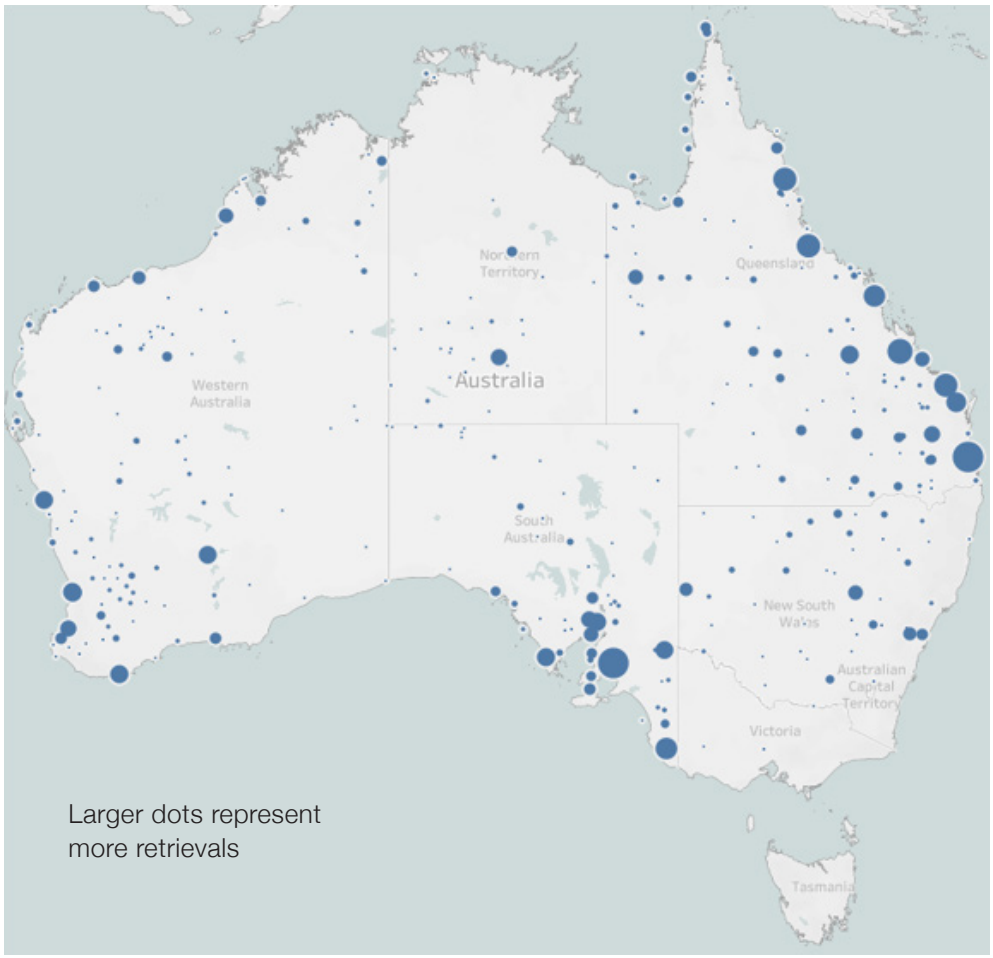


3.8.3 Aeromedical retrieval pick-up and drop-off locations

Figure 3.12 shows aeromedical retrieval pick-up locations for cerebrovascular disease. Some of the most remote primary evacuations for stroke were from Shark Bay, Mount Magnet, Jurien Bay (Western Australia); Aurukun, Pormpuraaw, Kowanyama (Queensland); Uluru, Amata, Ti Tree (Northern Territory/South Australia); and Moomba and Wilcannia (New South Wales) (Figure 3.8).

The main pick-up locations for inter-hospital transfers for stroke were Rockhampton, Townsville, Bundaberg, Cairns and Hervey Bay (Queensland); Albany, Geraldton, Broome, Bunbury and Kalgoorlie (Western Australia); Mount Gambier, Port Pirie, Port Lincoln, (South Australia); and Dubbo, Bankstown and Broken Hill, (New South Wales), as well as the movement of patients from Adelaide (South Australia) and Brisbane (Queensland), often for de-escalation of care following initial treatment.

Figure 3.12 Aeromedical retrieval pick-up locations for cerebrovascular diseases, 1 January 2017 to 31 December 2021



The main drop-off locations for stroke patients were Sir Charles Gardiner Hospital (Western Australia); Royal Adelaide Hospital (South Australia); Royal Brisbane Hospital and Royal Women's Hospital, Townsville Hospital (Queensland); Fiona Stanley Hospital (Western Australia); and Dubbo Base Hospital (New South Wales).

3.9 Acute rheumatic fever and rheumatic heart disease

Although acute rheumatic fever is rare among non-Indigenous Australians, it has a significant impact on Australia's Indigenous peoples.[2] Indeed, Indigenous Australians have some of the highest rates of acute rheumatic fever and rheumatic heart disease in the world, especially across Central and Northern Australia.[49] As at 31 December 2019, 5,385 people were living with rheumatic heart disease, of whom 81% were Indigenous.[2]

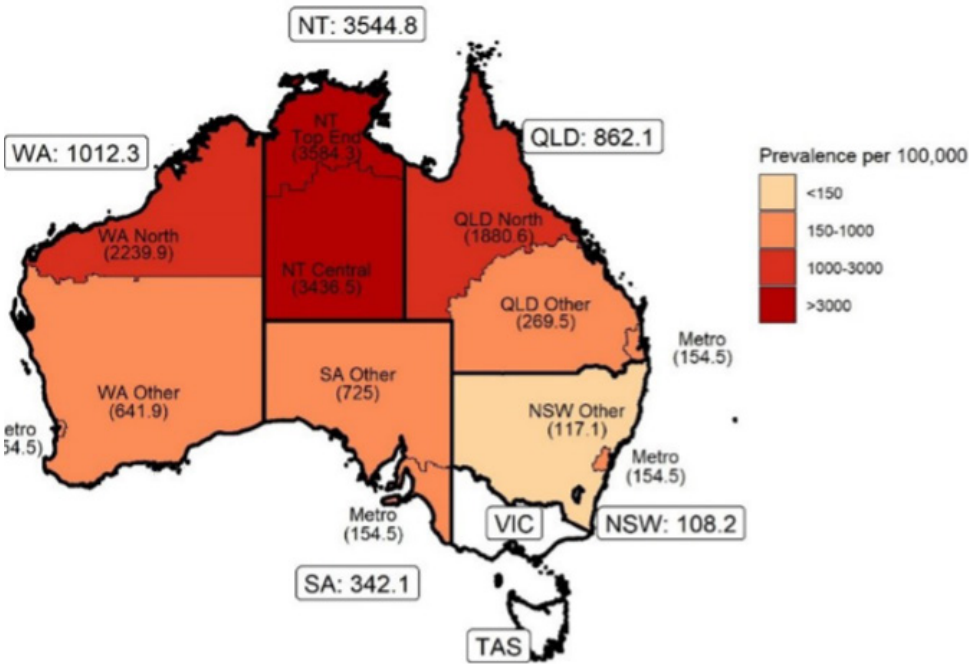
Figure 3.13 shows the age-standardised prevalence (Australian population and Indigenous population) of acute rheumatic fever or rheumatic heart disease in five Australian jurisdictions, by Indigenous Region Categories in 2015–17.[50] The data demonstrated that the Northern Territory (1,195.4 per 100,000 population) had the highest prevalence of acute rheumatic fever and rheumatic heart disease compared to other Australian states and territories.[50] The prevalence of acute rheumatic fever and rheumatic heart disease In 2015–17 among:

- Indigenous peoples (3,544.8 per 100,000 population) in the Northern Territory was three times as high as for the general population (1,195.4 per 100,000 population) in the Northern Territory;
- Indigenous peoples (1,012.3 per 100,000 population) in Western Australia was 18.4 times as high as for the general population (55 per 100,000 population) in Western Australia; and
- Indigenous peoples (862.1 per 100,000 population) in Queensland was 13.6 times as high as for the general population (63.3 per 100,000 population) in Queensland.[50]

From 2015 to 2019, regions of Australia most impacted by rheumatic heart disease included rural Darwin, East Arnhem, Alice Springs and Barkly (Northern Territory); Torres Strait, Cape and North West (Queensland); Kimberley (Western Australia); and Outback North and East (South Australia).[51]

In 2020–21, around 760 Indigenous peoples were hospitalised for acute rheumatic fever and rheumatic heart disease.[2] The age-standardised hospitalisation rate among Indigenous peoples (85 per 100,000 population) was 6.5 times as high as the non-Indigenous rate (13 per 100,000 population).[2] People living in remote and very remote areas (112 per 100,000 population) were nine times as likely to be hospitalised for acute rheumatic fever and rheumatic heart disease as those living in major cities (13 per 100,000 population) in 2020–21.[2]

Figure 3.13 Age-standardised prevalence (per 100,000) of acute rheumatic fever or rheumatic heart disease in Indigenous population in five Australian jurisdictions, by Indigenous Region Categories, 2015–17



Source: Katzenellenbogen, Bond-Smith, Seth, et al. (2020).[50]

3.9.1 RFDS aeromedical retrievals for rheumatic heart disease

RFDS carried out 109 aeromedical retrievals for patients with acute rheumatic fever and 169 aeromedical retrievals for patients with rheumatic heart disease between 1 January 2017 and 31 December 2021.

3.9.2 Patient characteristics

The greatest number of retrievals were for children aged 10–14 years of age (Figure 3.14). More than half (N=151, 54%) of all retrievals were for people under 29 years of age. Indigenous peoples with a primary diagnosis of rheumatic heart disease accounted for the majority (N=207, 74.2%) of retrievals. The mean age of Indigenous peoples retrieved was 18.5 years. There were 60 (21.5%) retrievals of non-Indigenous Australians with a mean age of 69.7 years. Eleven (4.3%) retrievals were for people who had not specified their Indigenous status, with a mean age of 57 years. Figure 3.15 demonstrates the disproportionately high number of Indigenous peoples impacted by acute rheumatic fever or rheumatic heart disease.

Figure 3.14 Number of patients who underwent an aeromedical retrieval for acute rheumatic fever or rheumatic heart disease, by five-year age group and Indigenous status, 1 January 2017 to 31 December 2021

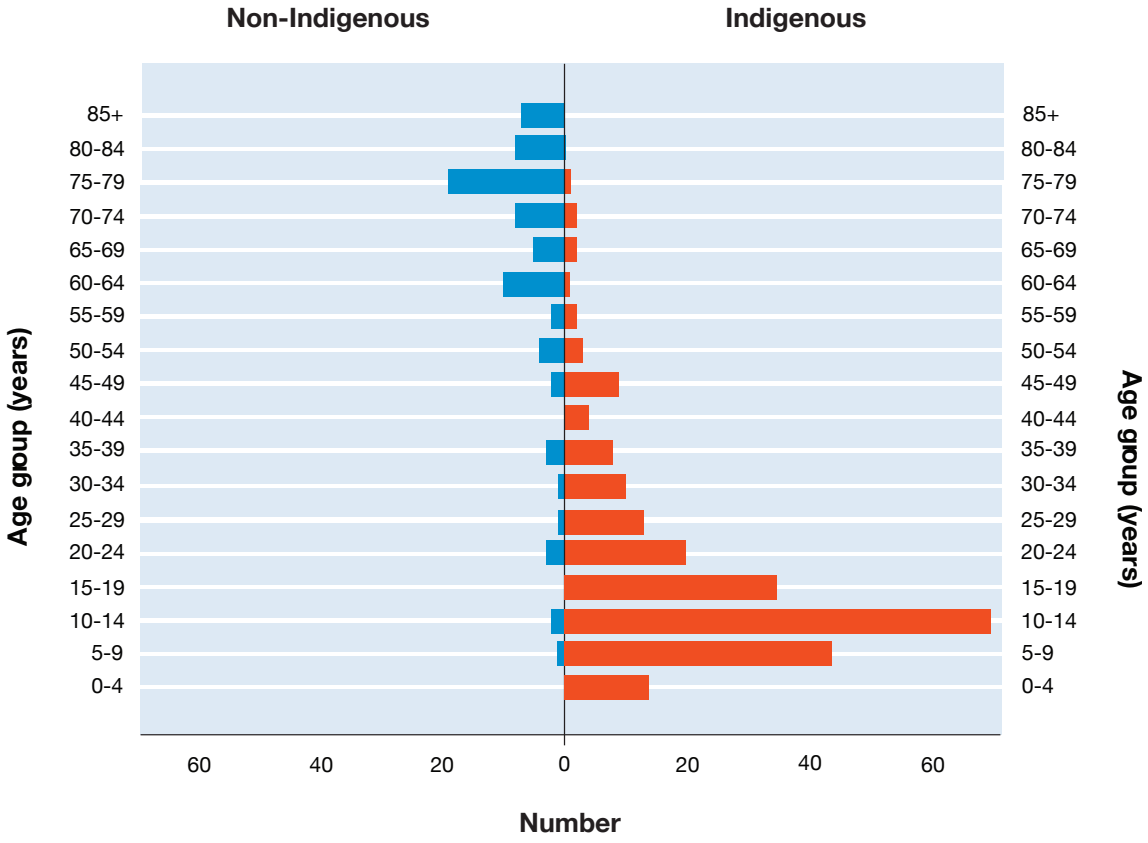
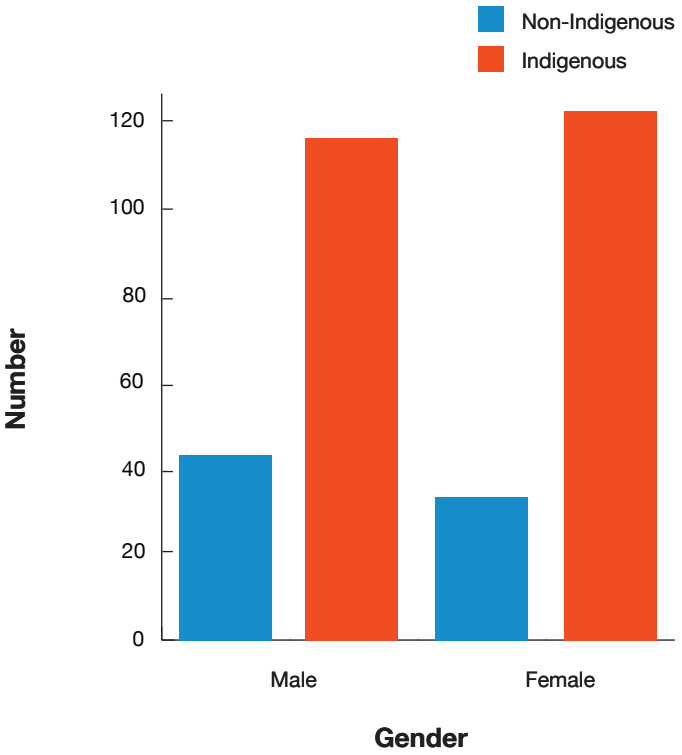


Figure 3.15 Number of patients who underwent an aeromedical retrieval for acute rheumatic fever and rheumatic heart disease, by gender and Indigenous status, 1 January 2017 to 31 December 2021

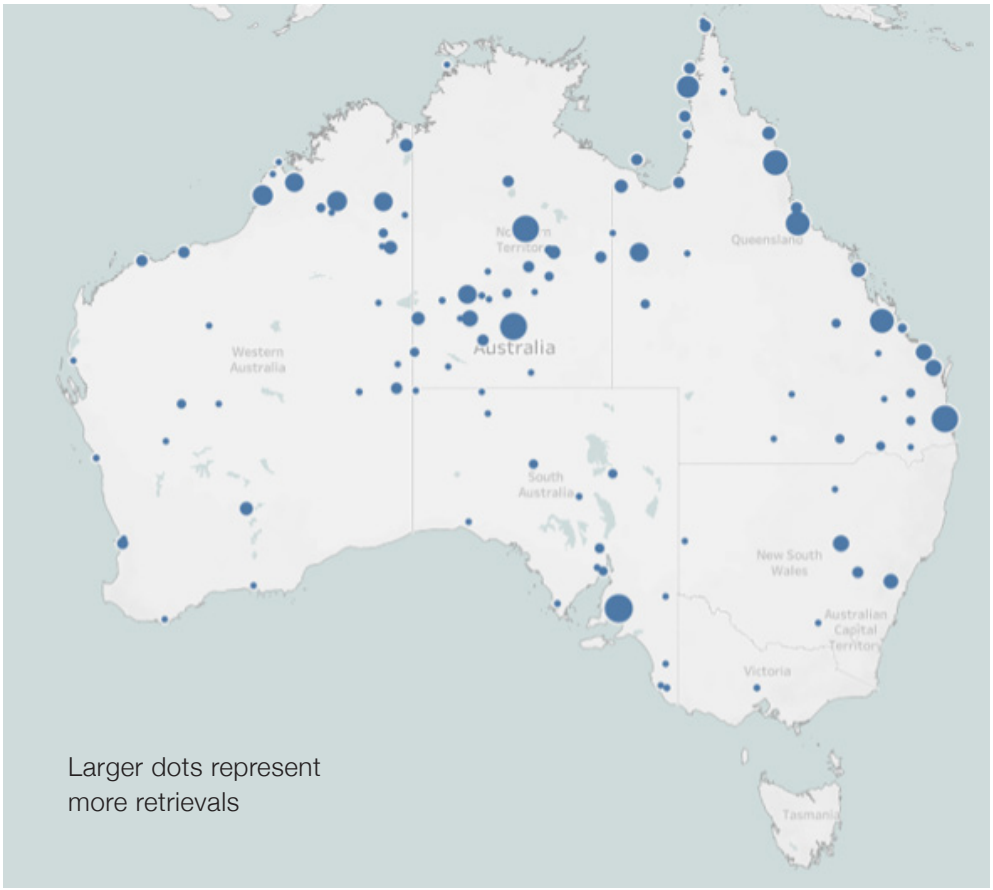


3.9.3 Aeromedical retrieval pick-up and drop-off locations

Figure 3.16 shows aeromedical retrieval pick-up locations for acute rheumatic fever and rheumatic heart disease.

People from some of the most remote communities underwent primary evacuations for acute rheumatic fever and rheumatic heart disease, including communities such as Aurukun (Queensland); Yuendumu and Papunya (Northern Territory); and Balgo Hills (Western Australia). The majority of inter-hospital transfers were from Tennant Creek and Alice Springs (Northern Territory); Cairns and Rockhampton (Queensland); and Fitzroy Crossing (Western Australia), as well as the movement of patients from Adelaide (South Australia) and Brisbane (Queensland), often for de-escalation of care following initial treatment. As with previous conditions, there are few local hospitals that can treat rheumatic heart disease and the majority of these patients were taken to a major city hospital.

Figure 3.16 Aeromedical retrieval pick-up locations for acute rheumatic fever and rheumatic heart disease, 1 January 2017 to 31 December 2021



3.10 Discussion

The data presented in the current chapter demonstrated that people living in rural and remote Australia, including Indigenous peoples, were disproportionally impacted by sub-types of heart, stroke and vascular disease, compared to people living in major cities.

Additionally, Indigenous peoples were impacted by heart, stroke and vascular disease sub-types at a much younger age than non-Indigenous Australians – sometimes 20 to 30 years earlier.

The high number of aeromedical retrievals for heart, stroke and vascular disease sub-types, conducted between 1 January 2017 and 31 December 2021, demonstrates that rural and remote Australians were unable to get the treatment they needed outside of major cities, where they were most often taken to receive definitive care.

When they are discharged from hospital, rural and remote Australians may be unable to access the follow-up care they need in rural and remote Australia, due to the lack of service access. Sometimes, they may need to move to access ongoing care. This can be costly and lonely for the patient.

For Indigenous peoples, this can be extremely detrimental, as Indigenous peoples have a strong connection to Country and community.[52] Being taken off Country to a hospital far from their home can lead to poor outcomes, especially when stays are prolonged or become permanent.[52] To improve the health of Indigenous peoples, their connections to family, community and Country – which, is often overlooked in Western medicine – must also be considered by health professionals.[53]

This is not only applicable to Indigenous peoples, but also to all Australians. There is evidence that people prefer to be cared for at home and in their community.[54] This perspective requires an emphasis on high-quality integrated care.[54] This reaffirms the need for place-based service models that promote good heart health, and that are community led. Place-based models are better situated to understand and consider the social determinants of health, to address the health needs of the community.

Some capital cities (e.g. Brisbane and Adelaide) were identified as RFDS aeromedical retrieval pick-up locations. In many cases this activity represents inter-hospital transfers of patients from high acuity care (such as a dedicated stroke or cardiac unit) to lower acuity care, such as to a large regional hospital. Patients who underwent an inter-hospital transfer from a major city hospital may have still required comprehensive medical treatment, but no longer needed the high acuity services provided by specialist units.

Chapter 4. Service models that promote good heart health

The Australian Institute of Health and Wellbeing identified three phases for the treatment and management of heart, stroke and vascular disease: prevention, acute care, and secondary prevention.[2]

Prevention activities assist people who may be at risk of heart, stroke and vascular disease before symptoms appear, or before they experience a cardiac event.[2] Primary healthcare teams, including general practitioners, nurses, Indigenous health workers, dental teams and allied health professionals (such as dieticians, diabetes educators, and physiotherapists), along with pharmacists, are integral to helping people manage risk factors for heart, stroke and vascular disease, via lifestyle modifications and the use of medicines.[2] There is strong evidence that acute heart, stroke and vascular disease events are largely preventable, especially with early diagnosis and treatment.[6]

Acute care is the treatment given during and immediately after an acute heart, stroke or vascular disease event, like a heart attack or stroke.[2] It includes pre-hospital emergency care, such as RFDS aeromedical retrievals and care from other ambulance services, as well as care given in the emergency department and in hospital.[2]

Secondary prevention describes health care that aims to prevent a recurrence of heart, stroke or vascular disease events, or complications for people with heart, stroke or vascular disease.[2] Secondary prevention involves medical treatment, modification of risk factors, psychosocial care, education and support for self-management.[2]

This chapter focuses on the significant role of primary health care in heart, stroke and vascular disease. It describes the role the RFDS plays in the provision of primary health care, including dental care, to people with heart, stroke and vascular disease living in rural and remote Australia, and provides examples of models of care that address sub-types of heart, stroke and vascular disease.

4.1 Role of primary health care

The National Strategic Action Plan for Heart Disease and Stroke (p.14) identified that 'early detection and ongoing management of those at high risk of heart disease and stroke can save lives and reduce avoidable hospital admissions'.[8] The RFDS *Best for the Bush: Rural and Remote Health Base Line 2022*[1] report identified that in many instances, heart, stroke and vascular disease, along with many other chronic diseases, can be prevented or carefully managed in the primary healthcare setting to avoid the need for acute care, such as an aeromedical retrieval or hospitalisation.[1] Modifiable risk factors associated with heart, stroke and vascular disease, which can be managed in the primary healthcare setting, include blood pressure, cholesterol, diet, physical activity, weight, smoking and alcohol intake.[8]

Primary health care is at the forefront for the delivery of services to identify, prevent and manage heart, stroke and vascular disease risk.[7] In addition to general practice, community-based lifestyle modification services and programs are required to support and sustain changes in the health behaviour of consumers.[7]

However, access to primary health care is poor in many areas of rural and remote Australia. Through the RFDS Service Planning and Operational Tool, which maps service data and overlays this with population data, the RFDS has been able to identify where there is a lack of access to primary health care. We found that in 2023, 22,003 people in remote and very remote Australia had no access to any type of primary healthcare service within a 60-minute drive time of their place of residence.[1] Specifically, 57,899 people did not have access to general practitioner services, with the highest numbers of people without access in the regions of Daly–Tiwi–West Arnhem, the Kimberley, and Far North Queensland. Moreover, 208,247 people did not have access to nurse-led services, with the highest numbers of people without access being in the regions of East Pilbara, Katherine and Esperance.[1] Many of these locations have also been demonstrated to have low socioeconomic status and to have higher standardised death ratios for heart, stroke and vascular disease. For example, the standardised death ratio for heart, stroke and vascular disease in Anindilyakwa/East Arnhem/ Nhulunbuy (Northern Territory) was 5.39 times higher than the national average in 2016–20.[4]

Unsurprisingly, the RFDS found that, with the exception of nurses, the distribution of the primary healthcare workforce (per 100,000 head of population) is significantly lower in rural and remote areas, compared to major cities.[1]

Prevention, early detection and effective management of heart, stroke and vascular disease can only be achieved by ensuring appropriate access to health services for people in rural and remote Australia, and a workforce to deliver these services.[1]

It is anticipated that as people live longer, they will also develop a greater prevalence of chronic disease, which will be even more apparent in an increasingly ageing population.[55] Cancer, disorders of mental health, and heart, stroke and vascular disease are predicted to be the most prevalent chronic diseases, with those in rural and remote areas expected to be impacted most by these growing rates, consistent with current trends.[55]

Additional health prevention and early intervention activities will be required to minimise and respond to growth in heart, stroke and vascular disease.[55] Despite the challenges in providing services to smaller populations spread across large distances, it is crucial that rural and remote Australians have the guarantee of reasonable access to comprehensive and enhanced primary healthcare services to respond to these trends, and particularly increases in chronic disease.[55]

Culturally appropriate services, delivered by multidisciplinary primary healthcare teams, as well as visiting programs involving specialists, allied health, mental health, dental and telehealth services, will be integral to improving health outcomes for rural and remote Australians.[55]

Some of the aeromedical retrievals for heart, stroke and vascular disease described in the previous chapters may have been preventable through the provision of appropriate early health interventions and disease management delivered in primary healthcare and community-based care settings.[56]

Examples of primary healthcare interventions that may help people avoid hospitalisation include:

- Reducing and managing disease risk factors;
- Diagnosis and prescribing to manage infections (for acute rheumatic fever and rheumatic heart disease);
- Lifestyle interventions to reduce the development of chronic conditions; and
- Management of chronic conditions to slow progression and risk of complications, including support for self-management.[57]

4.2 RFDS primary healthcare services

The RFDS, along with mainstream services and other organisations, such as Aboriginal Community Controlled Health Organisations, plays an important role in the delivery of a comprehensive suite of primary healthcare services for people who live in rural and remote Australia, including on behalf of the Australian Government. To address lack of access to the Medical Benefits Schedule in these areas, services funded by state and territory governments, philanthropy and fundraising are also provided by the RFDS throughout Australia. Our primary healthcare services comprise innovative and flexible models of care to meet the health needs of rural and remote communities, such as permanent, mobile or regular fly-in fly-out/ drive-in drive-out GP and nursing clinics, mental health and wellbeing services, dental health services, chronic disease management, and a growing number of allied health programs, health promotion activities and road transport services. These are integrated with a 24/7 remote consultation (telehealth) system.

With 78 aircraft at 23 aerobases along with over 180 road vehicles at regional bases, the RFDS provides aeromedical retrievals and clinic services at almost 200 rural and remote sites, and in 2021–22 provided over 387,000 patient contacts. These included over 24,000 primary healthcare clinics (an average of 65 per day); over 63,000 remote telehealth consultations; and almost 17,000 episodes of face-to-face mental health and dental health care. Through our extensive telehealth and primary healthcare we provide medical support to patients in rural and remote communities across Australia, including providing guidance on risk factors for heart, stroke and vascular disease, and evidence-based recommendations for treatment.[58]

The RFDS prioritises a place-based approach to service planning, to target the specific circumstances of the individual communities served by the RFDS. In many communities, despite operating as a visiting service, the RFDS is the 'local doctor' providing high-quality continuity of care – and in some cases, has been the only provider of these services for over 90 years. The RFDS endeavours to tailor services, including for heart, stroke and vascular disease, to the communities in which they are delivered, and is committed to both supporting the growth of local capacity, and also partnering with local service providers. Services are co-designed with the local community, consumers and carers, as well as partner organisations, such as Primary Health Networks and the Aboriginal and Torres Strait Islander health sector, including Aboriginal Community Controlled Health Organisations, and we continue to work with Indigenous communities and stakeholders to ensure services are culturally appropriate.[1]

4.2.1 Spotlight on RFDS dental services

People in rural and remote Australia have poorer oral health than people living in major cities, and oral health status declines with increasing remoteness.[59] Previous research has demonstrated that compared to people in major cities, rural and remote Australians have poorer access to dental services, experience longer travel times and have limited transport options to services.[59]

Poor oral health is associated with certain heart, stroke and vascular diseases, as well as a higher risk of mortality from heart, stroke and vascular disease.[59,60] There is consistent and strong epidemiological evidence that periodontitis, or gum disease, is a risk factor for future heart, stroke and vascular disease.[61] Analyses from a nationwide Korean cohort study demonstrated an association between five or more dental caries (cavities) and the occurrence of stroke or myocardial infarction among participants.[62]

Acute rheumatic fever and rheumatic heart disease can also be impacted by poor oral health. Ongoing dental care for people with acute rheumatic fever and rheumatic heart disease is indicated to reduce the risk of endocarditis, or heart inflammation, which is usually caused by an infection.[63] Good dental hygiene is important, since oral bacteria entering the bloodstream can increase the risk of heart complications, such as endocarditis.

Recognising the gap in provision of dental health services in rural and remote areas, the RFDS established dental services throughout Australia. These services are provided using fly-in, fly-out or drive-in, drive-out, mobile and outreach delivery models. The RFDS dental service employs a range of oral health professionals, such as dentists, oral health therapists, dental hygienists and dental assistants.

The RFDS delivers a range of dental services, including preventative services, diagnostic services, general services, restorative services, oral surgery, periodontics, endodontics, and prosthodontics. Analysis of RFDS dental data between 2017 and 2019 demonstrated that the RFDS conducted 120 dental procedures per day. Preventative and diagnostic services accounted for more than half of all procedures delivered by the RFDS (56.8%). Around one in five procedures were for general services (19.4%) or restorative services (17.2%) and 4.5% of procedures involved oral surgery. Of specific relevance is the number of procedures delivered per appointment. This ranged from 3.9 procedures per appointment to 7.1 per appointment with an average of 5.2 procedures conducted per appointment. The large number of procedures delivered through RFDS dental clinics reflects the high levels of poor oral health in rural and remote Australia.

The RFDS is committed to providing dental services to rural and remote Australians, to reduce the impacts of poor dental health on their overall heart health.

4.3 Other interventions

There are several examples of models of care that address the sub-types of heart, stroke and vascular disease. The models presented in this section of the report focus on one or more phases in the treatment and management of the sub-types of heart, stroke and vascular disease described in Chapter three – prevention, acute care and secondary prevention. All the models of care have been implemented in Australia.

The models presented include:

- The Heart Health Check;
- Cardiac rehabilitation services;
- Integrated Cardiovascular Clinical Network;
- The Australian Stroke Alliance;
- Take Heart: Deadly Heart; and
- Purple House.

4.3.1 Heart Health Check

Australian general practitioners play an important role in raising patient awareness about health checks.[8] The Heart Health Check, which determines a person's risk of heart disease and stroke, is recommended for non-Indigenous Australians aged 45 years or older and Indigenous peoples aged 30 years or older.[64] In rural and remote Australia, the Heart Health Check can be delivered by general practitioners and other medical professionals.

The Heart Health Check is based on the Australian absolute cardiovascular disease risk calculator.[65] Absolute cardiovascular disease risk assessment considers multiple risk factors, including blood pressure, cholesterol, blood glucose, smoking status and lifestyle factors, to predict the likelihood of a heart attack or stroke event in the next five years.[65]

Depending on the result, various measures may need to be implemented, ranging from lifestyle modifications to medication regimens.[26] An important factor in the ongoing management of a patient is access to comprehensive primary health care.[11,27]

Results from a 2022 survey conducted by the Heart Foundation found that 64% of eligible patients aged between 45 and 74 years had not had a Heart Health Check, despite more than half of that cohort having either high blood pressure, high cholesterol, diabetes, or being told that they are at high risk of heart disease.[66]

In 2022, the Heart Foundation cited modelling that proposed up to 76,500 deaths from heart, stroke and vascular disease could be avoided over the next five years, if Heart Health Checks were carried out widely.[65]

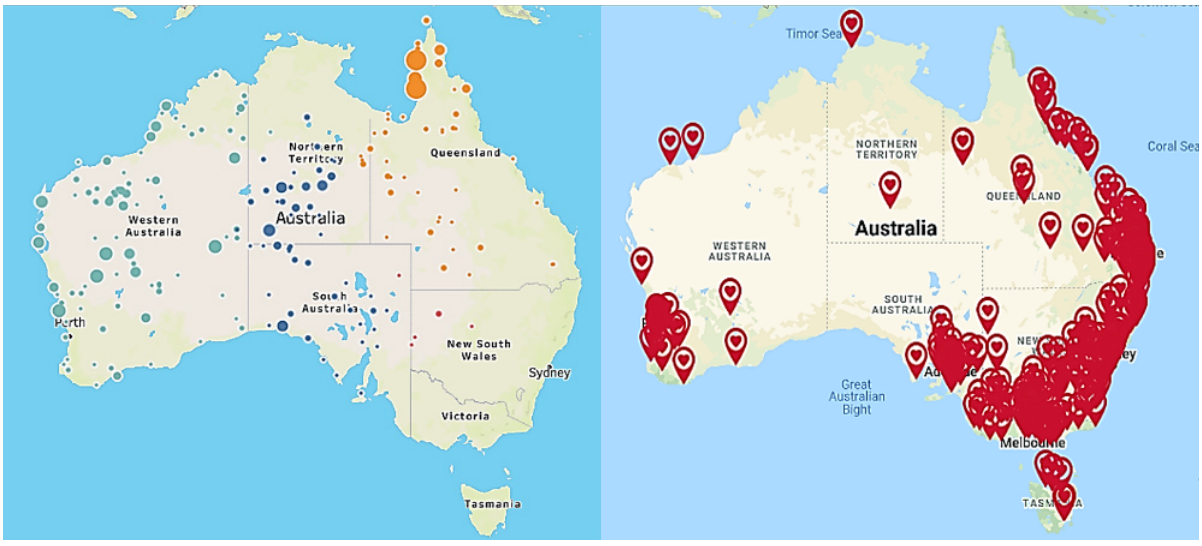
4.3.2 Cardiac rehabilitation services

Cardiac rehabilitation services are classified as secondary prevention, as they support a person after they have had a heart event. A multidisciplinary team of healthcare professionals usually work together to support cardiac rehabilitation and could include a cardiothoracic surgeon, cardiologist, general practitioner, cardiac nurse, physiotherapist, occupational therapist, dietician and social worker.[58]

In 2019, the RFDS produced a research report on Cardiovascular Disease Prevention and Rehabilitation in Rural and Remote Populations.[58] The report found that many rural and remote communities with high rates of heart, stroke and vascular disease do not have adequate access to cardiac rehabilitation services for secondary prevention.[58]

Figure 4.1 demonstrates the locations of RFDS primary evacuations for myocardial infarctions between 1 January 2017 and 31 December 2021, as well as the locations of cardiac rehabilitation services in Australia.[67] The majority of aeromedical retrievals (primary evacuations) were from locations where there were no cardiac rehabilitation services. This is concerning, since the evidence suggests that participation in a cardiac rehabilitation program is an important first step in a person's recovery.[58]

Figure 4.1 Locations of RFDS primary evacuations for acute myocardial infarction (left) compared to where cardiac services are based (right)[67]



Primary Evacuation locations for acute myocardical infarction

Cardiac rehabilitation services

Not only do cardiac rehabilitation programs improve quality-of-life and risk factors, but people are also 40% less likely to be readmitted to hospital and 25% less likely to die from another heart event if they have participated in cardiac rehabilitation.[58,68-70]

To assist people in areas where there are no cardiac rehabilitation services, there has been increasing availability of, and evidence for, alternative modes of delivery of cardiac rehabilitation, including phone-based, home-based and online services.[58] As such, there is an opportunity for rural and remote healthcare providers, such as the RFDS, to expand services to facilitate equitable health outcomes.

4.3.3 Integrated Cardiovascular Clinical Network

In South Australia, the Integrated Cardiovascular Clinical Network, which is a regionalised clinical cardiac support network, provides an example of a program that has been developed to improve access to services for people in rural and remote Australia with heart, stroke and vascular disease.[71] It includes over 70 hospitals, health centres and general practitioner surgeries that reach over 400,000 people.[71]

The network supports the capacity of primary health care to manage suspected myocardial infarction by providing expert risk stratification, point-of-care troponin testing, and cardiologist-supported decision-making for people with suspected myocardial infarction.[71] This program was progressively implemented in non-metropolitan areas of South Australia from 2001–2008.[71] It provides rapid assessment of non-metropolitan patients, and facilitates timely transport of patients to metropolitan hospitals, including RFDS patients, to receive medical interventions, such as coronary angiography, percutaneous coronary intervention, coronary artery bypass graft surgery and cardiac rehabilitation services.[71]

Researchers evaluated the relationship between availability of the Integrated Cardiovascular Clinical Network and mortality, and found that the immediate cardiac support provided through the Integrated Cardiovascular Clinical Network was associated with a reduction in 30-day mortality rates.[71] In addition, there was a strong association between network support and transfer of patients to metropolitan hospitals (before Integrated Cardiovascular Clinical Network, 1102/2419 [45.56%] versus after Integrated Cardiovascular Clinical Network, 2100/3211 [65.4%]; $P< 0.001$), with lower mortality observed among patients.[71]

4.3.4 The Australian Stroke Alliance

At present, people in rural and remote communities who have had a stroke often have to travel hundreds of kilometres, often for several hours, to access brain imaging. Without imaging, clinicians are unable to determine the type of stroke a patient has experienced, and therefore are unable to commence treatment in a timely manner.

One solution to this is to take the brain scanner to the patient.[72] The Australian Stroke Alliance commenced a five-year project in 2020 to develop world-first disruptive technologies to radically transform access to early pre-hospital treatments and dramatically improve stroke outcomes for all Australians.[72] Ultra-lightweight, portable and low-cost imaging devices are being designed by its commercial partners for use by ambulance services, and for use in aircraft, by aeromedical retrieval services.[72] The Australian Stroke Alliance has calculated that around 45,000 Disability Adjusted Life Years will be saved over 30 years through these interventions.

The RFDS is a major partner and is working with the Australian Stroke Alliance to develop and test scanners for the aeromedical environment. The technology will also enable digital telehealth so that first responders can share vital patient data with city-based neurologists on the ground and in the air.[72] Neurologists will be able to diagnose and instruct RFDS clinicians to administer treatment and direct the patient to a stroke unit if required.[72] This is likely to reduce the number of aeromedical retrievals associated with stroke, and will also enable those patients who have had a stroke to be transported to a stroke unit as quickly as possible.

4.3.5 *Take Heart: Deadly Heart*

Managing rheumatic heart disease is complex. It requires reliable access to medical support, routine dental care, timely access to surgery, rehabilitation, and regular penicillin injections to prevent recurrent acute rheumatic fever.[51] However, simple and cost-effective strategies can reduce and treat acute rheumatic fever, thus preventing chronic rheumatic heart disease.[51] Primary healthcare services are at the core of these strategies by providing early diagnosis and intervention to streptococcus A infections that are easily treated with penicillin.[51]

Take Heart: Deadly Heart is part of an impact campaign based around a film with the same title to promote the *Rheumatic Heart Disease End Game Strategy.*[73] It aims to eliminate the disease in Australia by 2030.[73] Strategies vary and require solutions that address prevention.[73] They also need to be community led, address the social determinants of health, and support culturally safe relationships.[74]

The RFDS is proud to be a silver sponsor of the film *Take Heart: Deadly Heart,* and to be able to use our voice to raise consciousness about this preventable disease, which has largely been eliminated from all other developed countries, with the exception of Indigenous populations within Australia and New Zealand, who still have high prevalence.

4.3.6 Purple House

Although not specific to heart, stroke and vascular disease, Purple House in Alice Springs is an excellent example of how the community came together to improve outcomes for patients with chronic kidney disease.[75] Purple House is an innovative Indigenous-owned and run health service that provides a home away from home for patients who have to leave their community to access care for end-stage renal failure.[75] The aim is to keep patients on Country with their family, where they can continue to share their culture.[75] They also have 18 remote clinics and the Purple Truck, a mobile dialysis unit.[75] This enables people to return home for family, cultural or sorry business, without risking their health.[75]

Indigenous peoples have drawn attention to the importance of relationships with their culture and Country. Purple House has assisted in supporting these connections.[75] The success of Purple House has led to communities requesting their help for other conditions. This model considers the needs of rural and remote Indigenous communities and either takes care to the patient, or provides a safe, social space where people feel comfortable to receive the help they need away from home.[75] This type of model could be considered for the treatment of heart, stroke and vascular diseases, especially for Indigenous peoples, where connection to Country is important.

4.4 Summary

This chapter has presented compelling evidence that primary healthcare services play a pivotal role in supporting good heart health. Primary health care is at the forefront for the delivery of services to identify, prevent, and manage heart, stroke and vascular disease risk.[7]

However, permanent primary healthcare services are not always accessible to people living in some of the most remote regions of Australia. Consequently, organisations such as a the RFDS play an important role in providing fly-in fly out and drive-in drive-out primary healthcare services to communities that are beyond normal medical infrastructure and where small populations spread across large geographical locations do not provide an adequate market to sustain services funded solely by the Medical Benefits Schedule.

In addition to primary healthcare services, communities in rural and remote Australia need access to other interventions and services to assist in managing their heart health. The current chapter presented several examples of models of care that address sub-types of heart, stroke and vascular disease. In particular, access to cardiac rehabilitation services would be beneficial to people who have experienced an acute heart, stroke or vascular disease event. Alternative modes of delivery of cardiac rehabilitation, including phone-based, home-based and online services could be implemented in rural and remote Australia, where on-the-ground services are not viable.[58]

Chapter 5. Conclusion and recommendations

5.1 Conclusion

Heart, stroke and vascular disease rates worsen by remoteness and socioeconomic status. RFDS aeromedical retrieval data mirrored the Australian Institute of Health and Welfare data for areas that have the highest prevalence of heart, stroke and vascular diseases. RFDS Service Planning and Operational Tool data showed that these communities have less access to healthcare services.

RFDS data demonstrated that the majority of patients retrieved from remote, rural and outer regional areas or facilities need to be taken to a major city for definitive care. The Northern part of Australia fares the worst for poor health across all heart, stroke and vascular diseases nationally, with mortality rates more than 10 times higher in some areas.

A higher proportion of Indigenous peoples, especially women, are retrieved for heart, stroke and vascular diseases than other Australians living in rural and remote areas. A higher proportion of Indigenous peoples live in the most remote areas of Australia with the least access to health care. The rates of rheumatic heart disease in Indigenous peoples demonstrates a huge gap in health equality in Indigenous peoples.

We currently partner with Primary Health Networks and Aboriginal Community Controlled Health Organisations to provide a comprehensive, coordinated and continuous service, but we want, and need, to do more. We are changing our policies to build a flexible and well-trained health workforce. We are upskilling our workforce to improve efficiency in services and investing in innovative technologies to improve patient outcomes.

5.2 Recommendations

Through the analysis of RFDS retrieval data as related to specific heart, stroke and vascular disease across rural and remote Australia, this report shines a light on where cardiac services are most needed, and based on this analysis, the RFDS makes the following recommendations and is committed to working with governments, communities, partners and other services to ensure the following:

1. Equitable access to comprehensive primary healthcare services in rural and remote areas, including specific cardiac care.

As identified in the RFDS *Best for the Bush: Rural and Remote Health Base Line 2022*[1] report, there must be equitable access to services, equitable use of services and equitable health outcomes for those in rural and remote areas as compared to other parts of Australia. This includes around cardiac care, noting in particular the increased risk factors, burden and impacts of heart, stroke and vascular diseases for rural and remote Australians, and the absence of services in many locations. Ultimately, prevention is key, while early detection and effective management of those with heart, stroke and vascular disease will save lives and reduce the need for emergency aeromedical retrievals and hospital admissions. Given the significantly higher rates across rural and remote Australia, particular attention must be given to preventing coronary heart disease and effective management to reduce the rates of heart attack. Those in rural and remote Australia must also have timely access to the best care possible; for example, ensuring those who suffer a stroke receive specialised care, as do those in metropolitan areas.

Ensuring adequate cardiac care in rural and remote Australia must include:

Primary prevention

Rural and remote populations have higher rates of modifiable risk factors contributing to heart, stroke and vascular disease. Primary healthcare providers can have a positive impact on patients making changes through counselling and advice, health checks and care plans, and programs such as smoking cessation and support to access dental services. People living in rural and remote areas should have equitable access to these services. For this to succeed, we need to raise the awareness of health checks among health professionals and the community, and provide rural health professionals with the resources, including funding and training, to support this activity – particularly as it relates to coronary heart disease. This is pertinent given we know that 64% of eligible patients between 45 and 74 years have not had a Heart Health Check.[66]

Secondary prevention

Those who have had an acute episode, or are living with a chronic heart, stroke and vascular disease require access to secondary prevention measures such as rehabilitation and chronic disease management. These services are often based in major city areas of Australia and are inaccessible to rural and remote Australians. Increased services should be delivered in rural and remote locations, and innovative outreach models of care, such as remote monitoring, hospital in the home, and phone-based, home-based and online cardiac rehabilitation services, should be supported to ensure accessibility. Further integration and efficiencies can be achieved by combining primary and secondary measures with community programs, which will allow services to target larger populations, increasing the benefits and making them cost effective.

Targeted prevention and management plans for the most at-risk populations and locations

The RFDS repeats the recommendation of the *Best for the Bush: Rural and Remote Health Base Line 2022*[1] report that comprehensive primary healthcare plans be developed for the most at-risk populations and locations. This should include for heart, stroke and vascular disease with initiatives based on evidence of the most effective prevention activities and interventions, paired with comprehensive monitoring and tracking. This should particularly include both Indigenous and non-Indigenous males. Findings in this report show that non-Indigenous Australians aged over 45 years and Indigenous peoples aged over 30 years in rural and remote Australia should receive additional intervention, information and prevention services addressing risk factors for heart, stroke and vascular diseases.

2. Supporting fit-for-purpose funding models and models of care for the prevention and management of heart, stroke and vascular diseases in rural and remote Australia.

To achieve access to comprehensive cardiac care in rural and remote Australia, additional resources are required to support targeted, innovative and fit-for-purpose services for rural and remote Australians. This report shows that innovative programs, such as the Integrated Cardiovascular Clinical Network and Australian Stroke Alliance, are available and successful. Supporting additional and expanded services models must include:

- Increased access to multidisciplinary teams that is relevant and appropriate to the needs of individual communities, through co-designed models of care that are culturally appropriate;
- Adequate resourcing, education and training of general practitioners in cardiac prevention and treatment, particularly where they lead primary healthcare teams;
- The use of telehealth, remote monitoring and digital approaches to supplement face-to-face services and increase access levels;
- Adequate and sustainable long-term funding models for the rural and remote context, which may include blended payments (e.g. Medicare Benefits Schedule, My Medicare), incentive payments and targeted initiatives;
- Coordinated service planning across different elements of the health system, and between the Commonwealth and state and territory governments, to ensure duplication and inefficiencies are avoided; and
- Additional and sustainable support for research and evaluation to ensure impact and effectiveness of interventions to ensure evidence-based outcomes that takes into account social and economic wellbeing.

3. Better data collection and integration

Work must be undertaken to better collect and coordinate data related to the incidence, treatment and outcomes associated with heart, stroke and vascular diseases in rural, and particularly remote Australia. This should include:

- Linkage of 'time-to-treatment' data, with a focus on heart disease and stroke through development of a national approach to collection and monitoring;
- Improvements in hospital transition of rural and remote patients back to community, including the provision of clear and culturally appropriate discharge plans, with a focus on post-discharge support planning;
- Improvements in discharge summary quality, provision of discharge summaries to rural and remote healthcare providers, and the sharing of patient medical records across professionals essential for rehabilitation and management;
- Costing avoidable hospitalisations for heart, stroke and vascular disease as a result of preventative primary healthcare services, to identify system savings through investment in primary healthcare services; and

Expanding clinical databases to improve data collection from rural and remote areas; for example, Australian Stroke Clinical Registry and cardiac rehabilitation registries.

These recommendations can be achieved through policy interventions, to enhance lasting cross-sector collaborations that address community health issues, deliver effective and integrated health, and incorporate social and environmental approaches.

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Appendix 1. Methodology for analysis of RFDS aeromedical retrieval data

Classifying diseases and related health problems

The RFDS uses the tenth edition of the *International Statistical Classification of Diseases and Related Health Conditions (ICD-10) Australian Modification (AM) (ICD-10-AM)* to code and classify health data. In the ICD-10-AM, diseases and injuries are classified under one of 22 chapter headings. Each chapter heading has a range of codes that denote specific illnesses and injuries. Heart, stroke and vascular diseases were coded under Chapter nine of the ICD-10-AM (Diseases of the Circulatory System). The sub-types of heart, stroke and vascular disease were assigned ICD-10-AM 3-item codes (I00-I99), as listed in Table A1.

RFDS data collection and coding

The RFDS records data for each aeromedical retrieval it conducts. De-identified data for all aeromedical retrievals for heart, stroke and vascular disease conducted between 1 January 2017 and 31 December 2021 were analysed for the report.

De-identified aeromedical retrieval data considered in this report include: retrieval date (day/month year); patient's age (aggregated by five-year age group); gender (male, female, unknown); Indigenous status (Indigenous, non-Indigenous, unknown); illness or injury associated with the retrieval (ICD-10-AM chapter code and three-item code (where known)); type of retrieval (primary evacuation, inter-hospital transfer, repatriation)[f]; priority (priority 1 – to be retrieved within one hour, priority 2 – to be retrieved within four hours, priority 3 – to be retrieved within 12 hours); and pick-up and drop-off location (nearest airstrip).

To supplement this data, we used data from the Australian Bureau of Statistics (ABS) National Health Survey, Australian Institute of Health and Welfare, and the Public Health Information Development Unit. This data reports prevalence by statistical area. We have used Statistical Areas Level 3 regions to provide a regional breakdown of Australia, which is the standard framework for ABS data. Statistical Areas Level 3 regions were designed to reflect regional identity and have both geographic and socioeconomic similarities.[65] Where possible, the Statistical Areas Level 3 region is used in conjunction with community/town name to provide more detail.

Population sizes in rural communities are much smaller than regional centres and cities. Reporting raw numbers for smaller populations can misrepresent the burden of disease. Where possible, we have reported the standardised mortality ratio. The standardised death ratio is a quantity, expressed as a ratio or percentage to quantify the increase or decrease in mortality. In this report a number greater than one indicates the ratio of the likelihood of death in a community compared to the national population of Australia.[66]

Data analyses

All data were analysed using IBM SPSS Statistics for Windows, Version 26.0 or Microsoft Excel 2016. All analyses used unweighted data. Data are reported as summary statistics, including the number (N) and proportion (per cent (%)) of patients in each category.

The initial analysis on total number of aeromedical retrievals included all retrievals, even if one variable was missing (e.g. age, Indigenous status, gender etc.), to provide an overall picture of aeromedical retrievals. All remaining analyses excluded cases where variables were missing and excluded analyses of repatriation flights.

f Unless defined, RFDS patient counts include primary evacuations and inter-hospital transfers.

Data limitations and exclusions

This dataset only includes patients who had a primary diagnosis of heart, stroke and vascular disease. Some of the data was not coded with an ICD-10 code or subheading and some demographic data is missing. Diagnosis is recorded based on the information the clinician has at the time and may be re-classified once further diagnostic tests have been carried out. When discussing demographics, only records that have definitive information have been included.

This report includes aeromedical data from RFDS and reports extensively on the communities that we serve.[g] Where available the report draws on non-aeromedical data, such as primary healthcare data across RFDS. Data from other aeromedical services have not been included in this report.

Retrieval numbers reported for each state do not represent the prevalence of disease. States and territories use aeromedical retrieval services to augment the health service and provide primary evacuations and inter-hospital transfers. The largest states – Queensland and Western Australia – transfer more patients by air between hospitals due to the distances they need to cover. Victoria and Tasmania have less aeromedical retrievals as road-based transport is better suited to their needs. RFDS provides repatriation flights, which is taking patients from the point of definitive care back to a facility closer to home. When reporting highest retrieval locations we have excluded the state capital cities to reflect the flights that are repatriating patients to lower care facilities.

g It should be noted that where gaps are apparent (for example in the Top End of the Northern Territory) this is not due to a lack of demand for these services – it is due to non-RFDS providers being contracted to supply these services.

Table A1: The International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM) for heart, stroke and vascular disease

ICD-10 Code	ICD-10 chapter subheading	Description/example
I00-I02	Acute rheumatic fever	7.47
I05-I09	Chronic rheumatic heart diseases	5.07
I10-I15	Hypertensive diseases	4.21
I20-I25	Ischaemic heart diseases	4.14
I26-I28	Pulmonary heart disease and diseases of pulmonary circulation	9.76
I30-I52	Other forms of heart disease	7.57
I60-I69	Cerebrovascular diseases	6.76
I70-I79	Diseases of arteries arterioles and capillaries	6.31
I80-I89	Diseases of veins, lymphatic vessels, and lymph nodes not elsewhere classified	2.25
I95-I99	Other and unspecified disorders of the circulatory system	1.99

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