



CARDIOVASCULAR HEALTH IN REMOTE AND RURAL COMMUNITIES

Lara Bishop, Andy Ransom, Martin Laverty



Acknowledgments

This report has been prepared by the Royal Flying Doctor Service (RFDS) Research and Policy Unit using data and evidence from multiple sources. Data were extrapolated from service information provided by RFDS Sections and Operations and analysed internally. The report has benefited from review by external reviewers and a number of RFDS staff. We are grateful for their assistance.

Published by
Royal Flying Doctor Service of Australia
Level 2, 10–12 Brisbane Avenue
Barton ACT 2600
Australia

ABN 74 438 059 643
Tel: (02) 6269 5500

Suggested citation: Bishop, L., Ransom, A., Lavery, M. (2018). Cardiovascular health in remote and rural communities. Canberra: Royal Flying Doctor Service of Australia.

© 2018 Royal Flying Doctor Service of Australia

About the Royal Flying Doctor Service (RFDS)

The RFDS is one of the largest and most comprehensive aeromedical organisations in the world. Using the latest in aviation, medical and communications technology, the RFDS delivers extensive primary health care (PHC) and 24-hour emergency service to those who live, work and travel throughout Australia.

Commitment to Indigenous Reconciliation

The RFDS has developed a [Reconciliation Action Plan](#) (RAP),¹ which commenced in 2016. The RAP proposes, among other things, to use research and policy to improve Indigenous health outcomes. RFDS research and policy reports include Indigenous data as part of a broader effort to improve health outcomes and access to health services for Indigenous Australians as a contribution to the 'Close the Gap' campaign.

Royal Flying Doctor Service Research and Policy Unit

In mid-2015, the RFDS established a Research and Policy Unit, located in Canberra. The Unit's role is to gather evidence about, and recommend solutions to, improving health outcomes and health service access for patients and communities cared for by RFDS programs. The Research and Policy Unit can be contacted by phone on (02) 6269 5500 or by email at enquiries@rfd.org.au.

Notes about this report

Use of the term 'Indigenous'

The term 'Aboriginal and Torres Strait Islander peoples' is preferred in RFDS publications when referring to the distinct Indigenous peoples of Australia. However, the term 'Indigenous Australians' is used interchangeably with 'Aboriginal and Torres Strait Islander peoples' in order to assist readability. The use of the term 'Indigenous' to describe Australia's Aboriginal and Torres Strait Islander peoples follows the Australian Institute of Health and Welfare's use of the term in their publication, *The health and welfare of Australia's Aboriginal and Torres Strait Islander peoples* (Australian Institute of Health and Welfare, 2015c).

Throughout this publication, the term 'Indigenous Australians' refers to all persons who identify as being of Aboriginal, Torres Strait Islander, or both Aboriginal and Torres Strait Islander origin.

Data limitations

Data in RFDS reports come from a number of different administrative datasets and surveys, all of which have limitations that should be considered when interpreting the results.

¹ The RFDS Reconciliation Action Plan can be viewed here: <https://www.flyingdoctor.org.au/first-australians/>

Contents

Acknowledgments.....	2
Commitment to Indigenous Reconciliation.....	3
Royal Flying Doctor Service Research and Policy Unit.....	3
Notes about this report.....	3
Tables.....	6
Figures.....	6
Abbreviations.....	7
1.0 Introduction and background.....	10
1.1 Purpose statement.....	11
2.0 About CVD.....	13
2.1 Classifying CVD.....	13
2.2 CVD risk factors.....	15
2.3 Social determinants of health and CVD.....	21
2.4 Summary.....	22
3.0 Prevalence of CVD.....	23
3.1 Worldwide CVD data.....	23
3.2 CVD in Australia.....	25
3.3 CVD in remote and rural Australia.....	27
3.4 CVD in Indigenous Australians.....	29
3.5 Summary.....	30
4.0 RFDS health services.....	31
4.1 RFDS PHC in remote and rural Australia.....	31
4.2 Other RFDS health services.....	32
4.3 CVD-specific health services provided by the RFDS.....	33
5.0 Aeromedical transport of Australians with CVD in remote and rural Australia.....	37
5.1 Aeromedical transport.....	37
5.2 RFDS tasking and transport process.....	38
5.3 RFDS data collection and coding.....	39
5.3.1 Classifying RFDS data.....	39
5.3.2 Data analyses.....	39
5.4 Results.....	40
5.4.1 Aeromedical transports for CVD by Indigenous status.....	41
5.4.2 Age-standardised and age-specific aeromedical transport rates.....	44
5.4.3 Demand for aeromedical transports.....	45
5.4.4 Demand for aeromedical transports for CVD by Australian state and territory.....	46
5.4.5 Aeromedical transports for CVDs by sub-chapter.....	48
5.5 Discussion.....	51
5.6 Future opportunities—RFDS data.....	52
5.7 Summary.....	55

6.0 Recommendations and conclusion	56
6.1 Prevention, early intervention and treatment of CVD.....	56
6.1.1 Remote and rural populations.....	60
6.1.2 Indigenous Australians.....	62
6.2 Actions to improve the cardiovascular health of people from remote and rural Australia.....	64
References	66

Tables

Table 2.1. ICD-10-AM Chapter 9—Diseases of the circulatory system	14
Table 2.2. Modifiable and non-modifiable CVD risk factors and their impact.....	16
Table 4.1. RFDS CVD services.....	33
Table 5.1. Demographic data for non-Indigenous and Indigenous Australians who underwent an aeromedical transport for CVD, July 2013–December 2016.....	41
Table 5.2. Aeromedical transports by Australian state and territory, July 2013–December 2016.....	47
Table 5.3. Aeromedical transports for CVD, by ICD-10-AM sub-chapter and 3-item code, July 2016–December 2016.....	49
Table 6.1. Examples of effective government, PHC and individual responses to modifiable CVD risk factors around prevention, early intervention and treatment of CVD, and their impact.....	57

Figures

Figure 3.1. Global map, age-standardised prevalence of CVD in 2015.....	23
Figure 3.2. Global map, age-standardised mortality rate of CVD in 2015.....	24
Figure 3.3. Prevalence of CVD in Australia, among persons aged 18 and over, by age and sex, 2014–15.....	25
Figure 3.4. Hospitalisations for CVD by diagnosis and sex, 2014–15.....	26
Figure 3.5. Heart-related hospital admissions by LGA, 2012–14.....	26
Figure 3.6. Death rates for CVD, CHD and cerebrovascular disease, 1950–2015.....	27
Figure 3.7. Prevalence of CVD by location and socioeconomic group, persons aged 18 or over, 2014–15.....	28
Figure 3.8. CVD burden (DALY) by age and disease, Indigenous Australians, 2011.....	29
Figure 3.9. Cardiovascular diseases burden (DALY) by disease, proportion for males and females, Indigenous Australians, 2011.....	30
Figure 4.1. RFDS clinic locations 2016–17.....	32
Figure 5.1. RFDS national aeromedical footprint.....	38
Figure 5.2. Gender of Australians, by age group, who underwent an aeromedical transport for CVD, July 2013–December 2016.....	41
Figure 5.3. Gender of non-Indigenous Australians, by age group, who underwent an aeromedical transport for CVD, July 2013–December 2016.....	42
Figure 5.4. Gender of Indigenous Australians, by age group, who underwent an aeromedical transport for CVD, July 2013–December 2016	43
Figure 5.5. Age-specific aeromedical transport rates by the RFDS for CVD, by Indigenous status, and ratio of Indigenous to non-Indigenous patients, July 2013–December 2016 (transports per 1,000 population).....	44
Figure 5.6. Spatial distribution of transports for CVD by non-Indigenous Australians, July 2013–June 2016.....	45
Figure 5.7. Spatial distribution of transports for CVD by Indigenous Australians, July 2013–June 2016.....	46
Figure 5.8. Aeromedical transports for CVD, by ICD-10-AM sub-chapter, July 2016–December 2016.....	48

Abbreviations

ABS	Australian Bureau of Statistics
ACCHO	Aboriginal Community Controlled Health Organisation
ACCHS	Aboriginal Community Controlled Health Service
AIHW	Australian Institute of Health and Welfare
ASGS	Australian Statistical Geography Standard
BMI	Body Mass Index
BP	blood pressure
CHD	coronary heart disease
COPD	chronic obstructive pulmonary disease
CKD	chronic kidney disease
CVD	cardiovascular disease
DALY	disability-adjusted life years
FH	familial hypercholesterolaemia
FTE	full-time equivalent
GP	general practitioner
HDL	high-density lipoprotein
HOPE-3	Heart Outcomes Prevention Evaluation-3
iCCNet	integrated Cardiovascular Clinical Network
ICD	International Statistical Classification of Diseases and Related Health Problems
ICD-10	International Statistical Classification of Diseases and Related Health Problems-10th Edition
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems-10th Edition-Australian Modification
IHD	ischaemic heart disease
LDL	low-density lipoprotein
LGA	Local Government Area
MI	myocardial infarction
NCD	non-communicable disease
NHS	National Health Survey
NOAC	novel anticoagulant therapy
NSW	New South Wales
NT	Northern Territory
PAR	population attributable risk
PHN	Primary Health Network
PHC	primary health care
Qld	Queensland
RAP	Reconciliation Action Plan
RFDS	Royal Flying Doctor Service
RR	relative risk
SEIFA	Socio-Economic Indexes for Areas
SES	socioeconomic status
SA	South Australia
Tas	Tasmania
TC	total cholesterol
Vic	Victoria
WA	Western Australia
WHO	World Health Organization
24/7	24-hour, seven-days-a-week

Executive summary

4.2 million Australian adults (22%) had cardiovascular disease (CVD) in 2014–15. In 2015–16, 556,638 Australians were hospitalised for CVD. It is the leading cause of mortality worldwide, and was responsible for 27.7% of all mortality in Australia in 2016. One person dies every 12 minutes from CVD in Australia.

Coronary heart disease (CHD) kills more Australians than any other disease. In 2013–14, people in remote and very remote areas were 1.6 times more likely to be hospitalised for CHD than people in major cities, and 1.3 times more likely than people in major cities to die from CHD.

CVD is largely preventable.

Smoking, high blood pressure, high cholesterol and triglyceride levels, poor diet, physical inactivity, obesity, harmful alcohol consumption and socioeconomic factors are all factors that increase a person's CVD risk. These factors are also able to be modified through interventions that lower CVD risk. Having type 2 diabetes or chronic kidney disease (CKD), diseases that are also largely preventable, are additional CVD risk factors.

Other factors cannot be modified: risk of CVD increases with age, males have a greater risk than pre-menopausal women, and familial hypercholesterolaemia contributes to overall risk.

Adults living in remote and rural communities, Indigenous Australians, adults living in the lowest socioeconomic areas, and people from culturally and linguistically diverse backgrounds are also at increased risk of CVD:

- > In 2014–15 rates of CVD were highest in inner regional areas (25%), followed by outer regional and remote areas (22%), and followed by major cities (21%);
- > Indigenous Australians were 1.7 times more likely than non-Indigenous Australians to die from CHD in 2016, and CVD occurred at much younger ages among non-Indigenous Australians;
- > Australians living in the lowest socioeconomic areas are more than twice as likely to have CHD, compared to those living in the highest socioeconomic areas. Educational attainment, an indicator of socioeconomic status, correlated with increased CVD risk in the '45 and Up' study. The study demonstrated that adults, aged 45–64 years, with no educational qualifications, were 1.62 times more likely to have a major CVD event and 2.31 times more likely to have a heart attack than those with a university education.

People living in remote and rural Australia are more exposed than city people to CVD risk behaviours; country people have higher rates of smoking, alcohol consumption, obesity, high blood pressure and low physical activity, as well as poorer diets, including lower levels of adequate fruit intake.

The Royal Flying Doctor Service (RFDS) provides primary health care and specific CVD prevention and management programs in hundreds of remote and rural communities. It also provides aeromedical transport of people from remote areas requiring definitive tertiary hospital care. Between July 2013 and December 2016, the RFDS conducted 95,723 aeromedical transports. Of these, 20,379 (21.3%) were for CVD, the most common reason for a transport.

This report provides analysis of RFDS aeromedical transport data for the period July 2013 to December 2016. This analysis revealed:

- > An average of **112 patients per week or 16 patients per day were transported for CVD;**
- > On average, per day, 10.1 (63%) were male and 5.9 (37%) were female, a ratio of 1.7 males for every female;
- > All age groups were represented; the mean age group was 55–59 years, more than one-third (35.3%) were aged 60–74 years, and 1% were children under the age of 5 years.

More than half (52.5%) of all CVD transports were for CHD. The two main CHDs that lead to a patient requiring an aeromedical transport were 'acute myocardial infarction' (heart attack) (38.9%) and 'angina pectoris' (angina) (9.4%). Almost one-quarter (22.2%) of CVD transports were for patients experiencing other forms of heart disease; the two main other forms of heart disease were 'heart failure' (4.6%) and 'atrial fibrillation and flutter' (4.0%).

This report's purpose is to detail the CVD burden on remote and rural Australia, and to propose action to ameliorate CVD impacts. Many CVD events are preventable. Increased investment in, and access to, evidence-based, culturally appropriate prevention and early intervention for people at increased risk of CVD, and those who have experienced a CVD event, is required.

Similarly, better treatment options for remote and rural Australians are also required. For example, between 2001 and 2008 the South Australian integrated Cardiovascular Clinical Network (iCCNet) established a support program for remote and rural primary care services to manage heart attacks by providing expert risk stratification, point-of-care troponin testing and cardiologist-supported decision making. The program's evaluation demonstrated a 22% improvement in 30-day survival rates for remote and rural patients, which closed the mortality disparity that had previously existed between city and country hospitals.

1.0 Introduction and background

The Royal Flying Doctor Service (RFDS) plays an important role in the provision of services to remote and rural² Australians with diseases of the circulatory system.³ Diseases of the circulatory system are also known as cardiovascular disease (CVD)⁴ and refer to diseases that affect the heart, arteries, veins and capillaries. Common types of CVD include coronary heart disease (CHD)⁵—also known as ischaemic heart disease (IHD), stroke, hypertensive disease, heart failure, cardiomyopathy, peripheral vascular disease, rheumatic heart disease and congenital heart disease (Australian Institute of Health and Welfare, 2017i; Department of Health, 2016).

In 2015–16, 556,638 Australians were hospitalised for CVD (Australian Institute of Health and Welfare, 2017a). Self-reported data established that around 4.2 million Australian adults (22%) experienced one or more CVDs in 2014–15 and that Australians living in inner regional areas (25%) and outer regional and remote areas (22%) demonstrated higher rates of CVD than people living in major cities (21%) (Department of Health, 2016).

CVDs accounted for 15% of the burden of disease in Australia in 2011 (Australian Institute of Health and Welfare, 2016c). Of all the CVDs, CHD is the most common in Australia and kills more people than any other disease (Department of Health, 2016). In 2013–14, people in remote and very remote areas were 1.6 times as likely as people in major cities to be hospitalised for CHD and 1.3 times as likely as people in major cities to die from CHD (Australian Institute of Health and Welfare, 2016a).

Between July 2013 and December 2016, the RFDS transported 20,379 patients from remote and rural Australia to receive definitive care⁶ for CVD—which was the main reason for an aeromedical transport by the RFDS. In addition to aeromedical transports for people with CVD, the RFDS provides primary health care (PHC) services, early intervention and prevention services, and chronic disease management services to people from remote and rural Australia with CVD.

The RFDS collects data on the services it provides, and the demographics of the population who receive these services. The current report presents detailed data on CVD amongst people from remote and rural Australia served by the RFDS.

This information will enable governments, policymakers and service delivery organisations to better target services for people from remote and rural Australia with CVD. Along with other data from remote and rural Australia, RFDS service data can be used to underpin the development of evidence-based solutions to improve long-term health outcomes for people from remote and rural Australia with CVD.

2 The term 'remote and rural' is used to encompass all areas outside Australia's major cities. This includes areas classified as inner regional (RA2), outer regional (RA3), remote (RA4) and very remote (RA5) under the Australian Statistical Geography Standard (ASGS). For more information on how the RFDS defines remote and rural Australia, go to <https://www.flyingdoctor.org.au/what-we-do/research/defining-rural-remote/>.

3 Diseases and injuries are classified under one of 22 chapter headings in the International Statistical Classification of Diseases and Related Health Problems (ICD). 'Diseases of the circulatory system' include all diseases described in Chapter 9 of the ICD.

4 The terms 'cardiovascular disease' (CVD) and 'diseases of the circulatory system' are used interchangeably throughout this report.

5 The terms 'chronic heart disease' (CHD) and 'ischaemic heart disease' (IHD) are used interchangeably throughout this report.

6 Definitive care: Care that is provided in a medical facility equipped to handle a patient with a serious illness or injury (<https://www.flyingdoctor.org.au/nswact/our-services/>).

Accordingly, the RFDS produced this research and policy paper to describe the impact of CVD on people from remote and rural Australia that access services provided by the RFDS. Detailed RFDS aeromedical transport data describing CVD is presented for the first time in the current report. The report presents both quantitative data about people from remote and rural Australia who are transported by the RFDS to receive medical care in a tertiary hospital for CVD, and descriptive and quantitative data around the other services provided to people with CVD by the RFDS. It presents key statistics describing international, national and remote and rural CVD. It considers options to address CVD, and provides the platform for discussions between service delivery organisations, researchers, policymakers, corporate and private sectors, and philanthropic organisations, to identify collaborative and innovative approaches to improving the health status of people from remote and rural Australia experiencing CVD.

To achieve this, the research and policy paper comprises six chapters. The current chapter introduces the report and describes the purpose of the report. Chapter two describes CVD, explores the risk factors for CVD, considers the impact of co-morbid health conditions on CVD, and considers the role of the social determinants of health in the development of CVD. Chapter three presents data on the prevalence of CVD throughout the world, within Australia, in remote and rural regions of Australia and amongst Aboriginal and Torres Strait Islander (Indigenous) Australians. Chapter four outlines the role of the RFDS in remote and rural Australia and describes the breadth of healthcare services it provides. It describes RFDS services provided to people with CVD through the RFDS PHC platform. Chapter five presents detailed RFDS aeromedical transport data for remote and rural Australians transported to a tertiary hospital to receive medical care for CVD, including data around the number of patients transported, their gender, Indigenous status, age and the state from which they were transported. Chapter six provides a summary of best practice principles for effective prevention, early intervention and treatment of Australians with current CVD, or at risk of a CVD event, and concludes the report. Evidence-based and emerging interventions are briefly reviewed.

1.1 Purpose statement

The RFDS provides health care, such as aeromedical transport, PHC services, telehealth,⁷ oral health services, and medical chests to around 300,000 Australians annually (Royal Flying Doctor Service of Australia, 2016). Clinical data around these services are routinely collected by the RFDS, but until recently, have not been publicly reported.

In mid-2015, the RFDS established a Research and Policy Unit, whose role is to gather evidence about, and recommend solutions to, improving health outcomes and health service access for patients and communities cared for by RFDS programs. The Unit is committed to giving voice to, and responding to, health outcome and clinical service needs of country Australians. An important method of communicating our findings is through the development and dissemination of research and policy reports, informed by RFDS clinical data, and other sourced evidence. The current research paper contributes to these aims by providing, for the first time, a consolidated description of the different ways CVD is managed within the RFDS. It describes the PHC services, and early intervention and prevention services the RFDS provides to remote and rural Australians to assist them in managing their heart health. It presents RFDS service data around aeromedical transport for CVD, also for the first time.

Reporting RFDS service data confers the additional benefit of providing a more comprehensive and complete picture of the heart health of people from remote and rural Australia. For example, RFDS CVD data may augment current data held by the Heart Foundation to facilitate more comprehensive mapping of cardiovascular events in remote and rural Australia. Consideration of RFDS data, along with other national data, can be used to inform the implementation of appropriate services in areas served by the RFDS.

⁷ The term 'telehealth' refers to telephone consultations between RFDS clinicians and other clinicians, first aiders or patients.

RFDS research and policy reports also include data describing Indigenous Australians as part of a broader effort to improve health outcomes and access to health services for Indigenous Australians as a contribution to the 'Close the Gap' campaign. The RFDS formalised this commitment through the development and implementation of its Reconciliation Action Plan (RAP),⁸ which was ratified in 2016. Given that around one-third of face-to-face RFDS PHC services, and more than one-quarter of aeromedical transports, are for Indigenous patients, this is vital (Centre for International Economics, 2015).

The RFDS holds a mature aeromedical transport database, which includes clinical information for CVD, and these quantitative data underpin the current report. Quantitative data on CVD services delivered through the RFDS's PHC platform are not currently consistent across all of the remote and rural areas serviced by the RFDS. Consequently, comprehensive quantitative PHC data are not presented in the current report. However, descriptive information around PHC services and quantitative and descriptive data around specific heart health programs delivered by PHC healthcare services to people from remote and rural Australia are presented.

The current paper was also developed for internal use, including to:

- a. Facilitate better targeting of the RFDS PHC programs;
- b. Facilitate service planning for future programs to support communities with high rates of CVD;
- c. Identify areas where the RFDS could implement targeted preventative strategies to reduce the impacts of CVD;
- d. Identify regions in remote and rural Australia where early intervention programs could be implemented by the RFDS, or by the RFDS in partnership with other organisations serving these areas;
- e. Review aeromedical transport data to identify where services are being delivered in accordance with best practice, where there are any gaps in service provision, and what, if any, improvements in service provision should be implemented; and
- f. Identify areas for improvement in the reporting and collection of CVD service data.

Finally, this research paper will serve as a platform for creating new, and strengthening existing, partnerships between the RFDS and other organisations, such as the Heart Foundation and the Aboriginal Community Controlled Health Organisations (ACCHOs), who are similarly committed to reducing CVDs and improving the heart health of the people from remote and rural Australia.

⁸ The RFDS Reconciliation Action Plan can be viewed here: https://www.flyingdoctor.org.au/assets/files/RN013_RAP_P1_low-res.pdf.

2.0 About CVD

CVD is the collective term used to describe many different conditions affecting the heart and blood vessels (Australian Institute of Health and Welfare, 2017b, p. 6). Common types of CVD include CHD, stroke, hypertensive disease, heart failure, cardiomyopathy, peripheral vascular disease, rheumatic heart disease and congenital heart disease (Australian Institute of Health and Welfare, 2017i; Department of Health, 2016). “The most common and serious forms of cardiovascular disease in Australia are coronary heart disease, stroke, and heart failure” (Australian Institute of Health and Welfare, 2017b, p. 6).

2.1 Classifying CVD

The RFDS uses the Australian Modification (AM) of the International Statistical Classification of Diseases and Related Health Problems (ICD-10-AM)⁹ (World Health Organization, 2016) to categorise diseases and injuries.

Diseases of the circulatory system, or CVDs, are coded under Chapter 9 of the ICD-10-AM, and are indicated by ICD-10-AM codes I00–I99 (Table 2.1). Table 2.1 also lists the 10 sub-chapter headings included in Chapter 9 of the ICD-10-AM, provides examples of specific illnesses coded under each sub-chapter, and describes the underlying processes causing these diseases.

⁹ ICD-10 is undergoing a review prior to the next release, which will remove cerebrovascular disease from circulatory disorders and assign it its own chapter heading.

Table 2.1. ICD-10-AM Chapter 9—Diseases of the circulatory system

Code range ¹	Categories ¹	Examples ¹	Underlying process
100-102	Acute rheumatic fever	Rheumatic fever without heart involvement, rheumatic fever with heart involvement	Caused by an autoimmune response to a bacterial Group A streptococcus infection. ¹¹ The acute episode can last for several weeks with significant joint pain, fevers and other symptoms. ¹¹
105-109	Chronic rheumatic heart diseases	Rheumatic mitral valve disease, rheumatic aortic valve disease	Damage to the valves of the heart caused by repeated episodes of acute rheumatic fever. ² Untreated, may cause heart failure—those affected are at risk of arrhythmias, stroke, endocarditis and complications of pregnancy. ² Almost exclusively found in Indigenous populations. ^{8,9} May require heart surgery. ²
110-115	Hypertensive diseases	Primary hypertension, hypertensive heart disease	Caused by elevated blood pressure. ³ Untreated or uncontrolled hypertensive diseases are associated with continuous increase in CVD risk and onset of vascular or renal damage. ³
120-125	Ischaemic heart diseases	Angina pectoris, ST elevation myocardial infarction and non-ST elevation myocardial infarction (i.e. heart attack), chronic CHD	Occurs when coronary arteries get narrower due to the build-up of fatty deposits/plaque (atherosclerosis). ⁴ Blood flow to the heart muscle is reduced. ⁴ Can lead to angina. ⁴ If untreated may result in a heart attack or death. ⁴
126-128	Pulmonary heart disease and diseases of pulmonary circulation	Pulmonary embolism	Describes altered structure and/or function of the right ventricle. ⁵ Occurs in association with abnormal respiratory function. ⁵ Untreated, can exacerbate left heart disease. ⁵ Can occur when blood clots form in the body (often the legs), dislodge, and move to the heart and lungs. ¹⁰
130-152	Other forms of heart disease	Acute pericarditis, acute myocarditis	An example is pericarditis. Occurs when the sac surrounding the heart becomes inflamed. ⁶ Most commonly caused by a viral infection. ⁶ Untreated, can lead to pericardial effusion, or death. ⁶
160-169	Cerebrovascular diseases	Cerebral infarction (stroke), nontraumatic subarachnoid haemorrhage	Disorders of the blood vessels supplying the brain or its covering membranes. ⁷ Cerebrovascular disease is often fatal—stroke is responsible for 75% of cerebrovascular disease deaths. ⁷
170-179	Diseases of arteries, arterioles and capillaries	Atherosclerosis, aortic aneurysm and dissection	There are a variety of underlying processes. For example, aortic aneurysms are caused from high blood pressure acting on weakened arteries, which forces the vessel to bulge. Risk of aneurysm is increased by smoking, uncontrolled hypertension, age >60, and being Caucasian. ¹²
180-189	Diseases of veins, lymphatic vessels and lymph nodes, not elsewhere classified	Phlebitis and thrombophlebitis, varicose veins of lower extremities	Thrombosis (or clot) in the deep veins results in obstructed blood flow return to the heart. There is a strong genetic link in recurring cases. ¹⁰
195-199	Other and unspecified disorders of the circulatory system	Hypotension	Multiple

Sources: ¹ICD10Data.com (Undated); ²Rheumatic Heart Disease Australia (2017b); ³National Heart Foundation of Australia (2016); ⁴Heart Foundation (2017); ⁵Forfia, Vaidya, and Wiegers (2013); ⁶National Heart Lung and Blood Institute (2012); ⁷Australian Institute of Health and Welfare (2017b); ⁸Colquhoun, Condon, Steer, Li, Guthridge, and Carapetis (2015); ⁹He, Condon, You, Zhao, and Burrow (2015); ¹⁰World Health Organization (2017b); ¹¹Rheumatic Heart Disease Australia (2017a); ¹²Aggarwal, Qamar, Sharma, and Sharma (2011).

¹⁰ Atherosclerosis occurs when plaque—made up of fat, cholesterol, calcium and other substances found in the blood—builds up inside arteries (National Heart Lung and Blood Institute, 2016). Over time, the plaque hardens and narrows the arteries limiting the flow of oxygen-rich blood to organs and other parts of the body, which may result in a heart attack, stroke, or death (National Heart Lung and Blood Institute, 2016).

While the CVD process is chronic, when unmanaged or undiagnosed, it can culminate in an acute event, requiring immediate treatment (World Health Organization, 2017b).

Notably, there are a number of risk factors for CVD, some of which are modifiable and some of which are non-modifiable.

2.2 CVD risk factors

Modifiable risk factors describe the risk factors that can be changed, while non-modifiable risk factors cannot be changed (Australian Institute of Health and Welfare, 2014b).

Importantly, CVD “is largely preventable, and many of its risk factors can be modified. Controlling risk factors for cardiovascular disease can result in large health gains in the population. It reduces the risk of onset of disease, the progression of disease, and the development of complications in those people with established disease” (Australian Institute of Health and Welfare, 2017b, p. 1).

In order to reduce the impact of CVD, it is first necessary to understand both the modifiable and non-modifiable risk factors. These are listed and described in Table 2.2.

Table 2.2. Modifiable and non-modifiable CVD risk factors and their impact

Contributing factor	Impact on CVD	Evidence
Modifiable CVD risk factors		
Smoking status	<ul style="list-style-type: none"> > Tobacco smoking is associated with an increased risk of CVD¹ > Damages blood vessels supplying the heart, reduces amount of oxygen in the blood^{2,3,4} 	<ul style="list-style-type: none"> > In 2016 in Australia: <ul style="list-style-type: none"> – 20.7% of adults in remote/very remote areas were daily smokers, compared to 10.6% in major cities¹⁷ > In 2014–15^c in Australia: <ul style="list-style-type: none"> – 14.5% of adults were daily smokers¹ – Rates of daily smoking were higher in outer regional/remote areas of Australia (20.9%), compared with inner regional areas (16.7%) and major cities (13.0%)¹ > Smoking causes about 10% of CVD worldwide⁴
Blood pressure (BP)	<ul style="list-style-type: none"> > Elevated BP (systolic/diastolic blood pressure \geq 140/90 mmHg) is associated with an increased risk of CVD⁶ including CHD and ischaemic and haemorrhagic stroke⁸ 	<ul style="list-style-type: none"> > In 2016 in Australia: <ul style="list-style-type: none"> – Adults living in regional areas (33.9%) were more likely to have high BP than people in major cities (32.0%)¹⁶ > In 2014–15 in Australia: <ul style="list-style-type: none"> – 23.0% of adults had high BP¹
Serum lipids (cholesterol^a and triglycerides^b)	<ul style="list-style-type: none"> > Hypercholesterolaemia (high cholesterol) (total cholesterol (TC) \geq 5.5 mmol/L) is associated with increased risk of CVD¹ > A high level of triglycerides is associated with an increased risk of CVD¹⁵ and of having a heart attack¹⁴ 	<ul style="list-style-type: none"> > In 2011–12 in Australia: <ul style="list-style-type: none"> – 32.8% of adults (5.6 million people) had abnormal or high TC levels according to their blood test results¹ > An Australian study, which estimated fifteen-year mortality data in 8,662 adults, demonstrated that high-density lipoprotein (HDL), also known as ‘good cholesterol’ and the TC:HDL ratio, together with smoking status and systolic BP, were significant predictors of CVD mortality⁶ > A meta-analysis demonstrated that an increase in plasma triglyceride levels was associated with an increase in CVD risk—after controlling for HDL and other risk factors, a 1 mmol/l increase in triglyceride levels was associated with a 14% increased risk of CVD in men and a 37% increased risk in women¹⁵
Overweight and obesity: Includes waist circumference and Body Mass Index (BMI)	<ul style="list-style-type: none"> > Overweight (defined as BMI within the range 25.0–29.9 kg/m²) and obese (BMI \geq 30kg/m²) adults are at increased risk of CVD^{4,6} > Obesity is associated with some of the major risk factors for CVD, such as hypertension and low concentrations of HDL cholesterol¹⁴ > A waist measurement of 94 cm or more for men or 80 cm or more for women indicates that a person is at increased risk of developing chronic disease, including CVD¹ 	<ul style="list-style-type: none"> > In 2014–15 in Australia: <ul style="list-style-type: none"> – 63.4% of Australian adults were overweight or obese¹ – Rates of overweight and obesity were higher in outer regional/remote areas (69.2%) compared with major cities (61.1%)¹ – The average waist measurement for men aged 18 years and over was 97.5 cm, while for women of the same age it was 87.5 cm¹ – People in outer regional/remote areas were more likely to have ‘increased risk’ waist measurements than people living in major cities¹

Contributing factor	Impact on CVD	Evidence
Diet	<ul style="list-style-type: none"> > Poor nutrition, including the consumption of foods that are high in fat, sugar and salt, and insufficient consumption of fruit and vegetables, may increase risk of CVD^{4,5} 	<ul style="list-style-type: none"> > In 2014–15 in Australia: <ul style="list-style-type: none"> – 49.8% of all adults met the Australian Dietary Guidelines for recommended daily serves of fruit and 7.0% met the guidelines for serves of vegetables¹ – 5.1% of adults met both guidelines¹ – People in remote and rural areas (51.2%) demonstrated slightly higher levels of inadequate fruit intake compared to people in major cities (50.0%)¹ – People in major cities (93.4%) demonstrated higher levels of inadequate vegetable intake compared to people in remote and rural areas (89.3%)¹
Physical activity	<ul style="list-style-type: none"> > Insufficient exercise or physical inactivity is associated with an increased risk of ill health and death, particularly relating to CVD⁶ 	<ul style="list-style-type: none"> > In 2014–15 in Australia: <ul style="list-style-type: none"> – 29.7% of 18–64-year-olds were insufficiently active (less than 150 minutes in the last week)¹ – 14.8% of 18–64-year-olds were inactive (no exercise in the last week)¹ – 72.4% of people in remote and regional areas were sedentary or participated in low levels of exercise compared to 64.3% of people in major cities¹
Alcohol intake	<ul style="list-style-type: none"> > Harmful levels of alcohol consumption are associated with an increased risk of developing CVD⁴ 	<ul style="list-style-type: none"> > In 2016 in Australia: <ul style="list-style-type: none"> – 25.9% of people in remote/very remote areas were risky drinkers (lifetime) compared to 15.4% in major cities¹⁷ – 36.7% of people in remote/very remote areas were risky drinkers (single occasion, at least monthly) drinkers compared to 24.2% in major cities¹⁷ > In 2014–15 in Australia: <ul style="list-style-type: none"> – 17.4% of adults aged 18 years and over consumed more than two standard drinks per day, exceeding the lifetime risk guideline¹
Non-modifiable risk factors		
Age	<ul style="list-style-type: none"> > Risk of all CVDs increases with age^{3,2} 	<ul style="list-style-type: none"> > Males aged 45 or older and females aged 55 or older are more likely to have a heart attack than younger males and females² > Risk of stroke doubles every decade after age 55² > In 2016 in Australia: <ul style="list-style-type: none"> – CHD was the leading cause of CVD death, accounting for 12.0% of all deaths—people who died from CHD in 2016 had a median age at death of 85.1 years¹⁸ > In 2014–15 in Australia: <ul style="list-style-type: none"> – One-third (30.7%) of all Australians aged 75 years and over had heart disease¹

Contributing factor	Impact on CVD	Evidence
Sex	<ul style="list-style-type: none"> > Males have a greater risk of heart disease than pre-menopausal women² > For females, risk increases after menopause and becomes equal to that of a male² 	<ul style="list-style-type: none"> > In 2016 in Australia: <ul style="list-style-type: none"> — Males were 1.4 times as likely as females to die from CVD¹⁸ > In 2014–15 in Australia: <ul style="list-style-type: none"> — 17.9% of males^{24,1} and 18.6% of females had CVD^{25,1}
Family history of premature CVD (father < 55 years, mother < 65 years)	<ul style="list-style-type: none"> > Family history of CVD influences future CVD risk, and is influenced by the number and age of affected first-degree relatives⁹ 	<ul style="list-style-type: none"> > Siblings of people with CVD have a 40% increased risk of CVD⁹ > Children of parents with premature CVD have a 60% to 75% increased risk of CVD⁹ > People with a family history of premature CVD have a relative risk increase of developing CVD that is similar to that of smoking¹⁰
Social history including: Cultural identity, ethnicity and socioeconomic status (SES)	<ul style="list-style-type: none"> > Indigenous Australians, adults living in remote and rural communities, adults living in the lowest SES areas, and people from culturally and linguistically diverse backgrounds are at increased risk of CVD¹¹ 	<ul style="list-style-type: none"> > Australians living in the lowest SES areas are more than twice as likely to have CHD compared to those living in the highest SES areas^{2,13} > Indigenous Australians were 1.7 times as likely as non-Indigenous Australians to die from CHD in 2016¹⁸ > In 2014–15 in Australia: <ul style="list-style-type: none"> — Rates of CVD were highest in inner regional areas (25%), followed by outer regional and remote (22%), and major cities (21%)¹⁹
Examples of related conditions		
Diabetes	<ul style="list-style-type: none"> > Diabetes is a major risk factor and trigger for CVD⁴ > Uncontrolled diabetes increases a person's risk of having a heart attack¹⁴ 	<ul style="list-style-type: none"> > People with diabetes are between two and four times more likely to develop CVD.² This occurs because several of the risk factors for CVD also occur more frequently in people with diabetes² > People who control their blood sugar can reduce their risk of having a CVD event by 42% and their risk of heart attack, stroke, or death from CVD by 57%²
Chronic kidney disease (CKD)	<ul style="list-style-type: none"> > People with moderate or severe CKD (defined as persistent proteinuria or eGFR < 45 mL/min/1.73 m²) have an increased risk of developing CVD⁶ 	<ul style="list-style-type: none"> > People with CKD are up to 20 times more likely to die from a heart attack or stroke than they are to receive dialysis²⁶ > CVD is the leading cause of death for people on dialysis and for people who have a transplanted kidney²⁶
Familial hypercholesterolaemia (FH) (high cholesterol)	<ul style="list-style-type: none"> > FH is a genetic (inherited) disorder resulting in impaired removal of cholesterol from the blood, causing high blood cholesterol levels and early CHD^{6,7} 	<ul style="list-style-type: none"> > There is around a 50% chance that the faulty gene responsible for FH will be passed on to the children of people who have FH⁷ > Approximately one in 250 Australians is affected by FH⁷

Contributing factor	Impact on CVD	Evidence
Mental health	<ul style="list-style-type: none"> > Harmful stress is associated with CVD⁴ > Anxiety, depression and CHD often occur together²⁰ > Depression can be as big a risk factor for CHD as smoking, high cholesterol and high blood pressure²¹ 	<ul style="list-style-type: none"> > People with depression and CVD have a reduced life expectancy⁴ > A 2006 meta-analysis of 21 studies found that people with depression, but no current CHD, had an elevated risk of 1.6 for a later CHD event²² > A worldwide study (INTERHEART) of patients who had experienced a heart attack, found that perceived stress and depression were important risk factors for CHD.^{23,20} Together, they accounted for 32.5% of the population attributable risk (PAR) for CHD, suggesting that together they were as important as smoking and more important than diabetes (PAR, 9.9%) and hypertension (PAR, 17.9%) as risk factors for CHD^{23,20}

Notes: ^a Cholesterol is a type of fat that circulates in the blood and is required for many metabolic processes (Australian Bureau of Statistics, 2015). There are two types of cholesterol that are used to calculate an individual's total cholesterol (TC)—high-density lipoprotein (HDL) cholesterol or 'good cholesterol' and low-density lipoprotein (LDL) cholesterol or 'bad cholesterol' (National Vascular Disease Prevention Alliance, 2012b). High cholesterol can result in fatty deposits building up in the blood vessels (atherosclerosis), making it harder for blood to flow and increasing the risk of heart attack or stroke (Australian Bureau of Statistics, 2015).

^b Triglycerides are a type of blood fat related to diet (Mayo Clinic, 2017).

^c Data from the 2014–15 National Health Survey (NHS) is included in the current publication. The NHS is the most recent in a series of Australia-wide health surveys conducted by the Australian Bureau of Statistics (Australian Bureau of Statistics, 2015). The survey was based on self-assessed health status, which reflects a person's perception of his or her own health at a given point in time (Australian Bureau of Statistics, 2015).

Sources: ¹Australian Bureau of Statistics (2015); ²Heart Foundation (2017e); ³Mayo Clinic (2017); ⁴World Health Organization (2017c); ⁵World Health Organization (2017b); ⁶National Vascular Disease Prevention Alliance (2012b); ⁷Heart Foundation (2015); ⁸World Health Organization (2017d); ⁹Kolber and Scrimshaw (2014); ¹⁰Hippisley-Cox, Coupland, Robson, and Brindle (2010); ¹¹Dunbar, Duggan, Fetherston, Knight, McNamara, Banks, Booth, Bunker Burgess, Colagiuri, Dawda, Ford, Greenland, Grenfell, Knight, and Moran (2017a); ¹²Australian Institute of Health and Welfare (2016a); ¹³Tideman, Taylor, Janus, Philpot, Clark, Peach, Laatikainen, Vartiainen, Trimacco, Montgomerie, Grant, Versace, and Dunbar (2013); ¹⁴Mayo Clinic (2017); ¹⁵Hokanson and Austin (1996); ¹⁶Heart Foundation (2017g); ¹⁷Australian Institute of Health and Welfare (2017g); ¹⁸Australian Bureau of Statistics (2017); ¹⁹Australian Institute of Health and Welfare (2017c); ²⁰Colquhoun, Bunker, Clarke, Glozier, Hare, Hickie, Tatoulis, Thompson, Toifer, Wilson, and Branagan (2013); ²¹beyondblue (2014); ²²Nicholson, Kuper, and Hemingway (2006); ²³Yusuf, Hawken, Ounpuu, Dans, Avezum, Lanas, McQueen, Budaj, Pais, Vavrigos, and Lisheng (2004); ²⁴Australian Institute of Health and Welfare (2017e); ²⁵Australian Institute of Health and Welfare (2017d); ²⁶Kidney Health Australia (2016)

The evidence presented in Table 2.2 suggests that Australians residing in remote and rural areas are more likely than Australians living in major cities to engage in high-risk behaviours associated with modifiable risk factors. Compared to Australians in major cities, people from remote and rural Australia have:

- > Higher rates of daily smoking and risky alcohol consumption;
- > Higher rates of overweight or obesity and 'increased risk' waist measurements;
- > Higher rates of high blood pressure;
- > Lower rates of physical activity; and
- > Poorer diet, including lower levels of adequate fruit intake.

Several of the risk factors for CVD are also risk factors for other diseases (Australian Institute of Health and Welfare, 2015b). People with CVD often have co-morbid diseases. Co-morbidity occurs when the primary disease exists concurrently with one or more additional diseases, resulting in worse health outcomes (Australian Institute of Health and Welfare, 2015a). The presence of multiple health risk factors increases the likelihood of developing a chronic disease, like CVD, and each risk factor may exacerbate other diseases (Australian Institute of Health and Welfare, 2015b). For example, data from 2014–15 demonstrated that people who nominated CVD as their primary chronic disease also had arthritis (40.6%), back problems (27.5%), mental or behavioural problems (25.6%), diabetes mellitus (17.7%), asthma (13.3%), chronic obstructive pulmonary disease (COPD), and/or cancer (4.5%) (Australian Bureau of Statistics, 2015). Of those who nominated diabetes as their primary chronic disease, 62.9% also had CVD, and of those who nominated COPD as their primary chronic disease, 48.9% also had CVD (Australian Bureau of Statistics, 2015).

Previously, an individual's likelihood of developing CVD was measured by reviewing individual risk factors (National Vascular Disease Prevention Alliance, 2012b). However, there is now good evidence that risk factors are additive in increasing a person's overall likelihood of developing CVD, and that they should be assessed together to determine absolute risk (National Vascular Disease Prevention Alliance, 2012b). In order to assess risk factors together, the National Vascular Disease Prevention Alliance developed the Australian Absolute Cardiovascular Disease Calculator (National Vascular Disease Prevention Alliance, 2012a). The Australian Absolute Cardiovascular Disease Calculator enables clinicians to calculate whether an individual has a low (< 10%), medium (10–15%) or high (> 15%) likelihood of experiencing a CVD event in the next five years (National Vascular Disease Prevention Alliance, 2012b). Assessment of CVD risk "on the basis of the combined effect of risk factors (absolute CVD risk) is more accurate than the use of individual risk factors, because the cumulative effects of risk factors may be additive" (National Vascular Disease Prevention Alliance, 2012b, p. 18). The updated Guidelines for the Assessment of Absolute Cardiovascular Disease Risk (National Vascular Disease Prevention Alliance, 2012b), which build on earlier guidelines (National Vascular Disease Prevention Alliance, 2009), support the use of the calculator and provide guidance on the management of CVD risk in a primary prevention setting in all adults over 45 years of age (or 35 years for Indigenous Australians) (National Vascular Disease Prevention Alliance, 2012b).

In addition to the CVD risk factors already identified, there are a number of social determinants of health that are likely to contribute to the poorer CVD health of people from remote and rural Australia.

2.3 Social determinants of health and CVD

The social determinants of health are the conditions in which people are born, grow, live, work, and age, and these are shaped by the distribution of money, power, and resources at global, national, and local levels (World Health Organization, 2015). There are many social determinants including social, economic, environmental, political, behavioural, and biological factors, and cultural perceptions (Smith, 2016). Examples of these social determinants include SES, access to education, access to health care, employment status, income, access to affordable housing, stress, age, race, Indigenous status, transport availability, and disability (World Health Organization, 2015).

In general, people in remote and rural areas have:

- > Lower educational achievement;
- > Lower employment prospects and incomes;
- > Higher rates of inadequate housing;
- > Higher occupational risks and hazards, including physical risks and workplace pressures;
- > The need for more long-distance travel;
- > Lack of access to fresh foods; and
- > Less accessible health services (Garvan Research Foundation, 2015).

For example, data from the '45 and Up Study' demonstrated that the incidence of CVD increased with decreasing education among people aged 45–64 years (Korda, Soga, Joshy, Calabria, Attia, Wong, & Banks, 2016). People aged 45–64 years with no educational qualifications, were 1.62 times as likely to have a major CVD primary event, 2.31 times as likely to have a heart attack and 1.48 times as likely to have a stroke, than those with a university education (Korda et al., 2016).

Indigenous Australians experience additional, unique social determinants, which relate to the loss of language and connection to the land; environmental deprivation; spiritual, emotional, and mental disconnectedness; lack of cultural respect; lack of opportunities for self-determination; poor educational achievement; reduced opportunities for employment; poor housing; and negative interactions with government systems (King, Smith, & Gracey, 2009; Osborne, Baum, & Brown, 2013).

High levels of social disadvantage and income inequality are evident in many remote and rural areas (Centre for International Economics, 2015). The Socio-Economic Indexes for Areas (SEIFA) ranks areas in Australia according to relative socioeconomic advantage and disadvantage (Australian Bureau of Statistics, 2013b). A large proportion of remote areas have a low SEIFA ranking (Centre for International Economics, 2015). The lower the score, the higher the disadvantage. Recent research has confirmed that people residing in capital cities are more likely to be in the top 20% of income earners, while those outside capital cities are more likely to be in the bottom 20% of income earners (Australian Council of Social Service, 2015). Around 39% of people living in remote areas have low SES, compared to 24% in regional areas and 17% in major cities (Garvan Research Foundation, 2015). This means that in addition to the practical difficulties associated with living in remote and rural locations, a large proportion of people living in remote and rural Australia are also some of Australia's most socioeconomically disadvantaged.

Understanding the impact of socioeconomic factors is crucial in light of recent research suggesting that socioeconomic factors account for 40% of all influences on health, rather than clinical care (20%), which has traditionally been identified as the major influence on health (British Academy, 2014). Other factors, including health behaviours (30%) and the physical environment (10%), also impact on health (British Academy, 2014).

It has been suggested that the “influence of a broad range of social determinants (e.g., quality of housing, employment, income level, education, etc) on biological determinants of CVD, as well as differential access to health-promoting services may explain a significant part of the rural/regional–urban divide in CVD mortality in Australia” (Tideman et al., 2013, p. 7). Recent research that focused on the Australian setting identified socioeconomic factors, distance from health facilities and Aboriginal and Torres Strait Islander ethnicity as strongly impacting CVD risk (Australian Institute of Health and Welfare, 2017f; Falster, Randall, Lujic, Ivers, Leyland, & Jorm, 2013). In addition, those living rurally or remotely, have a worse risk factor profile, and higher rates of hospitalisation and mortality due to CVD (Allenby, Kinsman, Tham, Symons, Jones, & Campbell, 2016; Australian Bureau of Statistics, 2015). In many cases, remote and rural patients, who are at highest risk of CVD, have not had their risk factors identified or managed correctly (Kinsman, Tham, Symons, Jones, Campbell, & Allenby, 2016). People from remote and rural Australia are also impacted by reduced access to cardiac specialists and less surgical interventions (Tideman, Tirimacco, Senior, Setchell, Huynh, Tavella, Aylward, & Chew, 2014). Poor access to effective, culturally appropriate health care may also be a factor in the increased burden of CVD borne by the Indigenous community (Hart, Moore, & Laverty, 2017).

2.4 Summary

In summary, there are many risk factors and social determinants of health that impact on an individual’s likelihood of developing CVD. Although it is difficult to quantify the exact contributions from biological and behavioural risk factors, social and economic determinants, access to quality care, and broader influences on CVD health outcomes (Tideman et al., 2013), it is clear that multiple factors impact the incidence and prevalence of CVD.

3.0 Prevalence of CVD

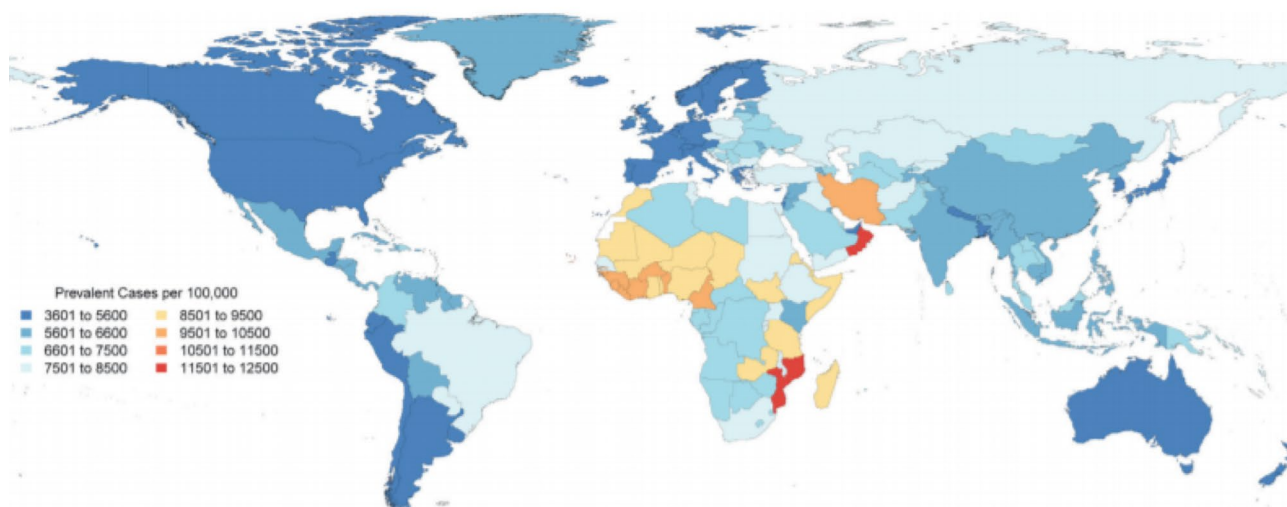
The current chapter presents data on prevalence and death rates from CVD throughout the world, within Australia, in remote and rural Australia, and for Indigenous Australians. It also considers the potential drivers of city country disparities in CVD prevalence and deaths in Australia.

3.1 Worldwide CVD data

CVD is the leading cause of mortality worldwide (World Health Organization, 2017b). Around 17.7 million people died from CVD in 2015, representing 31% of all global deaths (World Health Organization, 2017b). The majority of these deaths were the result of CHD (7.4 million) and stroke (6.7 million) (World Health Organization, 2017b).

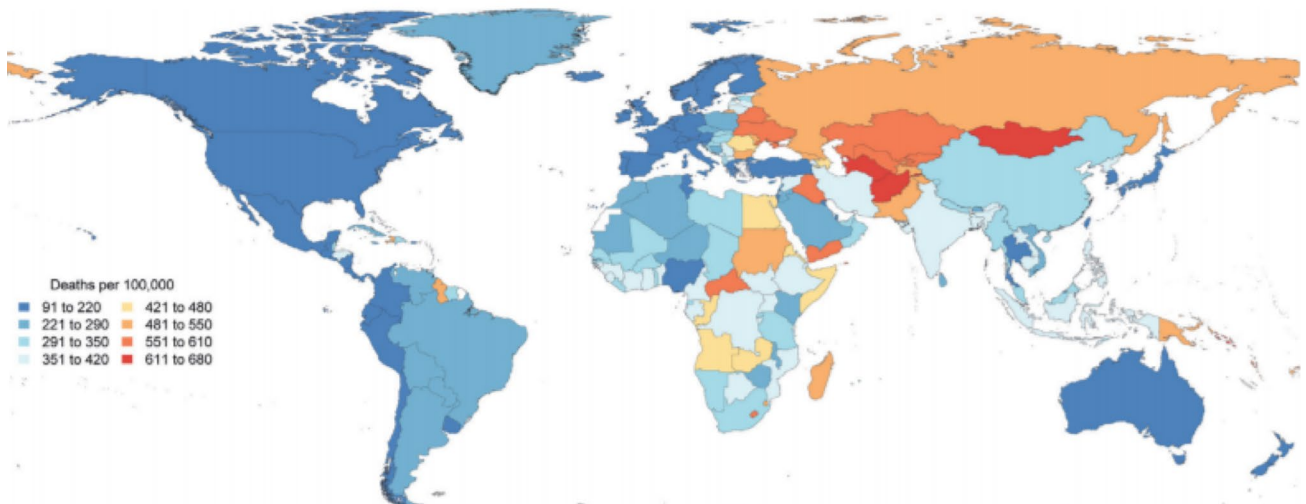
In 2015, both the age-standardised prevalence of CVD, and age-standardised mortality rate of CVD varied significantly by country (Figures 3.1 and 3.2). Generally, high-income countries demonstrated lower age-standardised prevalence and deaths from CVD compared to middle- and low-income countries.

Figure 3.1. Global map, age-standardised prevalence of CVD in 2015



Source: Roth et al. (2017, p. 10).

Figure 3.2. Global map, age-standardised mortality rate of CVD in 2015



Source: Roth et al. (2017, p. 11)

Burden of disease studies demonstrate the existence of health inequalities for CVD. Burden of disease, expressed as disability-adjusted life years (DALY)¹¹ “is a measure of the health impact of disease on a population in a given year both from dying from, and living with, disease and injuries” (Australian Institute of Health and Welfare, 2016c). CVD is the leading cause of non-communicable disease, morbidity and mortality in low- to middle-income countries and places the largest burden on populations within these countries—much of the burden from CVDs in these countries are in people under the age of 70 years (Yeates, Lohfeld, Sleeth, Morales, Rajkotia, & Ogedegbe, 2015). The global burden of CVD is expected to increase in these countries in the future, despite robust evidence regarding effective strategies to address the modifiable risk factors of CVD (World Health Organization, 2017a). This rise is likely to be driven by inequities in access to protection, increased exposure to risk factors, and poorer access to care (World Health Organization, 2017a).

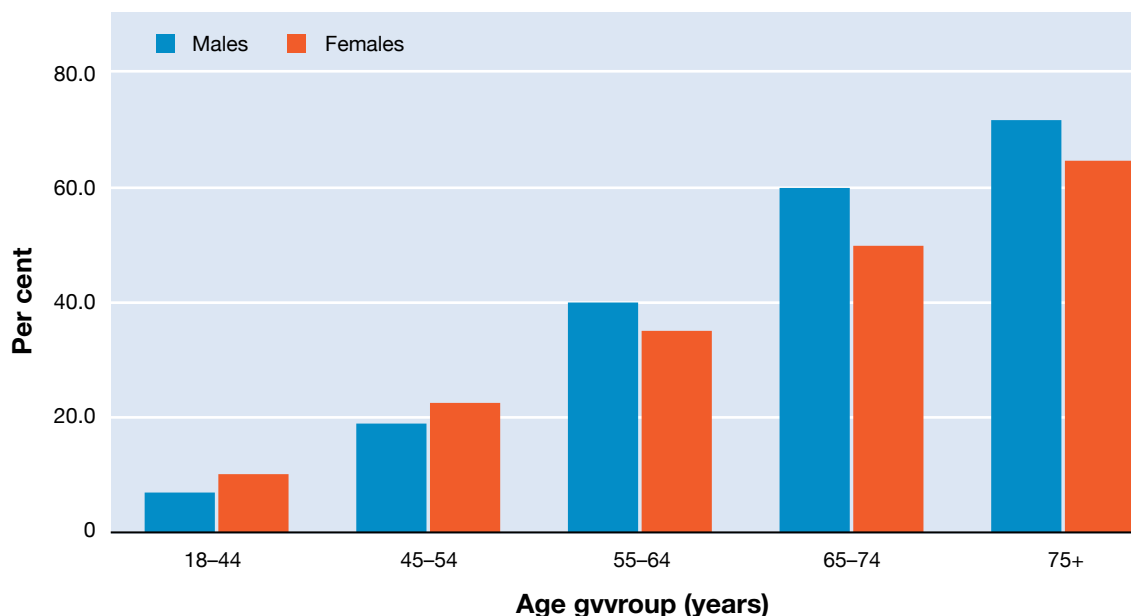
Conversely, CVD deaths have been declining in high-income countries as a result of improved risk factor management (Roth, Forouzanfar, Moran, Barber, Nguyen, Feigin, Naghavi, Mensah, & Murray, 2015). Combining medical screening for ‘at risk’ people with appropriate treatment, and reduced exposure to risk factors, has resulted in lower rates of mortality and morbidity (Roth et al., 2015).

¹¹ The DALY is a health metric that expresses years of life lost to premature death and years lived with a disability of known severity and duration—one DALY represents one lost year of healthy life (Murray & Lopez, 1996).

3.2 CVD in Australia

An estimated 4.2 million (22%) Australian adults had one or more CVD in 2014–15 (Australian Institute of Health and Welfare, 2016d, p. 1) (Figure 3.3). The prevalence was similar for males and females and increased with age (Australian Institute of Health and Welfare, 2016d).

Figure 3.3. Prevalence of CVD in Australia, among persons aged 18 and over, by age and sex, 2014–15

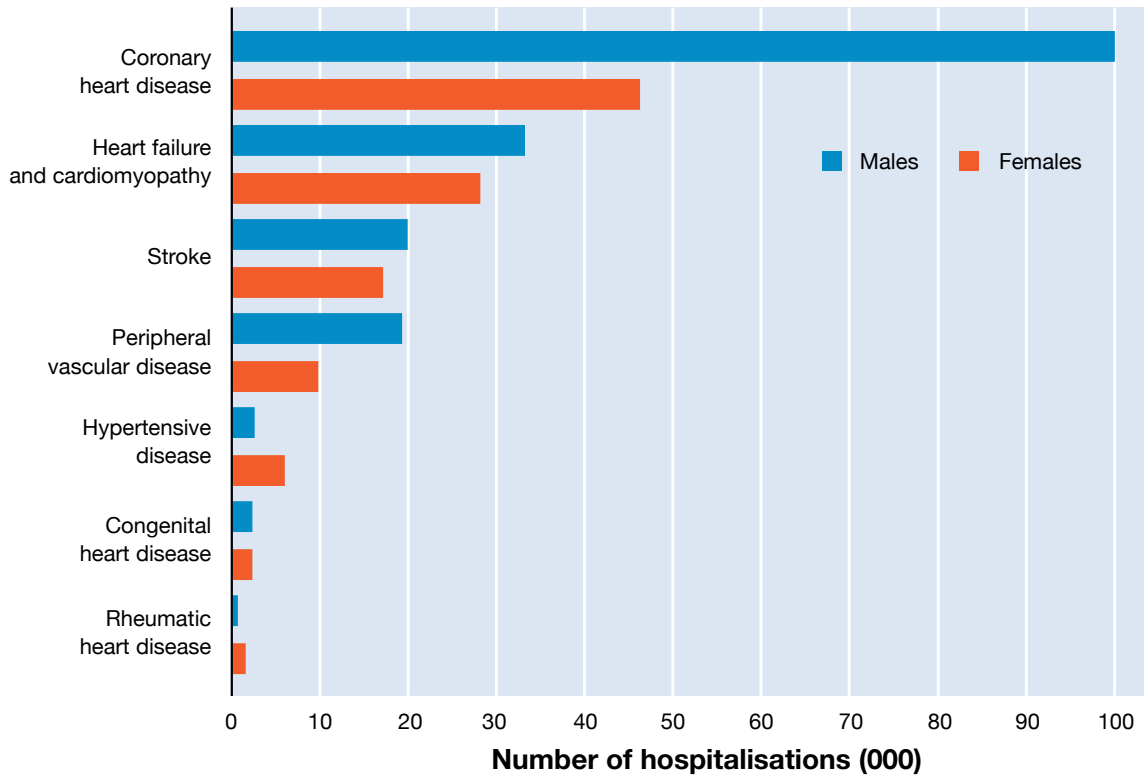


Note: Based on self-reported data.

Source: Australian Institute of Health and Welfare (2016d).

In 2014–15, males and females admitted to hospital for CVD were most likely to be admitted for CHD, heart failure and cardiomyopathy, and stroke (Figure 3.4). Males were twice as likely as females to be admitted to hospital for CHD and peripheral vascular disease. The number of people admitted to hospital for CVD in 2012–14 varied by geographical location (local government area (LGA)) (Figure 3.5). Hospitalisation rates varied from less than 38 people per 10,000 population to more than 66 people per 10,000 population (Heart Foundation, 2017b). Hospitalisation rates were higher for people living outside of major cities.

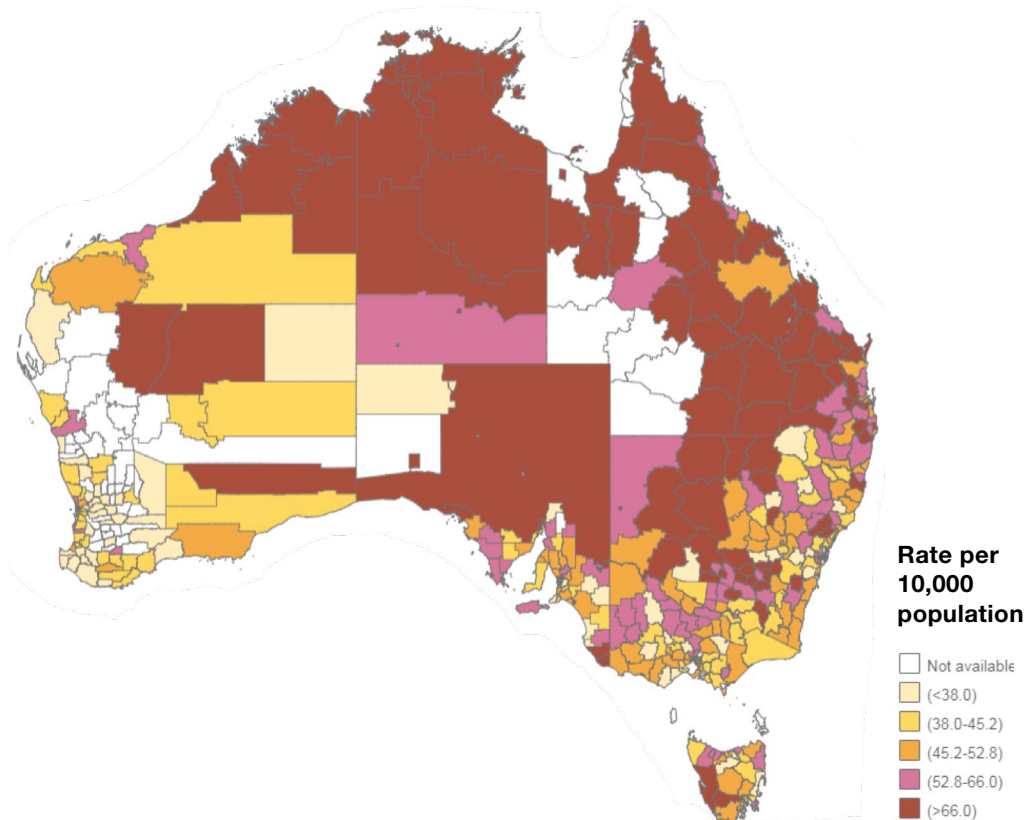
Figure 3.4. Hospitalisations for CVD by diagnosis and sex, 2014–15



Note: Data from AIHW National Hospital Morbidity Database.

Source: Australian Institute of Health and Welfare (2016d).

Figure 3.5. Heart-related¹ hospital admissions by LGA, 2012–14



Note: ¹Heart-related hospital admissions were for unstable angina, heart attack and heart failure only.

Source: RFDS analysis of Heart Foundation data (Heart Foundation, 2017b).

CVD accounts for 17% of the total disease burden in Australia and is the single greatest contributor to burden of disease (Alston, Allender, Peterson, Jacobs, & Nichols, 2017). One person dies every 12 minutes from CVD in Australia, 40% of them prematurely (Dunbar et al., 2017a).

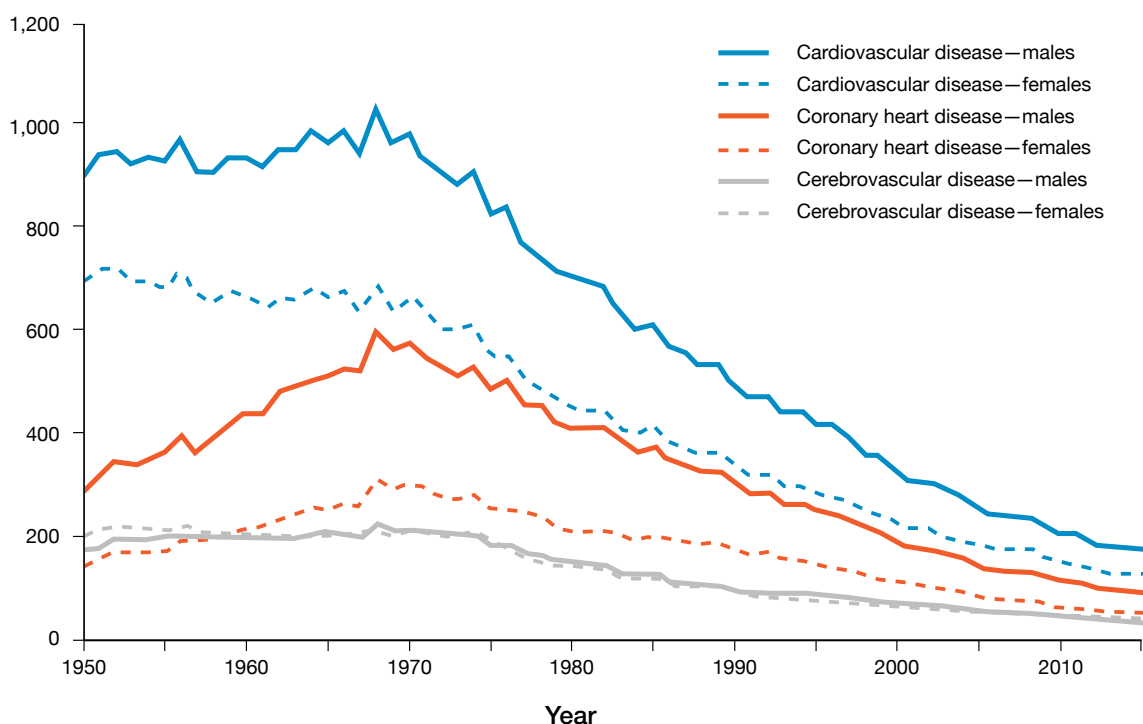
CVD was responsible for 27.7% of all mortality in Australia in 2016 (Australian Bureau of Statistics, 2017). Age-standardised death rates demonstrated that males (169 deaths per 100,000 population) were 1.4 times as likely as females (120 deaths per 100,000 population) to die from CVD in 2016 (Australian Bureau of Statistics, 2017).

In 2016, CHD was the leading cause of CVD mortality, accounting for 12.0% of all deaths (Australian Bureau of Statistics, 2017). People who died from CHD in 2016 had a median age at death of 85.1 years (Australian Bureau of Statistics, 2017). CHD has been Australia’s leading cause of death for several decades, but death rates have been declining for more than 40 years (Australian Bureau of Statistics, 2017). The death rate from CHD has decreased by more than a third, from 99.1 deaths per 100,000 population in 2007 to 62.4 per 100,000 population in 2016 (Australian Bureau of Statistics, 2017).

Overall death rates from CVD, CHD and cerebrovascular disease have progressively decreased for males and females in Australia since around 1970 (Figure 3.6) (Australian Institute of Health and Welfare, 2017b). The large reduction in the CVD death rate “represents a substantial public health gain in terms of deaths delayed and years of life extended” (Australian Institute of Health and Welfare, 2017b, p. 4).

Figure 3.6. Death rates for CVD, CHD and cerebrovascular disease, 1950–2015

Per 100,000 population



Source: Australian Institute of Health and Welfare (2017b, p. 5).

3.3 CVD in remote and rural Australia

The term ‘remote and rural’ is used to encompass all areas outside Australia’s major cities. This includes areas classified as inner regional (RA2), outer regional (RA3), remote (RA4) and very remote (RA5) under the Australian Statistical Geography Standard (ASGS).¹² Major cities comprise 0.3% of Australia’s land mass (Garvan Research Foundation, 2015) but support 70% of the population. The remaining population is distributed unevenly throughout inner

¹² For more information on how the RFDS defines remote and rural Australia, go to <https://www.flyingdoctor.org.au/what-we-do/research/defining-rural-remote/>.

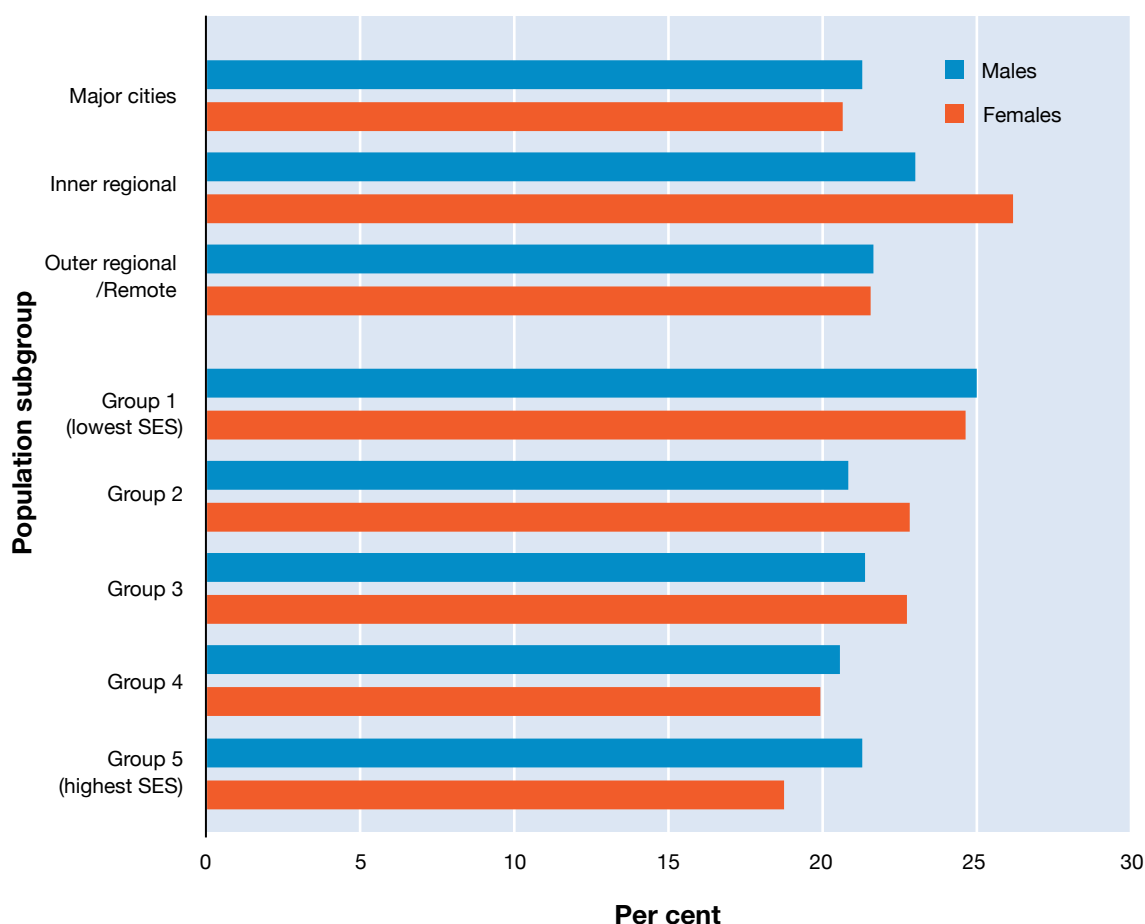
regional (18.4%), outer regional (9.1%), remote (4%) and very remote areas (0.9%) (Garvan Research Foundation, 2015).

Remoteness influences the nature of health care and involves consideration of the provision of services in an environment characterised by isolation and diversity—in geographic, cultural, socioeconomic and Indigenous health terms (Smith, Margolis, Ayton, Ross, Chalmers, Giddings, Baker, Kelly, & Love, 2008). This, combined with poor resourcing and extreme climate conditions, makes living and working in this region challenging.

People from remote and rural Australia generally experience poorer health than people living in major cities. They have reduced access to health care, travel greater distances to receive medical services, experience higher rates of ill health, and demonstrate higher levels of mortality, morbidity and health and disease risk factors, such as smoking, overweight and obesity, and alcohol and drug misuse, than people living in major cities (Australian Institute of Health and Welfare, 2014a, 2016a). People from remote and rural Australia also demonstrate lower use of health services (Australian Institute of Health and Welfare, 2017h).

In 2014–15, the prevalence of CVD, based on self-reported data, varied by location and socioeconomic disadvantage (see Figure 3.7). The highest areas of CVD were found in inner regional (25%) areas, followed by outer regional and remote (22%), and major cities (21%) (Australian Institute of Health and Welfare, 2017c). Rates of CVD were highest in the lowest socioeconomic group (25%) compared with 20% in the highest socioeconomic group (Australian Institute of Health and Welfare, 2017f).

Figure 3.7. Prevalence of CVD by location and socioeconomic group, persons aged 18 or over, 2014–15



Notes:

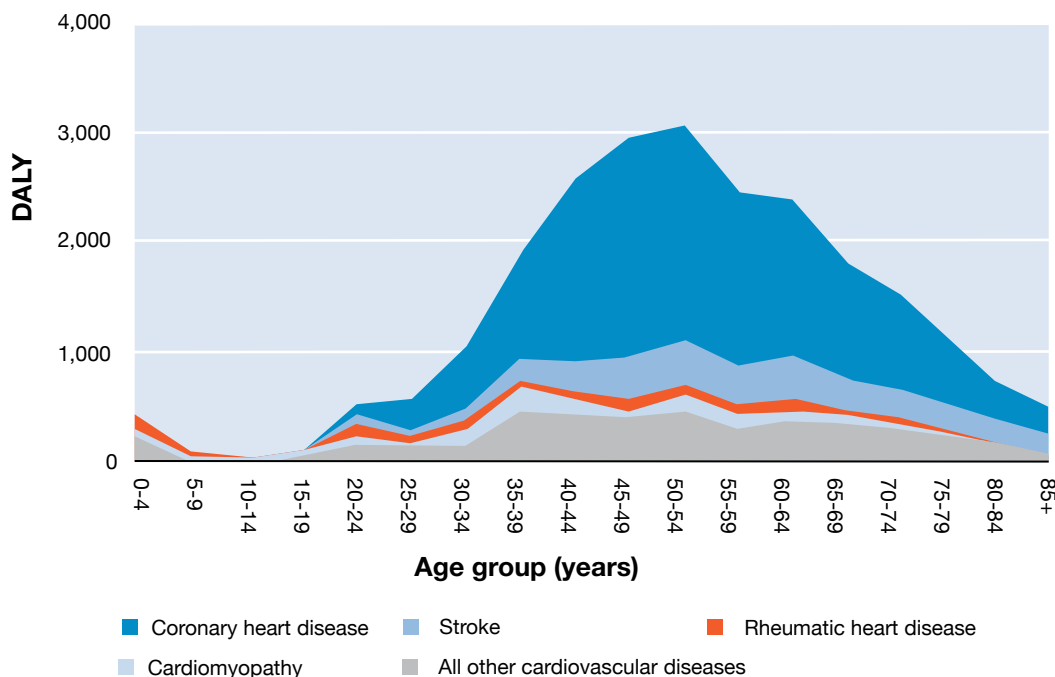
1. Based on self-reported data.
2. Age-standardised to the 2001 Australian Standard Population.
3. Data derived from AIHW analysis of ABS Microdata—NHS, 2014–15.

Source: Australian Institute of Health and Welfare (2016d).

3.4 CVD in Indigenous Australians

“CVD is a major cause of morbidity and mortality among Indigenous Australians. It is more common in the Aboriginal and Torres Strait Islander population, and occurs at much younger ages compared to the non-Indigenous population” (Australian Institute of Health and Welfare, 2016b, p. 157) (Figure 3.8).

Figure 3.8. CVD burden (DALY) by age and disease, Indigenous Australians, 2011

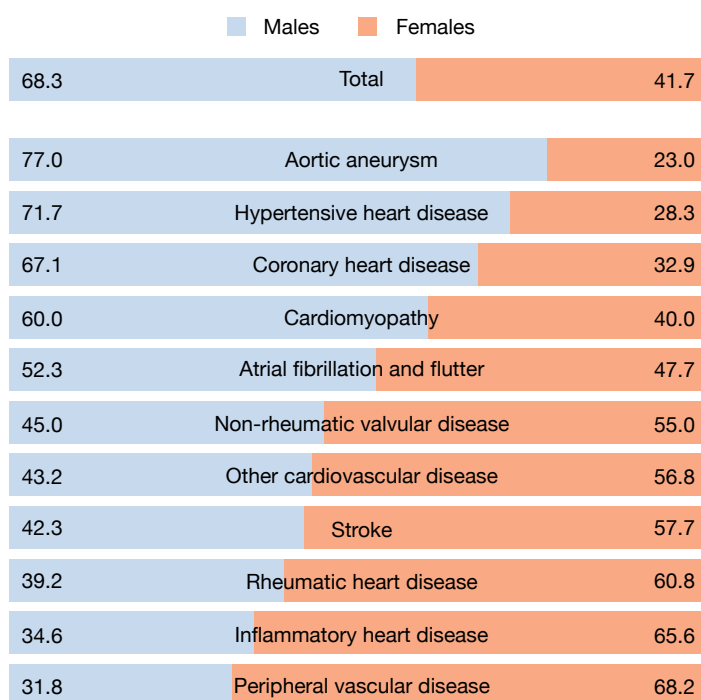


Source: Australian Institute of Health and Welfare (2016b, p. 159).

Figure 3.8 demonstrates that in 2011 the burden from CVD among Indigenous Australians was low in childhood but increased rapidly from about age 30 (Australian Institute of Health and Welfare, 2016b). Specifically, CHD and stroke contributed significantly to the burden of CVD from age 40 onwards (Australian Institute of Health and Welfare, 2016b). The burden from CHD peaked at around ages 45–54, and then declined (Australian Institute of Health and Welfare, 2016b). The burden from stroke peaked at around ages 50–64, and then declined (Australian Institute of Health and Welfare, 2016b).

In 2011, CVD burden was greater in Indigenous males than females (58% versus 42%), but this varied by type of CVD disease (Figure 3.9) (Australian Institute of Health and Welfare, 2016b). “Indigenous males experienced the majority of burden from aortic aneurysm (77%), hypertensive heart disease (72%) and CHD (67%), whereas Indigenous females experienced the majority of burden due to peripheral vascular disease (68%), rheumatic heart disease (61%), and stroke (58%)” (Australian Institute of Health and Welfare, 2016b, p. 160).

Figure 3.9. Cardiovascular diseases burden (DALY) by disease, proportion for males and females, Indigenous Australians, 2011



Source: Australian Institute of Health and Welfare (2016b, p. 158).

CVD is the leading cause of death for Indigenous Australians (Heart Foundation, 2017a). CVD was the most common cause of death for Indigenous Australians (24% of deaths) from 2011 to 2015 (Australian Health Ministers' Advisory Council, 2017). In 2016, CHD was the leading cause of CVD death for Indigenous Australians (Australian Bureau of Statistics, 2017). Age-standardised death rates demonstrated that Indigenous Australians (113 deaths per 100,000 population) were 1.7 times as likely as non-Indigenous Australians (68 deaths per 100,000 population) to die from CHD in 2016 (Australian Bureau of Statistics, 2017).

3.5 Summary

CVD is the leading cause of death worldwide, within Australia, among people from remote and rural Australia, and among Indigenous Australians. Although CVD deaths have declined over the last 50 years, largely as a result of improved risk factor management, CVD continues to be a major cause of morbidity and mortality. The RFDS plays a significant role in the provision of health care services to people from remote and rural Australia with CVD. The following chapters describe the role of the RFDS in providing services for people from remote and rural Australia with CVD.

4.0 RFDS health services

The RFDS is one of the largest and most comprehensive aeromedical organisations in the world.

It is a federated health charity which delivers health services through its 'Sections' and 'Operations,' comprising RFDS Central Operations (includes South Australia (SA) and the Northern Territory (NT)), RFDS Queensland (Qld) Section, RFDS South Eastern Section (includes New South Wales (NSW)), RFDS Tasmanian (Tas) Section, RFDS Victorian (Vic) Section, and RFDS Western Operations (includes Western Australia (WA)).

Each of the RFDS Sections and Operations have responsibility for the delivery of health services to the communities they serve through the establishment of effective systems and maintenance of efficient operations. The Sections and Operations are coordinated at a national level by the RFDS of Australia—Federation Company, Canberra.

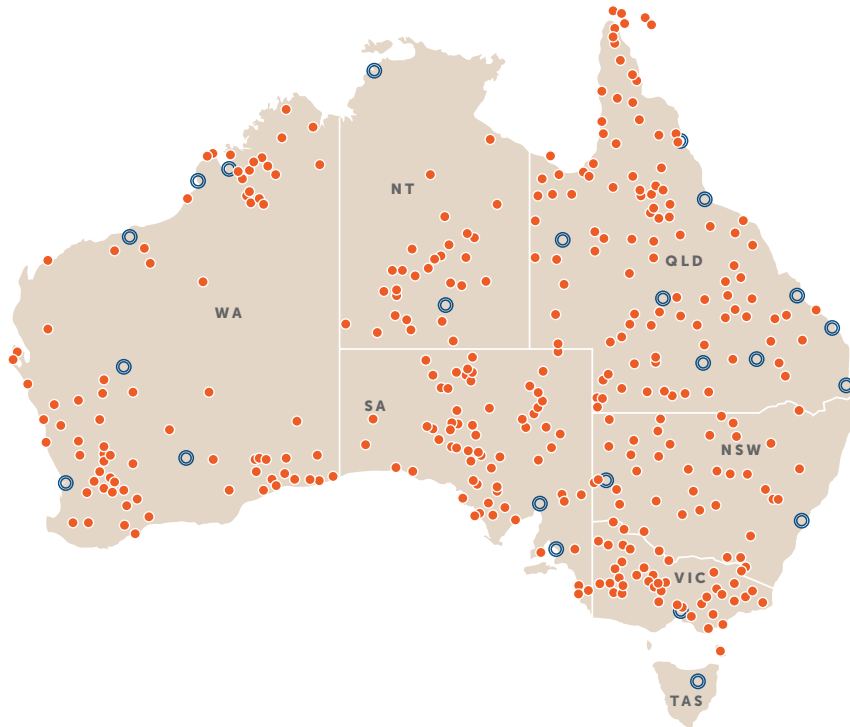
Using the latest in aviation, medical and communications technology, the RFDS delivers extensive PHC and 24-hour emergency service to those who live, work and travel throughout Australia.

Remote and rural Australians with CVD commonly access a range of health care services provided by the RFDS. The current chapter provides information on these services, and describes the CVD programs provided by the RFDS through its PHC clinics. Chapter 5 presents detailed data on the RFDS aeromedical retrieval service and its use by remote and rural Australians with CVD.

4.1 RFDS PHC in remote and rural Australia

The RFDS provides PHC services to people in remote and rural Australia. By providing services to people who, because of geographic factors, are beyond reasonable access to normal medical infrastructure, the RFDS plays a pivotal role in the provision of universal access to PHC. Within the RFDS, PHC is provided through general practice and nursing clinics. In 2016–17, the RFDS delivered 5,615 general practice clinics to 37,689 patients and 3,429 nursing clinics to 18,909 patients. Figure 4.1 shows RFDS clinic locations in 2016–17.

Figure 4.1. RFDS clinic locations 2016–17



RFDS PHC clinics provide comprehensive general practice services and offer, and facilitate, all aspects of primary medical care. General practice clinics are held on a regular basis in remote locations and the frequency of visits depends on local needs. Similar to general practitioners (GPs), all RFDS PHC services provide care to people with CVD. Although data on RFDS PHC consultations for CVD are unavailable for the current report (but will be included in a separate future report on PHC delivered by the RFDS), it is reasonable to assume that the proportion of visits to RFDS GPs for CVDs is high.

4.2 Other RFDS health services

The RFDS operates a 24/7 remote telehealth consultation system. In the RFDS, remote consultations describe telephone calls that come into an RFDS base from individuals or health workers in remote and rural areas who require medical assistance or advice from an RFDS doctor. This service supports the aeromedical retrieval service and provides a service to remote and rural residents who require doctor or nurse consultations. In most cases, the patient has no permanent medical services available and limited, if any, access to a hospital (Centre for International Economics, 2015). Unlike other remote consultation services, which are more akin to triage and referral services, the RFDS remote consultation service seeks to resolve medical issues for the patient (Centre for International Economics, 2015). Calls to this service range from GP services to assist in managing chronic conditions, such as diabetes or asthma, to emergency calls around heart attacks, stroke, injuries etc. Remote consultations are also used to assist in managing chronic CVD. Many issues discussed in remote consultations are resolved without patients needing to be transported to hospital or requiring additional evaluation (Centre for International Economics, 2015).

Other health services provided by the RFDS include: non-emergency patient ground transport services in Vic, NSW, Tas and SA; emergency patient ground transport services in SA; repatriation services; evacuations by charter aircraft from tour vessels along the Kimberly coast; assistance with staffing other aeromedical services that provide rescue activities; medical chests; oral health services; outreach programs; health promotion and education activities; clinic charter services; telehealth services, including access to specialist services via videolink in Victoria and a national trial of GP telehealth services which connect patients with GPs using videolink; and mental health, psychology and social and emotional wellbeing services.

4.3 CVD-specific health services provided by the RFDS

In addition to the care provided to people with CVD through the PHC platform, the RFDS provides services focused on CVD. In 2017, the RFDS delivered services through state- or territory-based programs in SA, Tas, Vic and Qld. Table 4.1 lists these services, and for each service provides information on: the name of the program; the service model, including information on the delivery platform; the geographical area it works in partnership with; who funds the program; the number and type of staff employed; the services provided; and additional notes about the program. Case studies are also provided to showcase some of the RFDS programs and to describe their impact.

Table 4.1. RFDS CVD services

Section or Operation	Program name	Partnerships	Dates	Service model	Services provided (e.g. group exercise class; clinic, telehealth appointment)	Area serviced	Who delivers the program
Central Operations (SA)	CVD risk identification, stratification and management	Primary health network (PHN)	2017–18	<ul style="list-style-type: none"> > Telehealth by videoconference and telephone plus fly-in fly-out service for remote communities > Integrated as a value-add to existing telehealth and fly-in fly-out clinics 	<ol style="list-style-type: none"> 1. Targeted screening to identify physiological and behavioural risk factors 2. Process of risk stratification to identify “at risk” population due to latent medical conditions which predispose patient to CVD 3. Classification of CVD risk into cohorts — high, intermediate and low 4. Delivery of primary prevention education, motivation and training for lifestyle change for all cohorts 5. Provide intense management and follow-up to high-risk cohort 6. Deliver a comprehensive program to high-risk cohort including lifestyle and pharmacological treatment 	Based out of Port Augusta on the traditional fly-in fly-out footprint	A nurse works (in a general practice nurse capacity) to support the existing primary health team to achieve the targeted expansion in service delivery
RFDS Tasmania	RFDS Prime Mover and Pulmonary Rehabilitation Program	<ul style="list-style-type: none"> > Primary Health Tasmania > Launceston General Hospital–Cardiac/Pulmonary Rehabilitation unit > Charles Clinic Heart Care 	2017–ongoing	<ul style="list-style-type: none"> > Initially one maintenance (phase 3) cardiac rehabilitation/ pulmonary rehabilitation class per week, potentially increasing to two depending on demand > Delivered through the PHC platform 	This rehabilitation maintenance program involves initial participant assessment, exercise training, education and social support. The exercise training and education classes will have a focus on teaching participants about their lungs and heart, how to exercise, how to perform activities of daily living with less shortness of breath and how to live more easily with their	North eastern/ eastern Tasmanian LGAs currently serviced by RFDS Tasmania PHC, including: <ul style="list-style-type: none"> > George Town > Dorset > Break O Day > Flinders Island > Glamorgan > Spring Bay 	Delivered by the physical health worker that occupies each LGA. Program overseen by senior exercise physiologist

Section or Operation	Program name	Partnerships	Dates	Service model	Services provided (e.g. group exercise class; clinic, telehealth appointment)	Area serviced	Who delivers the program
Victorian Section	Flying Doctor Telehealth	Small Rural Research Team	2017	Telehealth via the Flying Doctor Telehealth Platform	The service allows for rural patients to access a cardiologist via videolink telehealth for a range of problems	Service is available in all rural areas of Victoria, including in ACCHOs	Cardiologist. Patients are supported by an appointment facilitator at their local health service
Queensland Section	Healthy lifestyle education	Nil	Ongoing	Delivered in-person. The program was set up with the goal of promoting the benefits of health and wellbeing in remote communities through dedicated field days	Education regarding CVD risk factors at field days, which are held in remote towns	Remote and rural locations where field days are held	Delivered in-person by a health team. Teams may include doctors, nurses, mental health professionals and health promotion officers
South Eastern Section	Field days	Nil	Ongoing	Health checks	Provision of health checks to increase the chances of early detection and a positive outcome through changes to lifestyle, diet or medical treatment	Remote and rural locations where field days are held	Delivered in-person by a health team. Teams may include doctors, nurses, mental health professionals and health promotion officers

The service models include; drive-in drive-out face-to-face services, fly-in fly-out face-to-face services, telehealth support, videoconferencing, delivery of information sessions and field days.

RFDS programs may be delivered in partnership, including with other health services, community organisations, federal and state/territory governments, or Indigenous organisations, and may include funding from federal, state/territory and local governments, or PHNs.

Staff delivering the programs vary depending on the program being delivered but typically include a mix of clinicians such as doctors (including specialists), nurses, allied health professionals and administrative staff.

Models of care and services provided depend on the program being accessed. Services include: CVD risk identification, stratification and management; healthy lifestyle education; field days; rehabilitation services; and telehealth videolinks between patients and cardiologists

CASE STUDY > TASMANIAN RFDS PRIME MOVER INTEGRATED CARDIAC AND PULMONARY REHABILITATION PROGRAM

Program Aims

- I. Maximise physical, psychological and social functioning to enable people with cardiovascular and pulmonary disease to lead fulfilling lives with confidence.
- II. Develop a supportive, individualised exercise and education treatment program that promotes self-management.
- III. Introduce and encourage behaviours that may minimise the risk of further cardiac events and exacerbation frequency for participants living with CVD and/or lung conditions whilst promoting the benefits associated with exercise-based rehabilitation programs, including:
 - > Increased exercise tolerance and improved physical function.
 - > Reduced breathlessness.
 - > Improved quality of life.
 - > Improved mood and motivation.
 - > Improved knowledge of condition and management.
 - > Increased participation in everyday activities.

Educational sessions will include topics such as:

- > Maintaining healthy behaviours around smoking cessation, good nutrition, and exercise.
- > Goal setting and motivation.
- > Falls prevention and balance.
- > Effects of physical inactivity.

5.0 Aeromedical transport of Australians with CVD in remote and rural Australia

Although the RFDS delivers PHC and CVD-specific services to many remote and rural communities, not all communities can access prevention, early intervention or treatment services. Even in remote and rural communities where these services are provided, there may be times when individuals experience an acute CVD event that necessitates transportation to hospital to receive urgent medical care. Many remote and rural areas do not have access to comprehensive local medical services, and are either difficult to access by road or too remote to enable timely hospital transfer by road ambulance. Consequently, aeromedical transport by the RFDS may be the most effective way of transporting a patient to hospital to receive care for an acute episode of CVD.

Within national hospital statistics, data are reported on the care of Australians who attend hospital for CVD. The outcomes for people from remote and rural Australia who arrive at hospital via an aeromedical transport as the result of a CVD are also captured in these data. However, not all components of care provided to people from remote and rural Australia who are transported via an RFDS aeromedical transport for CVD are reported in national data. Specifically, the number of patients transported by the RFDS for CVD, and demographic data have not been previously reported by the RFDS. As a result, the full impact of CVD on people from remote and rural Australia has likely been underestimated, and not brought to the attention of policymakers.

The current chapter, therefore, presents aeromedical transport data for people from remote and rural Australia transported to hospital to receive care for CVD, for the period from 1 July 2013 to 31 December 2016.

5.1 Aeromedical transport

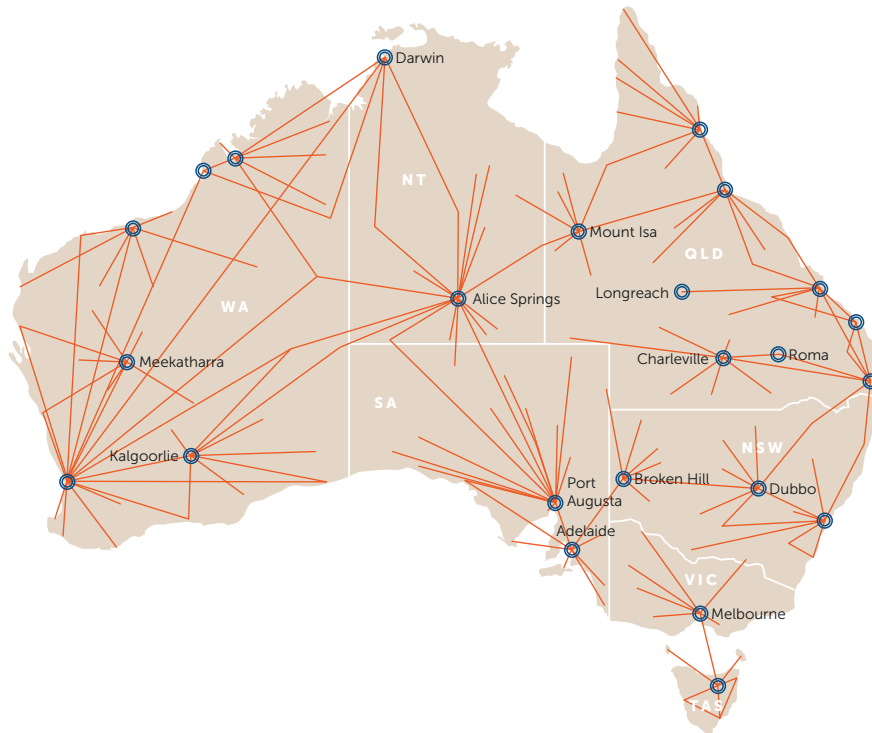
In major cities, the care of sick or injured Australians is characterised by timely access to emergency services, including road ambulance and hospital services. However, most Australian states and territories have areas that are inaccessible by road or have no local medical services. Consequently, patients sustaining illnesses and injuries may need to be transported long distances, in emergency situations, to receive definitive care in an appropriate hospital (McDonnell, Aitken, Elcock, & Veitch, 2009). The RFDS, as a provider of aeromedical transport services, fills this gap and provides a vital service to people from remote and rural Australia who require emergency medical treatment in a tertiary hospital for any reason, and who are unable to access local emergency medical treatment in a hospital, due to their remoteness.

The RFDS operates a 24/7 aeromedical transport service, supported by a 24/7 telehealth system, to patients who live, work or travel in remote and rural Australia and who experience a medical emergency requiring definitive care in a tertiary hospital. Patients requiring definitive care in an appropriate hospital are transported via a primary evacuation¹³ or inter-hospital transfer,¹⁴ known as an aeromedical transport. The RFDS operates its aeromedical transport service from 23 bases in Australia (Figure 5.1).

13 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 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) but excluding transfers from one hospital to another" (Aspex Consulting, 2014, p. 7).

14 Inter-hospital transfer: "Transfer of patients between hospitals designated as normal medical infrastructure to get specialist treatment and life-saving surgery required" (Aspex Consulting, 2014, p. 34).

Figure 5.1. RFDS national aeromedical footprint



Source: Royal Flying Doctor Service (2016)

5.2 RFDS tasking and transport process

The transport of sick or injured patients from remote and rural Australia can be challenging. There is a requirement for practitioners to possess a broad range of critical care skills and to be able to apply them in a highly restrictive and unpredictable environment. To deliver comprehensive care to sick or injured people from remote and rural Australia, remote and rural trauma systems also need to be well organised and coordinated (Norton & Kobusingye, 2013). Such services need to integrate prehospital care, transport, and trauma centre components, while also maximising the use of local health resources (Norton & Kobusingye, 2013).

There are many people who play an important role in the prehospital care of sick or injured remote and rural Australians. These are first responders—the people who work to provide medical care to a sick or injured person until the RFDS arrives. First responders may include members of the public, family, friends, work colleagues, staff from nursing posts or small rural hospitals, staff from ACCHOs, paramedics, local GPs, etc.

Once first responders have made contact with the RFDS, and a decision to retrieve a patient has been made, planning the transport process commences (Margolis & Ypinazar, 2009). Medical treatment is most often initiated prior to the arrival of the RFDS medical crew, by on-the-ground primary and secondary health care services (Margolis & Ypinazar, 2009). RFDS doctors provide advice and assistance to those providing immediate care for a sick or injured patient via the RFDS telehealth service (Margolis & Ypinazar, 2009), which may include prescribing the use of items from an RFDS medical chest—a secure package of pharmaceutical and non-pharmaceutical items held by custodians in remote areas of Australia. This is especially important for primary response transports to locations without any health care facilities (Margolis & Ypinazar, 2009) or where there is limited health infrastructure and health professionals to assist with sustaining the life of a patient requiring critical care.

5.3 RFDS data collection and coding

The RFDS collects patient information for each aeromedical transport. Patient notes may be handwritten by the transport doctor or flight nurse, and entered into specific databases, or electronically recorded at the point of care. Twice a year, each of the RFDS companies provides data to the RFDS of Australia. A health data analyst then collates, cleans and standardises the data prior to it being analysed and reported on.

RFDS clinical data from July 2013 to December 2016 are coded using the ICD-10-AM, at chapter level.

5.3.1 Classifying RFDS data

RFDS data presented in the current report were coded under Chapter 9 of the ICD-10-AM—diseases of the circulatory system, as described in Chapter 2.

The RFDS has traditionally only reported aeromedical transport data at the ICD-10-AM chapter heading level. In July 2016 the RFDS Sections and Operations commenced providing more comprehensive aeromedical transport data for analysis. In addition to ICD sub-chapter level data, ICD 3-character level data were provided for analysis for the six-month period from 1 July 2016 to 31 December 2016.

The RFDS aeromedical data collection is a unit-record level database of administrative data. Among the variables collected are:

- > The RFDS Section or Operation responsible for the transport (Central Operations, Western Operations, South Eastern Section,¹⁵ Queensland Section);
- > Transport date (day/month/year);
- > Transport airstrip (name, latitude and longitude);
- > Patient's age (both age in years and five-year age group);
- > Gender (male, female and other); and
- > Indigenous status (Indigenous, non-Indigenous, foreigner (some Sections/Operations), unknown).

Data around the Section or Operation tasked with performing the aeromedical transport, transport date, patient's age and Indigenous status were recoded into categorical variables: the Section or Operation tasked with performing the aeromedical transport was recoded into the state/territory from where the patient was retrieved;¹⁶ transport date was recoded by month and year; patient's age was recoded into discrete five-year and ten-year age groupings; and 'foreigners' were recoded as non-Indigenous Australians for the Section/Operation that had employed this coding category, in line with national RFDS data.

Within the RFDS, versions 9 and 10 of the ICD were initially used to code diseases of the circulatory system. To facilitate consistency, data were re-categorised according to ICD-10-AM 8th Edition.

5.3.2 Data analyses

All data were analysed using IBM SPSS Statistics for Windows, Version 24.0 or Microsoft Excel 2016.

All analyses used unweighted data, included patients who were transported by the RFDS and required definitive care in a tertiary hospital for CVD.

RFDS aeromedical transport data are provided for all Australians that underwent an aeromedical transport for a CVD. Data were then analysed by Indigenous status, age, gender, and state or territory from which they were retrieved, and results from this data analysis are presented.

15 RFDS aeromedical transport data presented in the current discussion paper excludes RFDS flights from Mascot airport, which are tasked by Ambulance NSW. It also excludes transports from Tasmania that are undertaken by RFDS under the Ambulance Tasmania contract.

16 For example, a flight may be tasked from Essendon airport in Victoria to pick up a patient in NSW. As the patient was retrieved from NSW, it would be coded as a NSW transport.

Aeromedical transport data around the 10 clinical sub-chapters of CVD, and 3-item ICD codes of CVD, are presented for a six-month period from 1 July to 31 December 2016. All CVD occasions of service, that had been assigned a 3-item ICD-10-AM diagnosis code (n=2,768) by an RFDS clinician were included in the analysis.

Crude rates, age-specific rates and age-standardised¹⁷ data are also presented in this chapter of the report. Age-specific rates reflect the number of people for a specific age group, expressed per 1,000 population. Rates reported by unit of population have also been age-standardised to control for the confounding effect introduced by variations in age compositions of the Indigenous and non-Indigenous populations. The direct method was used with the Standard Population for Use in Age-Standardisation (Australian Bureau of Statistics, 2013a), by five-year age groups. Ages 65 and older have been aggregated into a single age group to address volatility in small numbers. Age-standardised rates were calculated using an age-standardised rate Excel workbook (Ransom, 2011) and confirmed using a Direct Age-Standardisation Calculation Tool (Taylor & Morrell, 2015). Age-standardised rates are expressed per 100,000 population.

5.4 Results

Between July 2013 and December 2016, the RFDS conducted 95,723 aeromedical transports,¹⁸ equivalent to 526 aeromedical transports per week, or 75 per day.

Of these, 20,379 (21.3%) were for diseases of the circulatory system. Diseases of the circulatory system were the most common reason for a transport.

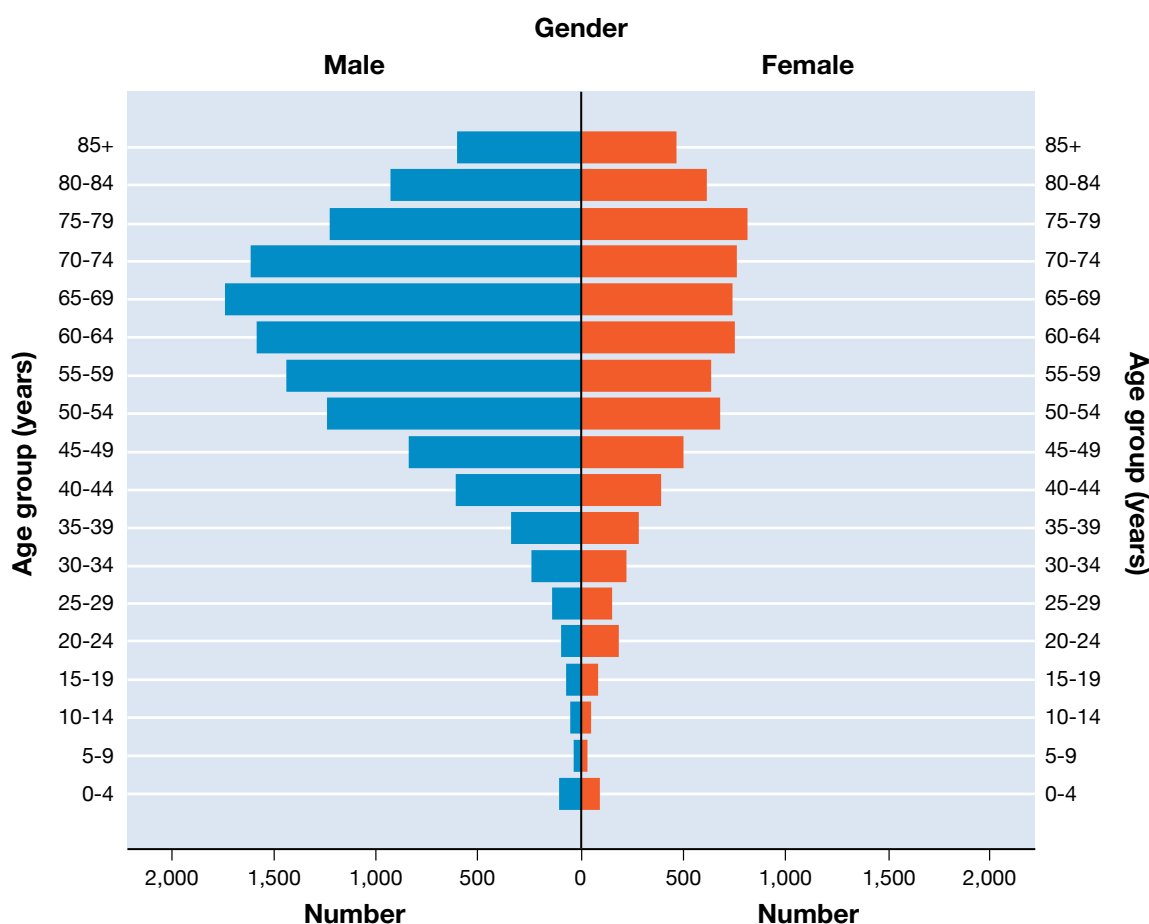
When aeromedical transport data for diseases of the circulatory system, between July 2013 and December 2016, were analysed (Figure 5.2), the following was observed:

- > An average of 112 patients per week or 16 patients per day were transported for CVD.
- > On average, per day, 10.1 (63%) were male and 5.9 (37%) were female, a ratio of 1.7 males for every female.
- > All age groups were represented.
- > The mean age group was 55–59 years.
- > More than one-third (35.3%) were aged 60–74 years.
- > 1.0% were children under the age of 4 years.
- > Aeromedical transport rates increased for each 5-year age group from 5–9 years to 65–69 years.
- > Males were more common in all age groups except for 10–14 years, 15–19 years, 20–24 years and 25–29 years.
- > Females aged 20–24 years were observed at 1.9 times the rate of males.
- > Males aged 55–59 years (2.3 times), 60–64 years (2.1 times), 65–69 years (2.3 times), and 70–74 years (2.1 times) were more likely than females of the same age group to undergo an aeromedical transport.

¹⁷ Age-standardisation: "A method of removing the influence of age when comparing populations with different age structures. This is usually necessary because the rates of many diseases vary strongly (usually increasing) with age. The age structures of the different populations are converted to the same 'standard' structure, and then the disease rates that would have occurred with that structure are calculated and compared" (Harrison & Henley, 2014, p. 137).

¹⁸ Each aeromedical transport is recorded as one occasion of service.

Figure 5.2. Gender of Australians, by age group, who underwent an aeromedical transport for CVD, July 2013–December 2016



5.4.1 Aeromedical transports for CVD by Indigenous status

When aeromedical transports for CVD were considered by Indigenous status, a number of differences were observed (Table 5.1).

Table 5.1. Demographic data for non-Indigenous and Indigenous Australians who underwent an aeromedical transport for CVD, July 2013–December 2016

Variable	Non-Indigenous ¹	Indigenous ¹	All persons ²
Number retrieved	N=13,632 (80.5%)	N=3,302 (38.9%)	20,379
Age³			
Age range	<4 years to 85+ years	<4 years to 85+ years	<4 years to 85+ years
Mean age group	60–64 years	50–54 years	55–59 years
Highest number of transports	65–69 years (N=1,871, 13.7%)	50–54 years (N=503, 15.2%)	65–69 years (N=2,482, 12.2%)
Gender⁴			
Male	n=8,993 (66.0%)	n=1,692 (51.3%)	N=10,685 (63.1%)
Female	n= 4,635 (34.0%)	n=1,608 (48.7%)	N=6,243 (36.9%)
Proportion	Males 1.9 times as likely as females to be transported	Males 1.1 times as likely as females to be transported	Males 1.7 times as likely as females to be transported

Notes:

¹ Includes data only for patients whose Indigenous status was known (N=16,934).

² Includes data for all patients (N=20,379), comprising non-Indigenous (N=13,632); Indigenous (N=3,302); and Indigenous status unknown (N=3,445).

³ Excludes patients whose age was unknown.

⁴ Excludes patients whose gender was unknown.

The data demonstrated that:

- > For patients whose Indigenous status was known (n=16,934), around four-fifths were non-Indigenous (n=13,632, 80.5%) and one-fifth were Indigenous (n=3,302, 19.5%);
- > Both non-Indigenous and Indigenous Australians retrieved for CVD ranged in age from 4 years or younger to 85 years or older;
- > The mean age at which a non-Indigenous Australian was retrieved for CVD was 60–64 years, while the mean age at which an Indigenous Australian was retrieved for CVD was 50–54 years;
- > Non-Indigenous males (n=8,993, 66.0% of non-Indigenous transports) were 1.9 times as likely as non-Indigenous females (n=4,635, 34.0% of non-Indigenous transports) to undergo an aeromedical transport for CVD;
- > Indigenous males (n=1,692, 51.3% of Indigenous transports) were 1.1 times as likely as Indigenous females (n=1,608, 48.7% of Indigenous transports) to undergo an aeromedical transport for CVD.

Population pyramids, presenting non-Indigenous and Indigenous aeromedical transport data for CVD, by gender and five-year age groups, were developed and enable further comparisons to be made by Indigenous status (Figures 5.3 and 5.4).

Figure 5.3. Gender of non-Indigenous Australians, by age group, who underwent an aeromedical transport for CVD, July 2013–December 2016

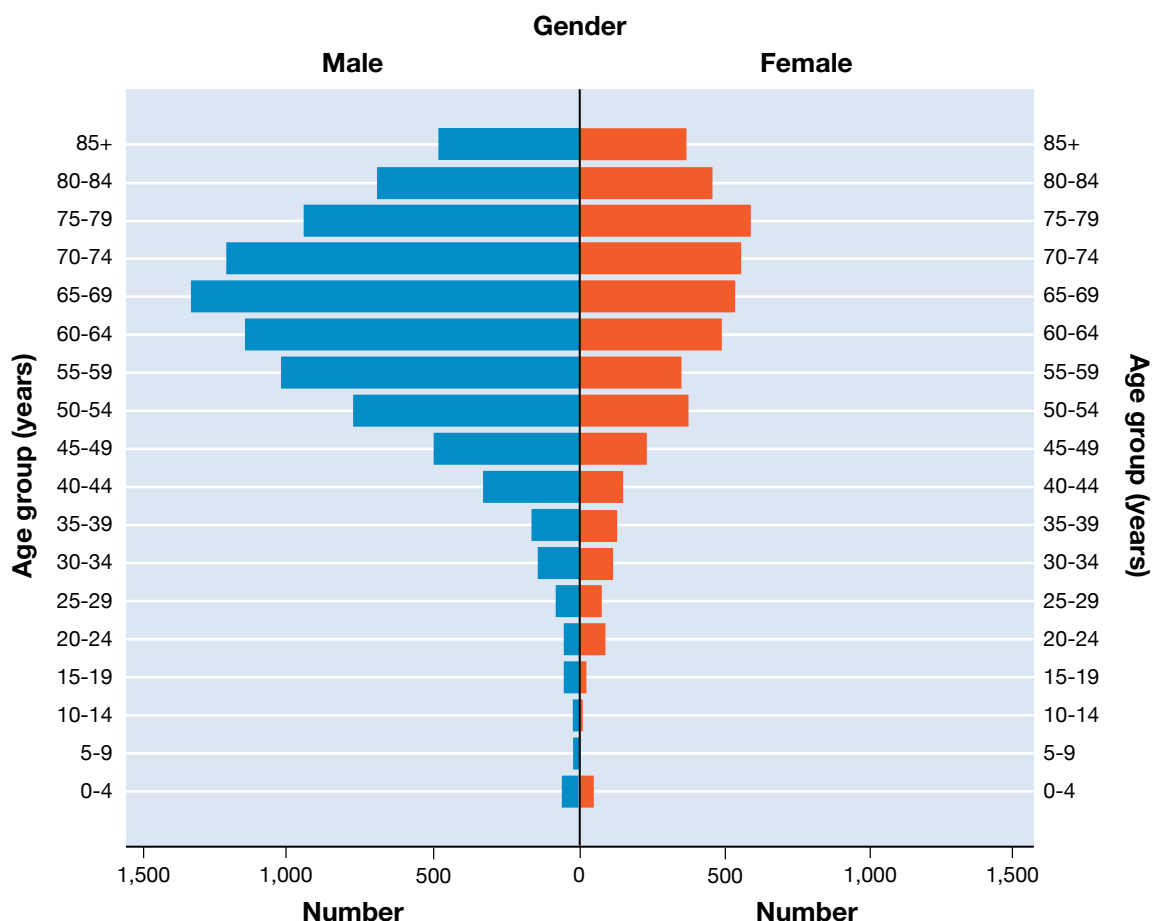
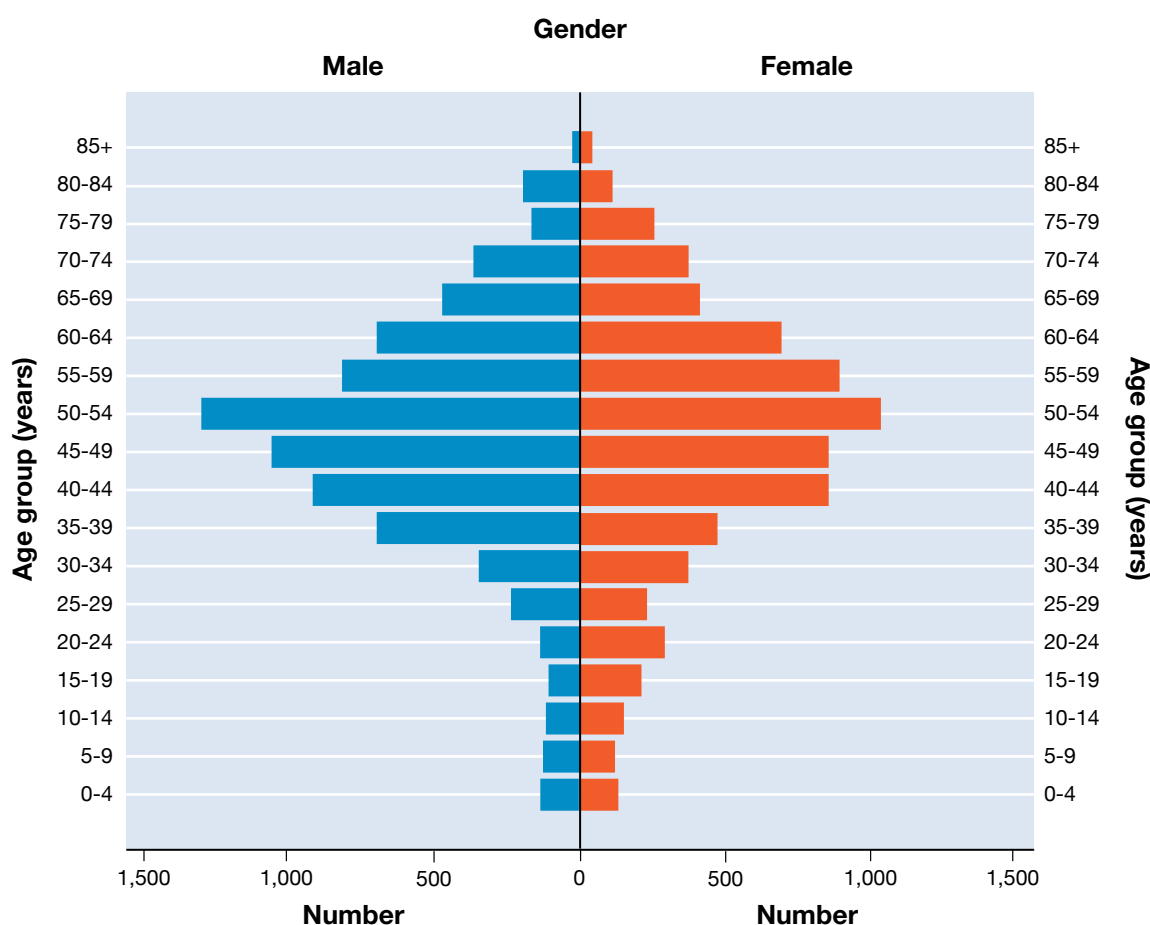


Figure 5.4. Gender of Indigenous Australians, by age group, who underwent an aeromedical transport for CVD, July 2013–December 2016



The population pyramids demonstrate that, for non-Indigenous Australians:

- > The mean age for a non-Indigenous person was 60–64 years;
- > Half (50.0%) of non-Indigenous people were aged 60–79 years;
- > Rates of transport for CVD were highest for non-Indigenous Australians aged 65–69 years — comprising 13.7% of non-Indigenous people;
- > Non-Indigenous males were most likely to undergo an aeromedical transport for CVD between the ages of 65 and 69 years (9.8% of all non-Indigenous people), whereas non-Indigenous females were most likely to undergo an aeromedical transport between the ages of 75 and 79 years (4.4% of all non-Indigenous people);
- > Non-Indigenous males were more likely to undergo an aeromedical transport than non-Indigenous females for all age groups except 20–24 years and 25–29 years;
- > 0.8% of non-Indigenous people were children under the age of 15 years; and
- > 14.8% of non-Indigenous people were 80 years of age or older.

The population pyramids demonstrate that, for Indigenous Australians:

- > The mean age for an Indigenous patient was 50–54 years;
- > More than half (50.4%) of Indigenous people were aged 40–59 years;
- > Rates of transport for CVD were highest for Indigenous Australians aged 50–54 years — comprising 15.2% of Indigenous patients;
- > Indigenous males were most likely to undergo an aeromedical transport for CVD between the ages of 50 and 54 years (8.5% of all Indigenous patients), whereas Indigenous females were most likely to undergo an aeromedical transport between the ages of 50 and 54 years (6.7% of all Indigenous patients);

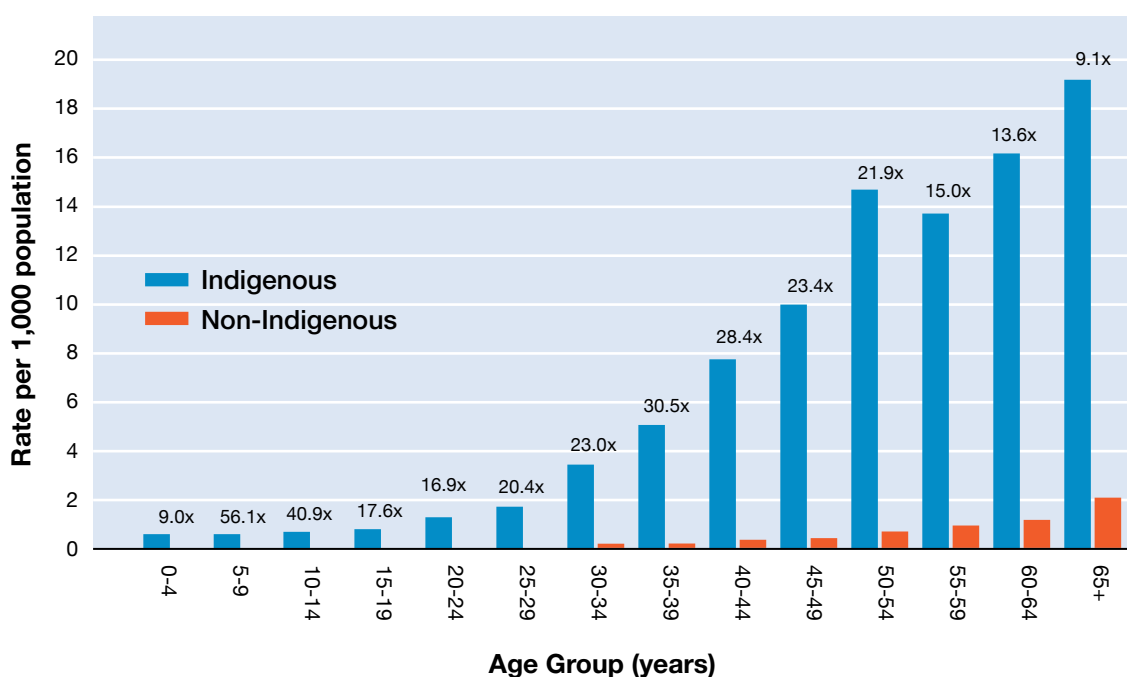
- > Indigenous males were more likely to undergo an aeromedical transport than Indigenous females for the following age groups; 35–39 years; 40–44 years; 45–49 years; 50–54 years; 65–69 years; whereas Indigenous females were more likely to undergo an aeromedical transport than Indigenous males for the following age groups: 10–14 years; 15–19 years; 20–24 years; 30–34 years; 55–59 years; and 75–79 years; for the remaining age groups, transport rates were the same;
- > 5.0% of Indigenous patients were children under the age of 15 years; and
- > 2.5% of patients were 80 years of age or older.

5.4.2 Age-standardised and age-specific aeromedical transport rates

Age-standardised data demonstrated that Indigenous Australians (717 per 100,000 population) were 14.2 times more likely to be transported than non-Indigenous Australians (51.0 per 100,000 population). Indigenous males (788.8 per 100,000 population) were 11.3 times more likely undergo an aeromedical transport than non-Indigenous males (69.6 per 100,000 population). Indigenous females (655.4 per 100,000 population) were 19.7 times more likely non-Indigenous females (33.3 per 100,000) during the same period.

Age-specific aeromedical transport rates between July 2013 to December 2016 are shown in Figure 5.5. For all age groups, age-specific transport rates were higher among Indigenous Australians than non-Indigenous Australians.

Figure 5.5. Age-specific aeromedical transport rates by the RFDS for CVD, by Indigenous status, and ratio of Indigenous to non-Indigenous patients, July 2013–December 2016 (transports per 1,000 population)



Overall, the age-specific transport rate from July 2013–December 2016 was highest in Indigenous Australians aged 65 years or older (19.4 per 1,000 population), closely followed by Indigenous Australians aged 60–64 years (16.3 per 1,000 population) and 50–54 years (14.8 per 1,000 population).

Age-specific aeromedical transport rates for non-Indigenous Australians ranged from less than 0.01 transports per 1,000 population (non-Indigenous children under 10 years of age) to 2.1 transports per 1,000 population (non-Indigenous Australians aged 65 years or older).

Age-specific aeromedical transport rates for Indigenous Australians ranged from 0.6 transports per 1,000 population (Indigenous children under 10 years of age) to 19.4 transports per 1,000 population (Indigenous Australians aged 65 or older)

Indigenous Australians of all age groups were between 9.0 times and 56.1 times as likely as non-Indigenous Australians to be retrieved for CVD. Specifically, Indigenous Australians aged 5–9 years were 56.1 times likely as non-Indigenous Australians of the same age to undergo an aeromedical transport for CVD as likely) and 40–44 years (28.4 times as likely) were more likely than their non-Indigenous peers of the corresponding age groups to undergo an aeromedical transport for CVD. Although Indigenous children aged under five years, and 5–9 years were 56.1 and 40.9 times (respectively) as likely as non-Indigenous children to undergo an aeromedical transport, the very low transport rates amongst this age group should be considered when interpreting this result.

5.4.3 Demand for aeromedical transports

Demand for aeromedical transports for CVD, by non-Indigenous and Indigenous Australians, from July 2013 to June 2016, is shown in Figures 5.6 and 5.7, respectively.

Figure 5.6. Spatial distribution of transports for CVD by non-Indigenous Australians, July 2013–June 2016

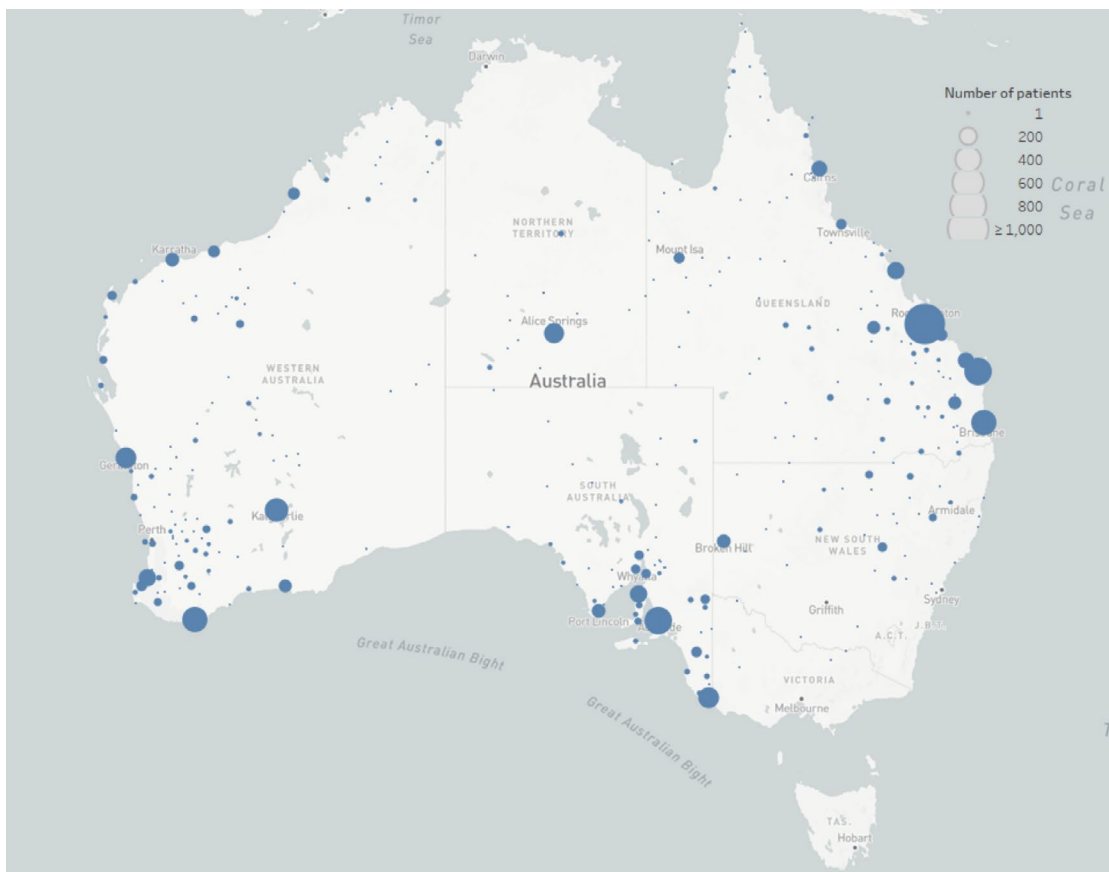


Figure 5.7. Spatial distribution of transports for CVD by Indigenous Australians, July 2013–June 2016

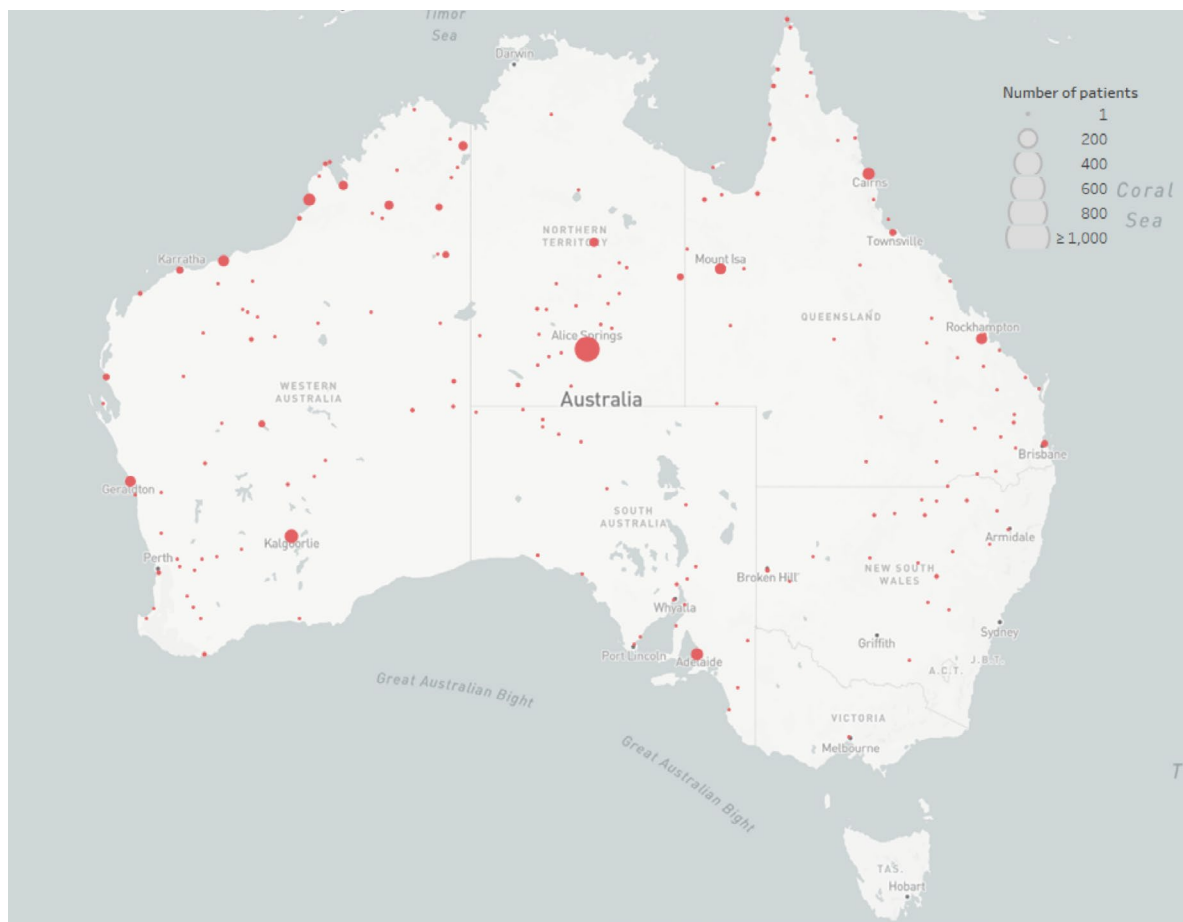


Figure 5.6 demonstrates that the greatest number of non-Indigenous patients were from Rockhampton (Qld). In Qld, the majority of aeromedical transports for CVD were from Rockhampton, Hervey Bay, Bundaberg, Brisbane, Cairns and Townsville. In NSW, the majority of transports were from Broken Hill, Dubbo and Tamworth. In SA, the majority of aeromedical transports for CVD were from Adelaide, Mt Gambier, Kadina and Port Lincoln. In the NT, the majority of transports were from Alice Springs. In WA, aeromedical transports for CVD were most likely to occur in Kalgoorlie, Jandakot, Albany and Geraldton. There was consistent demand for transporting non-Indigenous patients in the remaining remote and rural areas of Australia.

Figure 5.7 demonstrates that the greatest number of Indigenous patients were from Alice Springs (NT). In Qld, the majority of aeromedical transports for CVD were from Cairns, Rockhampton and Mt Isa. In NSW, the majority of transports were from Broken Hill. In SA, the majority of aeromedical transports for CVD were from Adelaide. In the NT, the majority of transports were from Alice Springs. In WA, the majority of transports were from Kalgoorlie, Broome and Geraldton. There was consistent demand for Indigenous transports in the remaining remote and rural areas of Australia.

5.4.4 Demand for aeromedical transports for CVD by Australian state and territory

Table 5.2 demonstrates the demand for aeromedical transports for CVD by Australian state and territory from 1 July 2013 to 30 December, 2016. Data for Tasmania and the ACT are not reported, because of small numbers, confidentiality or other concerns about the quality of the data. Similarly, some data are not recorded for Victoria, to maintain patient confidentiality. Low numbers of transports from Tasmania, the ACT and Victoria are most likely explained by the small proportion of remote and very remote areas in these states and territories, and/or by the fact that there are other emergency response organisations providing services in these areas.

Table 5.2. Aeromedical transports by Australian state and territory, July 2013–December 2016

Variable	NSW	Qld	NT	WA	SA	Vic	ACT	Tas
Number retrieved ²	1,201 (5.9%)	9,431 (46.3%)	903 (4.4%)	5,329 (26.2%)	3,401 (16.7%)	97 (0.5%)	n.p.	n.p.
Per week	6.6	51.8	5.0	29.3	18.7	0.5	n.p.	n.p.
Gender⁴								
Male	747 (62.2%)	5,961 (63.2%)	490 (54.3%)	3,492 (65.5%)	2,174 (63.9%)	63 (64.9%)	n.p.	n.p.
Female	454 (37.8%)	3,470 (36.8%)	413 (45.7%)	1,837 (34.5%)	1,227 (36.1%)	34 (35.1%)	n.p.	n.p.
Proportion	Males 1.6 times as likely as females to be retrieved	Males 1.7 times as likely as females to be retrieved	Males 1.2 times as likely as females to be retrieved	Males 1.9 times as likely as females to be retrieved	Males 1.8 times as likely as females to be retrieved	Males 1.8 times as likely as females to be retrieved	n.p.	n.p.
Indigenous status¹								
Non-Indigenous	1,005 (85.5%)	5,044 (83.6%)	292 (32.4%)	4,077 (76.6%)	3,114 (91.6%)	95 (100%)	n.p.	n.p.
Indigenous	171 (14.5%)	992 (16.4%)	610 (67.6%)	1,244 (23.4%)	285 (8.4%)	0	n.p.	n.p.
Age (years)³								
0–9	12 (1.0%)	149 (1.6%)	43 (4.7%)	39 (0.7%)	42 (1.2%)	n.p.	n.p.	n.p.
10–19	5 (0.4%)	110 (1.2%)	37 (4.1%)	57 (1.1%)	39 (1.1%)	n.p.	n.p.	n.p.
20–29	18 (1.5%)	248 (2.6%)	65 (7.2%)	125 (2.3%)	104 (3.1%)	n.p.	n.p.	n.p.
30–39	47 (3.9%)	449 (4.8%)	112 (12.4%)	338 (6.3%)	136 (4.0%)	n.p.	n.p.	n.p.
40–49	115 (9.5%)	1,001 (10.6%)	170 (18.8%)	771 (14.5%)	286 (8.4%)	n.p.	n.p.	n.p.
50–59	200 (16.6%)	1,705 (18.1%)	225 (24.8%)	1,246 (23.4%)	605 (17.8%)	n.p.	n.p.	n.p.
60–69	281 (23.3%)	2,258 (23.9%)	152 (16.8%)	1,310 (24.6%)	786 (23.1%)	n.p.	n.p.	n.p.
70–79	292 (24.2%)	2,217 (23.5%)	84 (9.3%)	977 (18.3%)	818 (24.1%)	n.p.	n.p.	n.p.
80+	235 (19.5%)	1,293 (13.7%)	18 (2.0%)	466 (8.7%)	585 (17.2%)	n.p.	n.p.	n.p.
Total	1,205 (100%)	9,430 (100%)	906 (100%)	5,329 (100%)	3,401 (100%)	n.p.	n.p.	n.p.

Notes:

¹ Includes data only for patients whose Indigenous status was known (n=16,934).

² Includes data for all patients (n=20,379), comprising non-Indigenous (n=13,632); Indigenous (n=3,302); and Indigenous status unknown (n=3,445).

³ Excludes patients whose age was unknown.

⁴ Excludes patients whose gender was unknown.

n.p.: Not publishable because of small numbers, confidentiality or other concerns about the quality of the data.

Between 1 July 2013 and 30 December 2016, Qld had the greatest proportion of patients (46.3%). WA (26.2%) and SA (16.7%) also had a large proportion of patients. Across all states and territories, males were more likely than females to undergo an aeromedical transport for CVD—males were between 1.2 and 1.9 times as likely as females to be retrieved for CVD.

5.4.5 Aeromedical transports for CVDs by sub-chapter

ICD-10-AM Chapter 9 CVD sub-chapter headings and 3-item code clinical diagnostic data were analysed in order to provide detailed information regarding the most prominent CVDs warranting aeromedical transport by the RFDS (Figure 5.8 and Table 5.3). Data for a six-month period from 1 July 2016 to 31 December 2016 were used for this analysis.

Figure 5.8. Aeromedical transports for CVD, by ICD-10-AM sub-chapter, July 2016–December 2016

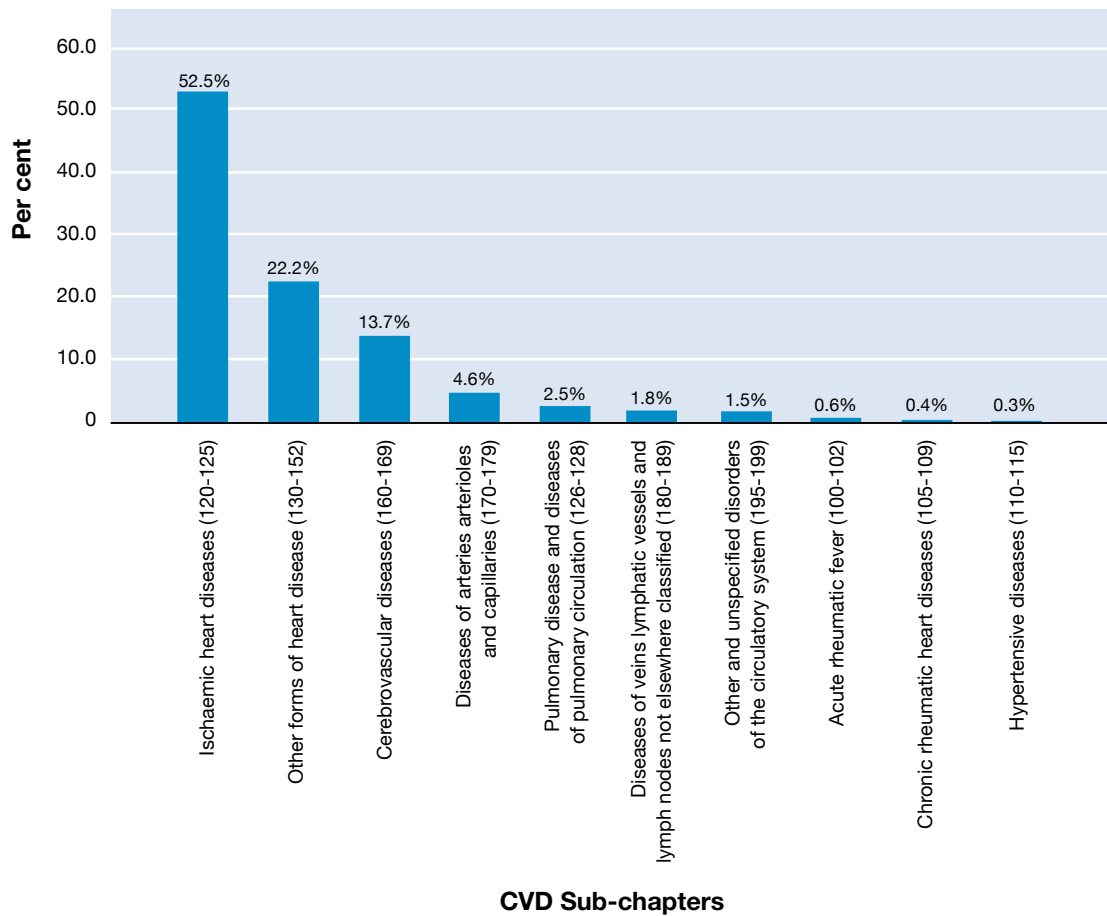


Table 5.3. Aeromedical transports for CVD, by ICD-10-AM sub-chapter and 3-item code, July 2016–December 2016

ICD-10-AM CVD chapter sub-headings ICD-10-AM CVD 3-character code	Number (N)	Percent (%)
Acute rheumatic fever (I00–I02)		
Rheumatic fever without mention of heart involvement	13	.5
Rheumatic fever with heart involvement	3	.1
Subtotal	16	0.6
Cerebrovascular diseases (I60–I69)		
Subarachnoid haemorrhage	71	2.6
Intracerebral haemorrhage	55	2.0
Other nontraumatic intracranial haemorrhage	31	1.1
Cerebral infarction	39	1.4
Stroke not specified as haemorrhage or infarction	151	5.5
Occlusion and stenosis of precerebral arteries not resulting in cerebral infarction	7	.3
Occlusion and stenosis of cerebral arteries not resulting in cerebral infarction	5	.2
Other cerebrovascular diseases	12	.4
Cerebrovascular disorders in diseases classified elsewhere	6	.2
Sequelae of cerebrovascular disease	2	.1
Subtotal	379	13.7
Chronic rheumatic heart diseases (I05–I09)		
Rheumatic mitral valve diseases	6	.2
Rheumatic aortic valve diseases	1	.04
Multiple valve diseases	3	.1
Other rheumatic heart diseases	1	.0
Subtotal	11	0.34
Diseases of arteries arterioles and capillaries (I70–I79)		
Atherosclerosis	2	.1
Aortic aneurysm and dissection	28	1.0
Other aneurysm and dissection	9	.3
Other peripheral vascular diseases	30	1.1
Arterial embolism and thrombosis	36	1.3
Other disorders of arteries and arterioles	20	.7
Disorders of arteries arterioles and capillaries in diseases classified elsewhere	1	.04
Subtotal	126	4.54
Diseases of veins, lymphatic vessels, and lymph nodes not elsewhere classified (I80–I89)		
Phlebitis and thrombophlebitis	8	.3
Other venous embolism and thrombosis	29	1.0
Oesophageal varices	6	.2
Other disorders of veins	3	.1
Nonspecific lymphadenitis	1	.05

ICD-10-AM CVD chapter sub-headings	Number (N)	Percent (%)
ICD-10-AM CVD 3-character code		
Other noninfective disorders of lymphatic vessels and lymph nodes	2	.1
Subtotal	49	1.74
Hypertensive diseases (I10–I15)		
Essential (primary) hypertension	6	.2
Hypertensive heart disease	2	.1
Hypertensive kidney disease	1	.04
Subtotal	9	0.34
Ischaemic heart diseases (I20–I25)		
Angina pectoris	260	9.4
Acute myocardial infarction	1078	38.9
Subsequent myocardial infarction	26	.9
Certain current complications following acute myocardial infarction	5	.2
Other acute ischaemic heart diseases	68	2.5
Chronic ischaemic heart disease	17	.6
Subtotal	1,454	52.5
Other and unspecified disorders of the circulatory system (I95–I99)		
Hypotension	9	.3
Postprocedural disorders of circulatory system not elsewhere classified	8	.3
Other disorders of circulatory system in diseases classified elsewhere	2	.1
Other and unspecified disorders of circulatory system	23	.8
Subtotal	42	1.5
Other forms of heart disease (I30–I52)		
Acute pericarditis	16	.6
Other diseases of pericardium	15	.5
Acute and subacute endocarditis	18	.7
Nonrheumatic mitral valve disorders	8	.3
Nonrheumatic aortic valve disorders	23	.8
Nonrheumatic tricuspid valve disorders	1	.04
Pulmonary valve disorders	2	.1
Endocarditis valve unspecified	12	.4
Endocarditis and heart valve disorders in diseases classified elsewhere	6	.2
Acute myocarditis	9	.3
Myocarditis in diseases classified elsewhere	1	.05
Cardiomyopathy	16	.6
Cardiomyopathy in diseases classified elsewhere	1	.05
Atrioventricular and left bundle-branch block	22	.8
Other conduction disorders	50	1.8
Cardiac arrest	38	1.4
Paroxysmal tachycardia	32	1.2
Atrial fibrillation and flutter	111	4.0

ICD-10-AM CVD chapter sub-headings	Number (N)	Percent (%)
ICD-10-AM CVD 3-character code		
Other cardiac arrhythmias	82	3.0
Heart failure	127	4.6
Complications and ill-defined descriptions of heart disease	15	.5
Other heart disorders in diseases classified elsewhere	9	.3
Subtotal	614	22.24
Pulmonary heart disease and diseases of pulmonary circulation (I26–I28)		
Pulmonary embolism	58	2.1
Other pulmonary heart diseases	10	.4
Subtotal	68	2.5
Total	2,768	100

During this six-month period, 2,768 remote and rural patients experienced an CVD event and were retrieved by the RFDS and transported to a hospital to receive definitive treatment for CVD. Data on patients retrieved for CVD were classified under one of 10 sub-chapters comprising 66 ICD-10-AM 3-character codes. More than half (52.5%) of all CVD transports were for CHD. The two main CHDs that lead to a patient requiring an aeromedical transport were ‘acute myocardial infarction’ (heart attack) (38.9%) and ‘angina pectoris’ (angina) (9.4%).

Almost one-quarter (22.2%) of CVD transports were for patients experiencing other forms of heart disease. The two main other forms of heart disease that lead to a patient requiring an aeromedical transport were ‘heart failure’ (4.6%) and ‘atrial fibrillation and flutter’ (4.0%).

Around one in seven (13.7%) CVD transports were for patients experiencing cerebrovascular diseases. The two main cerebrovascular diseases that lead to a patient requiring an aeromedical transport were ‘stroke not specified as haemorrhage or infarction’ (5.5%) and ‘subarachnoid haemorrhage’ (2.6%).

5.5 Discussion

RFDS data demonstrated that between July 2013 and December 2016, 20,379 Australians underwent an aeromedical transport for CVD. Each week, 112 patients, comprising 71 males and 41 females, were transported by the RFDS to receive definitive care in a hospital for CVD. This equates to 63% males and 37% females.

The average age for an aeromedical transport differed according to Indigenous status—on average Indigenous Australians (50–54 years) transported via an aeromedical transport were up to 10 years younger than non-Indigenous Australians (60–64 years). This is likely to reflect the younger age structure of the Indigenous population and the higher proportion of Indigenous Australians in remote and rural Australia. Indeed, age-standardised transport rates confirmed the significant overrepresentation of Indigenous Australians. Specifically, age-standardised data demonstrated that Indigenous Australians were between 9.0 times and 56.1 times as likely as non-Indigenous Australians to be retrieved for CVD.

The data demonstrated that the mean age for an aeromedical transport for CVD was 55–59 years and demand for aeromedical transports was highest among older Australians. This reflects national data that demonstrate CVD prevalence increases with age, with 36% of Australians aged 55–64 reporting a long-term CVD condition, increasing to 66% for Australians aged 75 and over (Heart Foundation, 2017c).

Analysis of clinical data collected between July 2016 and December 2016 demonstrated that more than half of these patients had a diagnosis related to CHD, such as a heart attack or angina. This is consistent with what is observed in national mortality data—in 2016, CHD was

the leading cause of CVD death in Australia, accounting for 12.0% of all deaths (Australian Bureau of Statistics, 2017). It is not surprising that patients with CHD accounted for a large proportion, given the potentially life-threatening impact of CHD on an individual experiencing it, and the requirement for rapid treatment.

These data are also consistent with other national data indicating that CVD is higher in men, and Indigenous Australians, in remote and rural areas. Specifically, CVD was responsible for 27.7% of all deaths in Australia in 2016 (Australian Bureau of Statistics, 2017). Nationally, age-standardised death rates demonstrated that males (169 deaths per 100,000 population) were 1.4 times as likely as females (120 deaths per 100,000 population) to die from CVD in 2016 (Australian Bureau of Statistics, 2017). Similar to RFDS data, national data have also demonstrated that CVD is more common among Indigenous Australians, and occurs at much younger ages compared to the non-Indigenous population (Australian Institute of Health and Welfare, 2016b).

This overrepresentation of males and Indigenous Australians in aeromedical transports for CVD, compared with females and non-Indigenous Australians, is unacceptable. It suggests that prevention, early intervention and ongoing treatment for people with CVD should target all remote and rural males and Indigenous Australians of all ages. In addition, targeted interventions for females aged 30 years or older may be warranted, given the increase in CVD amongst females with age. Targeted interventions amongst these groups may be helpful in reducing the incidence, or mediating the impacts of, CVD in remote and rural Australia.

The data also demonstrated that Indigenous patients were picked up from a wide spatial distribution and that the largest number of transports were undertaken in Qld. Within the states and territories, there were some specific areas where aeromedical transports were higher than other areas, including Alice Springs (high numbers of Indigenous patient transports) and Rockhampton (higher numbers of non-Indigenous patient transports). Early intervention, prevention and treatment services should be prioritised in these areas.

5.6 Future opportunities—RFDS data

There is an opportunity for the RFDS to review its data collection procedures and to develop a national data collection policy to be adopted throughout the RFDS Federation. This would enable better reporting of programs, facilitate direct comparisons of data across Australia, and facilitate better assessment of outcomes, and evaluations of, RFDS delivered programs.

More specifically, the RFDS has an opportunity to review its own data collection processes to ensure all relevant data around aeromedical transports are collected. It is especially important that Indigenous status is recorded for all patients, to enable the RFDS to gain a more complete picture of the nature of CVD impacting both Indigenous and non-Indigenous Australians. The RFDS has recently commenced systematically digitising Indigenous and non-Indigenous patient data around illnesses and injuries. Since 2013, illness and injury data have been consistently entered into RFDS electronic databases, enabling the RFDS to gain a national overview of the clients it serves. Systematic collection of data around CVD, including more detailed information on specific CVDs impacting patients, and the settings in which they occur, will enable more comprehensive analyses of aeromedical transport data in the future.

Data linkage between the RFDS and state, territory and national clinical datasets has commenced in some Sections and Operations. As linkages are established, longitudinal data on patients initially transported by the RFDS, and treated in hospital for CVD, will enable the RFDS to access comprehensive information on a patient's prognosis, treatment, recovery, and rehabilitation service use regarding their CVD. Data linkage with local service providers that operate in areas where the RFDS delivers services, such as local GPs, ACCHOs or local hospitals would also assist in providing a more complete picture of the health outcomes of people from remote and rural Australia.

CASE STUDY > HEART ATTACK IN ROCKHAMPTON



Graphic: Busby Marou Royal Flying



Jeremy Marou's father, a fit, athletic man in his 50s, was playing a game of touch football with his son, family and friends in Rockhampton. Unfortunately, it would be his last after a heart attack took his life that night.

15 years later, Jeremy himself was lying in a hospital bed awaiting RFDS transfer to Brisbane after a sickening coincidence, which saw him almost fall to the same fate as his father on the same touch footy field in Rockhampton.

"I was playing touch footy with my family and friends as I do quite often. I'm not the fittest bloke in the world but I'm not too bad," Jeremy said.

Jeremy is one half of Australian award-winning roots music duo, Busby Marou. Speaking to the RFDS following his latest shows in Tasmania as part of the band's latest album tour, Jeremy said it's lucky he is able to tour at all.

"Since the [Rockhampton] floods we were playing two games to catch up. We finished the first game off and I just had this weird feeling across my chest. I knew something wasn't quite right," he said.

Knowing he had to fly out of Rockhampton the following morning, Jeremy said he thought it would be wise to skip the second game and head home for some rest. However, on the drive home, a spinning head and tight chest forced him to pull over and let his wife take the wheel. Before she even had a chance to drive, Jeremy told her it might be best to just go straight to the hospital.

By the time the couple arrived at Rockhampton Hospital, Jeremy said he was actually feeling fine. He thought he might have just been experiencing exhaustion. Doctors told him otherwise.

Jeremy had suffered a heart attack as a result of his right artery being 99% blocked, and despite telling the doctors he was now feeling well enough to head home, he was instead told he should have someone bring a bag to the airport as he would be flying to Brisbane.

"I really didn't want to put them out, so I told them it's all good, I'm a platinum flyer so I can sort the flight out myself," Jeremy laughs. "They pretty quickly told me I would be flying with the Flying Doctor."

Jeremy said it was the sudden realisation of the seriousness of his situation that could have contributed the second heart attack, which hit him that night.

“It was the anxiety of knowing that I wasn’t going home, I was going straight to an ambulance and to the tarmac. That made me really anxious and it was actually then that I had secondary heart pains,” he said.

“I reckon it was purely because of my anxiety of being scared and worried and not really knowing what was going on because now I was being flown to Brisbane with the RFDS.

“I thought, ‘This is only for people who are dying!’ I was really scared.”

Jeremy’s anxiety was apparent to RFDS Flight Nurse Stacey Clayworth as she prepared Jeremy for his flight to the capital.

“Feeling anxious about not only the flight, but also what is to come when the patient is transferred onto a tertiary hospital is very common,” Stacey said.

“Our patients are often in a state of disbelief that they have had a major health scare and now find themselves in the back of an RFDS aircraft being flown to Brisbane, often in a hurry, for specialist treatment.

“It’s our job to provide the patient with reassurance while closely monitoring them during the flight.”

A self-declared fan of Busby Marou, Stacey said herself and pilot Stephen Clarke jokingly suggested to Jeremy that this experience may one day materialise in one of his songs.

“We really wish him well in his recovery and hope to see him playing back on stage in Rocky soon,” she said.

Jeremy praised Stacey and the flight crew for their calm heads in what was one of the most harrowing moments in his life.

“Stacey was so good,” Jeremy said. “I know for a fact I wasn’t the easiest patient. I just wanted to sit down, but I know they definitely had my best interests at heart and just wanted to ensure my wellbeing, and they got me through what was, at the time, a very scary time for me.”

Now well and truly on the mend after a short stay in Brisbane, Jeremy says he has never felt as good as he does now. “I’m really enjoying the recovery,” Jeremy said.

“We’re cutting out all of the bad things you do on tour like alcohol and cigarettes, and it’s giving me a whole new perspective on some of the amazing places we get to travel to.

“Instead of waking up hungover and running to catch the next flight, we’re taking the time to get out and see some of the towns and cities we visit. And my dog thinks it’s great because now he’s getting walked every day.

“It’s unfortunate that it took a heart attack—a massive close call—for me to make those changes. Genetics were obviously against me, knowing that I almost suffered the same fate as my father, but I know there are lifestyle choices I can make to keep me going.”

Jeremy also said that Stacey’s wish of seeing Jeremy and Busby Marou back performing in their hometown of Rockhampton would also be on the cards.

“Once we finish this tour towards the end of the year we plan on holding a concert in Rocky to raise funds and give back to the Flying Doctor,” he said.

“It’s the least I can do after what they did for me.”

5.7 Summary

The RFDS plays a vital role in transporting patients from remote and rural Australia to receive definitive care for CVD. With appropriate medical services often unavailable in remote and rural Australia, the RFDS is an integral part of the medical system. The RFDS provided aeromedical transports to 20,379 Australians from July 2013 to December 2016.

6.0 Recommendations and conclusion

Many CVD events, including heart attacks and strokes, are preventable (Dunbar et al., 2017a). Increased investment in, and access to, evidence-based, culturally appropriate prevention, early intervention, and treatment services for people at increased risk of CVD, and those who have experienced a CVD event, is required in order to improve cardiovascular health and reduce the disparities in prevalence, incidence and adverse outcomes from CVD for people living in remote and rural Australia. Addressing the modifiable risk factors for CVD has the potential to improve the cardiovascular health of all Australians, in addition to delivering potential savings to the Australian health system.

This chapter proposes recommendations around best practice principles that could be implemented to reduce, or minimise the impact of, CVD on remote and rural Australians served by the RFDS.

6.1 Prevention, early intervention and treatment of CVD

There is strong evidence that a dual approach to managing CVD risks—that encompasses prevention, and treatment and management for people who have had a CVD event—is beneficial in reducing the burden of disability and premature death from CVD (Dunbar et al., 2017a). “In Australia, 90% of the adult population has at least one modifiable risk factor, while 64% have three or more modifiable risk factors” (National Vascular Disease Prevention Alliance, 2012b, p. 16). Despite the fact that many Australians are at increased risk of CVD, they often do not receive optimal care (Dunbar et al., 2017a). For example, estimates suggest that around 20% of Australians aged 45–74 years at high risk of a CVD event within the next five years are not receiving recommended care (Banks, Crouch, Korda, Stavreski, Page, Thurber, & Grenfell, 2016).

Prevention, early intervention and treatment for CVD typically focuses on addressing the modifiable risk factors for the illness and may include lifestyle modifications and/or medication. There is evidence to suggest that addressing CVD risk factors using whole of population approaches is effective at reducing social inequalities (Capewell & Graham, 2010). There is preliminary evidence that approaches that focus exclusively on screening and treating high-risk individuals might inadvertently increase the inequalities gap (Capewell & Graham, 2010). Consequently, managing CVD risks should include management by individual patients and healthcare providers, “as well as whole population approaches, where change is societal and instituted collectively by agencies with statutory responsibility for public health” (Capewell & Graham, 2010, p. 3).

Table 6.1 provides examples of the impact of lifestyle modifications and/or medication on improving cardiovascular health, and briefly outlines examples of contributions from governments, PHC and individuals that could enhance cardiovascular health.

Table 6.1. Examples of effective government, PHC and individual responses to modifiable CVD risk factors around prevention, early intervention and treatment of CVD, and their impact

Risk factor	Government response	Primary care response	Individual response	Impact ^a
5-year CVD risk is medium (10–15%) or high (>15%) according to Absolute Cardiovascular Risk Assessment ³ or patient already known to be at risk (e.g. previous CVD event, diabetes and aged over 60 years, CKD etc.)	<ul style="list-style-type: none"> > Support mainstreaming of Absolute Cardiovascular Risk Assessment in PHC through: <ul style="list-style-type: none"> – Setting national targets and developing a national framework¹ – Improving data collection and monitoring to assess coverage¹ – Increasing financial support to the PHC sector¹ – Extending care planning to people identified as being at high risk of CVD¹ – Health promotion activities around risk screening¹ > Supportive government policies to embed preventative health within PHC 	<ul style="list-style-type: none"> > Screening for absolute risk of CVD (targeted to adults aged 45–74 years, or 35 years for Indigenous Australians), and appropriate evidence-based management of patients regarding lifestyle modifications (advise and support), blood pressure, lipids (cholesterol and triglycerides) as per current guidelines^{1,3} > Evidence-based treatment and management of patients who have already experienced a CVD event¹ > Use of recalls and reminders to follow up with patients¹ > Support from PHNs to build capability in general practice¹ 	<ul style="list-style-type: none"> > See PHC clinician for a heart health check³ > Follow treatment plan developed in consultation with PHC clinician if 5-year CVD risk is medium or high > CVD is largely preventable, so an approach focusing on Absolute Cardiovascular Risk Assessment facilitates effective management of identified modifiable risk factors through lifestyle changes and, where needed, pharmacological therapy³ 	<ul style="list-style-type: none"> > CVD is largely preventable, so an approach focusing on Absolute Cardiovascular Risk Assessment facilitates effective management of identified modifiable risk factors through lifestyle changes and, where needed, pharmacological therapy³
Tobacco smoking	<ul style="list-style-type: none"> > Tobacco control,^{1,13} including the continuation and scaling up of the National Tobacco Campaign⁷ > Supportive government policies to embed preventative health within PHC > Health promotion activities around smoking cessation > Enact laws to support smoke-free environments, such as in workplaces and public places¹³ 	<ul style="list-style-type: none"> > Offer smokers advice about methods to aid smoking cessation, including: <ul style="list-style-type: none"> – Counselling services³ – Nicotine replacement therapy (if assessed as nicotine dependent)³ – Other appropriate pharmacotherapy therapy (if assessed as nicotine dependent)³ 	<ul style="list-style-type: none"> > Seek treatment > Undertakes self-care and management > Quit smoking¹ 	<ul style="list-style-type: none"> > 2 weeks to 3 months after quitting: <ul style="list-style-type: none"> – Heart attack risk drops² > 1 year after quitting: <ul style="list-style-type: none"> – Excess risk for heart disease is reduced by 50%² > 15 years after quitting: <ul style="list-style-type: none"> – Heart disease is approximately the same as that of a lifelong non-smoker²
Elevated blood pressure	<ul style="list-style-type: none"> > Supportive government policies to embed preventative health within PHC 	<ul style="list-style-type: none"> > Provide advice and support for lifestyle interventions³ > Initiate blood pressure-lowering pharmacotherapy³ 	<ul style="list-style-type: none"> > Patient may be unaware of elevated blood pressure (may have no symptoms)³ > Once known, follow treatment plan developed in consultation with PHC clinician 	<ul style="list-style-type: none"> > A meta-analysis of 147 trials, involving 446,000 patients prescribed blood pressure-lowering medications demonstrated: <ul style="list-style-type: none"> – Reductions in total mortality and mortality from CHD and stroke¹⁰ – Lowering systolic blood pressure by 10 mmHg or diastolic blood pressure by 5 mmHg reduced CHD events by 24%, stroke by 34%, and heart failure by 22%¹⁰

Risk factor	Government response	Primary care response	Individual response	Impact ^a
Elevated serum lipids (cholesterol, triglycerides)	<ul style="list-style-type: none"> > Supportive government policies to embed preventative health within PHC 	<ul style="list-style-type: none"> > Provide advice and support for lifestyle interventions³ > Initiate lipid-lowering therapy³ 	<ul style="list-style-type: none"> > Patient may be unaware of elevated cholesterol or triglycerides (may have no symptoms)³ > Once known, follow treatment plan developed in consultation with PHC clinician 	<ul style="list-style-type: none"> > A meta-analysis of 10 trials, involving 70,388 patients without established CVD, but with risk factors for CVD, found that those who received statins, (versus placebo or usual care), over at least one year, demonstrated: <ul style="list-style-type: none"> — A 30% reduction in major coronary events¹¹ — A 29% reduction in major strokes¹¹
Overweight and obesity	<ul style="list-style-type: none"> > Develop a comprehensive national obesity prevention strategy⁷ > Health promotion activities around overweight and obesity¹² > Supportive government policies to embed preventative health within PHC > Consider taxation on foods that are high in fat, sugar and salt¹³ 	<ul style="list-style-type: none"> > Provide advice and support for lifestyle interventions³ > Promote weight loss interventions 	<ul style="list-style-type: none"> > Seek treatment¹² > Undertake self-care and management¹² > Reduce body weight, including waist circumference and BMI^{1,3} 	<ul style="list-style-type: none"> > Weight loss interventions can favourably influence CVD risk by reducing BP and blood lipid levels³ > A systematic review of weight loss interventions versus placebo/no intervention, from nine trials, involving 2,000 patients, demonstrated: <ul style="list-style-type: none"> — A reduction in TC at 12 months^{3,14} — A 35% reduction in recurrence of high blood pressure and CVD events^{3,15}
Poor diet	<ul style="list-style-type: none"> > Health promotion activities around diet¹ > Supportive government policies to embed preventative health within PHC 	<ul style="list-style-type: none"> > Provide advice and support for lifestyle interventions³ > Provide dietary advice³ > Refer for nutritional review and dietary counselling if needed³ > Advise and provide support to patients to follow the current Australian Dietary Guidelines³ 	<ul style="list-style-type: none"> > Seek advice > Improve diet¹ > Consume diet: <ul style="list-style-type: none"> — Rich in vegetables³ — Rich in fruit³ — Low in salt³ — Low in saturated and trans fats³ 	<ul style="list-style-type: none"> > A meta-analysis of 44 trials, involving 18,175 adults, found that those who received dietary advice demonstrated (over 3-24 months) <ul style="list-style-type: none"> — Reductions in TC⁸ — Reductions in LDL cholesterol⁸ — Reductions in BP⁸ — Reductions in total dietary fat as a percentage of total energy intake⁸ — Reductions in saturated fat intake⁸ — Increase in fruit and vegetable consumption⁸ — Increase in dietary fibre⁸

Risk factor	Government response	Primary care response	Individual response	Impact ^a
Insufficient physical activity	<ul style="list-style-type: none"> > Health promotion activities around exercise¹ > Supportive government policies to embed preventative health within PHC 	<ul style="list-style-type: none"> > Provide advice and support for lifestyle interventions³ 	<ul style="list-style-type: none"> > Increase physical activity¹ > At least 30 minutes moderate intensity physical activity on most or preferably every day of the week³ 	<ul style="list-style-type: none"> > A meta-analysis of 22 studies demonstrated that 2.5 hours a week (equivalent to 30 minutes daily of moderate intensity activity on five days a week) compared with no activity, was associated with a reduction in all-cause mortality risk of 19%^{3,4} > 7 hours a week of moderate activity, compared with no activity, reduced all-cause mortality risk by 24%^{3,4} > Physical activity: 150 minutes of moderate physical activity each week is estimated to reduce the risk of stroke and high blood pressure, as well as reducing the risk of CHD by 30%⁵
Harmful levels of alcohol intake	<ul style="list-style-type: none"> > Supportive government policies to embed preventative health within PHC > Health promotion activities around safe levels of alcohol consumption 	<ul style="list-style-type: none"> > Provide advice and support for lifestyle interventions³ > Advise all adults to follow current Australian guidelines to reduce health risks from drinking alcohol (2009)^{3,6} 	<ul style="list-style-type: none"> > Seek treatment > Reduce harmful drinking¹ 	<ul style="list-style-type: none"> > A meta-analysis of 84 observational studies involving >2 million participants found reduced relative risk (RR) for alcohol drinkers (1-2 drinks per day) relative to non-drinkers for: of 44 trials, involving 18,175 adults, <ul style="list-style-type: none"> — CVD mortality (RR 0.75)¹⁶ — Incident CHD (RR 0.71)¹⁶ — CHD mortality (RR 0.75)¹⁶ — Incident stroke (RR 0.98)¹⁶ > The meta-analysis demonstrated an increased risk for: <ul style="list-style-type: none"> > Stroke mortality (RR 1.06)¹⁶

Note: ^a Selected examples of impact are provided. For a comprehensive review of studies supporting the impact of treatment on modifiable risk factors for CVD, see National Vascular Disease Prevention Alliance (2012b).

Sources: ¹Dunbar et al. (2017a); ²National Center for Chronic Disease Prevention and Health Promotion (2009); ³National Vascular Disease Prevention Alliance (2012b); ⁴Woodcock, Franco, Orsini, and Roberts (2010); ⁵World Health Organization (2017c); ⁶National Health and Medical Research Council (2009); ⁷Heart Foundation (2017d); ⁸Rees, Dyakova, Wilson, Ward, Thorogood, and Brunner (2013); ⁹Heart Foundation (2017f); ¹⁰Law, Morris, and Wald (2009); ¹¹Brugts, Yeğin, Hoeks, Goffo, Shepherd, Westendorp, de Craen, Knopp, Nakamura, Ridker, van Domburg, and Deckers (2009); ¹²National Health and Medical Research Council (2013); ¹³World Health Organization (2017b); ¹⁴Witham and Avenell (2010); ¹⁵Wheilton, Appel, Espeland, Applegate, Ettlinger, Kostis, Kumanyika, Lacy, Johnson, Folmar, and Cutler (1998); ¹⁶Ronksley, Brien, Turner, Mukamal, and Ghali (2011).

Table 6.1 demonstrates that there is evidence to support positive impacts from lifestyle modifications including smoking cessation, reducing blood pressure, reducing cholesterol, achieving and maintaining a healthy weight, eating healthy food, being physically active, and reducing harmful alcohol consumption. There is also evidence that managing co-morbid or chronic conditions, such as diabetes and CKD, can improve cardiovascular health (National Vascular Disease Prevention Alliance, 2012b).

However, lifestyle modifications on their own may be insufficient to manage CVD risks in some people. Table 6.1 demonstrates that in some instances, medication may be required to assist in reducing the risk of a cardiovascular event by controlling risk factors such as high blood pressure and high blood cholesterol (Heart Foundation, 2017i). Examples of medications for CVD may include:

- > Medication to lower cholesterol (e.g. statins);
- > Medication to reduce high blood pressure such as:
 - angiotensin converting enzyme inhibitors
 - angiotensin II receptor blockers
 - beta-blockers;
- > Anti-angina medications (e.g. nitrates);
- > Anti-clotting/anti-platelet medications (e.g. aspirin); and
- > Anticoagulant medicines (e.g. warfarin, novel anticoagulant therapies (NOACs)) (Heart Foundation, 2017i).

In addition to lifestyle modifications and medication, surgical interventions and medical devices are sometimes required to treat CVD (World Health Organization, 2017b). Examples of surgical interventions may include:

- > Coronary artery bypass;
- > Balloon angioplasty (where a small balloon-like device is threaded through an artery to open the blockage);
- > Valve repair and replacement;
- > Heart transplantation; and
- > Artificial heart operations (World Health Organization, 2017b).

Examples of medical devices that may be required to treat some CVDs include:

- > Pacemakers;
- > Prosthetic valves; and
- > Patches for closing holes in the heart (World Health Organization, 2017b).

6.1.1 Remote and rural populations

The evidence-based prevention, early intervention, and treatment options described in Table 6.1 should be implemented in remote and rural areas, as a priority, due to the poorer cardiovascular health of Australians living in these areas.

The social determinants that impact on the cardiovascular health of patients from remote and rural Australia must also be considered (Tideman et al., 2013). Place of residence is an important determinant of cardiovascular health, with people living in remote and rural Australia experiencing poorer cardiovascular health than people living in major cities (Tideman et al., 2013). Poorer access to services, and variation in implementation of evidence-based CVD care across geographic boundaries, may contribute to poorer cardiovascular health in remote and rural Australia (Tideman et al., 2013). Specifically, remote and rural areas have fewer health professionals, reduced health infrastructure and higher costs of health care delivery. Compared to people living in major cities, people from remote and rural Australia also have poorer access to, and demonstrate lower use of, health services (Australian Institute of Health and Welfare, 2016a).

In 2014, there were 264 full-time equivalent (FTE) medical practitioners per 100,000 population in remote and very remote areas compared to 437 FTE medical practitioners per 100,000 population in major cities (Australian Institute of Health and Welfare, 2016a). Data from 2010–11 painted a similar picture—the number of GP services provided per person in very remote areas during 2010–11 was around half that of major cities (Duckett, Breadon, & Ginnivan, 2013).

Medicare Benefits Schedule access by people from remote and rural Australia is therefore much lower than for people living in major cities (Centre for International Economics, 2015). People living in very remote areas see GPs at half the rate of people living in major cities, allied health professionals at one-third of the rate, and specialists at one-fifth of the rate (Centre for International Economics, 2015).

Improvements in cardiovascular health for people from remote and rural Australia therefore involves addressing the underlying ‘causes of causes’ of poor heart health, or the social determinants of health (National Rural Health Alliance Inc & Heart Foundation, 2015). “These relate to a combination of social and economic factors, including education, employment, work conditions, housing, racism and discrimination” (National Rural Health Alliance Inc & Heart Foundation, 2015 p. 2) Such an approach requires “genuine partnerships across sectors, true community engagement and a commitment to long term solutions” (National Rural Health Alliance Inc & Heart Foundation, 2015 p. 2).

The development of a regionalised clinical cardiac support network in SA is one example of a program that has been developed to improve access to services for people from remote and rural Australia with CVD (Tideman et al., 2014). Specifically, the SA Integrated Cardiovascular Clinical Network (iCCNet) supports the capacity of primary care to manage suspected MI (heart attacks) by providing expert risk stratification, point-of-care troponin testing and cardiologist-supported decision-making for people with suspected MI (Tideman et al., 2014). This program was progressively implemented in non-metropolitan areas of SA from 2001 to 2008. It provides rapid assessment of non-metropolitan patients, and, with the RFDS, facilitates timely transport of patients to metropolitan hospitals to receive medical interventions such as coronary angiography, percutaneous coronary intervention, coronary artery bypass graft surgery and cardiac rehabilitation services (Tideman et al., 2014).

Researchers evaluated the relationship between availability of the iCCNet service and mortality by reviewing 30-day death rates among patients with MI presenting to rural hospitals before and after the clinical network implementation were compared and contrasted these with mortality rates among primary MI presentations in metropolitan hospitals (Tideman et al., 2014). The results demonstrated that the immediate cardiac support provided through iCCNet was associated with a 22% odds ratio in 30-day mortality (OR, 0.78; 95% CI, 0.65–0.93; P=0.007) (Tideman et al., 2014). In addition, there was a strong association between network support and transfer of patients to metropolitan hospitals (before iCCNet, 1102/2419 [45.56%] v after iCCNet, 2100/3211 [65.4%]; P< 0.001), with lower mortality observed among transferred patients (Tideman et al., 2014). “These interventions closed the gap in mortality between rural and metropolitan patients in South Australia” (Tideman et al., 2014, p. 157).

Evidence is also emerging around new technologies that could help improve CVD outcomes for people in remote and rural Australia. Telecardiology is often used in the PHC setting to assist in the diagnosis and management of CVD (Backman, Bendel, & Rakhit, 2010). A trial of paediatric telecardiology services in Queensland, involving videoconferencing for the transmission of echocardiograms, proved useful for the assessment of children with suspected cardiac disease (Justo, Smith, Williams, Van der Westhuyzen, Murray, Sciuto, & Wootton, 2004). Clinical records from 72 patients, who underwent paediatric echocardiograms at Hervey Bay or Mackay, between 2001 and 2004, were retrospectively assessed to determine patient outcomes (Justo et al., 2004). The echocardiograms were performed by local sonographers at both centres, under the guidance of a cardiologist at a tertiary centre in Brisbane, with parents present (Justo et al., 2004). All parties participated in the videoconference. Following the videoconference 90% of patients could be managed locally, and reviewed at a subsequent outreach clinic, and urgent transfers to a tertiary centre were organised in a timely manner (Justo et al., 2004).

Novel trials are also generating evidence about ways in which cardiovascular health can be improved. More recently, and with improved technology, new biomarkers are being used as predictors of CVD risk. Traditionally, cardiac troponin (c-Tn), which is a “specific marker of myocardial injury and an independent predictor of cardiovascular mortality in patients with and without cardiovascular disease” (Ford, Shah, Zhang, McAllister, Strachan, Caslake, Newby, Packard, & Mills, 2016, p. 2720), has been used in hospital settings for acute CVD presentations to assist with decision-making. With the development of high sensitivity troponin T and high sensitivity troponin I testing (collectively known as ‘hs-cTn’), previously undetected levels of troponin can now be captured (Xu, Zhu, Yang, & Ye, 2013).

As well as being used in hospital settings for acute events, hs-cTn can be used in a predictive role as part of chronic disease management, including in PHC. Higher troponin concentrations “may reflect subclinical coronary artery disease and identify those at greatest risk who would benefit from preventative therapies” (Ford et al., 2016, p. 2720), including lifestyle modifications and medications. When considered alongside other risk factors for CVD, elevated troponin levels may assist PHC clinicians in determining the most appropriate treatment for their patients.

It follows that the implementation of innovations and improved coordination of PHC services for people at risk of CVD, such as more enhanced screening, including the inclusion of hs-cTn testing, would enable clinicians to more accurately identify asymptomatic individuals at risk of CVD. Earlier identification and risk stratification of individuals by PHC physicians would facilitate earlier intervention with evidence-based treatments, which may assist in reducing the morbidity and mortality associated with premature CVD events. For example, the West of Scotland Coronary Prevention Study provided compelling evidence that treatment with a statin (pravastatin) for five years was associated with a significant reduction in coronary events for a subsequent 10 years in men with hypercholesterolemia who did not have a history of myocardial infarction (Ford, Murray, Packard, Shepherd, Macfarlane, & Cobbe, 2007; Ford et al., 2016).

6.1.2 Indigenous Australians

Indigenous Australians, especially those in remote and rural areas, have a substantially increased risk of CVD compared with their non-Indigenous counterparts. Consequently, improving their cardiovascular health, by facilitating access to the evidence-based prevention, early intervention, and treatment options described in Table 6.1 is essential. However, there are a number of potential barriers around their uptake.

There is strong evidence that inequitable access to quality healthcare, based on cultural origins, contributes to health disparities for Indigenous Australians (Bainbridge, McCalman, Clifford, & Tsey, 2015). For example, between 2002 and 2003 major disparities were identified in the management of Indigenous patients, hospitalised with acute coronary syndrome (ACS) (Mathur, Moon, & Leigh, 2006). Compared to non-Indigenous hospitalised patients with ACS, hospitalised Indigenous Australians had a 40% lower rate of coronary angiography, a 40% lower rate of percutaneous coronary intervention, and a 20% lower rate of coronary artery bypass graft surgery (Mathur et al., 2006).

Similarly, recent research identified discrepancies in ACS treatment uptake between Aboriginal and non-Aboriginal South Australians (Tavella, McBride, Keech, Kelly, Rischbieth, Zeitz, Beltrame, Tideman, & Brown, 2016). Specifically, Aboriginal patients presenting with an ACS were 60% less likely to receive angiography after adjustment for age, co-morbidities and remoteness, than non-Aboriginal patients (Tavella et al., 2016). “In 56% of cases in which Aboriginal patients did not undergo angiography, the decision was attributed to patient-related factors or no clear justification was provided, compared with 17% for non-Aboriginal patients. The rate of discharge against medical advice was high among Aboriginal patients who did not receive angiography (10.5%)” (Tavella et al., 2016, p. 226).

The researchers proposed a number of potential barriers to providing care for Aboriginal patients, including poor engagement and communication, a lack of coordinated care, and inadequate cultural competence of health care providers (Tavella et al., 2016). Shared decision-

making and cultural support structures were also identified as important, as patients who arrived at hospital with a family member or friend, or had involvement with an Aboriginal liaison officer, were more likely to undergo angiography (Tavella et al., 2016).

Consequently, it is important to “increase efforts to improve the ability of all systems, services and practitioners to work with the diversity of patients” (Bainbridge et al., 2015, p. 4). This can be achieved by taking an approach recognising the social determinants of health (Osborne et al., 2013, pp. 2–3).

A review of the characteristics of effective programs that take a social determinants approach to Indigenous health, identified 10 principles that characterise effective programs (Osborne et al., 2013). The RFDS recommends that the principles identified in that review are incorporated into any future health programs to improve the cardiovascular health of Indigenous Australians.

These principles include:

- > Holistic approaches which work with Indigenous people in ways which take into account the full cultural, social, emotional and economic context of their lives, including an awareness of the ongoing legacy of trauma, grief and loss associated with colonisation;
- > Active involvement of Indigenous communities in every stage of program development and delivery, in order to build genuine, collaborative and sustainable partnerships with Indigenous peoples, and build capacity within Indigenous communities;
- > Collaborative working relationships between government agencies and other relevant organisations in delivering services and programs, acknowledging the interrelatedness of key social and economic determinants across multiple life domains for Indigenous Australians;
- > Valuing Indigenous knowledge and cultural beliefs and practices which are important for promoting positive cultural identity and social and emotional wellbeing for Indigenous Australians;
- > Clear leadership and governance for programs, initiatives and interventions. This includes commitment from high level leadership of relevant organisations and agencies to the aims of reducing Indigenous disadvantage and addressing determinants of health and wellbeing;
- > Employing Indigenous staff and involving them fully in program design, delivery and evaluation, and providing adequate training, where necessary, to build capacity of Indigenous staff;
- > Developing committed, skilled staff (Indigenous and non-Indigenous) and providing diversity and cultural awareness training;
- > In cases where programs demonstrate success, it is important to provide adequate, sustainable resources for the long-term;
- > Adopting a strengths-based perspective which builds and develops the existing strengths, skills and capacities of Indigenous people; and
- > Clear plans for research and evaluation to identify successful aspects of programs, provide a basis to amend and improve, demonstrate success and build an evidence base to justify allocation of ongoing resources (Osborne et al., 2013, pp. 2–3).

In addition to these principles, all healthcare provided to Indigenous Australians, including government, community, or privately run, should be free of racism (Department of Health, 2013). This goal was established in The National Aboriginal and Torres Strait Islander Health Plan 2013–2023 (Department of Health, 2013) in recognition of the fact that historical and existing barriers prevent many Indigenous Australians from accessing healthcare or receiving optimal clinical care. These barriers are recognised in the Plan as contributing to poor and ultimately avoidable health outcomes (Department of Health, 2013).

There is compelling evidence that supports cultural competence as a “key strategy for reducing inequalities in healthcare access and improving the quality and effectiveness of care for Indigenous people” (Bainbridge et al., 2015, p. 2). Cultural competence “works to enhance the capacity and ability of health service systems, organisations and practitioners to provide more responsive health care to diverse cultural groups” (Bainbridge et al., 2015, p. 4).

The advent of Aboriginal Community Controlled Health Services (ACCHSs) has played a significant role in driving change and in providing culturally appropriate and competent services to Indigenous Australians (Bainbridge et al., 2015). ACCHSs have employed a model of comprehensive PHC and community governance, and “have reduced unintentional racism, barriers to access to health care, and are progressively improving individual health outcomes for Aboriginal people” (Panaretto, Wenitong, Button, & Ring, 2014).

Other organisations are also delivering culturally appropriate and competent services for Indigenous Australians. For example, The Heart Foundation, in partnership with the Australian Healthcare and Hospitals Association, developed a toolkit, with input from key stakeholders, to drive systemic change in the acute care sector by focusing on hospital-based quality improvement activities that could improve ACS outcomes for Aboriginal and Torres Strait Islander peoples (National Heart Foundation of Australia & Australian Healthcare and Hospitals Association, 2016). This Toolkit is part of the Lighthouse Hospital Project and “provides health practitioners with the tools and practical steps needed to ensure Aboriginal and Torres Strait Islander peoples receive clinically appropriate treatment that is delivered in a culturally safe manner, irrespective of the health service they attend” (National Heart Foundation of Australia & Australian Healthcare and Hospitals Association, 2016, p. 6). The toolkit outlines four areas that are critical in providing holistic care for Aboriginal and Torres Strait Islander peoples and their families as they journey through the hospital system and return to their communities. The four domains are: governance, cultural competence, workforce and care pathways (Heart Foundation, 2017h).

Although Indigenous Australians have worse cardiovascular health than their non-Indigenous counterparts, multiple initiatives have been developed and implemented, in partnership with Indigenous Australians to improve their cardiovascular health. It is important to highlight this progress and to celebrate the positive outcomes that such initiatives have produced (Walker, Lovett, Kukutai, Jones, & Henry).

6.2 Actions to improve the cardiovascular health of people from remote and rural Australia

The evidence presented in this report supports suggests that action is required to continue to improve the cardiovascular health of people from remote and rural Australia. In order to achieve optimal population-wide cardiovascular health of remote and rural Australians, a multi-faceted approach to managing CVD is required. In 2013, the 194 WHO member states agreed on global mechanisms to reduce the burden from avoidable non-communicable diseases (NCDs), including CVD, and developed a Global action plan for the prevention and control of NCDs 2013–2020 (World Health Organization, 2017b). Two of the nine voluntary global targets of the plan relate directly to CVDs. Target one proposed a “25% relative reduction in the overall mortality from cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases” (World Health Organization, 2013, p. 61). Target eight proposed “at least 50% of eligible people receive drug therapy and counselling (including glycaemic control) to prevent heart attacks and strokes” (World Health Organization, 2013, p. 63). Several of the remaining targets related to addressing risk factors for CVD, including smoking cessation, overweight and obesity and elevated blood pressure (World Health Organization, 2013).

The RFDS supports an approach that considers both individual and population-wide approaches to improving the cardiovascular health of all Australians. The RFDS recommends a number of actions be implemented by the Australian Government and state and territory governments to improve the cardiovascular health of Indigenous and non-Indigenous Australians. These include:

- > Supporting practices, policies and research that promote equity, and take a social determinants of health approach to improving cardiovascular health;
- > Development of supportive government policies to embed preventative health within PHC;
- > Adequately funded PHC, supported by appropriate tools (Dunbar et al., 2017a);

- > Support for mainstreaming Absolute Cardiovascular Risk Assessment in PHC (Dunbar, Duggan, Fetherston, Knight, McNamara, Banks, Booth, Bunker, Burgess, Colagiuri, Dawda, Ford, Greenland, Grenfell, Knight, & Moran, 2017b; National Vascular Disease Prevention Alliance, 2012b);
- > Development of “a comprehensive national cardiovascular disease strategy as an integral part of the National Strategic Framework for Chronic Conditions” (Heart Foundation, 2017d, p. 6), with a focus on groups most at risk of CVD including:
 - People from remote and rural Australia;
 - Indigenous Australians; and
 - Older Australians;
- > Supporting the development, and regular updating of, appropriate evidence-based guidelines by the NHMRC (e.g. overweight and obesity, dietary guidelines etc.) and providing adequate funding to achieve this;
- > Continued research funding for CVD research (Heart Foundation, 2017d)—every \$1 invested into the NHMRC-funded health and medical research workforce for CVD between 2000–15 returned \$9.80 (Deloitte Access Economics, 2016);
- > Health promotion activities and population engagement—such as social marketing campaigns to improve uptake for initiatives, e.g. population-wide absolute risk-screening programs (Dunbar et al., 2017a);
- > Supporting the implementation of cost-effective, culturally appropriate, high-impact interventions and cost-effective interventions to address behavioural risk factors (World Health Organization, 2013);
- > Expanding and embedding services in the community, close to need;
- > Supporting the implementation of novel approaches to primary prevention of CVD—for example, the Heart Outcomes Prevention Evaluation-3 (HOPE-3) trial, which was initiated in 2007, to “test a novel approach based on the use of a statin drug and combination BP-lowering drugs in a wide range of easily identifiable individuals at intermediate risk for CVD” (Lonn, Bosch, Pogue, Avezum, Chazova, Dans, Diaz, Fodor, Held, Jansky, Keltai, Keltai, Kunti, Kim, Leiter, Lewis, Liu, Lopez-Jaramillo, Pais, Parkhomenko, Peters, Piegas, Reid, Sliwa, Toff, Varigos, Xavier, Yusoff, Zhu, Dagenais, & Yusuf, 2016, p. 316);
- > Increasing investment in new and emerging technologies that show promising signs of effectiveness, such as telecardiology, video consultations and other telehealth services (Backman et al., 2010); and
- > Implementing of innovative service models—including consideration of further use of RFDS infrastructure to deliver necessary, appropriate, and more comprehensive prevention, early intervention and treatment services, more often.

References

- Aggarwal, S., Qamar, A., Sharma, V., & Sharma, A. (2011). Abdominal aortic aneurysm: A comprehensive review. *Experimental & Clinical Cardiology*, 16(1), 11–15.
- Allenby, A., Kinsman, L., Tham, R., Symons, J., Jones, M., & Campbell, S. (2016). The quality of cardiovascular disease prevention in rural primary care. *Australian Journal of Rural Health*, 24(2), 92–98.
- Alston, L., Allender, S., Peterson, K., Jacobs, J., & Nichols, M. (2017). Rural inequalities in the Australian burden of ischaemic heart disease: A systematic review. *Heart, Lung and Circulation*, 26(2), 122–133.
- Aspex Consulting. (2014). *Royal Flying Doctor Service traditional services–systems development: Paper on classification, counting and measurement*. East Melbourne: Aspex Consulting.
- Australian Bureau of Statistics. (2013a). *Australian demographic statistics, March 2013*. ABS cat. no. 3101.0. Retrieved from <http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/3101.0Feature+Article1Mar%202013> on 14/12/2016.
- Australian Bureau of Statistics. (2013b). *Technical paper: Socio-Economic Indexes for Areas (SEIFA)*. ABS cat. no. 2033.0.55.001. Canberra: Australian Bureau of Statistics.
- Australian Bureau of Statistics. (2015). *National Health Survey first results: Australia 2014–2015*. ABS cat. no. 4364.0.55.001. Canberra: Australian Bureau of Statistics.
- Australian Bureau of Statistics. (2017). *Causes of death, Australia, 2016*. ABS cat. no. 3303.0. Retrieved from <http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/3303.0~2016~Main%20Features~Summary%20of%20findings~1> on 24/10/2017.
- Australian Council of Social Service. (2015). *Inequality in Australia: A nation divided*. Sydney: Australian Council of Social Service.
- Australian Health Ministers' Advisory Council. (2017). *Aboriginal and Torres Strait Islander Health Performance Framework 2017 report*. Canberra: Australian Health Ministers' Advisory Council.
- Australian Institute of Health and Welfare. (2014a). *Australia's health 2014*. Canberra: Australian Institute of Health and Welfare.
- Australian Institute of Health and Welfare. (2014b). *Health care expenditure on cardiovascular diseases 2008–09*. Cat. no. CVD 65. Canberra: Australian Institute of Health and Welfare.
- Australian Institute of Health and Welfare. (2015a). *Cardiovascular disease, diabetes and chronic kidney disease— Australian facts: Aboriginal and Torres Strait Islander people. Cardiovascular, diabetes and chronic kidney disease*. Canberra: Australian Institute of Health and Welfare.
- Australian Institute of Health and Welfare. (2015b). *Cardiovascular disease, diabetes and chronic kidney disease—Australian facts: Aboriginal and Torres Strait Islander people. Cardiovascular, diabetes and chronic kidney disease series no. 5*. Cat. no. CDK 5. Canberra: Australian Institute of Health and Welfare.
- Australian Institute of Health and Welfare. (2015c). *The health and welfare of Australia's Aboriginal and Torres Strait Islander peoples 2015*. Cat. no. IHW 147. Canberra: Australian Institute of Health and Welfare.
- Australian Institute of Health and Welfare. (2016a). *Australia's health 2016. Australia's health series no. 15*. Cat. no. AUS 199. Canberra: Australian Institute of Health and Welfare.

Australian Institute of Health and Welfare. (2016b). *Australian Burden of Disease Study: impact and causes of illness and death in Aboriginal and Torres Strait Islander people 2011*. Australian Burden of Disease Study series no. 6. Cat. no. BOD 7. Canberra: Australian Institute of Health and Welfare.

Australian Institute of Health and Welfare. (2016c). *Australian Burden of Disease Study: Impact and causes of illness and death in Australia 2011*. Australian Burden of Disease Study series no. 3. BOD 4. Canberra: Australian Institute of Health and Welfare.

Australian Institute of Health and Welfare. (2016d). *Cardiovascular health compendium*. Retrieved from <https://www.aihw.gov.au/reports/heart-stroke-vascular-disease/cardiovascular-health-compendium/contents/how-many-australians-have-cardiovascular-disease> on 25/10/2017.

Australian Institute of Health and Welfare. (2017a). *Admitted patient care 2015–16: Australian hospital statistics*. Health services series no. 75. Cat. no. HSE 185. Canberra: Australian Institute of Health and Welfare.

Australian Institute of Health and Welfare. (2017b). *Bulletin 141: Trends in cardiovascular deaths*. Canberra: Australian Institute of Health and Welfare.

Australian Institute of Health and Welfare. (2017c). *Deaths from cardiovascular disease*. Canberra: Australian Institute of Health and Welfare.

Australian Institute of Health and Welfare. (2017d). *The health of Australia's females*. Retrieved from <https://www.aihw.gov.au/reports/men-women/female-health/contents/how-healthy> on 11/12/2017.

Australian Institute of Health and Welfare. (2017e). *The health of Australia's males*. Retrieved from <https://www.aihw.gov.au/reports/men-women/male-health/contents/how-healthy> on 11/12/2017.

Australian Institute of Health and Welfare. (2017f). *How many Australians have cardiovascular disease?* Retrieved from <http://www.aihw.gov.au/cardiovascular-disease/prevalence/> on 4/6/2017.

Australian Institute of Health and Welfare. (2017g). *National Drug Strategy Household Survey 2016: Detailed findings*. Drug Statistics series no. 31. Cat. no. PHE 214. Canberra: Australian Institute of Health and Welfare.

Australian Institute of Health and Welfare. (2017h). *Rural & remote Health*. Retrieved from <https://www.aihw.gov.au/reports-statistics/population-groups/rural-remote-australians/overview> on 13/09/2017.

Australian Institute of Health and Welfare. (2017i). *What is cardiovascular disease?* Retrieved from <http://www.aihw.gov.au/cardiovascular-disease/what-is-cvd/> on 20/6/2017.

Backman, W., Bendel, D., & Rakhit, R. (2010). The telecardiology revolution: Improving the management of cardiac disease in primary care. *Journal of the Royal Society of Medicine*, 103(11), 442–446.

Bainbridge, R., McCalman, J., Clifford, A., & Tsey, K. (2015). *Cultural competency in the delivery of health services for Indigenous people*. Issues paper no. 13. Produced for the Closing the Gap Clearinghouse. Canberra and Melbourne: Australian Institute of Health and Welfare and Australian Institute of Family Studies.

Banks, E., Crouch, S. R., Korda, R. J., Stavreski, B., Page, K., Thurber, K. A., & Grenfell, R. (2016). Absolute risk of cardiovascular disease events, and blood pressure- and lipid-lowering therapy in Australia. *Medical Journal of Australia*, 204(8), 320.

beyondblue. (2014). *Coronary heart disease, anxiety and depression*. Retrieved from https://www.heartfoundation.org.au/images/uploads/publications/Beyondblue_depression_CHD.pdf on 11/12/2017.

British Academy. (2014). 'If you could do one thing ...': nine local actions to reduce health inequalities. London: British Academy.

- Brugts, J. J., Yetgin, T., Hoeks, S. E., Gotto, A. M., Shepherd, J., Westendorp, R. G., de Craen, A. J., Knopp, R. H., Nakamura, H., Ridker, P., van Domburg, R., & Deckers, J. W. (2009). The benefits of statins in people without established cardiovascular disease but with cardiovascular risk factors: meta-analysis of randomised controlled trials. *British Medical Journal*, 338, b2376.
- Capewell, S., & Graham, H. (2010). Will cardiovascular disease prevention widen health inequalities? *PLoS Med*, 7(8), e1000320.
- Centre for International Economics. (2015). *The Royal Flying Doctor Service: Flexible and responsive primary healthcare for rural and remote Australia*. Canberra: Centre for International Economics.
- Colquhoun, D. M., Bunker, S. J., Clarke, D. M., Glozier, N., Hare, D. L., Hickie, I. B., Tatoulis, J., Thompson, D. R., Tofler, G. H., Wilson, A., & Branagan, M. G. (2013). Screening, referral and treatment for depression in patients with coronary heart disease. *Medical Journal of Australia*, 198(9), 483–484.
- Colquhoun, S. M., Condon, J. R., Steer, A. C., Li, S. Q., Guthridge, S., & Carapetis, J. R. (2015). Disparity in mortality from rheumatic heart disease in Indigenous Australians. *Journal of the American Heart Association*, 4(7), 1–9.
- Deloitte Access Economics. (2016). *Australia's health and medical research workforce: Expert people providing exceptional returns*. Retrieved from <https://www2.deloitte.com/content/dam/Deloitte/au/Documents/Economics/deloitte-au-economics-australias-health-and-medical-research-workforce-071116.pdf> on 17/12/2017.
- Department of Health. (2013). *National Aboriginal and Torres Strait Islander Health Plan 2013–2023*. Canberra: Australian Government.
- Department of Health. (2016). *Cardiovascular disease*. Retrieved from <http://health.gov.au/internet/main/publishing.nsf/Content/chronic-cardio> on 10/6/2017.
- Duckett, S., Breadon, P., & Ginnivan, L. (2013). *Access all areas: New solutions for GP shortages in rural Australia*. Melbourne: Grattan Institute.
- Dunbar, J. A., Duggan, M., Fetherstron, H., Knight, A., McNamara, K., Banks, E., Booth, K., Bunker, S. P., Burgess, C. P., Colagiuri, S., Dawda, P., Ford, D., Greenland, R., Grenfell, R., Knight, S., & Moran, M. (2017a). *Heart health: the first step to getting Australia's health on track. Technical paper No. 2017–02*. Melbourne, Victoria University: Australian Health Policy Collaboration.
- Dunbar, J. A., Duggan, M., Fetherstron, H., Knight, A., McNamara, K., Banks, E., Booth, K., Bunker, S. P., Burgess, C. P., Colagiuri, S., Dawda, P., Ford, D., Greenland, R., Grenfell, R., Knight, S., & Moran, M. (2017b). *Heart health: the first step to getting Australia's health on track: Policy paper*. Melbourne, Victoria University: Australian Health Policy Collaboration.
- Falster, M. O., Randall, D. A., Lujic, S., Ivers, R., Leyland, A. H., & Jorm, L. R. (2013). Disentangling the impacts of geography and Aboriginality on serious road transport injuries in New South Wales. *Accident Analysis and Prevention*, 54, 32–38.
- Ford, I., Murray, H., Packard, C. J., Shepherd, J., Macfarlane, P. W., & Cobbe, S. M. (2007). Long-term follow-up of the west of Scotland coronary prevention study. *New England Journal of Medicine*, 357(15), 1477–1486.
- Ford, I., Shah, A. S., Zhang, R., McAllister, D. A., Strachan, F. E., Caslake, M., Newby, D. E., Packard, C. J., & Mills, N. L. (2016). High-sensitivity cardiac troponin, statin therapy, and risk of coronary heart disease. *Journal of American College of Cardiology*, 68(25), 2719–2728.
- Forfia, P. R., Vaidya, A., & Wiegers, S. E. (2013). Pulmonary heart disease: The heart-lung interaction and its impact on patient phenotypes. *Pulmonary Circulation*, 3(1), 5–19.
- Garvan Research Foundation. (2015). *Medical research and rural health: Garvan report 2015*. Darlinghurst: Garvan Research Foundation.

- Harrison, J. E., & Henley, G. (2014). *Suicide and hospitalised self-harm in Australia: Trends and analysis. Injury research and statistics series no. 93. Cat. no. INJCAT 169*. Canberra: Australian Institute of Health and Welfare.
- Hart, M. B., Moore, M. J., & Laverty, M. (2017). Improving Indigenous health through education. *Medical Journal of Australia*, 2017(1), 11–12.
- He, V. Y., Condon, J. R., You, J., Zhao, Y., & Burrow, J. N. (2015). Adverse outcome after incident stroke hospitalization for Indigenous and non-Indigenous Australians in the Northern Territory. *International Journal of Stroke*, 10 Suppl A100, 89–95.
- Heart Foundation. (2015). *Familial hypercholesterolaemia (FH)*. Retrieved from <https://www.heartfoundation.org.au/images/uploads/publications/familial-hypercholesterolaemia.pdf> on 11/12/2017.
- Heart Foundation. (2017a). *Aboriginal Health*. Retrieved from <https://www.heartfoundation.org.au/for-professionals/aboriginal-health> on 18/07/2017.
- Heart Foundation. (2017b). *Australian heart maps*. Retrieved from <https://www.heartfoundation.org.au/for-professionals/heart-maps/australian-heart-maps> on 23/10/2017.
- Heart Foundation. (2017c). *Cardiovascular disease fact sheet*. Retrieved from <https://www.heartfoundation.org.au/about-us/what-we-do/heart-disease-in-australia/cardiovascular-disease-fact-sheet> on 10/6/2017.
- Heart Foundation. (2017d). *Cost-effective actions to tackle the biggest killer of men and women: Heart disease. Submission on the 2017-18 Federal Budget from the National Heart Foundation of Australia*. Retrieved from https://www.heartfoundation.org.au/images/uploads/publications/HF_Federal_Budget_Submission_2017-18_-_FINAL.pdf on 16/12/2017.
- Heart Foundation. (2017e). *Heart attack risk factors*. Retrieved from <https://www.heartfoundation.org.au/your-heart/know-your-risks/heart-attack-risk-factors> on 19/7/2017.
- Heart Foundation. (2017f). *Heart health check*. Retrieved from <https://www.heartfoundation.org.au/your-heart/know-your-risks/heart-health-check> on 16/12/2017.
- Heart Foundation. (2017g). *High blood pressure statistics*. Retrieved from <https://www.heartfoundation.org.au/about-us/what-we-do/heart-disease-in-australia/high-blood-pressure-statistics> on 16/12/2017.
- Heart Foundation. (2017h). *The Lighthouse Toolkit*. Retrieved from <https://www.heartfoundation.org.au/for-professionals/aboriginal-health/the-lighthouse-toolkit> on 19/12/2017.
- Heart Foundation. (2017i). *Medicines*. Retrieved from <https://www.heartfoundation.org.au/your-heart/living-with-heart-disease/medicines> on 19/7/2017.
- Heart Foundation. (2017j). *What is coronary heart disease?* Retrieved from <https://www.heartfoundation.org.au/your-heart/heart-conditions/what-is-coronary-heart-disease> on 2/11/2017.
- Hippisley-Cox, J., Coupland, C., Robson, J., & Brindle, P. (2010). Derivation, validation, and evaluation of a new QRISK model to estimate lifetime risk of cardiovascular disease: Cohort study using QResearch database. *British Medical Journal*, 341, c6624.
- Hokanson, J. E., & Austin, M. A. (1996). Plasma triglyceride is a risk factor for cardiovascular disease independent of high density lipoprotein cholesterol: A meta analyses of population based prospective studies. *Journal of Cardiovascular Research*, 5(3), 213–219.
- ICD10Data.com. (Undated). *2015/16 ICD-10-CM Codes*. Retrieved from <http://www.icd10data.com/ICD10CM/Codes> on 18/11/2015.
- Justo, R., Smith, A. C., Williams, M., Van der Westhuyzen, J., Murray, J., Sciuto, G., & Wootton, R. (2004). Paediatric telecardiology services in Queensland: A review of three years' experience. *Journal of Telemedicine and Telecare*, 10 Suppl 1, 57–60.

- Kidney Health Australia. (2016). *Cardiovascular disease and chronic kidney disease*. Retrieved from http://kidney.org.au/cms_uploads/docs/cardiovascular-disease-and-chronic-kidney-disease-fact-sheet.pdf on 14/11/2017.
- King, M., Smith, A., & Gracey, M. (2009). Indigenous health part 2: The underlying causes of the health gap. *The Lancet*, 374(9683), 76–85.
- Kinsman, L., Tham, R., Symons, J., Jones, M., Campbell, S., & Allenby, A. (2016). Prevention of cardiovascular disease in rural Australian primary care: an exploratory study of the perspectives of clinicians and high-risk men. *Australian Journal of Primary Health*, 22(6), 510–516.
- Kolber, M. R., & Scrimshaw, C. (2014). Family history of cardiovascular disease. *Canadian Family Physician*, 60(11), 1016.
- Korda, R. J., Soga, K., Joshy, G., Calabria, B., Attia, J., Wong, D., & Banks, E. (2016). Socioeconomic variation in incidence of primary and secondary major cardiovascular disease events: An Australian population-based prospective cohort study. *International Journal for Equity in Health*, 15(1), 189.
- Law, M. R., Morris, J. K., & Wald, N. J. (2009). Use of blood pressure lowering drugs in the prevention of cardiovascular disease: Meta-analysis of 147 randomised trials in the context of expectations from prospective epidemiological studies. *British Medical Journal*, 338, b1665.
- Lonn, E., Bosch, J., Pogue, J., Avezum, A., Chazova, I., Dans, A., Diaz, R., Fodor, G. J., Held, C., Jansky, P., Keltai, M., Keltai, K., Kunti, K., Kim, J.-H., Leiter, L., Lewis, B., Liu, L., Lopez-Jaramillo, P., Pais, P., Parkhomenko, A., Peters, R. J. G., Piegas, L. S., Reid, C. M., Sliwa, K., Toff, W. D., Varigos, J., Xavier, D., Yusoff, K., Zhu, J., Dagenais, G., & Yusuf, S. (2016). Novel approaches in primary cardiovascular disease prevention: The HOPE-3 trial rationale, design, and participants' baseline characteristics. *Canadian Journal of Cardiology*, 32(3), 311–318.
- Margolis, S. A., & Ypinazar, V. A. (2009). Aeromedical retrieval for critical clinical conditions: 12 years of experience with the Royal Flying Doctor Service, Queensland, Australia. *Journal of Emergency Medicine*, 36(4), 363–368.
- Mathur, S., Moon, L., & Leigh, S. C. (2006). *Aboriginal and Torres Strait Islander people with coronary heart disease: Further perspectives on health status and treatment*. *Cardiovascular disease series no. 25*. Canberra: Australian Institute of Health and Welfare.
- Mayo Clinic. (2017). *Heart attack risk factors*. Retrieved from <http://www.mayoclinic.org/diseases-conditions/heart-attack/basics/risk-factors/con-20019520> on 02/09/2017.
- McDonnell, A., Aitken, P., Elcock, M., & Veitch, C. (2009). The organisation of trauma services for rural Australia. *Australasian Journal of Paramedicine*, 7(2).
- Murray, C. J. L., & Lopez, A. D. (1996). *The Global Burden of Disease: A comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020*. Cambridge: Harvard University Press.
- National Center for Chronic Disease Prevention and Health Promotion. (2009). *The power of prevention: Chronic disease . . . the public health challenge of the 21st century*. Atlanta: National Center for Chronic Disease Prevention and Health Promotion.
- National Health and Medical Research Council. (2009). *Australian guidelines to reduce the health risks from drinking alcohol*. Retrieved from <http://www.nhmrc.gov.au/publications/synopses/ds10syn.htm> on 16/12/2017.
- National Health and Medical Research Council. (2013). *Clinical practice guidelines for the management of overweight and obesity in adults, adolescents and children in Australia*. Melbourne: National Health and Medical Research Council.
- National Heart Foundation of Australia. (2016). *Guideline for the diagnosis and management of hypertension in adults 2016*. Melbourne: National Heart Foundation of Australia.

- National Heart Foundation of Australia, & Australian Healthcare and Hospitals Association. (2016). *Improving health outcomes for Aboriginal and Torres Strait Islander peoples with acute coronary syndrome. A practical toolkit for quality improvement .Third edition*. Retrieved from https://www.heartfoundation.org.au/images/uploads/main/Lighthouse_Toolkit_How_to_use_this_toolkit.pdf on 19/12/2017.
- National Heart Lung and Blood Institute. (2012). *What is pericarditis?* Retrieved from <https://www.nhlbi.nih.gov/health/health-topics/topics/peri> on 2/11/2017.
- National Heart Lung and Blood Institute. (2016). *What is atherosclerosis?* Retrieved from <https://www.nhlbi.nih.gov/health/health-topics/topics/atherosclerosis> on 4/11/2017.
- National Rural Health Alliance Inc, & Heart Foundation. (2015). *Cardiovascular disease in rural Australia*. Retrieved from <http://ruralhealth.org.au/sites/default/files/publications/cardiovascular-disease-fact-sheet-may-2015.pdf> on 18/12/2017.
- National Vascular Disease Prevention Alliance. (2009). *Guidelines for the assessment of absolute cardiovascular disease risk*. Retrieved from https://lifeinthefastlane.com/wp-content/uploads/2010/10/A_AR_Guidelines_FINAL-FOR-WEB.pdf on.
- National Vascular Disease Prevention Alliance. (2012a). *Australian absolute cardiovascular disease calculator*. Retrieved from <http://www.cvdcheck.org.au/> on 14/12/2017.
- National Vascular Disease Prevention Alliance. (2012b). *Guidelines for the management of absolute cardiovascular disease risk*. Retrieved from <https://www.heartfoundation.org.au/images/uploads/publications/Absolute-CVD-Risk-Full-Guidelines.pdf> on 14/11/2017.
- Nicholson, A., Kuper, H., & Hemingway, H. (2006). Depression as an aetiologic and prognostic factor in coronary heart disease: a meta-analysis of 6362 events among 146 538 participants in 54 observational studies. *European Heart Journal*, 27(23), 2763–2774.
- Norton, R., & Kobusingye, O. (2013). Injuries. *New England Journal of Medicine*, 368(18), 1723–1730.
- Osborne, K., Baum, F., & Brown, L. (2013). *What works? A review of actions addressing the social and economic determinants of Indigenous health. Issues paper no. 7. Produced for the Closing the Gap Clearinghouse*. Canberra and Melbourne: Australian Institute of Health and Welfare and Australian Institute of Family Studies.
- Panaretto, K. S., Wenitong, M., Button, S., & Ring, I. T. (2014). Aboriginal community controlled health services: Leading the way in primary care. *Medical Journal of Australia*, 200(11), 649–652.
- Ransom, A. (2011). *Age-standardised rate Excel workbook*. Unpublished.
- Rees, K., Dyakova, M., Wilson, N., Ward, K., Thorogood, M., & Brunner, E. (2013). Dietary advice for reducing cardiovascular risk. *Cochrane Database of Systematic Reviews*(12).
- Rheumatic Heart Disease Australia. (2017a). *What is acute rheumatic fever?* Retrieved from <https://www.rhdaustralia.org.au/what-acute-rheumatic-fever> on 16/06/2017.
- Rheumatic Heart Disease Australia. (2017b). *What is rheumatic heart disease?* Retrieved from <https://www.rhdaustralia.org.au/what-rheumatic-heart-disease> on 31/10/2017.
- Ronksley, P. E., Brien, S. E., Turner, B. J., Mukamal, K. J., & Ghali, W. A. (2011). Association of alcohol consumption with selected cardiovascular disease outcomes: a systematic review and meta-analysis. *British Medical Journal*, 342, d671.
- Roth, G. A., Forouzanfar, M. H., Moran, A. E., Barber, R., Nguyen, G., Feigin, V. L., Naghavi, M., Mensah, G. A., & Murray, C. J. (2015). Demographic and epidemiologic drivers of global cardiovascular mortality. *New England Journal of Medicine*, 372(14), 1333–1341.

Roth, G. A., Johnson, C., Abajobir, A., Abd-Allah, F., Abera, S. F., Abyu, G., Ahmed, M., Aksut, B., Alam, T., Alam, K., Alla, F., Alvis-Guzman, N., Amrock, S., Ansari, H., Arnlov, J., Asayesh, H., Atey, T. M., Avila-Burgos, L., Awasthi, A., Banerjee, A., Barac, A., Barnighausen, T., Barregard, L., Bedi, N., Belay Ketema, E., Bennett, D., Berhe, G., Bhutta, Z., Bitew, S., Carapetis, J., Carrero, J. J., Malta, D. C., Castaneda-Orjuela, C. A., Castillo-Rivas, J., Catala-Lopez, F., Choi, J. Y., Christensen, H., Cirillo, M., Cooper, L., Jr., Criqui, M., Cundiff, D., Damasceno, A., Dandona, L., Dandona, R., Davletov, K., Dharmaratne, S., Dorairaj, P., Dubey, M., Ehrenkranz, R., El Sayed Zaki, M., Faraon, E. J. A., Esteghamati, A., Farid, T., Farvid, M., Feigin, V., Ding, E. L., Fowkes, G., Gebrehiwot, T., Gillum, R., Gold, A., Gona, P., Gupta, R., Habtewold, T. D., Hafezi-Nejad, N., Hailu, T., Hailu, G. B., Hankey, G., Hassen, H. Y., Abate, K. H., Havmoeller, R., Hay, S. I., Horino, M., Hotez, P. J., Jacobsen, K., James, S., Javanbakht, M., Jeemon, P., John, D., Jonas, J., Kalkonde, Y., Karimkhani, C., Kasaeian, A., Khader, Y., Khan, A., Khang, Y. H., Khera, S., Khoja, A. T., Khubchandani, J., Kim, D., Kolte, D., Kosen, S., Krohn, K. J., Kumar, G. A., Kwan, G. F., Lal, D. K., Larsson, A., Linn, S., Lopez, A., Lotufo, P. A., El Razek, H. M. A., Malekzadeh, R., Mazidi, M., Meier, T., Meles, K. G., Mensah, G., Meretoja, A., Mezgebe, H., Miller, T., Mirrakhimov, E., Mohammed, S., Moran, A. E., Musa, K. I., Narula, J., Neal, B., Ngalesoni, F., Nguyen, G., Obermeyer, C. M., Owolabi, M., Patton, G., Pedro, J., Qato, D., Qorbani, M., Rahimi, K., Rai, R. K., Rawaf, S., Ribeiro, A., Safiri, S., Salomon, J. A., Santos, I., Santric Milicevic, M., Sartorius, B., Schutte, A., Sepanlou, S., Shaikh, M. A., Shin, M. J., Shishehbor, M., Shore, H., Silva, D. A. S., Sobngwi, E., Stranges, S., Swaminathan, S., Tabares-Seisdedos, R., Tadele Atnafu, N., Tesfay, F., Thakur, J. S., Thrift, A., Topor-Madry, R., Truelsen, T., Tyrovolas, S., Ukwaja, K. N., Uthman, O., Vasankari, T., Vlassov, V., Vollset, S. E., Wakayo, T., Watkins, D., Weintraub, R., Werdecker, A., Westerman, R., Wiysonge, C. S., Wolfe, C., Workicho, A., Xu, G., Yano, Y., Yip, P., Yonemoto, N., Younis, M., Yu, C., Vos, T., Naghavi, M., & Murray, C. (2017). Global, Regional, and National Burden of Cardiovascular Diseases for 10 Causes, 1990 to 2015. *Journal of the American College of Cardiology*, 70(1), 1–25.

Royal Flying Doctor Service. (2016). *About the RFDS*. Retrieved from <https://www.flyingdoctor.org.au/about-the-rfds/> on 4/08/2016.

Royal Flying Doctor Service of Australia. (2016). *2016–2017 Reconciliation Action Plan*. Canberra: Royal Flying Doctor Service of Australia.

Smith, J. D. (2016). *Australia's rural, remote and Indigenous health 3e*. Chatswood: Elsevier.

Smith, J. D., Margolis, S. A., Ayton, J., Ross, V., Chalmers, E., Giddings, P., Baker, L., Kelly, M., & Love, C. (2008). Defining remote medical practice. A consensus viewpoint of medical practitioners working and teaching in remote practice. *Medical Journal of Australia*, 188(3), 159–161.

Tavella, R., McBride, K., Keech, W., Kelly, J., Rischbieth, A., Zeitz, C., Beltrame, J. F., Tideman, P. A., & Brown, A. (2016). Disparities in acute in-hospital cardiovascular care for Aboriginal and non-Aboriginal South Australians. *Medical Journal of Australia*, 205(5), 222–227.

Taylor, R., & Morrell, S. (2015). *Direct Age-Standardisation Calculation Tool*. Retrieved from <https://sphcm.med.unsw.edu.au/node/303112492> on 14/12/2016.

Tideman, P., Taylor, A. W., Janus, E., Philpot, B., Clark, R., Peach, E., Laatikainen, T., Vartiainen, E., Tirimacco, R., Montgomerie, A., Grant, J., Versace, V., & Dunbar, J. A. (2013). A comparison of Australian rural and metropolitan cardiovascular risk and mortality: The Greater Green Triangle and North West Adelaide population surveys. *British Medical Journal Open*, 3(8), e003203.

Tideman, P. A., Tirimacco, R., Senior, D. P., Setchell, J. J., Huynh, L. T., Tavella, R., Aylward, P. E., & Chew, D. P. (2014). Impact of a regionalised clinical cardiac support network on mortality among rural patients with myocardial infarction. *Medical Journal of Australia*, 200(3), 157–160.

Walker, J., Lovett, R., Kukutai, T., Jones, C., & Henry, D. Indigenous health data and the path to healing. *The Lancet*, 390(10107), 2022–2023.

Whelton, P. K., Appel, L. J., Espeland, M. A., Applegate, W. B., Ettinger, W. H., Jr., Kostis, J. B., Kumanyika, S., Lacy, C. R., Johnson, K. C., Folmar, S., & Cutler, J. A. (1998). Sodium reduction and weight loss in the treatment of hypertension in older persons: a randomized controlled trial of nonpharmacologic interventions in the elderly (TONE). TONE Collaborative Research Group. *Journal of the American Medical Association* 279(11), 839–846.

Witham, M. D., & Avenell, A. (2010). Interventions to achieve long-term weight loss in obese older people: a systematic review and meta-analysis. *Age and Ageing*, 39(2), 176-184.

Woodcock, J., Franco, O. H., Orsini, N., & Roberts, I. (2010). Non-vigorous physical activity and all-cause mortality: Systematic review and meta-analysis of cohort studies. *International Journal of Epidemiology*, 40(1), 121–138.

World Health Organization. (2013). *Global action plan for the prevention and control of noncommunicable diseases 2013-2020*. Geneva: World Health Organization.

World Health Organization. (2015). *Social determinants of health*. Retrieved from http://www.who.int/social_determinants/en/ on 14/07/2015.

World Health Organization. (2016). *International Statistical Classification of Diseases and Related Health Problems 10th Revision*. Geneva: World Health Organization.

World Health Organization. (2017a). *Cardiovascular diseases*. Retrieved from http://www.who.int/cardiovascular_diseases/en/ on 15/09/2017.

World Health Organization. (2017b). *Cardiovascular diseases (CVDs)*. Retrieved from <http://www.who.int/mediacentre/factsheets/fs317/en/> on 5/7/2017.

World Health Organization. (2017c). *Cardiovascular diseases: Data and statistics*. Retrieved from <http://www.euro.who.int/en/health-topics/noncommunicable-diseases/cardiovascular-diseases/data-and-statistics> on 5/7/2017.

World Health Organization. (2017d). *Mean systolic blood pressure (SBP)*. Retrieved from http://www.who.int/gho/ncd/risk_factors/blood_pressure_mean_text/en/ on 11/12/2018.

Xu, R., Zhu, X., Yang, Y., & Ye, P. (2013). High-sensitive cardiac troponin T. *Journal of Geriatric Cardiology*, 10(1), 102–109.

Yeates, K., Lohfeld, L., Sleeth, J., Morales, F., Rajkotia, Y., & Ogedegbe, O. (2015). A global perspective on cardiovascular disease in vulnerable populations. *The Canadian Journal of Cardiology*, 31(9), 1081–1093.

Yusuf, S., Hawken, S., Ounpuu, S., Dans, T., Avezum, A., Lanas, F., McQueen, M., Budaj, A., Pais, P., Varigos, J., & Lisheng, L. (2004). Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet*, 364(9438), 937–952.



Royal Flying Doctor Service