
# CARDIOVASCULAR DISEASE PREVENTION & REHABILITATION IN RURAL AND REMOTE POPULATIONS

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Royal Flying Doctor Service

## Acknowledgments

This report has been prepared by the Royal Flying Doctor Service (RFDS) Research and Policy Unit in collaboration with the Heart Foundation using data and evidence from multiple sources. The report has benefited from review by academic experts, and several RFDS and Heart Foundation staff. We are grateful for their assistance and would like to acknowledge the external experts and internal staff.

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## 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 and the Heart Foundation respect and acknowledge Aboriginal and Torres Strait Islander peoples as the first Australians and our vision for reconciliation is a culture that strives for unity, equity and respect between Aboriginal and Torres Strait Islander peoples and other Australians.

The RFDS is committed to improved health outcomes and access to health services for all Aboriginal and Torres Strait Islander Australians. Our Reconciliation Action Plan (RAP) outlines our intentions to use research and policy to drive improvement. RFDS research and policy reports include data from 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. This research and policy report contributes to the aims of the RAP.

The Heart Foundation believes improving health outcomes for Aboriginal and Torres Strait Islander peoples is everyone's business and recognises that we can only attain better outcomes by working with, not on behalf of, Aboriginal and Torres Strait Islander peoples. The Heart Foundation's RAP guides the organisation's reconciliation journey. A central focus of the RAP is to develop an organisation-wide culture that works towards a reconciled Australia. The Heart Foundation's reconciliation vision is one where we walk alongside Aboriginal and Torres Strait Islander peoples in respectful partnership to achieve equity in life expectancy and to reduce premature death and suffering from heart disease, stroke and blood vessel disease.

## 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, overcoming barriers to poor health outcomes and limited 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@rfds.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.

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## Professor Len Kritharides

It is a pleasure to be asked to provide a foreword to this Royal Flying Doctor Service (RFDS) – *Cardiovascular disease prevention and rehabilitation in rural and remote populations* – research report.

Cardiovascular disease (CVD) remains the major cause of premature death and disability in both men and women in Australia. It is also a major cause of disability, often compromising the ability to return to work. When we think of CVD, in particular, heart attack and stroke, we know very well how time is critical for restoring blood flow, and how timely access to expert medical care saves lives. Less well recognised is the importance of access to good rehabilitation after we have developed heart disease or stroke. Whether we are preventing our first heart attack (primary prevention) or our second heart attack (secondary prevention), access to expert health care can prevent heart attacks and saves lives. For people living in remote and rural Australia, the distances needed to be covered to access inner-regional and metropolitan prevention and rehabilitation services are prohibitive.

The RFDS has as special place in the Australian community. By providing timely expert care to those in remote and rural Australia, it has shown over many years a commitment to improving outcomes for Australians affected by all diseases, including CVD.  In this report the RFDS puts forward to case for doing more, much more, to help in the recovery after heart attack and stroke. Because we know that high quality cardiac rehabilitation reduces subsequent cardiac events, the access to rehabilitation services is a huge priority for all our communities.

Initiatives which improve access to preventative healthcare and cardiac rehabilitation in regional and remote Australia can save lives.

We should all support the RFDS, and other rural and remote health service providers, in their efforts to improve long term cardiovascular outcomes for people in the bush.

**Len Kritharides**
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# Summary


Globally, cardiovascular disease (CVD) accounts for millions of preventable deaths each year.[1] Based on 2014–15 data, more than 11 million Australians (47%) have at least one chronic condition,[2] with people living in rural and remote areas, and Indigenous Australians, having significantly increased chronic disease prevalence and risk.[3]

Access to health care in rural and remote areas is poor compared to metropolitan areas.[3,4] This includes insufficient service provision for the needs of the population and the requirement of many rural and remote patients to travel long distances to access health care such as hospitals, general practitioners and emergency departments.[4] As provision of primary health care is mainly located in urban and regional centres, it is of no surprise that secondary prevention services such as cardiac services, including cardiac rehabilitation (CR) programs, health services with cardiac capacity, and programs aimed at prevention, are mainly located in metropolitan and inner regional areas.[5]

This is concerning, as a leading reason for Royal Flying Doctor Service (RFDS) aeromedical retrievals[1] is diseases of the circulatory system, with acute myocardial infarction (heart attack) being the leading diagnosis.[6] Furthermore, many of the retrieval locations are in remote and very remote areas, with many of these locations having low primary care services per population.[7,8] This is important, as rural and remote populations have higher levels of mortality and morbidity, related to delayed acute treatment (i.e. heart attack treatment delays), and limited access to chronic disease management. Furthermore, rural and remote populations have increased prevalence of smoking, overweight and obesity, mental health acuity, and alcohol and drug misuse, than people living in major cities.[9,10]

The RFDS currently provides extensive telehealth and primary healthcare support to patients in rural and remote communities across Australia including providing guidance on risk factors for CVD and evidence-based recommendations for treatment, although there are limited programs focusing on the rehabilitation of CVD patients. Participating in a CR program is a first critical step in a person's recovery from their heart attack or heart event. Not only do these programs improve quality of life and risk factors, but people are 40% less likely to be readmitted to hospital and 25% less likely to die from another heart event if they have participated in CR.[11-13]

The reported barriers to participation in metropolitan and traditional hospital-based CR programs have included patient, provider, health system and societal-level barriers such as: older age, lower education level, a lack of perceived benefit, work or time constraints, transport difficulties, lack of referral, limited availability of programs and lack of patient financial reimbursement, as well as limited social or family support.[12-14] In addition to these barriers, rural and remote patients face additional obstacles to participating in CR, including extensive travel time to access the few services that exist.[3] To help overcome some of these barriers, there has been increasing availability of, and evidence for, alternative modes of delivery of CR, including phone-based, home-based and online CR. As such, there is an opportunity for rural and remote healthcare providers, such as the RFDS, to consider furthering the provision of innovative service developments to overcome these barriers to participation and address the significant treatment gap.


1 The terms 'aeromedical retrieval' and 'retrieval' are used interchangeably to describe the transportation of patients from rural and remote locations, by RFDS aircraft, to receive hospital care for acute illnesses or injuries.

For the RFDS, such an approach could consider telerehabilitation interventions in addition to the formulation and testing of an RFDS travelling CR service. Through geographical mapping, similar to the RFDS service planning operating tool (SPOT),[10] this service could identify and visit communities in most need, via a locally-tailored program. Services, such as a travelling CR service, could potentially address the limitations of traditional CR program delivery, by removing attendance access barriers for rural and remote patients and providing continuity of care for CR.

Regardless of the type of CR service the RFDS may develop or choose to implement in the future, it would ideally incorporate the Australian Cardiovascular Health and Rehabilitation Association (ACRA)'s CR guidelines of providing "equity and access to services",[15] utilise patient-centred telehealth and technology, and support and provide community-based CR. Further, the context of rural and remote healthcare provision must be carefully considered in service design. It is likely that the provision of co-designed, culturally appropriate CR services in rural and remote areas, that are understood, valued and supported by health professionals,[16] would provide a much-needed service that would be highly utilised. The intended outcomes are likely to include improved quality of life, positive lifestyle modifications, and reductions in future CVD patient admissions to hospital and cardiac-related deaths.

# Chapter 1 Introduction

Key messages:

- Globally, cardiovascular disease (CVD) accounts for millions of preventable deaths each year.
- The term ‘rural and remote’ was defined as all areas outside Australia’s major cities.
- People from rural and remote Australia generally experience poorer health than people living in major cities.
- Rural and remote populations demonstrate higher levels of mortality, morbidity and health risk factors, such as smoking, overweight and obesity, mental health issues and alcohol and drug misuse, than people living in major cities.
- Hypertension and diabetes mellitus are primary risk factors for heart attack, stroke and chronic kidney disease, with people living in rural and remote areas experiencing a high prevalence of each.
- Cardiac rehabilitation (CR) is the recommended ‘gold standard’ protocol for the management of CVD and its associated comorbidities.
- A leading reason for retrievals by the Royal Flying Doctor Service (RFDS) has been diseases of the circulatory system, such as heart attack or stroke.
- Many rural and remote communities with high rates of CVD do not have adequate access to cardiac rehabilitation services.

This report was designed as a companion to the RFDS report “Cardiovascular health in remote and rural communities”,[17] which provided an epidemiological picture of cardiovascular health in Australia. This report aims to:

- Determine the availability of dedicated CR programs in rural and remote areas of Australia, including areas serviced by the RFDS;
- Identify other secondary prevention services for CVD in rural and remote Australia, such as general cardiac services, health services with cardiac capacity, and programs aimed at prevention; and
- Consider the future development and implementation of CR programs as relevant and appropriate to the rural and remote context, including by the RFDS.

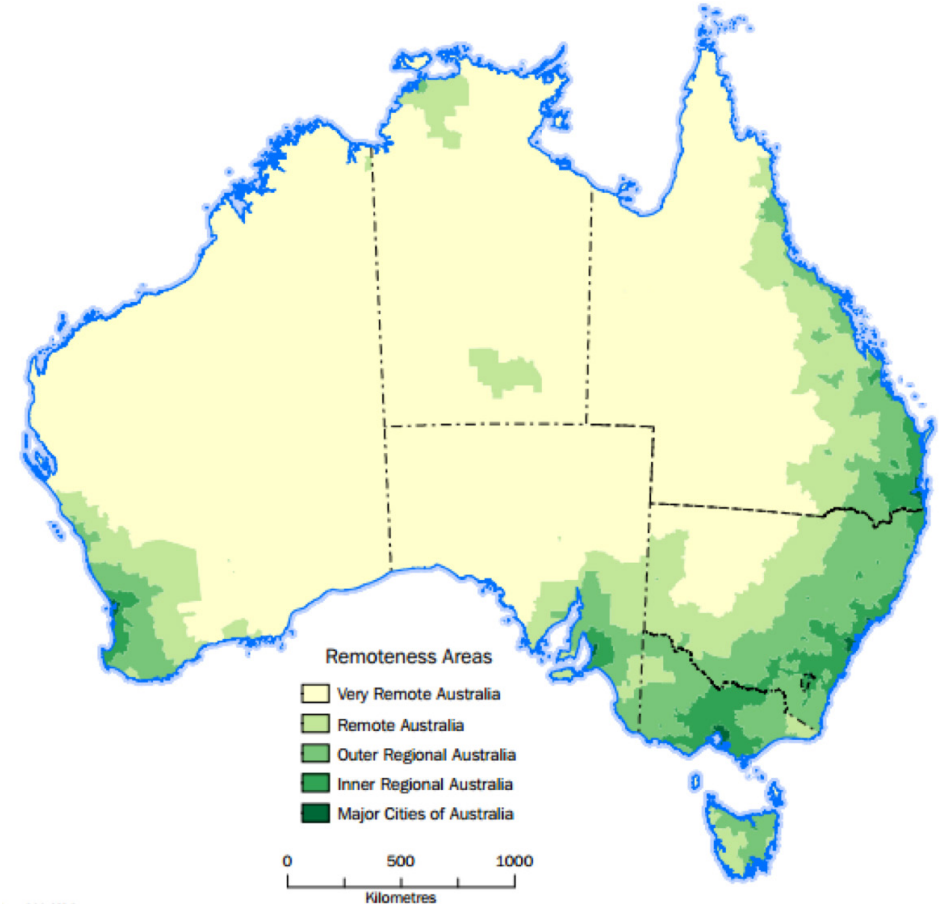
This information is designed to be used in the potential development of CR interventions in rural and remote areas of Australia, to help address the high prevalence of heart disease in the bush.[3]

## The population and setting

Globally, CVD accounts for millions of preventable deaths each year.[1] Based on 2014–15 data more than 11 million Australians (47%) have at least one chronic condition,[2] with people living in rural and remote areas and Indigenous Australians having significantly increased chronic disease prevalence and risk.[3]

The term ‘rural and remote’ is defined as all areas outside Australia’s major cities (see Figure 1.1). This includes areas that are classified as inner and outer regional (RA2 and RA3 respectively) and remote or very remote (RA4 and RA5 respectively) under the Australian Statistical Geography Standard (ASGS). The ASGS-RA system was used in this report because it provides good classification as it pertains to resource allocation per 100,000 population.[18]

**Figure 1.1 Remoteness areas of Australia**




Source: Australian Bureau of Statistics [19]

Rural and remote parts of Australia comprise the majority of Australia's land mass.[20] Based on 2013 estimates, almost 71% of the population (n=16,678,000) resided in Australia's major cities. Furthermore, a little over 27% (n=6,342,000) resided in regional areas with just 2.3% (n=540,300) living in remote or very remote Australia.[21] Refer to Figure 1.1 for a graphical representation of the Australian remoteness structure.

People from rural and remote 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 risk factors, such as smoking, overweight and obesity, mental health issues and alcohol and drug misuse, than people living in major cities.[22,23] People from rural and remote Australia also demonstrate lower use of health services.[24] In 2014–15, the prevalence of CVD, based on self-reported data, varied by location and socioeconomic disadvantage, with the highest prevalence of CVD being found in inner regional (25%) areas, followed by outer regional and remote (22%), and major cities (21%).[25] Rates of CVD were highest in the lowest socioeconomic group (25%) compared with the highest socioeconomic group (20%).[26]

The CVD death rates appear to increase with remoteness. In 2012 the death rate from CVD in very remote areas was 11.6 per 10,000 population compared with 7.1 per 10,000 population in major cities; the age-standardised rate was highest in very remote areas (8.4 per 10,000 population), followed by remote, outer regional, inner regional (6.1 per 10,000 population) and major cities (5.5 per 10,000 population). Five-year relative survival decreases with increasing remoteness, with the highest survival rates for people living in major cities of Australia (67%) and the lowest for people living in remote and very remote areas (63%).[21]

The high prevalence of avoidable death in rural and remote areas is concerning, and demonstrates the imbalance in healthcare provision between metropolitan and rural areas.[3] As such, the aims of this report are to determine effective interventions that the RFDS could employ throughout the next 10 years to help address CVD prevention and treatment, and to help drive policy change aimed at reducing the healthcare gaps between rural and remote and metropolitan populations.

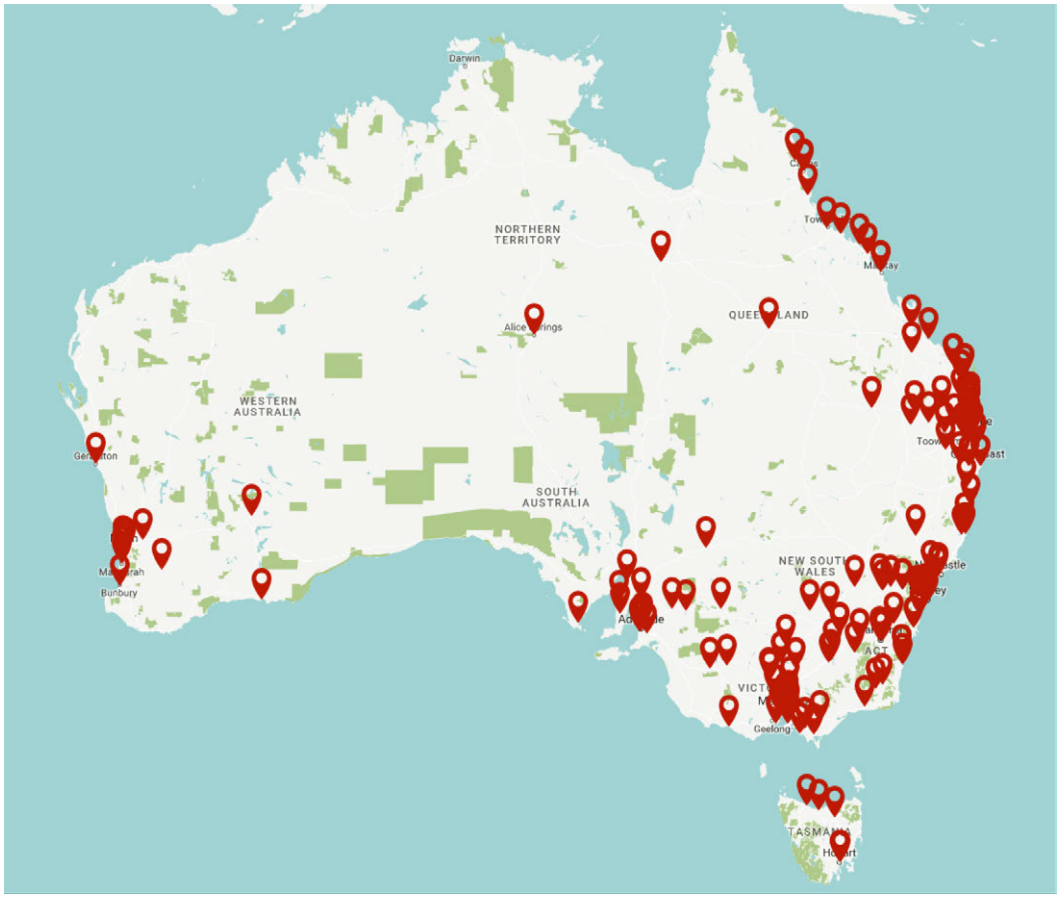
## Australian cardiovascular services and rural and remote cardiovascular health

Access to health care in rural and remote areas is poor compared to metropolitan areas.[3,4] This includes poor provision of local heart health checks, and the requirement of many rural and remote patients to travel long distances to access hospitals, general practitioners (GPs) and emergency departments.[4] As provision of primary health care is low in the bush, it is of no surprise that secondary prevention services are also limited, which focus on reducing future complications such as secondary heart attacks.

CR is the recommended 'gold standard' treatment of established coronary heart disease (CHD) and has evolved from a simple patient monitoring process to a multidisciplinary approach focusing on patient education, tailored exercise programs, modification of patient risk factors and overall wellbeing of the patient. Participating in a CR program is a critical step in a person's recovery from their heart attack or heart event. The patient benefits associated with a CR program include reduced mortality, symptom relief, smoking cessation, enhanced physical ability and improved psychological wellbeing.[1,27] CR programs are a cost-effective and comprehensive approach to address CVD, and help restore an individual's physiological, psychological, nutritional and functional status.[28-31] CR programs have shown dramatic reductions in morbidity and mortality by nearly 25% compared to conventional care.[32-34] Guidelines recommend CR for patients with acute coronary syndrome (ACS), and for patients who have received coronary revascularisation, including coronary artery bypass graft surgery or percutaneous coronary interventions, or valvular surgery.[27,35]

Cardiac services, including CR programs, health services with cardiac capacity, and programs aimed at prevention, are mainly located in metropolitan and inner regional areas, as detailed in Figure 1.2. This poor access to CR services is problematic for people in rural and remote areas, as the prevalence of CVD increases with remoteness, as detailed in Table 1.1.

**Figure 1.2 Heart Foundation Map detailing registered CR services**




* This figure only includes CR services, and not prevention services or health services with cardiac capacity.

** Of note, only an estimated 50% of CR services are currently included in the map, although the Australian Heart Foundation and the RFDS agree the trend would be the same.

The Australian Cardiovascular Health and Rehabilitation Association (ACRA) lists five core components for quality delivery and outcomes of services,[15] which include:

1. Equity and access to services;
2. Assessment and short-term monitoring;
3. Recovery and longer-term maintenance;
4. Lifestyle/behavioural modification and medication adherence; and
5. Evaluation and quality improvement.

At present, the Australian healthcare system does not provide all of these core components to people in rural and remote Australia. Specifically, rural and remote patients are not treated equally, with inequitable access to services, which generally requires them to travel more than an hour to access treatment and prevention services.[8]

**Table 1.1 Indications associated with CVD per population by location**

| Indication | Major cities | Inner regional | Outer regional | Remote | Very remote |
|---|---|---|---|---|---|
| **Hospitalisations per 10,000 population*** | | | | | |
| **Heart attack** | 15.6 | 19.0 | 21.2 | 21.1 | 34.4 |
| **NSTEMI**** | 11.5 | 14.5 | 16.0 | 15.9 | 26.1 |
| **STEMI***** | 4.0 | 4.5 | 5.1 | 5.3 | 8.3 |
| **Unstable angina** | 9.1 | 12.1 | 12.3 | 13.9 | 15.2 |
| **Heart failure** | 22.4 | 22.0 | 24.1 | 27.2 | 42.9 |
| ***All heart admissions*** | *47.1* | *53.1* | *57.6* | *62.2* | *92.5* |
| **Deaths per 100,000** | | | | | |
| **CHD mortality** | 71 | 81.1 | 85.7 | 92 | 116.3 |
| **Risk factors per 100 population** | | | | | |
| **Smoking** | 14.6 | 19 | | 22.4 | |
| **Obesity** | 25.4 | 32.6 | | 35.8 | |

* Data was gained from the Australian Institute of Health and Welfare[36] and the National Heart Foundation of Australia[37]

** Non-ST-elevation myocardial infarction

*** ST-elevation myocardial infarction

## RFDS retrievals associated with cardiovascular disease

The RFDS conducted 14,961 (21.0% of the total aeromedical retrievals) aeromedical retrievals for patients with diseases of the circulatory system (ICD-10 code IX) during the 2014 to 2017 financial years. Of those retrieved patients, 64.5% were males (n=9,645) and 35.5% were females (n=5,315). Indigenous Australians accounted for 2,400 (16.0%) retrievals. The mean age was 62.8 years (SD=16.7).

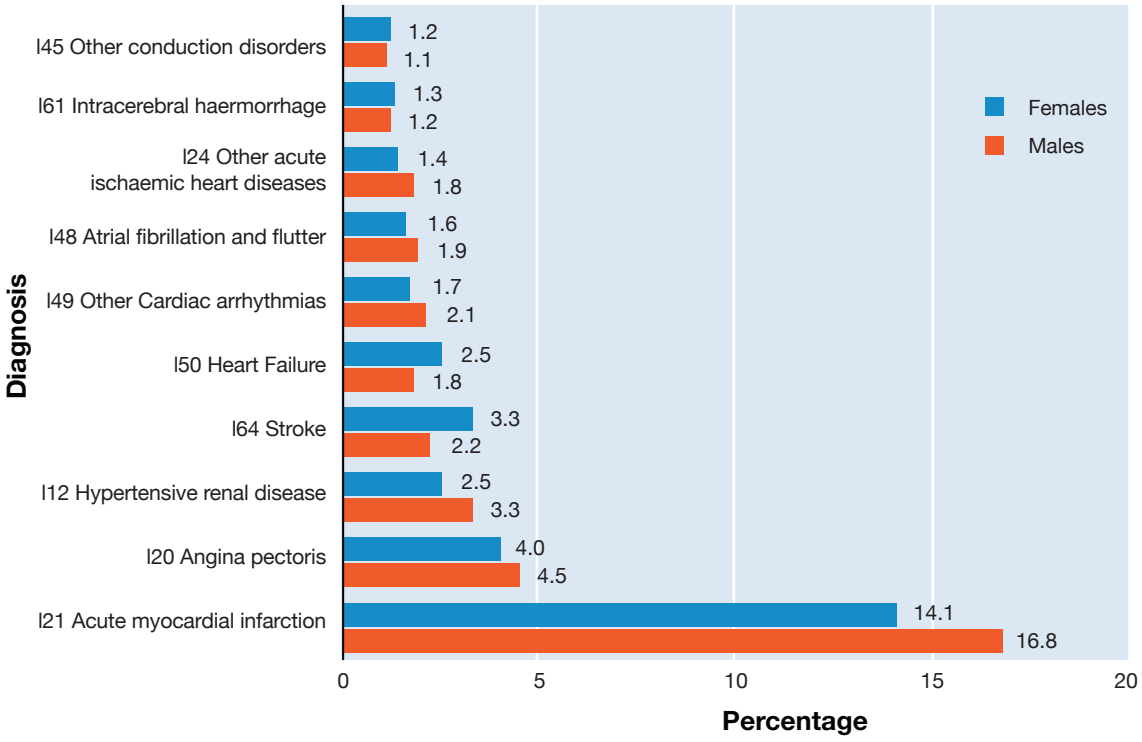
The main reasons for aeromedical retrieval for diseases of the circulatory system included acute myocardial infarction (heart attack) (ICD-10 code I21) (15.8%), angina pectoris (ICD-10 code I20) (4.3%), and hypertensive renal disease (ICD-10 code I12) (3.0%) (see Table 1.2). Men were more likely (all $p<0.01$) to have acute myocardial infarction (ICD-10 code I21), angina pectoris (ICD-10 code I20), hypertensive renal disease (ICD-10 code I12), other cardiac arrhythmias (ICD-10 code I49), atrial fibrillation and flutter (ICD-10 code I48), and other acute cardiac ischaemia (ICD-10 code I24). Conversely, women were more likely (all $p<0.01$) to have a stroke (ICD-10 code I64), heart failure (ICD-10 code I50), intracerebral haemorrhage (ICD-10 code I61), and other conduction disorders (ICD-10 code I45). As per Table 1.2, it should be noted that detailed diagnosis on the specific circulatory system disease was only recorded on 51.3% of the retrievals. Figure 1.3 highlights the aeromedical diseases of the circulatory system distribution by gender.

## Table 1.2 Main retrieval diagnosis reasons for disease of the circulatory system for the financial years 2014 to 2017

| ICD-10 code: diagnosis | Number (%) |
|---|---|
| I21 Acute myocardial infarction | 2,367 (15.8) |
| I20 Angina pectoris | 649 (4.3) |
| I12 Hypertensive renal disease | 448 (3.0) |
| I64 Stroke | 382 (2.5) |
| I50 Heart failure | 307 (2.1) |
| I49 Other cardiac arrhythmias | 289 (1.9) |
| I48 Atrial fibrillation and flutter | 266 (1.8) |
| I24 Other acute ischaemic heart diseases | 243 (1.6) |
| I61 Intracerebral haemorrhage | 185 (1.2) |
| I45 Other conduction disorders | 173 (1.2) |
| Other diagnosis | 2,370 (15.8) |
| **ICD-10 retrievals with known sub-diagnosis** | **7,679 (51.3)** |
| **ICD-10 retrievals with unknown sub-diagnosis** | **7,282 (48.7)** |
| **Total ICD-10 retrievals** | **14,961 (21.0%*)** |

* Percentage of all retrievals.

## Figure 1.3 Aeromedical retrievals for diseases of the circulatory system, distribution by gender




Many of the patient transfers for CVD were from rural and remote to metropolitan areas. The communities with the highest total number of retrievals included Rockhampton (n=1,036), Hervey Bay (n=839), Bundaberg (n=565), Geraldton (n=390) and Mackay (n=302). The most frequent destinations included Brisbane (n=3,698), Perth (n=3,104), Adelaide (n=3,076), Townsville (n=962) and Alice Springs (n=365). Many of these retrieval locations have a low provision of CR rehabilitation services per population (Table 1.3). This is challenging, as rural and remote populations have higher levels of mortality and morbidity related to delayed acute

treatment (i.e. myocardial infarction treatment delays) and limitations in chronic disease management. Furthermore, rural and remote populations have increased prevalence of risk factors, such as smoking, overweight and obesity, psychological distress, and alcohol and drug misuse, than people living in major cities.[37]

**Table 1.3 Leading cardiovascular retrieval locations and corresponding CR service provision per 10,000 population**

| RFDS retrieval location (SA3)* | Population** | Number of RFDS patients retrieved | CR Services available*** | Provision per 10,000 population |
|---|---|---|---|---|
| Rockhampton | 116,000 | 1036 | 1 | 0.09 |
| Hervey Bay | 56,678 | 839 | 4 | 0.71 |
| Alice Springs | 36,077 | 580 | 1 | 0.28 |
| Kalgoorlie | 13,937 | 438 | 1 | 0.72 |
| Mount Gambier | 25,512 | 396 | 0 | 0.00 |
| Albany | 59,173 | 380 | 0 | 0.00 |
| Mount Isa | 18,342 | 372 | 1 | 0.55 |
| Geraldton | 37,432 | 390 | 1 | 0.27 |
| Cairns | 144,787 | 320 | 2 | 0.14 |
| Bundaberg | 87,765 | 565 | 2 | 0.23 |
| Mackay | 114,969 | 302 | 2 | 0.17 |
| Kadina | 5,274 | 276 | 1 | 1.90 |
| Bunbury | 102,644 | 202 | 1 | 0.10 |
| Kingaroy | 10,289 | 196 | 1 | 0.97 |
| Broome | 13,984 | 188 | 1 | 0.72 |
| Port Hedland | 13,828 | 164 | 0 | 0.00 |
| Emerald | 13,532 | 158 | 0 | 0.00 |
| Karratha | 15,828 | 152 | 0 | 0.00 |

* The region name represents the non-metropolitan areas of this region and not the city/township areas. The location was based on Statistical Area level 3 (SA3) when available. When not available or inconsistent, Significant Urban Area (SUA) was used.

** The population includes only those permanently located within rural and remote areas, with the metropolitan populations excluded. Note also that this includes only non-Victorian and non-Tasmanian areas. 2016 Census:[38] http://www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/SED30036.

*** Please note, some of these areas are covered by phone-based models and as such are not accounted for in this analysis.

## RFDS primary health care associated with cardiovascular disease

The RFDS also provides primary health care to people with CVD. RFDS clinicians deliver services in accordance with the Guidelines for preventative activities in general practice, 9th edition[39] and the National guide to a preventative health assessment for Aboriginal and Torres Strait Islander people, 3rd edition.[40] These guidelines provide comprehensive advice on the most prominent behavioural and physiological risk factors for CVD, including smoking, diabetes, raised blood pressure, dyslipidaemia, obesity, physical inactivity and poor diet.[39,40] In addition to providing guidance on risk factors, they provide evidence-based recommendations for treatment, including pharmacological, behavioural, and cardiac services.

# Chapter 2 Secondary prevention of cardiovascular disease in the bush

Key messages:

- Globally, cardiovascular disease (CVD) accounts for millions of preventable deaths each year.
- The term ‘rural and remote’ was defined as all areas outside Australia’s major cities.
- People from rural and remote Australia generally experience poorer health than people living in major cities.
- Rural and remote populations demonstrate higher levels of mortality, morbidity and health risk factors, such as smoking, overweight and obesity, mental health issues and alcohol and drug misuse, than people living in major cities.
- Hypertension and diabetes mellitus are primary risk factors for heart attack, stroke and chronic kidney disease, with people living in rural and remote areas experiencing a high prevalence of each.
- Cardiac rehabilitation (CR) is the recommended ‘gold standard’ protocol for the management of CVD and its associated comorbidities.
- A leading reason for retrievals by the Royal Flying Doctor Service (RFDS) has been diseases of the circulatory system, such as heart attack or stroke.
- Many rural and remote communities with high rates of CVD do not have adequate access to cardiac rehabilitation services.

A leading cause of all deaths in Australia is CVD,[41] with around 80% of premature CVD deaths being preventable.[41-43] As discussed, people who attend CR programs have reduced mortality rates and hospitalisations and improved health knowledge, health behaviours and quality of life compared with patients who do not attend CR.[42] Even with these benefits, referral and attendance are poor,[12] and as a result, alternative methods of delivering CR and CVD prevention have been sought. These have included some home-based CR, case management and, more recently, telephone coaching programs that are flexible, multifaceted and integrated with the patient's primary healthcare provider. As with traditional CR programs, a key goal of these alternative models of CR is preventing further cardiac events, or secondary prevention. However, achieving optimal and sustainable delivery of these interventions to rural and remote communities presents a huge challenge.[42] As such, targeted outreach programs aimed at increasing equity of access to cardiac health services are likely to have the greatest potential to improve population health. These programs could focus on upskilling and supporting the current workforce via access to subject matter experts, in addition to engaging with the community in the development of programs that are flexible around community recruitments.

In addition to aeromedical retrievals, the RFDS currently provides extensive primary healthcare and telehealth support to patients in rural and remote communities across Australia; one dedicated CR program located in Tasmania; and other CVD service models involving telehealth medical education. However, there is not a widespread program that specifically focuses on the rehabilitation of CVD patients.

The reported factors associated with decreased participation in metropolitan and traditional CR programs have included patient, provider, health system and societal-level factors such as: older age, lower education level, a lack of perceived benefit, work or time constraints, transport difficulties, low referral rates, limited availability of programs and lack of patient financial reimbursement, as well as limited social or family support.[12-14] In addition to these factors, rural and remote patients face additional challenges to participating in CR, including extensive travel time to access the few services that exist, and the impact on the wider community of a single individual within that community system being absent.[3] To help overcome some of these barriers, there has been increasing availability and evidence of alternative modes of delivery of CR, including phone-based, home-based and online. As such, there is an opportunity for rural and remote healthcare providers, such as the RFDS, to consider furthering the provision of innovative service developments to overcome these barriers to participation and address the significant treatment gap.

Telephone-delivered (including mobile telephone) interventions have been shown to be convenient,[14] including flexibility with delivery time and location. Importantly, they have been shown to improve behavioural outcomes following myocardial infarction (heart attack).[44] Telephone interventions cannot reach those without access to a telephone. In Australia, approximately 97% of the population live in a household with at least one telephone connection,[14] with only 77% of people in rural and remote areas of Australia having a telephone connection.[45] In addition, it is the norm for people in rural and remote to have extended periods of time away from their household, in areas without any telephone access. Examples include mustering camps, road construction workers and exploration camps.

There are a number of well-researched telephone-delivered interventions for secondary prevention in CHD patients[46-48] and a large body of literature on home-based and telehealth programs for patients with heart failure[32] or diabetes mellitus.[49] These programs have been shown to be clinically and financially effective, with a high acceptability to participants.[14] Conversely, while traditional CR programs are effective, participation is generally low.[12]

## Economic and social impact of increasing uptake of CR services

CVD and CHD are leading causes of morbidity in Australia. Many RFDS aeromedical retrievals for these diseases may be avoidable with the implementation of appropriate primary prevention and early intervention programs. This is reflected in the research, which indicates that without modification and secondary preventative treatment, one in four people who have a cardiac event go on to have another.[50] Many repeat cardiac events are preventable through CR programs, thus leading to reduced costs to the healthcare system, reduced individual stress and reduced overall costs to the community (e.g. through lost productivity and contribution).

A study that aimed to investigate the social and economic impact of increasing the uptake of CR found that a "greater uptake of CR can reduce the burden of disease, directly translating to benefits for society and the economy".[51] The researchers in this study used a cost-benefit analysis, based on specific assumptions including the impact of CR program uptake for patients presenting to hospital with an acute myocardial infarction in Victoria. All assumptions used were consistent with other peer-reviewed literature, such as readmission and mortality rates. The authors used the following scenarios:[51] 1) a base case which consisted of the continuation of the status quo (i.e. 30% uptake of CR); 2) a 50% uptake of CR; and 3) 65% uptake of CR. The authors found that under the base case, the total financial impact was estimated to be $3,619.4 million, compared to $3,572.7 million and $3,532.7 million under scenarios 1 and 2 respectively. The net financial saving over a ten-year period by attending a CR program was estimated to be between $46.7 million and $86.7 million under the scenarios. Depending on attendance rates, this figure could increase to a net benefit of $138.9–$227.2 million if increased to a 50–65% attendance.[51] These results are encouraging; however, they are not driven from a multi-population context, and as such may not be translatable to a rural and remote context. However, cost saving through prevention would still be expected in a rural context.

These results indicate that if the RFDS was to consider embedding CR within its primary healthcare service delivery, this could improve patient outcomes in addition to saving the Commonwealth and State and Territory governments a considerable amount in preventable CVD hospital admissions.

## The RFDS Central Operations Healthy Living Program

Supported by the Li Ka Shing Foundation, the Healthy Living Program (HLP), conducted by RFDS Central Operations, provides practical education in healthy eating and exercise programs in isolated communities. Programs such as fitness circuits and healthy cooking sessions have been conducted in a wide range of locations since 2007. HLP Lifestyle Advisors provide communities with lifestyle health checks, exercise programs, nutritional advice and healthy weight goal support. The HLP team visits Coober Pedy, Marla, Oodnadatta, Marree, Leigh Creek, Roxby Downs, Andamooka, Woomera, Copley, Nepabunna, Ceduna, Smoky Bay, Penong and Hawker monthly, and works closely with other service providers in those communities. In 2015–16 there were 658 participants in HLP sessions in South Australia.

## The RFDS CVD secondary prevention recommendations

As further considered in the next chapter, the RFDS is in a good position to reduce CVD prevalence in rural and remote communities. Subject to sourcing of appropriate funding, programs similar to the Coaching patients On Achieving Cardiovascular Health (COACH) telephone coaching program (TCP), also described further in the next chapter, and could be integrated into the RFDS telehealth service provision. Furthermore, the RFDS HLP in Central Australia could be extended to other regions. Additionally, the RFDS could consider providing an RFDS road-based travelling CR service.

# Chapter 3 Current and potential CR services for CVD

Key messages:

- Patients in traditional CR programs have comprehensive multidisciplinary rehabilitation for an average period of six to 12 weeks, consisting of group-based therapies from a multidisciplinary team.
- CVD and CHD are a leading cause of morbidity in Australia, with many of the acute coronary events being avoidable.
- Increased uptake of CR can reduce the burden of disease, directly translating to benefits for society and the economy.
- The RFDS could leverage novel programs already established, in addition to establishing a travelling CR program to rural and remote areas where clinical need exists.

## Traditional CR

Patients in traditional CR programs have comprehensive multidisciplinary rehabilitation of a normal duration of six to 12 weeks. This consists of an individual assessment, one or more group-based therapies, including education (risk factors for heart disease; anatomy and physiology of the heart), physiotherapy and exercise, stress management, medications, healthy eating, GP presentations and support, and balanced lifestyle and relaxation. Therapy segments are operated by a multidisciplinary team, including cardiac nurses, physiotherapists, exercise physiologists, social workers, psychologists, pharmacists, dietitians, GPs and occupational therapists.

## Current rehabilitation services provided by the RFDS

The RFDS provides extensive medical treatment through primary healthcare clinics, in addition to the RFDS retrieval services. The RFDS also provides one dedicated cardiac service located in Tasmania, and other CVD service models involving telehealth medical education.[17] While these services are vital, the current report is designed to discuss expanding the RFDS' service provision of CR programs, keeping in mind that CR programs are historically the gold standard for CVD rehabilitation,[12] with the ultimate desire to extend this type of model to rural and remote populations.

## The COACH Program

The COACH TCP was established in 2009 with the aim of assisting people diagnosed with chronic diseases, specifically CVD, to reduce the risk of future complications, such as heart attack and stroke. The program has been found to be better than usual primary health care in reducing risk factors in two randomised control trials.[46,52] As per a recent Medical Journal of Australia article:

> *TCP is a standardised coaching program delivered by telephone and mail-out for people with or at high risk of chronic disease. Trained health professionals ('coaches') coach people to achieve national guideline recommended target levels for their particular risk factors and to take the medications as recommended by guidelines for the management of their particular medical condition or conditions.*[42]

TCP is currently available for eligible patients in Queensland, and is accessible 24 hours a day, seven days a week. It provides health information, triage and referral. Using 13 HEALTH telephone infrastructure, the Health Contact Centre also operates 13 QUIT to support smoking cessation, the Child Health Line, and TCP to deliver chronic disease management. Patients may be referred to the TCP from: public hospitals, GPs, medical specialists, other health professionals, CR services, Quitline and through self-referral. TCP is aimed at those who could not, or would not, attend traditional CR programs. Of note, the Country Access to Cardiac Health (CATCH) TCP is available to rural and remote patients in South Australia.[53]

Many traditional CR programs across Australia comprise exercise and education. The frequency and intensity of CR programs differs between programs, with no consistent measurement of changes in CVD risk factors. TCP is a standardised model that could be formally extended by the RFDS to rural and remote populations, with the aim of reducing CVD risk and hospital admissions.

## The TEXT ME trial

The Tobacco, Exercise and Diet Messages (TEXT ME) trial was a parallel-group, single-blind, randomised clinical trial that recruited 710 patients, with a mean age of 58, comprising mainly males (82%) with proven CHD (including myocardial infarction or proven angiographically) between September 2011 and November 2013 from a large tertiary hospital in Sydney, Australia.[54]

Patients were divided into an intervention (n=352) and non-intervention (control) group (n=358). The intervention group received four text messages per week for six months in addition to usual care, whereas the control only received usual care. Messages sent to the intervention group were selected from a bank of messages according to patient baseline characteristics (for example, if they were current smokers).[54] Usual care consisted of the majority of control participants receiving traditional CR,[12,13] as determined by their usual physicians.[54]

All patients received baseline and follow-up measurements at six months. This included fasting lipids levels, blood pressure, heart rate, body mass index (BMI) and waist circumference. Physical activity was assessed with the World Health Organization's Global Physical Activity Questionnaire, as well as the patient's medical history, self-reported portions of fruit and vegetables consumed in the prior seven days, and medications prescribed. Current or prior smoking history was assessed through self-report and confirmed with a carbon monoxide meter breath analyser. The primary outcome of this intervention was the level of plasma low-density lipoprotein cholesterol (LDL-C) at six months, with secondary measures being an improvement in systolic blood pressure, BMI, total cholesterol level, waist circumference, heart rate, total physical activity, and smoking status, and the proportion achieving guideline levels of modifiable risk factors, including LDL-C <77 mg/dL, blood pressure <140/90 mm Hg, exercising regularly (≥5 days/week × 30minutes of moderate exercise per session), non-smoker status, and BMI (<25).[54]

The results of this intervention were positive. At six months, levels of LDL-C were significantly lower in intervention participants, with reductions in systolic blood pressure and BMI, significant increases in physical activity, and a significant reduction in smoking. Furthermore, many of the patients were able to adhere to guideline recommendations concerning blood pressure, blood glucose and other contributors to macro and micro-vascular damage.[43,55] The majority reported the text messages to be useful (91%), easy to understand (97%) and appropriate in frequency (86%).[54]

## Novel external rehabilitation and secondary prevention interventions

Rather than focus on traditional models of CR program delivery, the RFDS could consider leveraging novel programs already established, in addition to establishing a travelling CR program to rural and remote areas in clinical need. This could include establishing (or formalising better referral pathways to) a COACH Program or a TEXT ME program, in addition to providing a travelling CR program.

To further improve outcomes from the COACH TCP, and ensure patient care is not fragmented, any extension of the program in rural and remote areas should occur in consultation with GPs in these areas of Australia. By integrating a feedback mechanism between the people delivering the COACH TCP and remote and very remote patients' GPs, patient outcomes may be enhanced. For example, if a remote or very remote patient is receiving the COACH TCP, they may be advised to increase their statin medication in line with the program's guidelines. However, their GP may have suggested a different dose of medication, based on their history, reaction to drugs etc. If there is good communication between the person coaching the patient, and the patient's GP, these sorts of issues could be discussed between both sets of professionals, minimising any conflicting advice to patients.

The TEXT ME method could be used by the RFDS and its patients, who have been identified as having CHD and are unable to regularly access traditional CR programs.[54] It has the potential to be an effective method that the RFDS could employ: that is, a simple, low-cost automated program of semi-personalised mobile phone text messages supporting lifestyle change that leads to significant reductions in LDL-C level, systolic blood pressure and BMI in patients with CHD.

Those patients who receive an RFDS retrieval who have confirmed CHD could be given the opportunity to participate in the program, during RFDS patient follow-up. However, this would need to be considered in the context of potentially limited phone reception in some rural and remote areas of Australia.

Home-based telerehabilitation may be another novel service that the RFDS could provide. Telerehabilitation is the delivery of rehabilitation services via technologies such as telephone, internet and videoconference. This delivery model has been successfully trialled in patients with various cardiopulmonary diseases.[56-58] A recent Australian study[59] aimed to determine whether a 12-week telerehabilitation program conducted in small groups was as effective as traditional CR programs, in terms of medical and personal benefit. Researchers found that telerehabilitation was as effective as hospital outpatient-based rehabilitation programs for patients with chronic heart failure (CHF). The CR sessions could occur in the evening or during lower activity times, such as between harvest and seeding. Additionally, self-directed learning modules could be made available in multiple forms, including paper, internet and mobile phone applications, with feedback to a coordinator detailing progress and flagging to the usual care team if the patient is not engaging. As per recent research, this would enable the clinician to then work with the patient to identify the individual barriers and develop individualised solutions.[60]

Telerehabilitation could be an appropriate alternative service for the RFDS to provide that would promote greater rural and remote patient attendance at rehabilitation sessions. As such, this service could be embedded into the RFDS travelling CR service, as detailed below. However, any phone-based program would need to account for any potential limited phone reception in some rural and remote areas of Australia.

## A travelling RFDS CR service

A travelling CR service could ideally leverage services currently provided through RFDS primary healthcare outreach programs. This could initially include broadening a few select services to provide CR. In practice, this would include increasing the provision of additional allied health staff in clinics, and could potentially include physiotherapists, exercise physiologists, pharmacists, social workers and psychologists. Once established, the team would visit sites identified as having an urgent need of services one to two times a week, for 12 weeks. If this trial is successful, the RFDS could establish additional CR travelling services.

The primary aim of this intervention would be to help address the main limitations of traditional CR program delivery. This includes removing attendance access barriers for rural and remote patients.[61] Metropolitan service delivery for CR is centre-based and incorporates a comprehensive program of assessment, education and self-management strategies to promote behaviour change, exercise, psychosocial support, medical follow-up and service evaluation and quality improvement. A travelling service would also address these areas while adhering to the ACRA's CR guidelines, and providing "equity and access to services".[15] The service could utilise patient-centred telehealth (COACH Program) and technology (TEXT ME) in addition to supporting and providing community-based CR (travelling CR program), and would be expected to be preferred by many patients in rural and remote settings.[61] As such, it would be expected that community interest and participation would be high in pre-identified areas of need. Despite this expectation, the implementation of such a service, with its aim of reducing access barriers, would need to be tested in rural and remote communities before any wide-ranging implementation. The RFDS would need to test this intervention in a clinical research trial.

A travelling CR service could also provide telerehabilitation services. This could involve the RFDS providing CR services to remote patients via technologies such as telephone, internet and videoconference, in addition to providing the services in person. This could enable patients, who would normally need to travel long distances, to access CR services.

# Chapter 4 Proposed RFDS CR provision for rural and remote patients

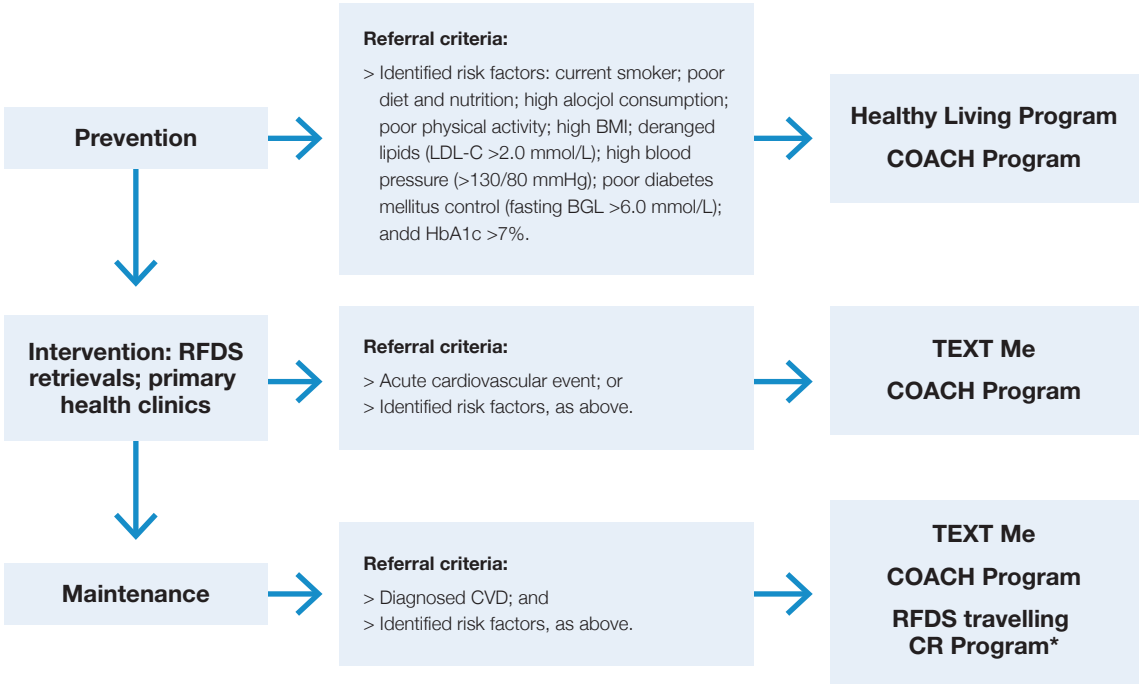
Key messages:

- The RFDS is in a unique position to extend the reach of CR services, as it directly reaches rural and remote populations who have poorer CVD outcomes than people in major cities.
- Services similar to the COACH Program could be used as an intervention for rural and remote patients identified as being at high risk of a cardiac event; or RFDS patients who have received a retrieval associated with CVD could also be referred to participate in the TEXT ME program.
- The RFDS could also consider broadening the HLP or establishing a travelling CR service in addition to the COACH and TEXT ME programs.

## Expected RFDS cardiac patient journey

The RFDS is in a unique position, as it directly reaches rural and remote populations who, on average, have poorer CVD outcomes.3 The previous chapters have identified that the RFDS could consider expanding current programs aimed at improving cardiovascular health, such as the HLP, and implementing new programs, similar to the COACH Program or TEXT ME. Furthermore, for patients with established CHD/CVD, the RFDS could also look at establishing, and referring patients to, an RFDS travelling CR program. The proposed patient journey and intervention is highlighted in Figure 4.1.

**Figure 4.1 RFDS CVD patient journey**




* An RFDS travelling CR program could also provide telerehabilitation services for patients unable to travel.

## Co-design and testing of the RFDS CVD patient journey

In establishing any CVD or CR programs, the RFDS would involve patients, carers, Aboriginal and Torres Strait Islander people and clinicians in the co-design and implementation of any travelling CR service it develops. Any CR program should be provided in collaboration with the patient's cardiac specialist, GP and other health professionals, who ultimately have overall responsibility for the patient's management.

CR programs should be available, and routinely offered, to everyone with CVD and be delivered by trained health professionals. There are a number of evidence-based best practice guidelines for CR that have been developed in Australia and internationally, with broad aims including: to promote physical, psychological and social functioning to enable people with cardiac disease to lead fulfilling lives with confidence; and to introduce and encourage behaviours that may minimise the risk of further cardiac events and conditions.[62]

It is crucial to ensure services for Aboriginal and Torres Strait Islander peoples are culturally appropriate and developed and delivered in consultation with local Indigenous communities in rural and remote areas.

Practical approaches to optimising cardiovascular care for Indigenous Australians include focusing on appropriate supportive care, general comorbidities and specific cardiac comorbidities, such as through the following principles, developed by Walsh and Kangaharan:[63]

- Ensure patient and family-centred care;
- Understand the specific barriers to care, such as:
  - Socioeconomic problems—use social worker for community support;
  - Language difficulty—use interpreter service and visual aids;
  - Shyness—use Indigenous health worker or relative;
  - Remoteness—use telehealth or specialist outreach services to minimise travel and social dislocation;
  - Adherence problems—use Indigenous health worker or relative;
  - Substance misuse or mental health problems—refer to appropriate support agencies;
- Remember that primary prevention is key whenever possible;
- Aim to achieve early detection and secondary prevention;
- Use multidisciplinary care planning and care coordination;
- Provide evidence-based therapies;
- Encourage self-management;
- Ensure close ongoing monitoring and support; and
- Communicate, collaborate and co-manage with local and relevant specialist services, if possible.

# Chapter 5 Recommendations and conclusion

Most of the premature deaths resulting from CVD are preventable, with rural and remote populations having an increased risk of CVD-associated death. This is associated with higher rates of smoking, overweight and obesity, mental health issues and alcohol and drug misuse, compared with people living in major cities.[64] This, coupled with the lower provision of health services, is only increasing the life expectancy gaps between rural and remote and metropolitan populations.

A leading reason for RFDS aeromedical retrievals is diseases of the circulatory system. Many of the patient retrieval locations have low provision of CR services per population. This inequitable access to services requires them to travel more than an hour to access treatment and prevention services, which is not always achievable.[6] The poor provision of CR in rural and remote areas further compounds the issue. Evidence suggests that poor post-acute event rehabilitation, and lack of education, results in repeat hospital presentations by people with CVD.[12] Implementing ACRA's recommendations around "equity and access to services" is a crucial first step in improving outcomes for CVD patients in rural and remote Australia.[15]

The RFDS is in a good position to provide improved referrals and services to reduce CVD risk in rural and remote communities. This approach could include telerehabilitation interventions in addition to the formulation and testing of an RFDS travelling CR service. Through geographical mapping, similar to the RFDS service planning operating tool (SPOT),[10] this service could identify and visit communities in most need, via a community-tailored program. Services such as a travelling CR service could potentially address the limitations of traditional CR program delivery, by removing attendance access barriers for rural and remote patients and providing continuity of care for CR.

Possible next steps could include starting a co-designed pilot project, involving one travelling CR service. This could include the outfitting of a single travelling CR vehicle (e.g. bus or truck), with telehealth capacity, using a similar model to the successful RFDS dental services.[65] The service could leverage current RFDS primary healthcare services; however, it could also include employing a cardiac nurse, a physiotherapist, a social worker, and/or an occupational therapist, coupled with cardiologist, nutrition and dietitian telehealth support. The program could also look at using local GP, psychology, and pharmacy services where available. Where not available, the RFDS could recruit telehealth-based practitioners, use other RFDS clinical staff, or upskill local community members.

The research evidence suggests that the content of any CR program developed or implemented by the RFDS should include components on education (risk factors for heart disease; anatomy and physiology of the heart), physiotherapy and exercise, stress management, medication adherence, healthy eating, GP presentations and support, consumer input from Health Support Australia, and balanced lifestyle and relaxation. Therapy segments could ideally be delivered by a multidisciplinary team, involving a cardiac nurse, physiotherapist, social worker, pharmacist, dietitian, GP and occupational therapist.

To determine the initial location of a travelling CR service, the RFDS should ideally use RFDS SPOT to determine current CR service provision as it pertains to population concentrations. SPOT is designed for exploring healthcare coverage in rural and remote Australia. Working from a geographic distribution of 'demand' and a set of healthcare facilities that provide cover for a range of services, SPOT calculates the proportion of demand covered by those facilities within a user-specified drive time. Demand is represented by population levels in different categories (e.g. CR services) as well as some specific RFDS demand types (e.g. heart disease retrievals).[10] By using SPOT it is possible to identify communities without current CR service provision, which the RFDS could engage with to co-design a culturally appropriate, evidence-based, travelling CR service.

The establishment of a travelling CR program would require measuring healthcare quality through evidence-based quality indicators (QIs) before broadening the service to other areas. QIs are associated with improved patient experience and patient outcomes.[66] QIs for CVD prevention and CR have been developed internationally, however have been lacking in an Australian context.[11,67,68] Recognising this gap, recent research identified 11 QIs that could be suitable in an Australian context,[11] including:

> *1a) principal referral diagnosis, (1b) intervention and/or complication, (2) cardiac rehabilitation wait time, (3) assessment of adiposity pre and post CR, (4a) assessment of prescription of ACS and/or CHF medications pre (4b) and post CR, (5) assessment of exercise capacity pre and post CR, (6) diabetes diagnosis, (7a) assessment of depression, (7b) referral of patients screened positive, (8a) assessment of smoking, (8b) referral/ counselling for smoking, (9) symptom management education, (10) CR program completion, and (11) continuity of care — referral and/or follow-up.*[11]

As per program testing,[66] the RFDS clinicians will develop performance measures against these 11 QIs to ensure program efficiency.

The provision of a travelling CR service is not the traditional business of the RFDS, however is in keeping with the RFDS recent dental programs.65,69 As with the RFDS dental service, a travelling CR program would require substantial additional funding, such as through donations and Government funding.

Regardless of the type of CR service the RFDS may develop, or choose to implement in the future, it would ideally incorporate ACRA's CR guidelines of providing "equity and access to services",[15] utilise patient-centred telehealth and technology, and would support and provide community-based CR. Further, the context of rural and remote healthcare provision must be carefully considered in service design. It is likely that the provision of evidence-based, co-designed, culturally appropriate CR services in rural and remote areas, that are understood, valued and supported by health professionals,[16] would provide a much-needed service that would be highly utilised. The intended outcomes are likely to include improved quality of life, positive lifestyle modifications, reductions in future CVD patient admissions to hospital and reductions in cardiac-related deaths.

# References


1. World Health Organization. Cardiovascular diseases. 2013; http://www.who.int/cardiovascular_diseases/en/. Accessed 15 July, 2016.
2. Australian Institute of Health and Welfare. Australia's health 2016. Canberra: Australian Institute of Health and Welfare, 2016.
3. Gardiner FW, Gale L, Ransom A, Laverty M. Looking ahead: responding to the health needs of country Australians in 2028—the centenary year of the RFDS. 2018; https://www.flyingdoctor.org.au/assets/documents/RN064_Looking_Ahead_Report_D3.pdf.
4. Gardiner FW. Flying Doctor research in remote Australia: what's the data telling us? Paper presented at National Conference for Rural and Remote Allied Health Professionals. Darwin: 2018.
5. Gardiner FW, Bishop L, Gale L, Harwood A, Teoh N, Lucas R, Jones M, Laverty M. Poor access to kidney disease management services in susceptible patient populations in rural Australia is associated with increased aeromedical retrievals for acute renal care. In review, 2019.
6. Gardiner F, Arnold R, Teoh N. The heart of the matter: cardiac services in the bush. MJA Insight. 2019.
7. Clark RA, Coffee N, Turner D, et al. Cardiac ARIA Index: measuring accessibility to cardiovascular services in rural and remote Australia via applied geographic spatial technology. 2011; https://eprints.qut.edu.au/49163/. Accessed 2 July, 2018.
8. Clark RA, Coffee N, Turner D, et al. Application of geographic modeling techniques to quantify spatial access to health services before and after an acute cardiac event: the Cardiac Accessibility and Remoteness Index for Australia (ARIA) project. Circulation 2012;125(16):2006–2014.
9. Gardiner FW, Hewat C, Richardson A, Crockett J, Lucas RM, Laverty M. Rural and remote provision of social workers, speech pathologists, audiologists, and dietitians. Rural and Remote Health 2019 (in review).
10. Gardiner FW, Teoh N, Coleman M, et al. Aeromedical retrievals of people for mental health care and the low level of clinical support in rural and remote Australia. MJA 2019 (accepted).
11. Zecchin R, Candelaria D, Ferry C, et al. Development of quality indicators for cardiac rehabilitation in Australia: a modified Delphi method and pilot test. Heart, Lung and Circulation 2018.
12. Gardiner FW, Nwose EU, Regan E, et al. Outpatient cardiac rehabilitation: patient perceived benefits and reasons for non-attendance. Collegian 2018;25(5):479–485.
13. Gardiner FW, Regan E, Nwose EU, Bwititi PT, Crockett J, Wang L. Outpatient cardiac rehabilitation: effects on patient improvement outcomes. Diabetes Metab Syndr 2017;11(Suppl. 2):S1025–S1030.
14. Hawkes AL, Atherton J, Taylor CB, et al. Randomised controlled trial of a secondary prevention program for myocardial infarction patients ('ProActive Heart'): study protocol. BMC Cardiovascular Disorders 2009;9(16):1–7.
15. Woodruffe S, Neubeck L, Clark RA, et al. Australian Cardiovascular Health and Rehabilitation Association (ACRA) core components of cardiovascular disease secondary prevention and cardiac rehabilitation 2014. Heart Lung Circ 2015;24(5):430–441.
16. Field PE, Franklin RC, Barker RN, Ring I, Leggat PA. Cardiac rehabilitation services for people in rural and remote areas: an integrative literature review. Rural and Remote Health 2018;18(4):4738.
17. Bishop L, Ransom A, Laverty M. Cardiovascular health in remote and rural communities. Canberra: Royal Flying Doctor Service, 2018.

18. Australian Bureau of Statistics. Australian Statistical Geography Standard (ASGS): Volume 5—Remoteness structure, July 2016. 2016; http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/1270.0.55.005Main%20Features15July%202016?opendocument&tabname=Summary&prodno=1270.0.55.005&issue=July%202016&num=&view=. Accessed 2 May, 2018.
19. Australian Bureau of Statistics. Australian Statistical Geography Standard (ASGS): Volume 5—Remoteness structure, July 2011. ABS cat. no. 1270.0.55.005. Canberra: Australian Bureau of Statistics, 2013.
20. Bishop L, Gale L, Laverty M. Responding to injuries in remote and rural Australia. Canberra: Royal Flying Doctor Service, 2016.
21. Garvan Research Foundation. Medical research and rural health Garvan report 2015. Darlinghurst: Garvan Research Foundation, 2015.
22. Australian Institute of Health and Welfare. Australia's health 2014. Canberra: Australian Institute of Health and Welfare, 2014.
23. Australian Institute of Health and Welfare. Australia's health 2016. Australia's health series no. 15. Cat. no. AUS 199. Canberra: Australian Institute of Health and Welfare, 2016.
24. Australian Institute of Health and Welfare. Rural & remote Health. Rural & remote Australians 2017; https://www.aihw.gov.au/reports-statistics/population-groups/rural-remote-australians/overview. Accessed 13 September, 2017.
25. Australian Institute of Health and Welfare. Deaths from cardiovascular disease. Canberra: Australian Institute of Health and Welfare, 20 May 2017.
26. Australian Institute of Health and Welfare. How many Australians have cardiovascular disease? 2017; http://www.aihw.gov.au/cardiovascular-disease/prevalence/. Accessed 4 June, 2017.
27. Piepoli MF, Corra U, Benzer W, et al. Secondary prevention through cardiac rehabilitation: from knowledge to implementation. A position paper from the Cardiac Rehabilitation Section of the European Association of Cardiovascular Prevention and Rehabilitation. European Journal of Cardiovascular Prevention and Rehabilitation 2010;17:1–17.
28. Papadakis S, Oldridge NB, Coyle D, et al. Economic evaluation of cardiac rehabilitation: a systematic review. Eur J Cardiovasc Prev Rehabil 2005;12(6):513–520.
29. Wenger NK. Current status of cardiac rehabilitation. J Am Coll Cardiol 2008;51(17):1619–1631.
30. Lavie CJ, Milani RV. Cardiac rehabilitation and exercise training in secondary coronary heart disease prevention. Prog Cardiovasc Dis 2011;53(6):397–403.
31. Heran BS, Chen JM, Ebrahim S, et al. Exercise-based cardiac rehabilitation for coronary heart disease. Cochrane Database Syst Rev 2011;7(7):CD001800.
32. Clark AM, Hartling L, Vandermeer B, McAlister FA. Meta-analysis: secondary prevention programs for patients with coronary artery disease. Ann Intern Med 2005;143(9):659–672.
33. Taylor RS, Brown A, Ebrahim S, et al. Exercise-based rehabilitation for patients with coronary heart disease: systematic review and meta-analysis of randomized controlled trials. Am J Med 2004;116(10):682–692.
34. deVries H, Kemps HMC, vanEngen-Verheul MM, Kraaijenhagen RA, Peek N. Cardiac rehabilitation and survival in a large representative community cohort of Dutch patients. European Heart Journal 2015.
35. Aragam KG, Moscucci M, Smith DE, et al. Trends and disparities in referral to cardiac rehabilitation after percutaneous coronary intervention. Am Heart J 2011;161(3):544–551.
36. Australian Institute of Health and Welfare. Data. Hospitals 2018. Accessed June 20, 2018.
37. Heart Foundation. Heart maps. 2018; https://www.heartfoundation.org.au/for-professionals/heart-maps/australian-heart-maps. Accessed 20 June, 2018.

38. Australian Bureau of Statistics. Census of population and housing: reflecting Australia—stories from the census, 2016. Snapshot of Australia 2017; http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2071.0~2016~Main%20Features~Snapshot%20of%20Australia,%202016~2. Accessed 5 May, 2018.
39. The Royal Australian College of General Practitioners. Guidelines for preventive activities in general practice. 9th Edition. East Melbourne: The Royal Australian College of General Practitioners, 2016.
40. National Aboriginal Community Controlled Health Organisation, The Royal Australian College of General Practitioners. National guide to a preventive health assessment for Aboriginal and Torres Strait Islander people. 3rd edition. East Melbourne: The Royal Australian College of General Practitioners, 2018.
41. Australian Institute of Health and Welfare. Australia's health 2018: In brief. Cat. no. AUS 222. Canberra: Australian Institute of Health and Welfare, 2018.
42. Ski CF, Vale MJ, Bennett GR, et al. Improving access and equity in reducing cardiovascular risk: the Queensland Health model. MJA 2015;202(3):148–153.
43. Gardiner FW, Nwose EU, Bwititi P, Crockett J, Wang L. Blood glucose and pressure controls in diabetic kidney disease: narrative review of adherence, barriers and evidence of achievement. Journal of Diabetes and its Complications 2018;32(1):104–112.
44. Castro CM, Kind AC. Telephone-assisted counselling for physical activity. Exerc Sport Sci Rev 2002;30(2):64–68.
45. Australian Bureau of Statistics. 8146.0—Household use of information technology, Australia, 2016–17. 2018; http://www.abs.gov.au/ausstats/abs@.nsf/mf/8146.0. Accessed 28 June, 2018.
46. Vale MJ, Jelinek MV, Best JD, et al. Coaching patients On Achieving Cardiovascular Health (COACH): a multicenter randomized trial in patients with coronary heart disease. Arch Intern Med 2003;163(22):2775–2783.
47. DeBusk RF, Miller NH, Superko HR, et al. A case-management system for coronary risk factor modification after acute myocardial infarction. Ann Intern Med 1994;120(9):721–729.
48. Hawkes AL, Patrao TA, Atherton J, et al. Effect of a telephone-delivered coronary heart disease secondary prevention program (proactive heart) on quality of life and health behaviours: primary outcomes of a randomised controlled trial. International journal of behavioral medicine 2013;20(3):413–424.
49. Taylor CB, Miller NH, Reilly KR, et al. Evaluation of a nurse-care management system to improve outcomes in patients with complicated diabetes. Diabetes Care 2003;26(4):1058–1063.
50. Chew DP, Amerena JV, Coverdale SG, et al. Invasive management and late clinical outcomes in contemporary Australian management of acute coronary syndromes: observations from the ACACIA registry. MJA 2008;188(12):691–697.
51. Gruyter ED, Ford G, Stavreski B. Economic and social impact of increasing uptake of cardiac rehabilitation services – A cost benefit analysis. Heart, Lung, and Circulation 2015;25(2):175–183.
52. Vale MJ, Jeinek MV, Best JD, Santamaria JD. Coaching patients with coronary heart disease to achieve the target cholesterol: a method to bridge the gap between evidence-based medicine and the "real world"—randomized controlled trial. J Clin Epidemiol 2002;55(3):245–252.
53. Integrated Cardiovascular Clinical Network CHSA. Country Access to Cardiac Health (CATCH). 2019; http://www.iccnetsa.org.au/catch.aspx. Accessed 3 April, 2019.
54. Chow CK, Redfern J, Hillis GS, et al. Effect of lifestyle-focused text messaging on risk factor modification in patients with coronary heart disease: a randomized clinical trial. JAMA 2015;314(12):1255–1263.

55. Gardiner FW, Nwose EU, Bwititi PT, Crockett J, Wang L. Services aimed at achieving desirable clinical outcomes in patients with chronic kidney disease and diabetes mellitus: a narrative review. SAGE Open Medicine 2017;5:2050312117740989.
56. Frederix I, Vanhees L, Dendale P, Goetschalckx K. A review of telerehabilitation for cardiac patients. Journal of Telemedicine and Telecare 2014;21(1):45–53.
57. Zanaboni P, Lien LA, Hjalmarsen A, Wootton R. Long-term telerehabilitation of COPD patients in their homes: interim results from a pilot study in Northern Norway. Journal of Telemedicine and Telecare 2013;19(7):425-429.
58. Piotrowicz E, Baranowski R, Bilinska M, et al. A new model of home-based telemonitored cardiac rehabilitation in patients with heart failure: effectiveness, quality of life, and adherence. European Journal of Heart Failure 2010;12(2):164–171.
59. Hwang R, Bruning J, Morris NR, Mandrusiak A, Russell T. Home-based telerehabilitation is not inferior to a centre-based program in patients with chronic heart failure: a randomised trial. Journal of Physiotherapy 2017;63(2):101–107.
60. Cui X, Zhou X, Ma L-l, et al. A nurse-led structured education program improves self-management skills and reduces hospital readmissions in patients with chronic heart failure: a randomized and controlled trial. Rural and Remote Health 2019 (accepted).
61. Hamilton S, Mills B, McRae S, Thompson S. Evidence to service gap: cardiac rehabilitation and secondary prevention in rural and remote Western Australia. BMC Health Services Research 2018;18(1):64.
62. Heart Foundation. Recommended framework for cardiac rehabilitation. 2004; https://www.heartfoundation.org.au/images/uploads/publications/Recommended-framework.pdf. Accessed 15 March, 2019.
63. Walsh WF, Kangaharan N. Cardiac care for Indigenous Australians: practical considerations from a clinical perspective. MJA 2017;207(1):40–45.
64. Australian Institute of Health and Welfare. Australia's health 2018. Australia's health series no. 16. AUS 221. Canberra: Australian Institute of Health and Welfare, 2018.
65. Gardiner FW, Richardson A, Gale L, et al. Rural and remote dental care: patient characteristics and healthcare provision. Australian Journal of Remote Health 2019 (in review).
66. Doyle C, Lennox L, Bell D. A systematic review of evidence on the links between patient experience and clinical safety and effectiveness. BMJ Open 2013;3(1):e001570.
67. Grace SL, Poirier P, Norris CM, Oakes GH, Somanader DS, Suskin N. Pan-Canadian development of cardiac rehabilitation and secondary prevention quality indicators. Canadian Journal of Cardiology 2014;30(8):945–948.
68. Ohtera S, Kanazawa N, Ozasa N, Ueshima K, Nakayama T. Proposal of quality indicators for cardiac rehabilitation after acute coronary syndrome in Japan: a modified Delphi method and practice test. BMJ Open 2017;7(1):e013036.
69. Bishop LM, Laverty MJ. Filling the gap: disparities in oral health access and outcomes between metropolitan and remote and rural Australia. Canberra: Royal Flying Doctor Service, 2015.

Royal Flying Doctor Service