The Heart of Inequality

Parliament House Canberra
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The Heart of Inequality

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The CRE to Reduce Inequality in Heart Disease collaboration (see Figure 1) was initially founded in late 2012 by the National Health and Medical Research Council (NHMRC) of Australia and will complete its 5-year funding cycle late 2017. The primary aim of this Centre of Research Excellence (CRE; under the mission of “equal hearts for all”) is:

To develop and apply practical and sustainable health care services across the continuum of heart health and disease that reduces an inequitable burden of risk and disease in vulnerable individuals and groups.

Consistent with the broad health service research activities outlined in this report, collectively, we focussed on the needs of those individuals (and communities):

- At high risk of developing acute and chronic heart disease;
- Most likely to develop more severe forms of heart disease and/or die prematurely;
- Who suffer from debilitating forms of chronic heart disease with limited treatment options

Figure 1: NHMRC CRE to Reduce Inequality in Heart Disease Collaboration

All CRE activities are firmly consistent with the following definition of health services research: a multidisciplinary field of inquiry that examines access to, and the use, costs, quality, delivery, organisation, financing, and outcomes of health care services to produce new knowledge about the structure, processes, and effects of health services for individuals and populations. Our experienced multidisciplinary team coordinated an integrated range of innovative and unique research explicitly designed to develop health services that address disparities in heart disease across the continuum of risk and disease while building capacity for teams to perform pragmatic trials that readily translate to “real world” application.
Consistent with our mission and primary aim, the CRE coordinated a series of pragmatic trials of prevention and disease management across the “heart health” spectrum that specifically targeted the needs of four vulnerable groups

**Indigenous Australians (Theme 1):** in whom health disparities (including elevated morbidity and premature mortality) are profound compared to non-Indigenous Australians.

**Regional Australians (Theme 2):** in whom differentials in risk and disease outcomes are apparent in the context of often limited health care resources.

**Chronic Heart Disease (Theme 3):** among older individuals in whom treatment options are often limited by the fine line between benefit and risk of pharmacological agents.

**International Heart Health (Theme 4):** among communities with limited health care resources that are overwhelmed by the diseases of poverty and a new epidemic of non-communicable disease.

Though different in many ways, these groups share the same, urgent health priority for sustainable health services that overcome the barriers to effective prevention/management in order to reduce the inequitable burden and impact of heart disease.

As shown in Figure 2, via a unique series of trials and the embedded program of integrated CRE activities, our continuing plan is to demonstrate it is possible to bridge persistent inequalities in “heart health” across the life-span by developing cost-effective health programs that: 1) reduce ambient levels of future risk, 2) slow the progression of heart and cardiovascular disease (CVD), 3) reduce costly health care including hospitalisation, 4) improve quality of life and 5) prolong survival in affected individuals.

![Figure 2: CRE support and research covering the life span of “heart health”](image)

As detailed later in this report, in addressing the pervasive and complex issues surrounding inequality in heart disease, we have continuously focussed on building capacity in respect to multidisciplinary, health service research teams with the ability to integrate expertise in disease surveillance, clinical trial design, individual and family health, health service delivery, health economics and research translation. The CRE has been instrumental in directly supporting more than 50 clinicians and early-to-mid career researchers in this manner.
Executive Summary

At the whole population level, CVD, including its most common form heart disease, generates the largest disease burden in Australia and is responsible for over one fifth of all deaths. However, this substantial and growing burden is not shared equally among Australian men and women.

This report highlights our collective work in investigating heart health disparities among disadvantaged individuals and communities. It also highlights our ongoing efforts to develop and apply innovative strategies that will reduce key inequalities in the “heart health” of vulnerable individuals/communities.

Key Findings

In highlighting the substantive impact of heart disease in Australia, we report the following:

- Within an ageing Australian population, the latent risk of developing acute and/or chronic forms of heart disease remain at historical highs;
- The number of Australians aged 35 years and over admitted to hospital with the three most common forms of CVD is estimated to be more than 800,000, 170,000 and 330,000 per annum, respectively, for coronary artery disease (CAD), the form of heart failure (HF) most commonly linked to CAD and atrial fibrillation (AF);
- In 2017, we estimate that a minimum of 60,000, 30,000 and 50,000 Australian men and women aged 35 years and over will have experienced their first hospital admission linked to CAD, HF and AF, respectively;
- The distribution of de novo and recurrent heart disease-related events is uneven – with a combination of factors relating to socio-economic status, geographical location and access to health services driving large disparities in health outcomes;
- Inequality in heart disease is most evident among Indigenous Australians living in communities remote to central health services – with those affected more likely to develop more severe heart disease complicated by diabetes, renal disease and other forms of vascular disease at a much younger age;
- Despite progressive therapeutic improvements in treating acute events, those lucky enough to survive their first cardiac event will inevitably develop a chronic (and inherently costly) form of heart disease that will impair their quality of life and reduce their longevity
Beyond quantifying the challenge of addressing the overall and inequitable burden of heart disease in Australia, a major component of our research has focussed on developing key strategies to improve health outcomes. On this basis we make the following recommendations:

1. **Establishment of an Inequality in Heart Disease Advisory Group**: This expert group’s terms of reference will include recommendations to government on effective policies and intervention strategies to reduce inequalities in heart disease in high-risk populations.


3. **Expert Guidelines**: As highlighted in the 2016 Hidden Hearts Report, much of the evidence to prevent and treat CVD is male-centric. Urgently needed updates of guidelines for treatment of the most common forms of CVD could incorporate special consideration (and education) of the prevention and management of CVD in high-risk populations.

4. **National Campaign to raise awareness of CVD in high-risk populations**: This includes a targeted campaign for women as recommended in the 2016 Hidden Hearts Report.

5. **ESSENCE Measurement Indicator monitoring system**: Implement systemic measurements, synthesis and reporting of the ESSENCE Measurement Indicators set across Australia. It must consider the best mechanisms to integrate the measurement indicators into practice as a national tool.

6. **Establish integrated regional cardiovascular service delivery networks across Australia**: A range of management programs for CVD (notably chronic heart disease) have been shown to cost-effectively improve outcomes for high-risk populations (who often struggle to attend existing medical services).

7. **Nurse-led models of care in chronic heart disease**: Explore the utility and cost effectiveness of nurse-led models of care for all patients admitted to hospital with a chronic form of heart disease in high-risk populations, with a particular focus on those living in regional, rural and remote settings.

8. **Establish a national Nurse Practitioner program**: for the prevention and management of heart disease and other forms of CVD for Indigenous Australians.

*ESSENCE - Measurement Indicators: Essential Service Standards for Equitable National Cardiovascular Care for Aboriginal and Torres Strait Islander people – Measurement Indicators. (The ESSENCE Steering Committee 2015. Essential Service Standards for Equitable National Cardiovascular Care for Aboriginal and Torres Strait Islander people: Measurement Indicators. SAHMRI, Adelaide.)*
Rediscovering Heart Failure: The contemporary burden and profile of heart failure in Australia (2015)
In a follow-up to a seminal study conducted more than a decade ago, (1) we quantified the increasing burden of HF in Australia; identifying the need for a definitive epidemiological study of HF and other forms of CVD. The need for sustainable funding of cost-effective HF care programs was recommended. Of primary importance, we identified a critical lack of awareness (in both men and women) of HF and other forms of CVD.

Hidden Hearts (2016)
Building upon the Rediscovering Heart Failure report, Hidden Hearts sheds light on the lack of public awareness surrounding the burden of CVD, the most common form of which is heart disease, amongst Australian women. The report provides conservative estimates regarding the prevalence of all forms of CVD among Australian women; including CAD, AF, HF, stroke and peripheral artery disease. A number of key priorities and recommendations for action to reduce the number of Australian women adversely affected by CVD were made. This included the urgent need for a public health campaign to help all Australians to better understand their risk of developing CVD and to seek health care in a timely manner.

Snapshot of Heart Failure in Australia (2017)
The Snapshot of Heart Failure in Australia report examines the contemporary burden and distribution of the deadly and disabling syndrome of HF in Australia from a detailed geographical perspective. Taking into consideration the reality of inequality and related health outcomes across the country, the report provides region-by-region estimates of the burden of HF; identifying key “hot-spots” of HF in many communities.
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
</tr>
<tr>
<td>ACT</td>
<td>Australian Capital Territory</td>
</tr>
<tr>
<td>ACU</td>
<td>Australian Catholic University</td>
</tr>
<tr>
<td>AF</td>
<td>Atrial Fibrillation</td>
</tr>
<tr>
<td>AIDS</td>
<td>Acquired Immune Deficiency Syndrome</td>
</tr>
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<td>AIHW</td>
<td>Australian Institute of Health and Welfare</td>
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<td>AUS</td>
<td>Australia</td>
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</tr>
<tr>
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<td>COAG</td>
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<td>CRE</td>
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<td>GP</td>
<td>General Practitioner</td>
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<tr>
<td>HF</td>
<td>Heart Failure</td>
</tr>
<tr>
<td>HFpEF</td>
<td>Heart Failure with Preserved Ejection Fraction</td>
</tr>
<tr>
<td>HFrEF</td>
<td>Heart Failure with Reduced Ejection Fraction</td>
</tr>
<tr>
<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
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<tr>
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<td>Queensland</td>
</tr>
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<td>SA</td>
<td>South Australia</td>
</tr>
<tr>
<td>TAS</td>
<td>Tasmania</td>
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<tr>
<td>VIC</td>
<td>Victoria</td>
</tr>
<tr>
<td>WA</td>
<td>Western Australia</td>
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### Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tr>
<td>Atrial Fibrillation (AF)</td>
<td>A fast and irregular heartbeat affecting the top two upper chambers of the heart (the right and left atria)</td>
</tr>
<tr>
<td>Coronary Artery Disease (CAD)</td>
<td>Caused by blockages in the blood vessels supplying the two main muscles/chambers of the heart. These blockages (known as atherosclerosis or coronary plaques) are closely linked to saturated fat-rich diets and high cholesterol levels</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Is a condition whereby the body is unable to regulate the amount of sugar/glucose in the blood leading to damage of the blood vessels and other parts of the body (including the heart and kidneys)</td>
</tr>
<tr>
<td>Heart Failure (HF)</td>
<td>Caused by a structural or mechanical inability of the heart to properly pump or relax and therefore supply the rest of the body with sufficient blood supply</td>
</tr>
<tr>
<td>Heart Failure with Preserved Ejection Fraction (HFpEF)</td>
<td>Associated with individuals with CAD and who have experienced some form of heart attack with an impaired ability to pump blood from the heart - also known as left ventricular systolic dysfunction</td>
</tr>
<tr>
<td>Heart Failure with Reduced Ejection Fraction (HFrEF)</td>
<td>Associated with older individuals with chronic hypertension with a typically “stiff” heart that is unable to relax properly - also known as diastolic dysfunction</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Is when blood pressure is persistently higher than normal (an ideal / optimal blood pressure reading is &lt;120/80mmHg). The exact causes are not clear but may include family history, diet pattern, alcohol, weight gain and physical inactivity</td>
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<tr>
<td>Left Ventricular Failure</td>
<td>When the left side of the heart fails (left ventricular failure), congestion of the veins in the lungs will cause fluid build-up in the lungs</td>
</tr>
<tr>
<td>Peripheral Artery Disease</td>
<td>A disease in which plaque builds up in the arteries that supply blood to areas other than the heart or brain</td>
</tr>
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</table>
In this *Mary Mackillop Institute for Health Research* report that coincides with our 3rd Annual Parliamentary Meeting in Canberra (October 2017), we firstly present updated estimates of the overall burden of heart disease in Australia. Consistent with the theme of this report and the research undertaken under the auspices of the *NHMRC of Australia CRE to Reduce Inequality in Heart Disease*, we then highlight the number of Australians living with heart disease, before considering who is most adversely affected in this regard.

**Methods**

Our latest burden of disease estimates are consistent with those applied in our previous reports (see page 7) and reflects Australia’s critical lack of representative data to accurately and reliably describe the pattern of heart disease-related events (including hospital admissions and deaths).

**Data source:** We utilised best available Australian published data to estimate the burden of heart disease. The latest population statistics were used in each state and Commonwealth Electoral Division (CED) (from the Australian Bureau of Statistics [ABS]) (2, 3) with validated clinical data-sets (i.e. Western Australian linkage data on all hospital admissions in that State). (4-8)

**Data extraction:** All analyses were supervised by the Principal Investigator. Excel spreadsheets were generated from all ABS population data on an age and gender-specific basis and according to geographic location and electoral division. Absolute and proportion rates for each specific parameter of interest were applied to the population data on an age and gender-specific basis to derive the key parameters. All data sources have obtained appropriate approval from a Human Research Ethics Committee that complies with the *NHMRC National Statement on Ethical Conduct in Human Research.* (9)

**Data presentation:** We used the most recent Australian National census data which was collected on 30 June 2016 when Australia’s population was at 24,210,809. An updated estimate of Australia’s population as at 30 June 2017 was 24,614,766. (2) At the broadest level, all key parameters to outline the burden of heart disease are presented on an age and gender-specific basis for the total population. Outputs from the Census/population estimates are organised into a number of regions including a broad socioeconomic definition of each of the eight state and territory capital cities. For the purpose of this report we applied a combination of these areas on a state-by-state basis (minimal level Greater Capital City Statistical Areas) to describe the geographical distribution of three common CVD conditions on an age and gender-specific basis. We also present the CED-specific figures on the annual hospitalisations for CAD.

**Limitations:** We acknowledge that applying a blanket approach (using the national age-standardised average) to estimate the theoretical burden of heart disease across different states/CED with diverse age dynamics could potentially overestimate or underestimate the actual clinical burden, e.g., the Northern Territory has a high proportion of Indigenous residents and has the youngest median age of all the states and territories. Consequently, without a definitive national data linkage, our numbers should be interpreted with some caution as they do not necessarily reflect the true burden in Australia.
Figure 3: New & all admissions for common forms of heart disease among Australians aged ≥35 years (30 June 2017)

<table>
<thead>
<tr>
<th>State</th>
<th>CAD</th>
<th>HF</th>
<th>AF</th>
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<td>CAD</td>
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<tr>
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### Figure 4: New & all admissions for CAD in Australians aged ≥35 years (30 June 2017)

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<th>Over 15000</th>
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<td>305,512</td>
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<tr>
<td>MEN</td>
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</table>
Figure 5: New & all admissions for HFrEF (HF mostly linked to CAD) among Australians aged ≥35 years (30 June 2017)
Figure 6: New & all admissions for AF in Australians aged ≥35 years (30 June 2017)
Heart disease affects some populations and communities more than others. It occurs more often and with a greater impact among socioeconomically disadvantaged Australians, including Indigenous Australians, which leads to poorer health outcomes among this population. The Central Australia region is an epicentre for social disadvantage, geographic isolation, and profound health disadvantage, especially for Indigenous Australians. As such, it represents the “heart of inequality” in Australia.

In 2008/2009, as part of the Heart of the Heart Study we recruited participants across Central Australia from 6 diverse Indigenous communities. Participants undertook comprehensive cardiovascular assessments including echocardiography, and B-type natriuretic peptide estimation, alongside detailed assessment of psychological stress and socioeconomic status. 436 participants were enrolled (64% female and a mean age of 44 years). Latent risk of developing the deadly and disabling syndrome HF was very high with 5.4% already affected: two-thirds being undiagnosed prior to the study. Cardiac dysfunction was most commonly associated with a combination of diabetes (40%), hypertension (42%) and obesity (42%).

Confirming the concerning predictions of Heart of the Heart Study (i.e. markedly higher levels of HF), we recently found critical differences in the pattern of HF hospitalisations among Indigenous and non-Indigenous Australians living in this region. As shown in Figure 7 below, Indigenous men and women develop this deadly and disabling syndrome at a much younger age and in greater numbers compared to the rest of the population.

![Figure 7: Age-standardised incident cases of heart failure-related hospitalisation among Indigenous and non-Indigenous Australians living in Central Australia (reproduced with permission)](image)

As highlighted in our recently published Snapshot of Heart Failure in Australia Report (2017), despite the high-income status and health resources of Australia, the high-levels of HF and related admissions and premature deaths observed in the Indigenous peoples of Central Australia are in stark contrast to the rest of Australia. Indeed, they more mirror the poor outcomes typically seen in vulnerable communities residing in Low-income countries.
People living in regional, rural or remote Australia have poorer health outcomes compared to individuals living in metropolitan locations. The proportion of adults with antecedent risk for cardio-metabolic disease rises with increasing remoteness; (13) this geographical pattern of inequality is reflected by higher rates of CVD and diabetes, (14) deaths (15) and hospitalisations. (16) Regional Australians are more likely to die from CAD (44%) or stroke (31%) compared to those living in major cities, (17) with even greater differentials for fatal hypertensive heart disease (90% more likely) and HF (70%) events. Management of elevated cardio-metabolic risk factors is absorbed by primary care clinics which places significant burden on health care resources and expenditure. Despite this, specialist cardiac services are scarce and fewer cardiologists practice in non-metropolitan areas. (17) Fortunately, there are benefits of lifestyle and pharmacological interventions for decreasing the likelihood of developing CVD (18) and type II diabetes, (19) particularly via nurse-led interventions that modulate health and lifestyle factors to reduce cardio-metabolic abnormalities. (20) Their potential effectiveness, however, has not yet been established to date in higher risk, non-urban settings.

The CRE team have made many contributions to profiling and understanding the inequalities associated with rurality across the spectrum of heart disease. (21-23) Recently, the widely reported and discussed ‘Snapshot of Heart Failure in Australia’ report (24) showed that the burden of HF (in all its forms) is very much likely to be higher in those Australians living in rural and regional Australia when compared to most urban centres.

Figure 8 below (from the report) shows the ‘hotspots’ of HF in Australia - all of which (including Central Australia) fall outside the five largest urban areas in the country.

Figure 8: Epidemiology of heart failure in Australia (including hotspots)

This disparity in the burden of HF and other forms of heart disease (notably in AF and CAD) is again evident in the data presented in the ‘Electoral Perspective’ section of this report (see Figures 11-27). These disparities reflect critical differences in the population profile of each electorate, availability of preventative and treatment services and the key drivers of poor heart health (from life-long socio-economic health issues to a lack of heart disease awareness) in vulnerable communities.
The Heart of Inequality: Chronic Heart Disease Perspective

In the past 20-30 years there has been a dramatic and profound evolution in the overall pattern of heart disease within the ageing populations of high-income countries such as Australia – from a predominance of acute and often deadly events to chronic forms of heart disease. The rising burden of HF and AF represent key indicators of this costly phenomenon (see the Burden of Heart Disease - 2017 Update section). Coupled with our ageing population and an evolving sedentary lifestyle with increasing cardiometabolic risk factors such as hypertension, lipid disorders, obesity and diabetes; chronic heart disease will continue to be one of the leading causes of death, disability and very poor quality of life among adult Australians for the foreseeable future.

The increasing prevalence of heart disease is placing an increasing demand on already limited health care resources; posing a critical threat to the overall effectiveness and efficiency of the health care system. Past attempts to solve these problems have produced inconsistent outcomes and any future limitations in financial resources will result in much lower quality of care. Thus, our utmost importance is changing the approach to care for heart disease. It is within this context that we need better identification of antecedent risks for individuals and formulate effective prevention and management programs for those affected. One of the critical challenges to improve persistently poor health outcomes associated with chronic heart disease in the geographically dispersed Australia is matching health services and individualised management to individual needs. In the recently completed, NHMRC-funded WHICH? II Trial including two forms of HF management, we profiled the individual needs of >800 typically older patients with the syndrome living in urban and regional Australia according to the unique Clinical, Location and Socio-Economic status (CLOSE) profiling tool. As shown in Figure 9, this tools profiles the individual needs of patients according to their ability to access health care and recommends how best to deliver HF management.

These “real world” data reflect the challenge of providing “gold-standard” care to all patients admitted with HF in Australia (now >170,000 per annum); including providing structured telephone support for rural-dwelling patients. It also highlights the further challenge of applying a “flexible” health care service for all patients affected by chronic heart disease.
The Heart of Inequality: International Health

The majority of CVD deaths occur in low-to-middle income countries (25) with increasing recognition that there are a number of paradoxical challenges arising from economic development and urbanisation. (26) While many high-income countries have observed a relative decline in the population impact of heart disease and are focussed on the problem of an older patient population who readily survive earlier nonfatal encounters with the condition, Africa is contending with a typically younger population with frequently advanced and often fatal heart disease. Similarly, while high-income countries are predominately faced with the problem of non-communicable forms of heart disease, Africa faces the burden of both communicable and non-communicable forms of heart disease. In clear contrast to regions such as Europe and North America, case complexity in Africa is often high and available resources from the individual to the societal perspective (particularly primary health care services) are often suboptimal. (27) Accordingly, the international health research theme of the CRE to Reduce Inequality in Heart Disease primarily focuses on those vulnerable populations in sub-Saharan Africa.

The Heart of Africa: Clinical Profile of an Evolving Burden of Heart Disease in Africa (27) presents the most prominent research detailing the evolving burden of communicable and non-communicable forms of heart disease published within the past decade. Additionally, the incidence of previously rare forms of CVD such as CAD will increase, in concert with historically prevalent forms of disease, such as rheumatic heart disease, that are yet to be optimally prevented or treated. (25) Secondary prevention programs designed to not only detect those with established and often disabling forms of heart disease and other forms of CVD (including ischaemic and non-ischaemic forms of stroke (28)) but prevent disease progression and a premature death are an obvious priority; whilst acknowledging the challenges of undertaking research in a resource-poor environment. (29)

Figure 10, adapted from a comprehensive review published in Nature Reviews Cardiology (Cardiovascular disease in Africa: epidemiological profile and challenges (25) highlights the enormous challenges of improving health outcomes in the diverse countries and countries that comprise the 1 billion people living on the African continent.

Figure 10: East Africa – A diverse and heterogeneous region
Percentage of people ≥35 y/o hospitalised with CORONARY ARTERY DISEASE annually, compared to the national average (2016/17):

- ≥15% Lower
- 10-15% Lower
- 5-10% Lower
- 0-5% Lower
- 0-5% Higher
- 5-10% Higher
- 10-15% Higher
- ≥15% Higher

People ≥35 y/o hospitalised annually with:
- Coronary Artery Disease
- Heart Failure
- Atrial Fibrillation

Figure 11: Annual hospitalisations by electorate in Tasmania
Percentage of people ≥35 y/o hospitalised with CORONARY ARTERY DISEASE annually, compared to the national average (2016/17):

- ≥15% Lower
- 10-15% Lower
- 5-10% Lower
- 0-5% Lower

- 0-5% Higher
- 5-10% Higher
- 10-15% Higher
- ≥15% Higher

Figure 12: Annual hospitalisations by electorate in Victoria
Percentage of people ≥35 y/o hospitalised with CORONARY ARTERY DISEASE annually, compared the national average (2016/17):

- ≥15% Lower
- 10-15% Lower
- 5-10% Lower
- 0-5% Lower
- 0-5% Higher
- 5-10% Higher
- 10-15% Higher
- ≥15% Higher

Figure 13: Annual hospitalisations by electorate in Melbourne surrounds
Figure 14: Annual hospitalisations by electorate in Southern Melbourne

Percentage of people ≥35 y/o hospitalised with CORONARY ARTERY DISEASE annually, compared to the national average (2016/17):

- ≥15% Lower
- 10-15% Lower
- 5-10% Lower
- 0-5% Lower
- 0-5% Higher
- 5-10% Higher
- 10-15% Higher
- ≥15% Higher

People ≥35 y/o hospitalised annually with:
- Coronary Artery Disease
- Heart Failure
- Atrial Fibrillation
Percentage of people ≥35 y/o hospitalised with CORONARY ARTERY DISEASE annually, compared to the national average (2016/17):

- ≥15% Lower
- 10-15% Lower
- 5-10% Lower
- 0-5% Lower
- 0-5% Higher
- 5-10% Higher
- 10-15% Higher
- ≥15% Higher

People ≥35 y/o hospitalised annually with:
- Coronary Artery Disease
- Heart Failure
- Atrial Fibrillation

Figure 15: Annual hospitalisations by electorate in Northern Melbourne
Percentage of people ≥35 y/o hospitalised with **CORONARY ARTERY DISEASE** annually, compared to the national average (2016/17):

- ≥15% Lower
- 10-15% Lower
- 5-10% Lower
- 0-5% Lower
- 0-5% Higher
- 5-10% Higher
- 10-15% Higher
- ≥15% Higher

**People ≥35 y/o hospitalised annually with:**
- Coronary Artery Disease
- Heart Failure
- Atrial Fibrillation

**Figure 16: Annual hospitalisations by electorate in New South Wales**
Percentage of people ≥35 y/o hospitalised with **CORONARY ARTERY DISEASE** annually, compared to the national average (2016/17):

- 0-5% Higher
- 5-10% Higher
- 10-15% Higher
- ≥15% Higher

**People ≥35 y/o hospitalised annually with:**
- Coronary Artery Disease
- Heart Failure
- Atrial Fibrillation

**Figure 17: Annual hospitalisations by electorate in Sydney surrounds**
Percentage of people ≥35 y/o hospitalised with CORONARY ARTERY DISEASE annually, compared to the national average (2016/17):

- ≥15% Lower
- 10-15% Lower
- 5-10% Lower
- 0-5% Lower
- 0-5% Higher
- 5-10% Higher
- 10-15% Higher
- ≥15% Higher

Figure 18: Annual hospitalisations by electorate in Northern Sydney
Percentage of people ≥35 y/o hospitalised with **CORONARY ARTERY DISEASE** annually, compared to the national average (2016/17):

- ≥15% Lower
- 10-15% Lower
- 5-10% Lower
- 0-5% Lower
- 0-5% Higher
- 5-10% Higher
- 10-15% Higher
- ≥15% Higher

People ≥35 y/o hospitalised annually with:
- Coronary Artery Disease
- Heart Failure
- Atrial Fibrillation

**Figure 19: Annual hospitalisations by electorate in Southern Sydney**
Percentage of people ≥35 y/o hospitalised with **CORONARY ARTERY DISEASE** annually, compared to the national average (2016/17):

- **≥15% Lower**
- **10-15% Lower**
- **5-10% Lower**
- **0-5% Lower**
- **0-5% Higher**
- **5-10% Higher**
- **10-15% Higher**
- **≥15% Higher**

**Figure 20: Annual hospitalisations by electorate in Queensland**
Figure 21: Annual hospitalisations by electorate in Brisbane surrounds

Percentage of people ≥35 y/o hospitalised with **CORONARY ARTERY DISEASE** annually, compared to the national average (2016/17):

- ≥15% Lower
- 10-15% Lower
- 5-10% Lower
- 0-5% Lower
- 0-5% Higher
- 5-10% Higher
- 10-15% Higher
- ≥15% Higher

People ≥35 y/o hospitalised annually with:
- Coronary Artery Disease
- Heart Failure
- Atrial Fibrillation
Percentage of people ≥35 y/o hospitalised with **CORONARY ARTERY DISEASE** annually, compared to the national average (2016/17):

- ≥15% Lower
- 10-15% Lower
- 5-10% Lower
- 0-5% Lower
- 0-5% Higher
- 5-10% Higher
- 10-15% Higher
- ≥15% Higher

**Figure 22: Annual hospitalisations by electorate in urban Brisbane**
Percentage of people ≥35 y/o hospitalised with CORONARY ARTERY DISEASE annually, compared to the national average (2016/17):

- ≥15% Lower
- 10-15% Lower
- 5-10% Lower
- 0-5% Lower
- 0-5% Higher
- 5-10% Higher
- 10-15% Higher
- ≥15% Higher

People ≥35 y/o hospitalised annually with:
- Coronary Artery Disease
- Heart Failure
- Atrial Fibrillation

Figure 23: Annual hospitalisations by electorate in Western Australia
Percentage of people ≥35 y/o hospitalised with **CORONARY ARTERY DISEASE** annually, compared to the national average (2015/17):

- ≥15% Lower
- 10-15% Lower
- 5-10% Lower
- 0-5% Lower
- 0-5% Higher
- 5-10% Higher
- 10-15% Higher
- ≥15% Higher

**Figure 24: Annual hospitalisations by electorate in Perth**
Percentage of people ≥35 y/o hospitalised with **CORONARY ARTERY DISEASE** annually, compared to the national average (2016/17):

- Grey: ≥15% Lower
- Pink: 10-15% Lower
- Light pink: 5-10% Lower
- Red: 0-5% Higher
- Orange: 5-10% Higher
- Brown: 10-15% Higher
- Black: ≥15% Higher

People ≥35 y/o hospitalised annually with:
- Coronary Artery Disease
- Heart Failure
- Atrial Fibrillation

Figure 25: Annual hospitalisations by electorate in South Australia
Percentage of people ≥35 y/o hospitalised with **CORONARY ARTERY DISEASE** annually, compared to the national average (2016/17):

- 0-5% Lower
- 5-10% Lower
- 10-15% Lower
- ≥15% Lower

People ≥35 y/o hospitalised annually with:
- Coronary Artery Disease
- Heart Failure
- Atrial Fibrillation

*Figure 26: Annual hospitalisations by electorate in Adelaide*
Figure 27: Annual hospitalisations by electorate in Northern Territory / Australian Capital Territory

The above electorate figures are based on age/sex estimations. They do not take into account other factors such as socioeconomic status and percentage of Indigenous residents. This is particularly limiting for Northern Territory (above) which has substantially high rates of CVD - regardless of age and sex.
Theme leader: Professor Alex Brown

CVD is the biggest single cause of death for Indigenous Australians, which, according to ABS data from 2013, comprises 3% of the total Australian population, and the primary contributor to the life expectancy gap. Our previous findings from The Heart of the Heart Study (11) indicate that Indigenous Australians have very high rates of pre-existing cardiovascular conditions and cardiometabolic risk despite their young age, and CVD risk is particularly associated with psychosocial factors and socioeconomic indicators. Despite the heavy burden of heart disease, there are significant disparities in the delivery of evidence based health care among Indigenous Australians.

Working in partnership with Indigenous communities and representative bodies, the CRE has examined the major determinants contributing to the inequalities in heart disease. This research has included a set of intervention programs that effectively and efficiently reduce the disparities in care of CVD and health outcomes experienced by Indigenous Australians, and identified the critical policy targets moving forward. Key projects are as follows:

The Implementing Cardiovascular Standards to Improve Indigenous Cardiovascular Care and Outcomes project has developed a framework for monitoring and evaluating the quality of cardiovascular care for Indigenous Australians, against minimum standards of evidence-based care. This framework has guided COAG’s “Better Cardiac Care for Aboriginal and Torres Strait Islander People” activities. The standards have also been applied in South Australia to inform the development of government strategy to improve cardiovascular care across the life course, from primary prevention to acute management and ongoing care.

A retrospective cohort study examining the pattern and outcomes for HF-related hospitalisation among Indigenous and non-Indigenous individuals living in Central Australia shows that Indigenous men and women develop HF on average 20 years younger than the general population. Indigenous patients with HF have more complex case presentations and greater levels of health care utilisation compared to non-Indigenous patients with heart failure. (12)

CAHPS (Central Australian Heart Protection Study) is an ongoing, pragmatic, health service trial investigating the potential benefits of a nurse-mediated outreach program of secondary prevention for Indigenous and non-Indigenous in-patients discharged to home from the Alice Springs Hospital following an acute cardiac presentation. The early findings based on 50 subjects initially allocated to the intervention arm reinforce the difficulties that exist in overcoming the tyranny of distance to provide optimal secondary prevention for Indigenous Australians living with heart disease in remote communities. (22)

ASH-RAPP (Alice Springs Hospital ReAdmission Prevention Project) is an ongoing randomised controlled trial evaluating a tailored multidimensional transitional care intervention to prevent readmission in Indigenous and non-Indigenous Australian residents living in remote Australia who are frequently admitted to their local hospital(s). Preliminary results suggest that most patients recruited have multiple comorbidities. Drivers for readmission appear to include acute deterioration of chronic conditions, missed medications, lack of social supports and issues relating to homelessness and alcohol. This project will provide valuable insights into how local health care providers, including community-controlled health organisations, can provide leadership and coordination of existing clinical services and facilitate service improvements and health care savings in this setting. (30)
Theme leader: Associate Professor Melinda Carrington

The CRE to Reduce Inequality has driven a number of projects to achieve the following:

- Accurately estimate the burden of risk (including metabolic disorders) and established heart disease in regional Victoria
- Develop innovative and cost-effective health care programs to deliver state-of-the-art prevention and disease management strategies to reduce cardiac events in regional communities
- Translate these (and other) innovative strategies into sustainable health services to meet the additional needs of those living in Regional Australia

MODERN (Management to Optimise Diabetes and mEtabolic Risk reduction via Nurse-led intervention) is a clinical trial to determine whether a nurse-implemented health and lifestyle modification program is more beneficial than standard care to reduce cardio-metabolic abnormalities and future risk of CVD and diabetes in individuals with the metabolic syndrome. Metabolic Syndrome is defined as a combination of risk factors that increase the likelihood of a person developing CVD or type 2 diabetes. Participants residing in Colac or Shepparton, Victoria, and aged between 40 to 70 years with any three or more risk factors for metabolic syndrome who had no evidence of cardiovascular or other chronic disease were eligible to participate.

The MODERN trial is ongoing and due to be completed in early 2018. However, from 853 individuals who underwent a screening assessment, 276 fulfilled the metabolic syndrome criteria and were randomised. The intervention includes risk factor management, health education, care planning and scheduled follow-up commensurate with level of risk. The primary cardio-metabolic end-point is achievement of risk factor thresholds to eliminate metabolic syndrome or achievement of minimal (clinically significant) changes for at least 3 risk factors that characterise metabolic syndrome over 2 year follow-up. Key outcomes will be measured at baseline, 12 and 24 months via questionnaires, physical examinations, pathology and other diagnostic tests. Health economic analyses will be undertaken to establish the cost-effectiveness of the intervention.

The MODERN trial will provide evidence for the potential benefit of independent nurse-run clinics in the community and their cost-effectiveness in adults with metabolic syndrome. Findings will enable more nurse-led clinics to be adopted outside of major cities and encompassing other chronic diseases as a key primary preventative initiative.

Regional Field Day health promotion in partnership with the Royal Flying Doctor Service. This Field Day cardiovascular and diabetes screening program detected some potentially serious hidden risk factors in people living in regional Victoria. One in three people were found to have hypertension and/or prediabetes, and 235 (44%) participants were advised to see their doctor. A follow-up survey of these people found that 173 (74%) individuals had subsequently visited or made plans to see their general practitioner (GP). Of those people who visited their GP, ten (6%) received additional multidisciplinary care including referral to a medical specialist (4%), community nurse (3%) and dietitian (1%). This pre-trained volunteer medical student model was found to be an effective approach to identifying people in rural communities who are at risk of developing CVD and encouraging them to seek timely medical care. Short term gains were seen, however the sustainability of risk improvement gains over the longer term is unknown.
Theme leader: Professor Simon Stewart

CVD including its most common manifestation, heart disease (ischemic and atherosclerotic) affects more Australian adults than any other disease group. (31) CVD kills 1 Australian every 12 minutes (~45,000 deaths or 29% of all deaths) (32) and affected 1 in 5 or 4.2 million Australians during 2014-2015. (33) Despite modern therapeutic improvements, CVD consistently tops our annual health spending, costing more than $7.4 billion during 2008-09 with more than half spent on patients (older individuals with chronic heart disease and those living in disadvantaged communities) admitted to hospital. (34)

In recent decades, Australia’s CVD risk factor profile has worsened considerably resulting from a more sedentary lifestyle and adopting unhealthy dietary patterns. The consequential impact of clinical risk factors such as elevated blood pressure, blood cholesterol levels, overweight and obesity, (35) coupled with an ageing Australian population, means that more and more Australians are likely to face inequitable risks of developing and then dying from heart disease. Building on a rich tradition of developing innovative health services for individuals with chronic heart disease, investigators working on the Chronic Heart Disease Research Theme have developed and tested many of our innovative strategies (with strong translational implications) across the continuum of heart disease.

Specifically, we have completed the following key research projects and have presented study primary outcomes at major international cardiac conferences and published concurrently in prestigious international medical journals including the Lancet, Circulation, European Heart Journal and Journal of the American College of Cardiology:

SAFETY (Standard versus Atrial Fibrillation-specific management) was a secondary prevention, multicentre randomised controlled trial that aimed to optimise the management of patients with AF by improving delineation of individual risk factors over and above conventional risk profiling. (36)

WHICH? (Which Heart failure Intervention is most Cost-effective & consumer friendly in reducing Hospital care trial) was a multicentre randomised trial comparing two different forms of HF management to determine the best way to prolong survival and reduce hospital care for those affected by this often deadly and disabling condition. (37, 38)

NIL-CHF (the Nurse-led Intervention for Less Chronic Heart Failure Study) was a randomised trial exploring the potential to extend the proven benefits of multidisciplinary HF management programs to those at high-risk of developing the syndrome. (39)

WHICH? II (Which Heart failure Intervention is most Cost effective in reducing Hospital care trial) was a multicentre, randomised trial of standard versus intensified management of metropolitan and regional-dwelling patients with HF. (40)
Theme leader: Professor Karen Sliwa

Given the overwhelming burden of non-cardiac-related infectious diseases (including malaria and the broader epidemic of HIV/AIDS), CVDs are often overlooked as a matter of health importance. Ultimately, a more comprehensive and accurate picture of the epidemiology of cardiovascular risk and CVD in Africa will require a substantial investment in a purposeful network of surveillance sites collecting standardised data across all parts of Africa. (25) Through strong collaborations with leading cardiovascular researchers throughout Africa, with a clear focus on building research capacity and working with local communities to best understand their needs, the CRE seeks to develop sustainable strategies to understand and then address a rising tide of heart disease within vulnerable communities throughout the continent.

The CRE has recently expanded its population studies (from a South African focus) to the wider populations of Africa. The MOZambique snApshot of emeRging Trends (MOZART) Disease Surveillance Study (41) is a prospective, multicentre study with random profiling of one-in-five representative case presentations to the emergency departments at three tertiary hospitals in Mozambique. The primary aim of the MOZART Study is to understand and investigate the balance between communicable and non-communicable forms of heart disease in a representative cohort of patients seeking acute hospital care in four urban areas of Mozambique. A secondary aim is to describe potential variance in the balance of disease on a seasonal basis (between wet and dry seasons). The Pan-African Nurse-led And Community-basEd cAre in Heart Failure (PANACEA-HF) Trial (commencing in March 2018) is a multicentre, randomised controlled trial that addresses typically poor outcomes associated with one of Africa’s most deadly and disabling forms of non-communicable disease (NCD) – HF. This trial will be conducted in two hospitals in four African countries (South Africa, Mozambique, Cameroon and Nigeria).

As shown in Figure 28, the Pan-African Nurse-led And Community-basEd cAre in Heart Failure (PANACEA-HF) Trial (commencing in March 2018) is a multicentre, randomised controlled trial that addresses typically poor outcomes associated with one of Africa’s most deadly and disabling forms of NCD – HF). This trial will be conducted in two hospitals in four African countries (South Africa, Mozambique, Cameroon and Nigeria).
As outlined in this report, the CRE to Reduce Inequality in Heart Disease has generated an enormous body of work that has highlighted key disparities in heart disease across the Australian population (and beyond) from a societal to an individual perspective.

Thus far, our collective work has laid the foundation framework to improve our understanding of the causes and consequences of heart disease. However, the CRE core research team recognises a continued need to provide an integrated, multidisciplinary and collaborative approach to address the enormous and persistent issue of inequitable risk of developing and then dying from heart disease in vulnerable Australian communities and beyond.

Via a unique series of trials and the embedded program of integrated CRE core activities, our ongoing legacy is to demonstrate that it is possible to bridge persistent inequalities in heart disease by refining cost-effective health programs that:

1. Reduce ambient levels of future risk of heart disease in vulnerable individuals;
2. Slow the progression/worsening of heart disease in those already affected;
3. Reduce costly health care including recurrent hospitalisation in those suffering debilitating forms of chronic heart disease (e.g. HF and AF);
4. Improve the quality of life and indeed prolong survival in typically older individuals with limited treatment options

Indicative, but not exclusively given the broad body of translational research undertaken, of the progress we have collectively made under the auspices of our four key themes, the CRE to Reduce Inequality in Heart Disease will be responsible for the following:

**Indigenous Cardiovascular Health**: completion and reporting of the ASH-RAPP Study and the Central Australia Heart Protection Study of two similar models of care designed to address poor health outcomes associated with chronic heart disease and other chronic illnesses among the Indigenous and non-Indigenous peoples of Central Australia. Positive findings from both studies are highly likely to influence the provision of care for individuals with chronic disease in both Central Australia and other vulnerable communities throughout Australia.

**Remote Australians Heart Health**: completion and reporting of the MODERN Study of a nurse-led regional risk clinic to reduce progression to CVD among high-risk individuals with metabolic disease. If positive, this study has the potential to generate a network of regional risk clinics to address high-levels of heart disease (“hot-spots”) in regional Australia.

**Chronic Heart Disease**: successful completion of two pivotal trials of the management of chronic AF (the SAFETY Trial) and HF (the WHICH? II Trial) that provide clear evidence of the best management strategies to cope with an increasing patient population of older patients with chronic heart disease and multiple other conditions leading to recurrent and costly hospitalisations and premature death.

**International Heart Health**: successful completion of a number of surveillance studies designed to illuminate the growing burden of communicable heart disease in sub-Saharan Africa. Strengthened collaborations have led to an African-wide initiative to undertake Africa’s first-ever trial of HF management (the PANACEA-HF Trial) with a specific goal to create a network of HF management services across the continent.
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**Mary MacKillop Institute**

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A total of 447 publications (listed below) have arisen from our eight CRE lead investigators over the programs’ five year duration. **Figure 29** shows how these publications spread across different collaborations between investigators.


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Rhythm Association (EHRA) consensus document endorsed by the Heart Rhythm Society (HRS), Asia Pacific Heart Rhythm Society (APHRS), and Societad Latinoamericana de Estimulacion Cardiaca y Electrofisiologia (SOLACE), Europe. 2015;17(12):1747-69.


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2017


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## Appendix

### Table 1: Key CRE Projects

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<th>CRE THEME – CHRONIC HEART DISEASE</th>
<th>Investigators</th>
<th>Study</th>
<th>Aims / design</th>
<th>Target population</th>
<th>Main findings</th>
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<tbody>
<tr>
<td>Stewart, Carrington</td>
<td>The Valsartan Intensified Primary carE Reduction of Blood Pressure (VIPER-BP) Study (42)</td>
<td>The aim of the Australia-wide, multicentre, VIPER-BP study was to evaluate the efficacy of intensive blood pressure management versus usual care in primary care settings. This was a pragmatic, multicentre, randomised controlled trial.</td>
<td>Hypertensive patients in primary care settings.</td>
<td>In contrast to typical primary care management of hypertension, VIPER-BP combined more intensive and aggressive therapies that rapidly attain and sustain individualized BP targets in hypertensive patients. There was an 8.8% absolute difference in individual blood pressure target achieved at 26 weeks in favour of the intervention group compared with usual care group (358/988) (36.2%) v 138/504 (27.4%): adjusted relative risk 1.28 (95% confidence interval 1.10 to 1.49, p=0.0013). There was also a 9.5% absolute difference in favour of the intervention group for achieving the classic blood pressure target of ≤140/90 mm Hg (627/988 (63.5%) v 272/504 (54.0%)): adjusted relative risk 1.18 (1.07 to 1.29, p&lt;0.001). The group with intensive structured achieved their target blood pressure, and avoided cardiovascular events overall.</td>
<td></td>
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</table>

**Translational Implications**: The VIPER-BP study can be used as a template for the application of pragmatic interventions that combine pharmacotherapy with structured approaches to profiling and management of high risk individuals (with a critical role for the practice nurse) requiring long term treatment for hypertension and other chronic conditions in the primary care setting.
<table>
<thead>
<tr>
<th>Investigators</th>
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<tr>
<td>Stewart, Scuffham, Carrington</td>
<td>Nurse led Intervention for Less Chronic Heart Failure (NIL-CHF) Study (39)</td>
<td>The purpose of this single-centre study was to determine the effectiveness of long term, nurse led, multidisciplinary program to prevent progressive cardiac dysfunction in patients at risk for developing de novo chronic heart failure (CHF). This is a pragmatic, single centre, open label, randomized controlled trial.</td>
<td>All elective and emergency patients admitted to the cardiology unit in a 390 bed tertiary referral hospital.</td>
<td>During 51.0 ± 8.2 months follow-up, 38/310 (12%) standard care [mean event-free survival 1865 days, 95% confidence interval (CI)1817–1913 days] vs. 41/301 (14%) intervention participants (1855 days, 95% CI 1804–1906 days) experienced the primary composite endpoint of de novo CHF hospitalisation or all-cause mortality (p = 0.574). Although there were no statistically significant differences in the rate of cardiovascular-related and emergency hospitalisations, the NIL-CHF group accumulated 1097 fewer days of hospital stay compared with standard care. The intervention group also showed better cardiac recovery on echocardiography at 3 years [81/226 (35.8%) vs. 56/225 (24.9%), odds ratio 1.44, 95% CI 1.08–1.92, p = 0.011]. The NIL-CHF intervention was ineffective in preventing CHF and re-hospitalisation. On the contrary, it was associated with reduced hospital length of stay and improved cardiac function in the long term.</td>
</tr>
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**Translational Implications:** The NIL-CHF Study demonstrated the potential to apply a hybrid model of nurse-led management to prevent progression to HF in high-risk individuals with chronic forms of heart disease.
<table>
<thead>
<tr>
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<tr>
<td>Stewart, Carrington, Scuffham</td>
<td>Which Heart failure intervention is most Cost-effective and consumer friendly in reducing Hospital care (WHICH?) Trial (37, 38)</td>
<td>A prospective, multicentre, randomised controlled trial comprising 280 patients hospitalised with chronic heart failure (CHF) (27% female, aged 71 ± 14 years) across three Australian tertiary hospitals. The trial aimed to compare two different forms of heart failure (HF) management (home-based vs. specialist clinic) to determine the best way to reduce hospital costs, all-cause mortality, and hospital readmission during a 12-18 month follow-up.</td>
<td>Patients hospitalised with heart failure, recruited across three Australian tertiary hospitals.</td>
<td>The home-based intervention (HBI) was not superior to the clinic-based intervention (CBI) in reducing all-cause death or hospitalisation (71% HBI vs. 76% CBI; P = 0.861). However, the HBI was associated with significantly lower health care costs than the CBI, attributable to fewer days of hospitalisation (median $AU34 [IQR 13-81] vs. $AU41 [13-107] per day; p=0.030).</td>
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**Translational Implications:** The WHICH? Trial highlights the benefits of applying home visits wherever possible to reduce the risk of rehospitalisation and prolong survival in typically older patients hospitalised with the syndrome HF.
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<tr>
<td>Carrington, Thompson, Scuffham, Stewart</td>
<td>Standard versus Atrial Fibrillation spEcific managementY (SAFETY) (36)</td>
<td>SAFETY was a prospective, multi-centre, randomized controlled trial with blinded-endpoint adjudication. The SAFETY intervention involved home-based assessment, extensive clinical profiling and the application of optimal gold-standard pharmacology and therapeutic management. The primary endpoint was event-free survival from all-cause death or unplanned readmission during 18–36 months follow up. Secondary endpoint include rate of recurrent hospital stay, treatment success and cost-efficacy.</td>
<td>Patients with a chronic, non-valvular form of Atrial Fibrillation from three tertiary referral hospitals in Australia.</td>
<td>A post-discharge management program specific to atrial fibrillation was associated with proportionately more days alive and out of hospital (but not prolonged event-free survival) relative to standard management. Disease-specific management is a possible strategy to improve poor health outcomes in patients admitted with chronic atrial fibrillation. Patients assigned to the SAFETY intervention had 99.5% maximum event-free days (95% CI 99.3–99.7), equating to a median of 900 (IQR 767–1025) of 937 maximum days alive and out of hospital. By comparison, those allocated to standard management had 99.2% (95% CI 98.8–99.4) maximum event-free days, equating to a median of 860 (IQR 752–1047) of 937 maximum days alive and out of hospital.</td>
</tr>
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</table>

**Translational Implications:** The positive results of the seminal SAFETY Trial demonstrate the potential to reduce recurrent hospital stay and prolong survival in an increasing number of typically older patients hospitalised with chronic AF. They replicate the early potential of nurse-led, home-based, multidisciplinary management programs to improve health outcomes in HF that have translated into cost-effective health services.
<table>
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<tr>
<td>Carrington, Stewart</td>
<td>Healthy Hearts Beyond City Limits (21)</td>
<td>The aim of the study was to determine age and sex specific cardiovascular disease risk factor levels and potential value of national risk clinics. This was an observational research study conducted in four purposefully selected high risk communities in Victoria, Australia.</td>
<td>2,125 self-selected participants from Colac, East Gippsland, Geelong and Shepparton all high risk areas for cardiovascular disease.</td>
<td>Overall, CVD risk factors were highly prevalent, more men than women had ≥2 modifiable CVD risk factors (76% vs. 68%, p &lt; .001), pre-existing CVD (20% vs. 15%, p &lt; .01) and a major ECG abnormality requiring follow-up (15% vs. 7%, p &lt; .001). Fewer men reported depressive symptoms compared to women (28% vs. 22%, p &lt; .01). A higher proportion of women were obese (adjusted OR 1.36, 95% CI 1.13 to 1.63), and physically inactive (adjusted OR 1.32, 95% CI 1.07 to 1.63). This close engagement with the community provided insight for management clinics to reduce cardiovascular disease in regional Australia.</td>
</tr>
</tbody>
</table>

**Translational Implications:** The Healthy Hearts Beyond City Limits Study provides definitive evidence of elevated risk of heart disease and other forms of CVD in rural/regional communities. At the same time it demonstrated high levels of community engagement and support for outreach initiatives of this kind.
<table>
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<tbody>
<tr>
<td>Carrington, Stewart</td>
<td>Protecting Healthy Hearts (43)</td>
<td>Using a pre- and post-intervention follow-up design, this trial aimed to evaluate the benefits of a nurse-led, self-management intervention program from reducing risk factors for cardiovascular disease and diabetes in a high risk, under-serviced population in regional Victoria. Participants were recruited through responding to advertisements for a free health check, and individual targets and multidisciplinary strategies to reduce risk factors were applied, with a primary endpoint of change in cardiovascular risk factors.</td>
<td>Regional Australians</td>
<td>A nurse-led risk reduction clinic that employed the Protecting Healthy Hearts intervention was highly acceptable and popular in a regional community where health care resources are often limited. The intervention demonstrated sustainable improvements from baseline to 6 months in reducing the future risk of future cardiovascular events.</td>
</tr>
</tbody>
</table>

**Translational Implications:** The Protecting Health Hearts study confirmed the feasibility of a dedicated heart health service and provided proof of concept for the establishment of regional nurse-led clinics – informing the design of the prospective, multicentre MODERN Trial.
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<tr>
<td>Carrington, Stocks, Thompson, Stewart, Scuffham</td>
<td>Management to Optimise Diabetes and mEtabolic syndrome Risk reduction via Nurse-led intervention (MODERN) Study</td>
<td>A prospective, multicentre randomised controlled trial comprising 300 participants recruited in two regional Victorian towns: Colac and Shepparton. The study aims to measure and reduce participants’ risk factors that can lead to the development of Type 2 Diabetes and cardiovascular disease. The study will compare two different forms of management (standard care vs. MODERN intervention). Those in the intervention group will receive access to a health and lifestyle program from a specialist nurse at the study clinic in order to manage their risk factors, whilst those in the standard care group will receive their usual health care services.</td>
<td>Residents in Colac and Shepparton between 40 and 70 years of age who are at risk of developing Type 2 Diabetes or cardiovascular disease.</td>
<td>This study is currently ongoing.</td>
</tr>
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</table>

**Translational Implications:** This study has the potential to influence primary prevention strategies for reducing the risk of people developing Type 2 Diabetes and cardiovascular disease, especially in regional areas in which residents may have limited access to health care services.
<table>
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<tr>
<td>Scuffham, Carrington, Stewart</td>
<td>Which Heart failure intervention is most Cost-effective in reducing Hospital stay (WHICH? II) Trial (40)</td>
<td>A prospective, multicentre, randomised controlled trial with blinded endpoint adjudication comprising 787 patients (41% female, aged 74-12 years) hospitalised with chronic heart failure across four Australian tertiary hospitals from September 2013 – February 2016. The trial aimed to investigate whether ‘a more intensive, nurse-led, post-discharge, multidisciplinary, HF management programme incorporating outreach home-based intervention enhanced by structured telephone support (STS) (INT HF-MP) would be superior to standard management (SM) incorporating home-based care and STS for metropolitan and remote-dwelling patients, respectively, in reducing the total cost of health care during 12-month follow-up’</td>
<td>Patients hospitalised with heart failure, recruited across four Australian tertiary hospitals.</td>
<td>After 12 months follow-up, there was no significant difference in median health care costs between the INT-HF-MP and SM groups ($1579, IQR $644 to $3717 vs. $1450, IQR $564 to $3615 per patient per month, respectively). There was also minimal difference in mortality at 12 months between the two groups (17.7% INT-HF-MP and 18.4% SM, ( P = 0.848 )). Additionally, participants in both groups spent similar amounts of time in hospital, with median hospital stay 18.6 ± 26 days and 16.6 ± 24.8 days in the INT-HF-MP and SM groups, respectively (( P = 0.199 )).</td>
</tr>
</tbody>
</table>

**Translational Implications:** The WHICH? II Trial highlights the possibility of the ‘threshold effect’, where the additional support given to patients with HF may be counterproductive. As such, trial findings demonstrate that the current application of HF management in urban areas of Australia (when applied) is the most cost-effective strategy to reduce the risk of recurrent hospital stay and prolong survival. At the same time, it confirms the strong need for establishing HF management services (particularly in the form of nurse-led, structured telephone support) for those individuals with HF living in rural/regional communities.
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<tr>
<td>Maguire, Stewart, Scuffham</td>
<td>Alice Springs Hospital ReAdmission Prevention Project (ASH RAPP) (30)</td>
<td>This randomised controlled trial aims to determine if a multidimensional intervention can reduce hospital readmission for patients at risk of recurrent readmission to Alice Springs Hospital. Participants include both Indigenous and non-Indigenous Australians who had recurrent admissions to Alice Springs Hospital, with those within the intervention group receiving a multi-dimensional and case-based transitional care package led by a designated team consisting of a medical officer, nurse, Aboriginal Health Practitioner and pharmacist, on top of usual care.</td>
<td>Remote dwelling patients with recurrent hospital admissions, with an emphasis on Indigenous Australians</td>
<td>Whilst ongoing, initial results suggest that most patients recruited are Indigenous Australians from both Alice Springs and remote communities, and have multiple co-morbidities. Drivers for readmission appear to include acute deterioration of chronic conditions, missed medications, lack of social supports and issues relating to homelessness and alcohol.</td>
</tr>
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</table>

**Translational Implications:** The results of ASH RAPP will provide evidence as to whether the use of multidimensional intervention is an effective approach to reducing recurrent hospital admissions in Indigenous and non-Indigenous Australians affected by chronic disease in Central Australia.
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<tr>
<td>Brown, Stewart, Carrington, Thompson</td>
<td>Central Australia Heart Protection Study (CAHPS) (12, 22)</td>
<td>This study aimed to develop and evaluate a flexible, cost-effective, culturally sensitive, integrated family based secondary prevention program to reduce the incidence of major adverse coronary events over a two year period in both Indigenous and non-Indigenous patients discharged from Alice Springs Hospital. Participants were recruited following an admission to Alice Springs Hospital for an acute cardiac event, and assessed over a two year period post admission. Participants were provided with regular health reviews, follow-up home visits, continued clinical, social and family assessments, health education, support and goal setting, and referred to relevant social services if required.</td>
<td>Remote dwelling cardiac patients admitted to the Alice Springs Hospital with acute forms of heart disease with an emphasis on Indigenous Australians</td>
<td>The findings from this study will be released in the near future.</td>
</tr>
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</table>

**Translational Implications:** The results of CAHPS will provide important insights into the benefits of an integrative, family based secondary prevention program in remote-dwelling and Indigenous Australians to reduce their risk of major cardiovascular events and prolong their survival overall.
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<thead>
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<tr>
<td>Sliwa, Stewart</td>
<td>Pregnancy-Related Obesity prevention Through Education &amp; Communication Technology in AFRICA: The PROTECT-AFRICA Study</td>
<td>This multi-centre randomised controlled trial aims to investigate whether overweight but not obese pregnant African women having <em>ad libitum</em> access to an IT-based health education intervention package fall within the lowest quartile for excess weight gain. Patients will be screened from four primary care clinics, and a prospective health-economics design analysis will examine the potential cost-benefits of the intervention. Data will also be extrapolated to a whole-of-community and health system-wide perspective.</td>
<td>Pregnant women in South Africa</td>
<td>Findings of this study will be released in the near future.</td>
</tr>
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**Translational Implications:** The results from the PROTECT-Africa study could potentially influence South African health care policies (i.e. creating more cost effective and efficient interventions) and provide a fresh perspective on the impact of maternal obesity in South Africa.
<table>
<thead>
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<tr>
<td>Stewart</td>
<td>MOZambique snApshot of emeRging Trends (MOZART) Disease Surveillance Study (41)</td>
<td>The MOZART Study is a prospective, hospital-based, multicentre surveillance study with random profiling of case presentations. The study aims to understand and investigate the balance between communicable diseases, non-communicable diseases, and injuries in a representative cohort of patients seeking acute hospital care in the Northern, Central, and Southern regions of Mozambique. Additionally, the study aims to describe potential variance in the balance of disease on a seasonal basis (between wet and dry seasons). An objective of the study is to generate an easy and inexpensive scalable surveillance tool which can be used to track and compare future trends in the pattern of NCDs presenting to urban health units in other low-income countries in sub-Saharan Africa.</td>
<td>Patients seeking acute hospital care in the Northern, Central, and Southern regions of Mozambique.</td>
<td>This study is currently ongoing.</td>
</tr>
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**Translational Implications:** We believe that findings from the MOZART Disease Surveillance Study will make a significant contribution to describing essential data on the contemporary burden of NCDs and informing future public health policy in Mozambique and beyond. This model has the undoubted potential to be replicated and tailored to other resource-limited settings in Africa.
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<tr>
<td>Stewart, Sliwa, Scuffham</td>
<td>The Pan-African Nurse-Led And Community-Based Care in Heart Failure (PANACEA-HF) Trial</td>
<td>The aim of this research is to address high-levels of morbidity and premature mortality among increasingly young African patients hospitalised each year with HF. PANACEA-HF is a pragmatic, multicentre, randomised controlled trial (RCT) that will recruit a total of 400 patients. Patients included in the study intervention will be followed-up for a period of 6-months to measure the study endpoints. The intervention a takes successful Home-Based, Nurse-Led Management Program (WHICH?) and adapts it to the African context by engaging with local researchers and Health Practitioners. The outcomes that will be measured in this study are the 1) days alive and out-of-hospital (DAOH), 2) rate of re-hospitalisation and duration of hospital stay, 3) all-cause mortality, 4) event-free survival from death or hospitalisation, 5) change in physiological indicators of cardio-respiratory health, and 6) change in health-related Quality of Life.</td>
<td>Patients hospitalised with heart failure, recruited across eight hospitals in four African countries (Cameroon, Mozambique, Nigeria, and South Africa).</td>
<td>This study is currently ongoing.</td>
</tr>
</tbody>
</table>

**Translational Implications:** A plethora of evidence and trials has seen Nurse-Led Heart Failure Management programs become well established in High income countries, however, this is not the case for Low-Middle Income countries. In Africa, there are no specific guidelines for HF management, despite the syndrome affecting a large proportion of African’s during the prime of their lives. Positive results from the PANACEA-HF trial will be critical in establishing evidence-based guidelines for applying HF management programs specific to the African environment.