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| Strategic Overview **Cardiovascular Disease in New Zealand** |
|  | December 2013 |

# Executive Summary

Cardiovascular disease places a significant burden on the New Zealand health system. In 2011/12, it accounted for $501 million worth of public hospital casemix discharges. Because of this large burden, the National Health Committee (NHC) has flagged cardiovascular disease as a priority disease area for the 2013/14 financial year.

This ‘Tier 1’ document presents a high-level overview of each cardiovascular condition in terms of prevalence and incidence, health outcomes and health utilisation and cost. The findings are then assessed against the relevant NHC decision-making criteria. The purpose of this document is to provide the Committee with context around a recommendation as to which disease area should be assessed in ‘Tier 2’ and subsequent tiers in order to improve health outcomes and efficiency for the health sector.

The prevalence of ischaemic heart disease (IHD) was 5.5% in New Zealand adults aged over 15 years in 2011/12. This equated to about 193,000 individuals, with more men than women affected. Almost 30% of individuals aged over 75 years have been diagnosed with IHD. Māori are about 1.8 times as likely to have been diagnosed with IHD as non-Māori adults when adjusted for age and sex. IHD contributed to 6,027 deaths in 2006 (57% of all cardiovascular deaths) and was associated with over 89,000 DALYs (56% of total cardiovascular DALYs). In 2011/12, $228 million was spent on 30,745 hospitalisations for 21,764 individuals with IHD. Each hospitalised individual cost about $10,500 on average, with each hospitalisation lasting an average of 4.4 days.

The prevalence of stroke in 2011/12 was about 1.8% of adults (62,000 individuals), with prevalence rising to 8% in those aged over 75 years. Māori individuals were 1.3 times as likely to have had a stroke as non-Māori individuals when adjusted for age and sex. Strokes killed about 2,700 people and were responsible for 37,688 DALYs in 2006 (26% and 24% of deaths and DALYs, respectively). Stroke was responsible for 10,370 hospitalisations for 9,000 individuals in 20011/12. Average cost per hospitalised individual was $7,400 whilst average hospitalisation length of stay was 4.9 days. Total acute hospitalisation costs were $67 million. Including rehabilitation costs, this cost is closer to between $120.6 million and $127.7 million.

While hypertension is very common, requiring 16% of adults to take antihypertensive medication, it makes a relatively small contribution in terms of disease burden (280 deaths and 3,300 DALYs in 2006) and hospitalisation costs ($1 million in 2011/12) compared with IHD and stroke. Rheumatic heart disease is important in terms of inequalities, with incidence being respectively 20- and 40-times higher for Māori and Pacific children than for non-Māori/non-Pacific children. However, the disease burden was relatively low (100 deaths and 2,800 DALYs in 2006) and the hospitalisation cost was $6 million in 2011/12.

The other cardiovascular disease sub-areas each contributed less than 5% of cardiovascular deaths and DALYS, and were associated with hospitalisation costs of $7 million to $37 million in 2011/12.

In terms of absolute prevalence, DALY and death burden, IHD places the most burden on health independence compared to all other cardiovascular diseases including stroke. From an equity perspective, Māori have a DALY burden for IHD that is 3 times that of non-Māori. In terms of materiality, a saving of $26 per patient or $163 (2.2%) per hospitalisation for IHD would produce $5 million in savings.

Based on the evidence in this report, it is recommended that ischaemic heart disease (IHD) is assessed for the 2013/14 year as per the NHC’s tiered approach. This recommendation is supported by the Cardiac Society of Australia and New Zealand (CSANZ) and the Heart Foundation.

Stroke is recommended as the next disease for assessment within cardiovascular disease.

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#

# Introduction

The National Health Committee (NHC) is the body tasked with improving health outcomes whilst maintaining or reducing costs through the prioritisation of the most cost effective new and emerging health technologies. It does this by assessing ‘value for money’ in terms of health outcomes and cost to the health sector. By recommending the appropriate mix of investment in technologies (including models of care) that provide the greatest value for money, the NHC’s goal is to improve both health outcomes and health sector sustainability. The process by which the NHC chooses the technologies it assesses, consequently, becomes vitally important.

The burden cardiovascular disease places on health outcomes and the health budget provides a potential source for significant health gains through the improvement of health services across the continuum of care. The NHC has a ‘tiered’ approach to prioritise what work should be undertaken within the broad area of cardiovascular disease.

This ‘Tier 1’ document presents a high-level overview of each cardiovascular condition in terms of prevalence and incidence, health outcomes and health utilisation and cost. The findings are then assessed against the relevant NHC decision-making criteria. The purpose of this document is to provide the Committee with context around a recommendation as to which disease area the Committee should conduct ‘Tier 2’ work.

At Tier 2, the evidence for the interventions that comprise the pathway of care for a particular disease from prevention to secondary/tertiary care is presented and assessed against the relevant decision-making criteria for prioritisation into ‘Tier 3’ health technology assessments (HTAs).

An HTA is a type of assessment methodology that presents the evidence for a particular intervention across a multi-disciplinary set of assessment domains. For the NHC, those domains are clinical safety and effectiveness; economic; societal and ethical; and feasibility of adoption.

The final tiers in the process are to develop an implementation and monitoring/evaluation plan for the recommendations.

Cardiovascular disease is a general term for a complex set of conditions that affect the heart and blood vessels. Globally it is responsible for a large proportion of both negative health outcomes and economic burden. In New Zealand the case is no different.

Analysis of New Zealand’s 2010/11 public hospitalisations[[1]](#footnote-1), categorised using International Classification of Disease groupings, shows circulatory diseases (including cardiovascular) as a significant burden in terms of the number of people hospitalised, the price of those hospitalisations, and the average price per person hospitalised (Figure 1). Analysis of the 2011/12 New Zealand public hospitalisations, using a modified disease grouping system based on the New Zealand Burden of Diseases, Injuries and Risk Factors Study (NZBDS) ([1](#_ENREF_1)) shows cardiovascular disease accounting for 18% of the costs, or $501 million (Appendix 1). A breakdown of how these costs are spread across the various types of cardiovascular disease is presented in Appendix 2.

Figure 1: Price of public hospitalisations, by International Classification of Disease groupings, 2010/11



Note: Size of the bubble represents total price whilst the colour represents mean price growth

**Source:** 2012 NHC Executive Analysis of 2010–2011 NMDS

Because of the large burden that cardiovascular disease places on the health system, the NHC has flagged it as a priority disease area for the 2013/14 financial year to follow from its earlier work on cardiac conditions in 2012/13. Using the tiered approach, the NHC will further explore cardiovascular disease following the process outlined above in subsequent documents. This report provides a broad overview of cardiovascular disease with the intention of highlighting priority areas within cardiovascular disease through the perspectives of prevalence and incidence, health outcomes and health utilisation/costs. The document is divided into individual disease sections:

* Ischaemic Heart Disease (IHD)
* Stroke
* Hypertension (HTN)
* Rheumatic Heart Disease (RHD)
* Non-Rheumatic Valvular Heart Disease (NRVHD)
* Aortic Aneurysms
* Atrial Fibrillation (AF)
* Cardiomyopathies
* Inflammatory Heart Disease
* Peripheral Vascular Disease (PVD)
* Pulmonary Embolism and Venous-Thrombo Embolism (VTE)
* Other Cardiovascular Diseases

A discussion section follows that compares the diseases and outlines the limitations. Finally, a recommendation is made as to which disease area(s) the NHC should investigate further for the 2013/14 financial year and subsequent years based on the relevant decision-making criteria.

# Purpose

This document is intended to provide the Committee with a broad overview of cardiovascular disease to prioritise further work in this area in order to improve health outcomes and efficiency.

# Methods

This section details the methodology used to group the diseases, synthesise information and prioritise the diseases for further work. The main sources of information used were the National Minimum Dataset (NMDS) (used to estimate the financial burden), the New Zealand Burden of Disease Study (used to estimate mortality and disease burden); and New Zealand population-based surveys and the New Zealand Health Tracker database for information on prevalence and/or incidence.

The diseases in this document are based on the New Zealand Burden of Disease standard classification, used in the New Zealand Burden of Diseases, Injuries and Risk factors Study, 2006 – 2016 (NZBDS) to represent cardiovascular disease. All mortality and disability-adjusted life year (DALY) figures used in this report are 2006 based, the most recent available from the NZBDS. DALYs combine years of life lost (YLLs) and years lived with disability (YLDs) such that one DALY is equivalent to loss of one year of healthy life. As such, they are more than just a metric for death; they include both fatal and non-fatal outcomes. For the purposes of this report, blood conditions and pulmonary arterial disease have been excluded to limit the ‘Vascular and Blood Disorders’ NZBDS standard classification to cardiovascular disease.

The NHC’s methods and analyses are constantly being updated. To ensure the work programme can progress in a timely manner each NHC document presents the best methods and analysis available at the time. Recommendations are then based upon this information, taking into account the limitations involved e.g., only using public hospital prices as a proxy for economic burden. This process is preferable to suspending the improvement of the health system until comprehensive analysis can be achieved.

## Literature Searches

Between June 2013 and July 2013, various non-systematic searches were conducted using Google Scholar and the New Zealand Ministry of Health website. Where possible, New Zealand population-based surveys were used for prevalence and incidence estimates. Where New Zealand population-based surveys were unavailable, estimates based on the New Zealand Health Tracker were used. If neither of these sources had appropriate data, international epidemiological studies were used. Because of this search strategy, some disease sections contain more information than others, a reflection of the accessibility of evidence for various diseases.

## Hospital Events

NMDS data for the 2011/12 financial year was used for the hospitalisation event (inpatient and day patient) data, with filtering to exclude non-publicly funded and/or non-casemix purchased events. Each hospital discharge has one or more diagnosis codes associated with it. These codes are based on the Australian Modification of the World Health Organization’s International Classification of Diseases (ICD-10-AM). The diagnosis code used was either the primary diagnosis, the secondary diagnosis if the primary diagnosis was a ‘Z’ code (Factors influencing health status and contact with health services), or the primary external cause code if the event was recorded as being an accident. These codes were mapped to the condition codes used in the NZBDS. For the purposes of the hospital event data the redistribution process used in the NZBDS was not used, as this is specific to calculating years of life lost. However, because many conditions are not considered 'causes of death', fewer DALYs and deaths may be evident from certain condition groups than what may be expected when considering the number of hospitalisations associated with these condition groups. For instance, the 'other cardiovascular' category below is assigned only 34 deaths and 670 DALYs in the NZBDS, but is associated with 10,880 hospitalisations in the NMDS.

Price has been used as a proxy for cost as it is more readily available and is correlated with the cost of the services being summarised. Each (filtered) hospitalisation event has a resource-based volume measure of the relative resources used in the delivery of inpatient heath care based on the diagnosis code (derived using Weighted Inline Equivalent Separation methodology). For this analysis the WIESNZ10 caseweight has been multiplied by the national unit price for 2011/12 ($4,567.49).

The National Health Index (NHI) is a unique alpha-numeric identifier assigned to each person accessing New Zealand’s health services. The NHI dataset (Quarter 4, 2012) was used to differentiate how many individuals were hospitalised. The mean patient price was calculated as the total price per condition group divided by the number of individuals hospitalised for that condition in the 2011/12 year. Time in care, a proxy for lost time or disability, is the sum of the length of stay for each discharge. Mean percentage budget growth is based on three years of NMDS casemix price data, 2009/10, 2010/11, and 2011/12; price consistency has been controlled using the one purchase unit price for all years.

## New Zealand Health Tracker

The New Zealand Health Tracker (NZHT) is a health census of resident New Zealanders created through the linkage of data in the Ministry of Health’s national collections and other data sources. It was established and is maintained by the Ministry of Health’s Health and Disability Intelligence (HDI) unit. Many of the prevalence estimates in this report have been sourced from the NZHT using the methods used for the NZBDS. To be included as a prevalent case, a person had to be alive on 30 June of the year stated for the data (in most cases this is 2008) and must have been enrolled in a primary health organisation (PHO) at that time or had a contact event in a PHO in that year or a recorded event in the NMDS. This method excludes most people who have emigrated. A case had to meet the relevant diagnostic criteria outlined in Table 1. Both the primary and secondary diagnoses were searched for the relevant ICD-10-AM code in public and private (where available) hospitalisation datasets.

Table 1: Diagnostic criteria applied to New Zealand Health Tracker - sourced prevalence estimates in this report

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| --- | --- |
| Condition | ICD-10-AM codes |
| Rheumatic Heart Disease | I00-I02, I05-I07, I08^, I09 |
| Non-rheumatic Valvular Disease | I34-37, I08^ |
| Atrial Fibrillation/Flutter | I48 |
| Inflammatory Heart Disease | I33, I38-I39 (endocarditis), I30, I31.0-I31.1, I31.4-I319, I32, I40-I41\* (myocarditis and pericarditis). (note inclusion of asterisk codes) |
| Cardiomyopathy | I42-I43  |
| Peripheral Vascular Disease | I70.2, I72, I73.9, I74  |

Note: ^ Individuals only identified via the mixed valvular disease code are redistributed to rheumatic and non-rheumatic categories proportionately.

# Ischaemic Heart Disease (IHD)

## Disease Description

Ischaemic heart disease (IHD) is a condition in which there is insufficient blood and oxygen flow to heart muscle (myocardium), as a result of a mismatch between supply and demand. This is most commonly as a result of coronary artery disease (CAD) due to atherosclerosis (the process of progressive inflammation, lipid deposition and narrowing of medium to large blood vessels) reducing the blood supply to the myocardium. It is more common in males and in Māori. The mortality rate due to IHD has been steadily declining across all subgroups since a peak in the 1960s and 1970s ([2](#_ENREF_2)).

A number of societal and individual risk factors contribute to the development of IHD, including tobacco smoking, diabetes mellitus, high cholesterol, obesity, hypertension and a family history of IHD. Sufferers will most often have symptoms resulting from lack of oxygen to the myocardium. This usually begins with breathlessness, early fatigue and chest discomfort associated with exertion (angina pectoris) but often progresses until these symptoms are present on minimal exertion or at rest. Occasionally sufferers present with a myocardial infarction (MI), the death of myocardium due to lack of oxygen, which may lead to sudden death. If sufficient cardiac muscle dies or if there is an accumulation of damage over time, this can lead to heart failure and premature death.

Prevention of IHD is primarily through public health measures to reduce smoking, encourage exercise, improve diet and modify other risk factors. This includes targeting individuals at high risk of IHD through primary care and the use of medication to control hypertension, high cholesterol and diabetes mellitus. These measures seek to prevent, slow or reverse the changes associated with IHD. Once IHD is established, treatment is aimed at reducing symptoms and complications of the disease. If coronary artery narrowing becomes severe, an attempt to either re-open or bypass the diseased vessel can be made. This is done through percutaneous coronary intervention (PCI) and angioplasty (with or without stenting) or by surgical coronary artery bypass grafting (CABG). Following a MI, medication is introduced to prevent further MIs and eventual progression to heart failure.

## Prevalence and Incidence

In 2011/12 IHD prevalence was about 5.5% for New Zealand adults aged over 15 years ([3](#_ENREF_3)). This equated to about 193,000 individuals. This rate was virtually unchanged from 2006/07. Men were more affected than women (6.9% versus 4.1%) with prevalence for both groups increasing with age (Figure 2). Almost 30% of individuals aged over 75 years have been diagnosed with IHD ([3](#_ENREF_3)).

Figure 2: IHD Prevalence by Age and Gender



Source: The Health of New Zealand Adults 2011/12: Key findings of the New Zealand Health Survey

Māori are about 1.8 times as likely to have been diagnosed with IHD compared to non-Māori adults. About 2% of Pacific adults have been diagnosed with IHD as have 1.7% of Asian adults. Lastly, people living in more deprived areas are 1.9 times as likely to have IHD compared with people from non-deprived areas (Table 2).

Table 2: Ethnic Adjusted Prevalence Ratios by Gender

Source: The Health of New Zealand Adults 2011/12: Key findings of the New Zealand Health Survey

## Health Outcomes

IHD contributed to 6,027 deaths in 2006 (57% of all cardiovascular deaths). The over 89,000 IHD DALYs (56% of total cardiovascular DALYs) demonstrated its huge burden on healthy life years lived. Both deaths and DALY burden increased with age with about 75% of DALYs lost in individuals aged over 60 years.

## Health Utilisation and Cost

In 2011/12 about $228 million was spent on 30,745 hospitalisations for 21,764 individuals with IHD (1.4 hospitalisations per person, on average). Each hospitalised individual cost about $10,500 on average with each hospitalisation lasting an average of 4.4 days.

# Stroke

## Disease Description

Stroke is classed as insufficient blood flow to the brain. It may occur as the result of an occlusion in a blood vessel (ischaemic stroke) or as the result of a burst brain aneurysm (haemorrhagic). Stroke symptoms that resolve before significant cell death is a transient ischaemic attack (TIA).

Risk factors for stroke include high blood cholesterol, hypertension, diabetes and smoking. Stroke incidence increases with age with individuals aged over 75 years having the greatest risk of stroke. Confirmation of stroke may be with the use of Computed Tomography (CT), MRI, ultrasound or angiography. Symptoms of stroke may include slurred speech, weakness of the face arms or legs, dizziness and blurred vision. Treatment may include thrombolysis (clot busting), anti-coagulation medication, such as warfarin or aspirin, and/or surgical intervention ([4](#_ENREF_4)).

## Prevalence and Incidence

In 2011/12, about 1.8% of adults or 62,000 individuals had ever experienced a stroke at some point during their lives. The rate for men and women is about the same (1.9% versus 1.7%) and the proportion of individuals who have ever had a stroke has not changed since 2006/07 ([3](#_ENREF_3)). Stroke risk increases with age; 8.0% of individuals over the age of 75 years have had a stroke, the highest of any age group (Figure 3).

Figure 3: Stroke Prevalence by Age and Gender



Source: The Health of New Zealand Adults 2011/12: Key findings of the New Zealand Health Survey

Māori individuals were 1.3 times as likely to have a stroke versus non-Māori individuals when adjusted for age and sex. Māori women had the highest discrepancy with their non-Māori counterparts as they were 2.3 times as likely as non-Māori women to have ever experienced a stroke. No significant differences existed for Pacific and Asian populations compared to other populations (Table 3).

Table 3: Ethnic Standardised Prevalence by Gender



Source: The Health of New Zealand Adults 2011/12: Key findings of the New Zealand Health Survey

Individuals from an area of high deprivation were more likely to have had a stroke than individuals from an area of low deprivation (2.7% versus 1.1%). Women from an area of high deprivation were over 4 times more likely than women from more affluent areas to experience a stroke when adjusted for age, sex and ethnicity; no such differences existed for men by neighbourhood (Figure 4).

Figure 4: Stroke Prevalence by Gender and Deprivation Quintile



Source: The Health of New Zealand Adults 2011/12: Key findings of the New Zealand Health Survey

In terms of stroke type, ischaemic stroke accounted for 73% of all strokes in Auckland’s New Zealand/European population, primary intra-cerebral haemorrhage (PICH) accounted for 11% and subarachnoid haemorrhage 6% ([5](#_ENREF_5)). The onset of stroke was earlier for Māori/Pacific and Asian/Other (62 and 64 years, respectively) compared to New Zealand/European individuals (74 years). These ethnic differences may suggest different risk factor profiles for different ethnic groups ([5](#_ENREF_5)).

## Health Outcomes

Strokes killed about 2,700 people and were responsible for 37,688 DALYs in 2006 (26% and 24% of deaths and DALYs, respectively). Both mortality and DALY burden increased with age, especially for individuals aged over 40 years. Relative to deaths, stroke is responsible for a significant disability burden on individuals who survive with over 75% of stroke survivors dependent on others for care one year post-stroke ([6](#_ENREF_6)). Despite the high mortality associated with stroke and ongoing disability, long-term stroke survivors reported similar quality of life outcomes as the general age-standardised population in one New Zealand study ([7](#_ENREF_7)).

## Health Utilisation and Cost

Stroke was responsible for 10,370 hospitalisations for 9,000 individuals (1.2 hospitalisations per person) in 2011/12. Average cost per hospitalised individual was $7,400 whilst average hospitalisation length of stay was 4.9 days. Total hospitalisation costs were $67 million.

Besides hospitalisations, there are other direct and indirect costs associated with stroke. Rehabilitation is often a greater component of stroke care than the initial hospitalisation with average rehabilitation stays estimated at 23-26 days depending on the type of ward. Rehabilitation is necessary for about 30% of stroke admissions at a cost of about $750 per day ([8](#_ENREF_8)). Extrapolating from the above hospitalisation count, approximately 2,700 individuals would have required rehabilitation at an additional cost of $46.6 million-$52.7 million. Taking these costs into account brings the average cost per hospitalised individual to between $12,600 and $13,300. Including rehabilitation, total acute care costs are estimated at $113.6 million-$119.7 million.

Residential care and community support services add additional costs. Adding these costs to individuals, the estimated cost per patient in the first year post-stroke was about $21,000-$24,000([8](#_ENREF_8)). Including these costs takes the estimated yearly direct costs of stroke to between $189 million and $216 million. Indirect costs are estimated to be roughly the same as direct costs (i.e. acute hospitalisation and ward rehabilitation) ([9-11](#_ENREF_9)). Using this figure, the total (direct and indirect) cost of stroke in New Zealand is estimated at $378 million-$432 million, broadly in line with the published estimate of $450 million ([12](#_ENREF_12)).

# Hypertension (HTN)

## Disease Description

Hypertension (HTN - raised blood pressure beyond defined limits) is thought to affect more than half of adults globally, and contributes to 49% of all coronary heart disease and 62% of strokes ([13](#_ENREF_13)). Cardiovascular risk doubles for every 20-mmHg increase in systolic blood pressure (the highest pressure in the blood vessels) or 10-mmHg increase in diastolic blood pressure (lowest pressure in the blood vessels). HTN can either be primary (also called essential HTN) or secondary to another disease process (e.g. renal artery stenosis or Cushing's syndrome).

Risk factors for primary hypertension include family history, obesity, weight-gain, lack of exercise, high dietary sodium, alcohol consumption and psychosocial stress. Although generally asymptomatic (malignant hypertension can rarely cause acute symptoms), hypertension manifests through damage to target organs, particularly the heart, kidneys, brain and peripheral arteries. Treatment is aimed at reducing the blood pressure to normal levels through lifestyle and dietary change, medication and, more recently, percutaneous interventions for renal artery denervation.

## Prevalence and Incidence

Using the number of adults who took blood pressure medication as a proxy for HTN prevalence[[2]](#footnote-2), about 16% of adults over the age of 15 years took blood pressure medication in 2011/12, an increase of 2.0% since 2006/07 (14%, Figure 5)) ([3](#_ENREF_3)). In 2011/12 this equated to 558,000 adults. Women were more likely to take medication than men for high blood pressure (17% versus 14%, Figure 5).

Figure 5: HTN Prevalence Trend from 2000-2012



Note: Rates are age-standardised to the WHO World Population
Source: The Health of New Zealand Adults 2011/12: Key findings of the New Zealand Health Survey

HTN rates increase with age with over half the individuals over 65 years taking medication for HTN (Figure 6). Whilst the overall rate of HTN increased from 2006/07 to 2011/12, most of this growth was driven by an increasing rate among women, especially women over the age of 75 years.

Figure 6: HTN Prevalence by Age and Gender



Source: The Health of New Zealand Adults 2011/12: Key findings of the New Zealand Health Survey

Māori and Pacific people were 1.3 and 1.4 times more likely than non-Māori/non-Pacific peoples to take medication for HTN after adjusting for sex and age (Table 4).

Table 4: Ethnic Standardised Prevalence by Gender

Source: The Health of New Zealand Adults 2011/12: Key findings of the New Zealand Health Survey

Individuals from an area of high deprivation were 1.4 times more likely than individuals from an area of low deprivation to take HTN medication when adjusted for age, sex and ethnicity (Figure 7).

Figure 7: HTN Prevalence by Gender and Deprivation Quintile



Source: The Health of New Zealand Adults 2011/12: Key findings of the New Zealand Health Survey

## Health Outcomes

Hypertensive heart disease contributed to over 280 deaths and 3,300 DALYs in 2006 (3.0% and 2.0% of cardiovascular deaths and DALYs, respectively). About 70.0% of DALYs occurred in individuals over the age of 60 years, but an even higher percentage of deaths (78.2%) occurred in individuals aged over 80 years.

## Health Utilisation and Cost

Over 120 hospitalisations involving 111 individuals (1.1 hospitalisations per person) occurred at an average cost of $6,200 per hospitalised person in 2011/12. Each hospitalisation was 5.7 days in length, on average, and contributed to the $1 million spent on hypertensive heart disease hospitalisations.

# Rheumatic Heart Disease (RHD)

## Disease Description

Rheumatic heart disease (RHD) occurs as a consequence of acute rheumatic fever (ARF). ARF is systemic inflammatory disease, most commonly affecting children 5–14 years of age as a result of a group A streptococcus infection of the upper respiratory tract. In a susceptible host, the response to the infection causes an autoimmune effect (cross-reactivity of the immune response causes damage to normal tissues). Incidence of ARF is closely linked to socioeconomic deprivation. Although many parts of the body are affected by ARF, most recover completely with the exception of the heart. RHD affects approximately 60% of patients with ARF and is a result of the autoimmune damage to the cardiac valves. The mitral valve is almost universally involved, but any of the cardiac valves may be affected. The valvular damage is progressive and leads to scarring, thickening, calcification, regurgitation and stenosis of the valves. This can lead to compromised heart function and may require heart valve replacement.

## Prevalence and Incidence

RHD is particularly important in New Zealand as there is a significant disparity between Māori and non-Māori. Between 1993 and 2009 rates of ARF increased by 79% and 73% in Māori and Pacific children, respectively, and declined by 71% in non-Māori/non-Pacific children. Incidence rates per 100,000 for children 5–14 years of age were 40.2 for Māori, 81.2 for Pacific and 2.1 for non-Māori/non-Pacific ([14](#_ENREF_14)).

## Health Outcomes

RHD contributed to over 100 deaths and 2,800 DALYs in 2006 (1.0% and 2.0% of total cardiovascular deaths and DALYs, respectively). DALY burden was especially apparent in 35–65 year olds.

## Health Utilisation and Cost

In 2011/12 RHD was responsible for 487 hospital discharges for 392 individuals (1.2 hospitalisations per person). At an average cost of $15,000 per hospitalised individual and a length of stay of 9.7 days per hospitalisation, RHD cost the health system $6 million in public hospitalisations. On top of hospitalisations, government efforts to reduce ARF are expected to be $24 million over the next 5 years[[3]](#footnote-3).

# Non-Rheumatic Valvular Heart Disease (NRVHD)

## Disease Description

Non-Rheumatic valvular heart disease (NRVHD) refers to diseases of the four valves in the heart (excluding RHD) which ensure unidirectional flow through the heart and lungs ([4](#_ENREF_4)). The heart valves are two or three leaflets of thin, flexible tissue which open to allow blood to flow through the heart and close to prevent backflow. The valves can be affected by a number of disease processes which lead to regurgitation (back leakage) or stenosis (narrowing of the valve opening) that result in abnormal cardiovascular haemodynamics. Although most valvular disease is either asymptomatic or minimally symptomatic, if the lesion is severe it can lead to permanent impairment of cardiovascular function, heart failure and eventually death.

Causes of NRVHD depend on the lesion and valve affected but includes the following: degeneration, congenital abnormalities, endocarditis, trauma and systemic inflammatory diseases. Treatment involves use of medications to slow progression and treat any related symptoms (e.g. chest pain, oedema, breathlessness). If the valvular lesion and symptoms are severe then valve replacement or repair is the standard treatment option. Treatment options include percutaneous valve replacement and repair and surgical techniques.

## Prevalence and Incidence

In 2010 New Zealand prevalence of NRVHD was 531 per 100,000 individuals ([15](#_ENREF_15)). This equated to about 22,700 individuals. Prevalence was similar for men and women (605 and 463 per 100,000 respectively) with prevalence for both groups increasing with age. Māori (366 per 100,000) are not disproportionately affected by NRVHD compared with non-Māori (562 per 100,000).

## Health Outcomes

In 2006 nearly 470 deaths and 6,730 DALYs were attributed to NRVHD with the burden of both increasing with age (4.0% of both deaths and DALYs). NRVHD is a significant burden on older individuals (aged over 65 years) with nearly 93.0% of NRVHD deaths and 73.0% of DALYs lost in these individuals.

## Health Utilisation and Cost

In 2011/12 there were 2,250 hospital discharges for 1,573 people with NRVHD (1.4 hospitalisations per person) at an average cost of $23,800 per hospitalised individual. Each hospitalisation had an average length of stay of 6.3 days and contributed to $37 million in costs.

# Aortic Aneurysms

## Disease Description

An aneurysm is defined as a pathological dilation of a blood vessel segment ([4](#_ENREF_4)). Aortic aneurysms are classed by location: thoracic versus abdominal. Thoracic aortic aneurysms occur higher up on the descending aorta, in the thoracic cavity, as opposed to abdominal aortic aneurysms (AAA) which occur lower than thoracic aortic aneurysms in the abdominal cavity. Aortic aneurysms result from conditions that cause degradation or abnormal production of the structural components of the aortic wall: elastin and collagen.

The causes of aortic aneurysms may be broadly categorised as degenerative diseases, inherited or developmental diseases, infections, vasculitis, and trauma. Inflammation, proteolysis, and biomechanical wall stress contribute to the degenerative processes that characterise most aneurysms of the abdominal and descending thoracic aorta. Factors associated with degenerative aortic aneurysms include aging, cigarette smoking, high cholesterol, male sex, and a family history of aortic aneurysms. The most common condition associated with aortic aneurysms is atherosclerosis (narrowing of the arteries) ([4](#_ENREF_4)).

The risk of rupture for a thoracic aneurysm is related to the size of the aneurysm and the presence of symptoms, ranging approximately from 2–3% per year for thoracic aortic aneurysms <4 cm in diameter to 7% per year for those aneurysms >6 cm in diameter. Most thoracic aortic aneurysms are asymptomatic; however, compression or erosion of adjacent tissue by aneurysms may cause symptoms such as chest pain, shortness of breath, cough, hoarseness and dysphagia. Aneurysmal dilation of the ascending aorta may cause congestive heart failure as a consequence of aortic regurgitation, and compression of the superior vena cava may produce congestion of the head, neck, and upper extremities.

At least 90% of all abdominal aortic aneurysms >4 cm are related to atherosclerotic disease and most of these aneurysms are below the level of the renal arteries. Prognosis is related to both the size of the aneurysm and the severity of coexisting coronary artery and cerebrovascular disease. The risk of rupture increases with the size of the aneurysm: the 5-year risk for aneurysms <5 cm is 1–2%, whereas it is 20–40% for aneurysms >5 cm in diameter ([4](#_ENREF_4)).

An AAA commonly produces no symptoms. It usually is detected on routine examination as a palpable, pulsatile, expansile, and non-tender mass, or it is an incidental finding observed on an abdominal x-ray or ultrasound study performed for other reasons. However, as AAAs expand they may become painful. Some patients complain of strong pulsations in the abdomen; others experience pain in the chest, lower back or scrotum. Aneurysmal pain is usually a precursor to rupture and represents a medical emergency. More often, acute rupture occurs without any prior warning and this complication is always life-threatening. Rarely, there is leakage of the aneurysm with severe pain and tenderness. Acute pain and hypotension occur with rupture of the aneurysm, which requires an emergency operation.

Thoracic aneurysms are detected with a chest x-ray while AAAs may be detected with an abdominal ultrasound. Contrast CT scans may be used to further investigate and follow-up detected thoracic or abdominal aortic aneurysms. Treatment for thoracic aortic aneurysms includes beta blockers to control hypertension and surgery if necessary. AAAs may require elective surgery to repair the vessel before it bursts or emergency surgery to repair a burst vessel. Surgical procedures for aneurysm repair may be either endovascular (percutaneous) or open ([4](#_ENREF_4)).

For AAAs, there are screening programmes in the UK and USA to systematically detect aneurysms.

## Prevalence and Incidence

The prevalence of thoracic aortic aneurysms has appeared to triple in the last two decades ([16](#_ENREF_16), [17](#_ENREF_17)). Whether this represents an increase in the elderly proportion of our population, improved diagnostic capabilities, or an actual increase in incidence is unknown. According to a recent study thoracic aortic aneurysms are now estimated to affect 10 of every 100,000 elderly adults, with 30% to 40% of these being descending thoracic aneurysms (DTA) ([18](#_ENREF_18)).

International estimates of AAA prevalence range from 4% to 8% in older men (over age 65) ([19](#_ENREF_19)). In New Zealand this would translate into approximately 10,000 to 20,000 men over 65 years. For women, the prevalence of AAA is less than for men (0.5%-1.5%), but the incidence of death as a result from AAA is higher as a proportion of females who have an AAA ([19](#_ENREF_19)). Of the various subgroups, Māori males over 65 years of age with a history of smoking were identified as having the highest incidence/prevalence of AAA. Many of the same risk factors associated with AAA (history of smoking, hypertension, obesity) disproportionately affect groups from a lower socioeconomic group, so it could be expected that AAA also disproportionately affects individuals from a lower socioeconomic group.

## Health Outcomes

Aortic Aneurysms were attributed to about 400 deaths and 5,500 DALYs in 2006. In total, 4% of cardiovascular deaths and 3% of cardiovascular DALYs were attributable to aortic aneurysms. As evident in the risk factors for the disease, individuals aged over 45 years experienced the highest mortality and DALY burden.

## Health Utilisation and Cost

In 2011/12 aortic aneurysms contributed to about 1,100 hospital discharges in 889 people (1.2 hospitalisations per person). Each hospitalised person cost, on average, $27,800 while each hospitalisation lasted an average of 6.6 days totalling $25 million in hospitalisation costs.

# Atrial Fibrillation (AF)

## Disease Description

Atrial fibrillation (AF) is the most common adult cardiac arrhythmia (abnormal heart rhythm). AF is associated with a 2-fold increase in overall mortality, as well as increased risk of stroke, dementia, and heart failure. Atrial fibrillation is characterised by loss of the normal electrical rhythm of the heart (sinus rhythm), which is replaced by chaotic contraction of the atria (upper chambers of the heart) and results in an irregular, often rapid, heartbeat.

AF may be asymptomatic (“silent AF”) but more frequently presents with palpitations, dizziness, reduced exercise tolerance, breathlessness, collapse or chest discomfort. More importantly, it is associated with an increased risk of cardio embolic complications (especially stroke), dementia, heart failure and death. AF increases the risk of stroke between 2- and 7-fold. It is associated with increased risk of post-stroke mortality, disability, longer hospital stays and lower rates of discharge home.

Standard treatment involves the use of medications to control symptoms and reduce the rate of complications. Medication is most often used to return the heart to sinus rhythm, but it is only moderately successful. Traditional surgical techniques, thoracoscopic surgery and percutaneous catheter ablation of AF have emerged as options for the maintenance of sinus rhythm. If AF becomes permanent then heart rate control and anticoagulation therapy are instituted. Newer invasive procedures such as percutaneous left atrial appendage occlusion have been trialled and are beginning to diffuse internationally.

## Prevalence and Incidence

AF is the most common sustained cardiac dysrhythmia ([20](#_ENREF_20)). In New Zealand in 2011 (with a look back period to 1988) prevalence of AF was 3.2% (approximately 141,050 people). Prevalence estimates rose steeply from 1.9% of 50–54 year olds to 33% of 85+ year olds. The effect of New Zealand’s aging population and aforementioned gradient of life-time prevalence with increasing age is expected to see life-time prevalence of AF reaching 5% (288,558 people) by 2026. Half of these people (145,906 people) will be over the age of 60 (Figure 8).

Figure 8: Projected AF Prevalence by Age and Year

Source: 2012 NHC Executive Analysis of 2006–2011 New Zealand Health Tracker data

There is a higher percentage of Europeans with AF than in the general population and a lower percentage of Pacific and Māori peoples with AF, possibly attributed to European New Zealanders living longer than Māori and Pacific peoples and, therefore, more likely to have a diagnosis of AF. However, in those individuals aged less than 65 years, AF is present in a larger proportion of Māori and Pacific peoples than in the general population, reflecting the earlier age at which Māori and Pacific peoples are diagnosed with AF ([21](#_ENREF_21) ).

## Health Outcomes

AF contributed to189 deaths and 4,385 DALYs in 2006 (2% and 3% of cardiovascular deaths and DALYs, respectively). Most AF deaths occurred in individuals aged over 85 years, but the DALY burden was higher in younger individuals (60–64 years) and steadily increased with age. Whilst AF does not necessarily place a significant direct mortality burden on society, it is responsible for impaired quality of life, especially in older people. As a risk factor for ischaemic stroke, it contributes to about 4,000 DALYs.

## Health Utilisation and Cost

In 2011/12 about 7,700 individuals experienced about 9,600 hospitalisations for AF (1.2 hospitalisations per person) at an average cost of $3,800. Each hospital stay lasted an average of 2 days; all AF hospitalisations totalled $30 million.

# Cardiomyopathies

## Disease Description

Cardiomyopathies are diseases of the heart muscle that impair proper function. It excludes cardiac dysfunction from structural abnormalities, coronary heart disease or severe hypertension. The impairment of cardiac muscle function caused by widespread coronary artery disease is, however, commonly called ischaemic cardiomyopathy. The classification of cardiomyopathies is complex but can broadly be divided into primary (disease primarily of myocardium) or secondary (myocardial involvement as part of a systemic disease). Primary cardiomyopathies can be genetic, acquired (e.g. inflammatory, stress-related, peripartum) or mixed. There are a significant number of secondary causes of cardiomyopathy including infiltrative disease (e.g. amyloid), storage disease (e.g. hemochromatosis), autoimmune disease, nutritional deficiency and medications.

Cardiomyopathies are initially asymptomatic but can subsequently present with a wide variety of symptoms from exercise intolerance, fatigue and breathlessness to heart failure and sudden death. Treatment is aimed at the underlying disease process where possible (for example, ablation of abnormally enlarged myocardium in hypertrophic cardiomyopathy), reducing symptoms of heart failure or prevention of complications (for example, insertion of an implantable cardioverter/defibrillator in arrhythmogenic right ventricular dysplasia). Prognosis is extremely variable and depends on the exact nature of the disease in question. Heart transplant is a treatment option for certain severe cases.

## Prevalence and Incidence

In 2008, New Zealand cardiomyopathy prevalence (with a look back period of ten years) was 148 per 100,000 ([15](#_ENREF_15)). This equated to about 6,700 individuals. Prevalence for men (201 per 100,000) was double that for women (98 per 100,000) with prevalence for both groups increasing from the age of twenty. Prevalence of cardiomyopathies in Māori (283 per 100,000) was more than twice that in non-Māori (128 per 100,000).

## Health Outcomes

In 2006 nearly 175 deaths occurred as the result of a cardiomyopathy coupled with 4,824 DALYs (2% and 3% of deaths and DALYs, respectively). Both the death and DALY burden is borne pretty evenly regardless of age with individuals aged over 40 years comprising the majority of deaths and DALYs lost.

## Health Utilisation and Cost

In 20011/12 there were 826 hospital discharges for 683 individuals suffering from cardiomyopathy (1.2 hospitalisations per person) at an average cost of $12,100 per hospitalised individual. At an average length of stay of 6.7 days, these hospitalisations aggregated to $8 million.

# Inflammatory Heart Disease

## Disease Description

Inflammatory heart disease includes any disease that inflames a part of the heart. Myocarditis, endocarditis and pericarditis are the main inflammatory conditions included.

Myocarditis is an inflammatory process, most commonly attributed to infectious organisms that can invade the myocardium (heart muscle) directly, produce cardio-toxins, and trigger chronic inflammatory responses. Infective myocarditis has been reported with almost all types of infectious agents but is most commonly associated with viral infections ([4](#_ENREF_4)). Although viral myocarditis is generally considered to be an acquired cardiomyopathy, families have been reported whose clinical disease appeared after a syndrome consistent with viral myocarditis suggesting a possible hereditary component. Young adults tend to present more frequently than other age groups with progressive dyspnoea (difficulty breathing) after a recent viral infection. The true prognosis of viral myocarditis is not known, as most unrecognised cases probably resolve spontaneously, while others progress to cardiomyopathy (heart muscle death) without other obvious cause. MRI is used to detect. Neurohormonal antagonist therapy is usually continued indefinitely as tolerated, with dose adjustments to avoid side effects ([4](#_ENREF_4)).

Endocarditis is the inflammation of the endocardium (inner lining of the heart and valves). A few bacterial species cause the majority of cases ([4](#_ENREF_4)). The clinical features of endocarditis are nonspecific. However, these symptoms in a febrile patient with valvular abnormalities or a behaviour pattern that predisposes him or her to endocarditis (e.g., injection drug use) suggest the diagnosis, as do bacteraemia with organisms that frequently cause endocarditis, otherwise-unexplained arterial emboli, and progressive cardiac valvular incompetence. In patients with sub-acute presentations, fever is typically low-grade and rarely exceeds 39.4°C; in contrast, temperatures of 39.4°– 40°C are often noted in acute endocarditis ([4](#_ENREF_4)). Fever may be blunted or absent in patients who are elderly or severely debilitated or who have marked cardiac or renal failure. In acute endocarditis involving a normal valve, murmurs may be absent initially but ultimately are detected in 85% of cases. Congestive heart failure (CHF) develops in 30–40% of patients; it is usually a consequence of valvular dysfunction but occasionally is due to endocarditis-associated myocarditis or an intracardiac fistula. Emboli to a coronary artery occur in 2% of patients and may result in myocardial infarction. Echocardiography and blood cultures confirm diagnosis whilst treatment comprises anti-microbial treatment or surgical intervention ([4](#_ENREF_4)).

Pericarditis is the inflammation of the pericardium (sac enclosing the heart). Pericarditis may present as acute or chronic and usually involves chest pain which may lead to pericardial effusion or cardiac tamponade ([4](#_ENREF_4)). Weakness, fatigue, weight gain, increased abdominal girth, abdominal discomfort, a protuberant abdomen and oedema are common with chronic patients. The condition is detected with MRI or echocardiography and treatment may include surgical intervention ([4](#_ENREF_4)).

## Prevalence and Incidence

In 2008, New Zealand prevalence of inflammatory heart disease (with a look back period of ten years) was 212 per 100,000 ([15](#_ENREF_15)). This equated to about 9,000 individuals. Prevalence was higher for men than women (276 and 152 per 100,000 respectively) with prevalence for both groups increasing from the age of forty-five. Prevalence of inflammatory heart disease in Māori was 194 per 100,000 compared with 215 per 100,000 for non-Māori.

## Health Outcomes

This disease contributed to 43 deaths and 1,351 DALYs in 2006 (less than 1.0% of deaths and DALYs). Noteworthy is that patients aged under 4 years made up the largest proportion of DALYs lost (13.4%).

## Health Utilisation and Cost

In terms of 2011/12 hospitalisations, inflammatory heart diseases cost the health system $7 million. This cost comprised 523 hospitalisations involving 419 individuals (1.2 hospitalisations per person) at an average cost of $16,000. Average length of stay was 8.4 days.

# Peripheral Vascular Disease (PVD)

## Disease Description

Peripheral vascular disease (PVD) refers to all diseases of the arteries, veins and lymphatic system ([22](#_ENREF_22)). The most significant group of disorders are those classified as peripheral artery disease (PAD). This is a clinical disorder in which there is stenosis, occlusion or dilatation of either the aorta or the peripheral arteries. Diseases of the peripheral veins include superficial venous thrombosis, varicose venous and chronic venous insufficiency. Diseases of the peripheral lymphatic system are the least common and the most significant is lymphedema which has a number of primary and secondary causes ([22](#_ENREF_22)).

## Prevalence and Incidence

In 2008 New Zealand prevalence (with a look back period of ten years) of PVD was 416 per 100,000 ([15](#_ENREF_15)). This equated to about 17,000 individuals. Prevalence was higher for men than women (491 and 347 per 100,000 respectively) with prevalence for both groups increasing with age. Prevalence of PVD in non-Māori (438 per 100,000) was higher than that in Māori (269 per 100,000).

## Health Outcomes

Over 100 deaths and 1,300 DALYs were associated with PVD in 2006 (1% of both deaths and DALYs). Individuals aged over 85 comprised over half of all deaths and about 22% of DALYs.

## Health Utilisation and Cost

PVD cost $26 million in total (average cost per hospitalised individual of $14,100) in 2011/12. There were 2,409 hospitalisations for 1,859 individuals (1.3 hospitalisations per person) lasting an average of 1.7 days.

# Pulmonary Embolism and Venous Thrombo-Embolism (VTE)

## Disease Description

Venous thrombo-embolism (VTE) occurs when a thrombus (clot) forms in a vein. This clot may travel to the pulmonary circulatory system and occlude blood flow in a pulmonary blood vessel (pulmonary embolization) ([4](#_ENREF_4)). Thrombi from deep vessels (i.e. in the upper leg) occur as the result of deep vein thrombosis (DVT). The result of pulmonary embolization is impaired gas exchange in the lungs which can lead to hypoxia (lack of oxygen in the blood) or the blockage of blood from the right ventricle. This can cause right ventricular dilatation (stretching) and lead to heart failure. Difficulty breathing and oedema in the extremities may occur. Common co-morbidities include heart failure, cancer and stroke. Detection may include the use of CT and other imaging equipment. Treatment is with anticoagulation therapy, embolectomy to remove the emboli and/or clot busting drugs ([4](#_ENREF_4)).

## Prevalence and Incidence

The overall incidence of venous thromboembolism was found to be 1.83 per thousand per year in France ([23](#_ENREF_23)). The incidences of DVT and pulmonary embolism were 1.24 per thousand per year and 0.60 per thousand per year, respectively. The incidence of VTE rose markedly with increasing age for both sexes; over the age of 75, the annual incidence reached 1%.

## Health Outcomes

Pulmonary embolisms contributed to 44 deaths and 1,084 DALYs in 2006, both less than 1.0% of total cardiovascular deaths and DALYs. Individuals aged over 40 years comprised the majority of both deaths and DALYs lost.

## Health Utilisation and Cost

This condition accounted for $14 million in hospital costs (average price of $5,800 per hospitalised individual) in 2011/12. About 2,500 people experienced 2,779 hospitalisations (1.1 hospitalisations, on average) with each hospitalisation lasting an average of 3.4 days. The total cost may be an underestimate since VTE may occur as a complication of another condition.

# Other Cardiovascular Diseases

## Disease Description

This category includes a collection of circulatory conditions such as varicose veins and cardiovascular syphilis. As such, treatment and diagnosis of these diseases is the most varied and may include the use of pharmaceuticals for treatment and imaging techniques for diagnosis.

## Prevalence and Incidence

As this disease group represents a wide range of diseases, no estimates have been presented.

## Health Outcomes

About 34 deaths and 670 DALYs were attributed to other cardiovascular diseases in 2006. Individuals aged over 80 years and individuals aged 15–19 years accounted for the most deaths and DALYs lost out of all other age groups.

Congenital heart defects were not initially grouped with cardiovascular conditions; however more recent analysis with further consultation and alignment of the disease groupings to the major diagnostic codes has indicated that the most suitable grouping for congenital heart defects is within cardiovascular disease. Reflecting upon the death (58 in 2006) and DALY (4,295 in 2006) results of congenital heart defects from the NZBDS, further analysis of this group will not been carried out at this stage.

## Health Utilisation and Cost

These other cardiovascular diseases hospitalised 9,536 people an average of 1.1 times for a total of 10,880 discharges in 2011/12. Each hospitalisation lasted 2.4 days, on average, and contributed to $54 million worth of costs ($5,600 per hospitalised individual, on average).

# Public Health

An important public health initiative within cardiovascular disease is the national health target to increase heart and diabetes checks, with the goal of 90% of eligible patients receiving these by 2014. Working with the Health Promotion Agency (HPA), the Ministry of Health aims to increase awareness and importance of receiving blood tests to assess one’s risk for cardiovascular disease.

Many cardiovascular diseases are associated with smoking. The HPA in partnership with the Ministry of Health has created various campaigns and tools to help curb tobacco use and track progress ([24](#_ENREF_24)).

Of the smoking cessation programmes, Smokefree 2025 represents the broad overall goal of the smaller, targeted programmes. The goal is to reach smoking levels of less than 5% of the population by 2025 through a combination of price increases and youth-centred anti-smoking campaigns.

These campaigns are primarily focused on Māori youth since smoking disproportionately affects this population. Through the ‘Smoking Not Our Future’ campaign, smoke free rock concerts and partnerships with schools, the proportion of 14-15 year olds who have never smoked increased from 33% in 2000 to 70% in 2011. Other tobacco control efforts include tax increases and pictorial warnings.

Rheumatic fever, a leading cause of rheumatic heart disease has been identified as a priority area for the Ministry of Health. The result has been an expansion of throat swabbing in schools for streptococcal throat infections with the aim to reduce the incidence of rheumatic fever in children. This expansion of services has been made possible with a $24 million funding boost over 5 years.

Additional public health initiatives include a commitment to improve nutrition and physical activity, especially among younger individuals. The work of the HPA in this field includes educational campaigns to increase knowledge about good nutrition in schools, advocating the importance of children eating breakfast and working with the Ministry of Health to produce guidelines about food and nutrition. These publications include guidelines for parents and health practitioners as well as older people.

# New and Growing

This section highlights the hospitalisation growth pattern in cardiovascular diseases from 2009/10–2011/12. Total hospitalisation cost growth over this period for all cardiovascular diseases was 2.6%.

In terms of relative growth, HTN grew significantly quicker than the other cardiovascular diseases at 37.2% followed by inflammatory heart disease (8.4%) and rheumatic heart disease (7.3%). Although these three diseases grew the fastest of all cardiovascular diseases, their combined expenditure was $14 million or less than 3% of total cardiovascular hospitalisation expenditure.

IHD grew modestly at 1.6%, but in real terms this translated into over $3.6 million of hospital cost growth. With the exclusion of the aggregated ‘other’ category, NRVHD grew second fastest in real terms with growth of 6.0% or about $2.2 million in hospital costs. Lastly, stroke grew at 2.5% or about $1.7 million.

In addition to new and growing disease areas, within cardiovascular disease there is a significant amount of new technology on the horizon. These technologies have been summarised in the HealthPACT- commissioned DLA-Piper report on New and Emerging Technologies in Australian and New Zealand Public Health Services over the Next Decade[[4]](#footnote-4). The report highlights seven areas of significance:

* Trans-Catheter Aortic Valve Implantation (TAVI)
* Trans-Catheter Mitral Valve Repair/Replacement
* Percutaneous Left Atrial Appendage Occlusion Interventions
* Pump/Assist Devices for Heart Failure
* Pacemakers and Implantable Cardiac Defibrillators (ICDs)
* Renal Denervation (RDN)
* Genetic Testing

TAVI, trans-catheter mitral valve repair/replacement, left atrial appendage occlusion interventions and RDN are separate to NHC assessment work. Pump/assist devices, pacemakers and ICD as well as genetic testing have not yet been assessed by the NHC.

Pump/assist interventions for heart failure are interventions that aid the heart’s ability to pump blood during heart failure. With cardiomyopathy and IHD being major underlying causes of heart failure, the potential growth of these interventions could be significant. These interventions will be explored further in Tier 2 analysis on IHD.

Pacemakers and ICDs help the heart to maintain or correct proper and improper electrical activity. Patients with certain types of arrhythmias or cardiomyopathies may be indicated for a pacemaker or ICD depending on the severity of the arrhythmias or potential for arrhythmias. ICDs will also be explored in greater depth in Tier 2 IHD analysis.

Genetic testing may play a part in both testing for a particular condition and treating a condition. Certain diseases such as IHD have a genetic component and patients may benefit from learning about their risk for the disease. IHD is just one example of where genetic testing may aid in screening for particular diseases, an area the NHC is likely to conduct further work in 2013/14.

Genetic testing may also impact on treatments since some pharmaceuticals are only indicated in persons with a particular genetic makeup. Likewise, with the rise of personalised medicine, treatments may be tailored to a person’s genes utilising genetic testing. Further work in this area is expected later in the year from the NHC.

# Discussion and Limitations

This section synthesises the evidence above for each disease. For a summary of hospitalisations and costs by disease, see Appendix 1. This section concludes with a discussion on the limitations of this report. It is divided into a section for each of the Committee’s relevant decision-making criteria:

* Health and Independence Gain
* Equity
* Materiality
* Policy Congruence
* Risk

As this document explores disease states as opposed to specific interventions, some of the NHC’s decision-making criteria and assessment domains used in health technology assessments are not appropriate. For example, whilst clinical safety and effectiveness are important considerations for making a recommendation as to whether or not an intervention should be funded, they are not applicable to diseases since a disease cannot be defined as clinically safe or effective. Similarly, the affordability, feasibility of adoption and value for money criteria were not assessed. Whilst this report does take into account the 5 criteria above, the recommendation is mostly informed by materiality and health and independence gain. With an explicit focus on the financial burden of diseases in the programme budget and the epidemiological burden of prevalence/incidence, this report presents robust evidence on materiality and health and independence gain. Documents in the subsequent tiers will encompass a more explicit look at the rest of the decision-making criteria.

## Health and Independence Gain

IHD contributed to over 6,000 deaths and over 80,000 DALYs, both significantly higher than the next most burdensome disease stroke (Figure 9). IHD and stroke contributed to a combined 80% and 81% of total DALYs and deaths, respectively, with IHD accounting for over half the total (Figures 10 and 11). With a total IHD population of 193,000 and a stroke population of 62,000 the potential health gain from improving the pathway of care for both of these diseases could be significant. These gains would also be realised by a large proportion of the population, many of whom have significantly worse health outcomes than the general population. In terms of absolute prevalence, DALY and death burden, IHD places the most burden on health independence compared to all other cardiovascular diseases.

Figure 9: Deaths and DALYs by Disease

Source: NZBDS 2013

Figure 10: DALYs by Disease

Source: NZBDS 2013

Figure 11: Deaths by Disease

Source: NZBDS 2013

## Equity

For every cardiovascular disease, Māori had a higher proportion of both deaths and DALYs than non-Māori (Figures 12 and 13). This trend is especially true for DALYs attributable to IHD with Māori having a DALY burden that is 3 times that of non-Māori. Also, Māori had a three-fold burden of stroke death than non-Māori. A focus on any of these diseases would likely help improve health inequities, but given the high DALY and death burden associated with IHD (more than any other cardiovascular disease), a focus on IHD has the greatest potential to reduce health inequities between Māori and non-Māori.

Figure 12: Death Rate per 100,000 for Māori and non-Māori

Source: NZBDS 2013

Figure 13: DALY rate per 100,000 for Māori and non-Māori

Source: NZBDS 2013

## Materiality

Materiality in this report is defined as the potential for health efficiency gains. The NHC’s goal is to improve health outcomes by investing in technology that provides the greatest value for money. Efficiencies may be realised through:

* Reprioritisation - directing funding from low value interventions to higher value interventions
* Cost avoidance - the adoption and appropriate use of only technologies that deliver value for money
* Pathway improvement - constructing pathways of care that work for patients and reduce waste

This report focuses on the latter method. By improving the entire pathway of care from prevention to end of life care through the use of interventions that provide good value for money, there is the potential for significant health gains, notably a reduction in hospitalisations and, thus, cost. Tables[[5]](#footnote-5) 5 and 6 show the number of people affected by various diseases and the corresponding raw amount of efficiency gains required per patient and/or hospitalisation to reach $5 million.

Table 5: Prevalent Diseases: Efficiency Gains Required to Reach $5 million

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Disease | Population | Savings required (Per Person) | Savings required (Per Hospitalisation) | Percentage of Average Hospitalisation Cost |
| IHD | 193,000 | $26 | $163 | 2.2% |
| Stroke | 62,000 | $81 | $482 | 7.5% (~3.7%)^ |
| NRVHD | 23,392 | $214 | $2,222 | 13.5% |
| Aortic Aneurysms | 17,800 | $281 | $4,550 | 20% |
| HTN | 558,000 | $9 | $39,370 | 500% |
| Cardiomyopathies | 6,700 | $746 | $6,053 | 62.5% |
| AF and Flutter | 44,052 | $114 | $519 | 16.7% |
| PVD | 18,326 | $273 | $2,076 | 19.2% |
| Inflammatory Heart Disease  | 9,339 | $535 | $9,560 | 71.4% |

Per Person gains were calculated by dividing $5 million by the population. Per Hospitalisation gains were calculated by dividing $5 million by the number of hospital discharges. Percentage of Average Hospitalisation Cost was calculated by dividing the gains per hospitalisation by the average hospitalisation cost and converting to a percentage.

^Includes rehabilitation costs for an average hospitalisation cost of $12,950 per patient

Source: 2013 NHC Executive analysis of 2011/12 NMDS

Table 6: Incident Diseases: Efficiency Gains Required to Reach $5 million

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Disease | Population | Savings required (Per Person) | Savings required(Per Hospitalisation) | Percentage of Average Hospitalisation Cost |
| VTE | 806 | $6,200 | $1,800 | 35.7% |
| RHD | 6450 | $775 | $10,267 | 83.3% |

Source: 2013 NHC Executive analysis of 2011/12 NMDS

It is important to consider both the absolute gains required per person or hospitalisation as well as the relative reduction in costs. This report uses average hospitalisation prices per person as a proxy for average total costs per person. Whilst this assumption has some limitations, it does provide some insight as to the feasibility of reaching a material efficiency gain. Based on the numbers above, only hypertension would require a reduction in hospitalisations greater than the total number; however, there are three distinct groups of diseases that require differing levels of hospitalisation reductions to achieve a material efficiency gain. Figure 14 displays these groups graphically.

Figure 14: Percentage Required to Reach $5 Million by Disease

Source: NZBDS 2013

The diseases represented by the red bars would require a reduction of more than half of all hospitalisations whilst the diseases represented by the yellow bars would require between 10%-40% reduction in hospitalisations. The diseases represented by the green bars (IHD and stroke) would require a less than 10% reduction in hospitalisations. A smaller percentage reduction in hospitalisations may be more feasible than a larger percentage reduction; therefore, stroke and IHD may have the most potential for material efficiency gain.

The hospitalisation rate for stroke in New Zealand was 211 and 423 per 100,000 non-Māori and Māori individuals aged over 35 years between 2006 and 2008 whilst in Canada, the rate was 118 per 100,000 individuals in 2005/06 ([26](#_ENREF_26), [27](#_ENREF_27)). A 10% reduction in hospitalisations for non-Māori and Māori would equate to a hospitalisation rate of 190 and 381 per 100,000 which are both higher than the Canadian rate; therefore, a 10% reduction in stroke hospitalisations may be achievable.

For IHD, the hospitalisation rate for all individuals was 698 per 100,000 individuals in 2011/12 ([27](#_ENREF_27)). The Canadian IHD hospitalisation rate was 495 per 100,000 individuals in 2005/06 ([26](#_ENREF_26)). A 2.2% reduction in IHD hospitalisations would equate to 683 per 100,000 individuals.

Stroke prevalence in Canada is 1.1% whilst in New Zealand the rate is about the same at 1.4%. IHD prevalence in Canada is 4.8% and 4.4% in New Zealand. Since the relative prevalence rates are similar, New Zealand may be able to achieve Canada’s hospitalisation rate.

As we do not have enough detail of the methodology for these Canadian hospitalisation rates they should only be considered indicative of possible improvement. However, given the rates come from the same study the relative differences between the cardiovascular conditions within each country provide enough information to ascertain that IHD has a larger potential efficiency gain than stroke and would require a smaller hospitalisation reduction to meet a $5 million efficiency gain threshold.

## Policy Congruence

The New Zealand government has established various health targets for the health system. Relevant to cardiovascular disease are the health targets of smoking reduction, reduced emergency department (ED) wait times, increased heart health checks and reduced incidence of rheumatic fever. Nearly all of the cardiovascular diseases mentioned in this report will benefit from a decrease in the prevalence of smoking, notably IHD, stroke and aortic aneurysms have smoking as a significant risk factor. Both IHD and stroke will benefit from the government’s targets to increase heart health checks and reduce emergency department waiting times. A focus from the NHC on improving the efficiency of these conditions will align well with the government’s current policies. However it will be important to establish that efficiencies gained through the work of the NHC are on top of those gained through the government’s current policies in these areas.

## Risk

Cardiovascular disease places a large burden on the health system, both socially and economically, so any improvement in this disease area is likely to have a significant impact on the health system. Risk has been interpreted here as the risk of both conducting further analysis on a particular disease as well as the risk of not conducting such analysis.

As established above, the main risk of conducting further analysis is that the gain in health outcomes or savings will not be material for that chosen disease. To mitigate this risk, the Committee’s other decision-making criteria favour disease areas that affect a large number of people and, thus, require a smaller reduction in costs/gains in health outcomes per person to realise materiality. As a result, some diseases that have a lower prevalence burden are prioritised below diseases with a higher prevalence burden.

Relative health gains may be greater for individuals in these diseases but when aggregated do not reach the materiality guideline used in this report. For example, aortic aneurysms are a relatively expensive disease to treat and significantly impact individual health outcomes. Compared to the whole of cardiovascular disease, though, it represents a relatively small health and economic burden. So while potential population health gain may be greater for IHD than for aortic aneurysms, potential individual health gain may be greater for aortic aneurysms.

## Limitations

The methods used in this report have both strengths and weaknesses. This section outlines some of those limitations, notably the use of NMDS price data.

NMDS prices include the inter-district flow (IDF) price of a cost weight, the price that one DHB pays another DHB to perform services for its own population. These NMDS prices are not the actual cost of each hospital stay and vary significantly from the real cost, especially when new procedures are involved. NMDS prices include public casemix discharges which comprise about 20% of the Vote: Health spend. Other costs not represented in our NMDS analysis include the following:

 Primary care consultations such as with General Practitioners (GPs) and community nurses

 Community pharmaceuticals

 Community laboratory tests

 Disability support services

 Emergency Department attendances

 Outpatient attendances

 Health promotion programmes and

 Community hospice palliative care

The NHC recognises that these costs are significant and is developing ways of incorporating these into future analysis of this kind. For this report in particular, rehabilitation costs and some other direct medical costs have been included for stroke because they comprise such a large proportion of the disease’s economic impact. Although NMDS prices alone are insufficient to cover the entire cost of a particular disease, they are a good proxy for relative economic disease burden and we have a relatively comprehensive data set in New Zealand compared to other countries. Another limitation of this report was the use of non-systematic searches.

One of the limitations of conducting non-systematic searches is the possibility that the non-appraised studies reported unreliable results that may have biased the evidence in this report. To mitigate this risk, multiple sources were checked to gauge accuracy and where no suitable evidence was available, this was clearly stated. To ensure a robust recommendation these limitations were considered alongside the other risks outlined in this document.

# Recommendation

**Based on the evidence presented in this report and the above discussion section, it is recommended that the NHC conduct further analysis on IHD during the 2013/14 financial year.** This recommendation is supported by the Cardiac Society of Australia and New Zealand (CSANZ) and the Heart Foundation.

IHD fits the established decision-making criteria most fully and has the greatest potential for health gain and material savings. Stroke also fits the decision-making criteria, but most of the associated health gains are outside of hospitalisations. In light of this, it is also recommended that stroke be assessed as the next cardiovascular disease.

Figure 15 graphically summarises how each disease compares to the decision-making criteria used in this report. Figure 15: Diseases Against the Decision-Making Criteria

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Disease** | **Health / Independence** | **Materiality** | **Policy Congruence** | **Equity** | **Risk** |
| IHD |   |   |   |   |   |
| Stroke |   |   |   |   |   |
| NRVHD |   |   |   |   |   |
| Aortic Aneurysms |   |   |   |   |   |
| HTN |   |   |   |   |   |
| AF |   |   |   |   |   |
| Cardiomyopathies |   |   |   |   |   |
| RHD |   |   |   |   |   |
| PVD |   |   |   |   |   |
| VTE |   |   |   |   |   |
| Inflammatory HD |   |   |   |   |   |

|  |  |
| --- | --- |
| **Key** |   |
|   | Very Well/Low Risk of Assessment/High Risk of No Assessment |
|   | Well/Some Risk of Assessment or No Assessment |
|   | Somewhat/Some Risk of Assessment/Low Risk of No Assessment |
|   | Not Really/Some Risk of Assessment/High Risk of No Assessment |
|   | None/High Risk of Assessment/Low Risk of No Assessment |

Source: 2013 NHC Executive Appraisal

# Appendix 1: NMDS Summary Data for Publically Funded Hospital Casemix Events (inpatient or day patient) for 2011/12



Source: 2013 NHC Executive analysis of 2009/10–2011/12 NMDS and 2010 National Mortality Collection data

# Appendix 2: Cardiovascular Disease Growth in terms of Mean Price for Publically Funded Hospital Casemix Events (inpatient or day patient) from 2009/10 to 2011/12



Source: 2013 NHC Executive analysis of 2009/10–2011/12 NMDS

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## National Health Committee (NHC) and Executive

The National Health Committee (NHC) is an independent statutory body which provides advice to the New Zealand Minister of Health. It was reformed in 2011 to establish evaluation systems that would provide the New Zealand people and health sector with greater value for the money invested in health. The NHC Executive are the secretariat that supports the Committee. The NHC Executive’s primary objective is to provide the Committee with sufficient information for them to make recommendations regarding the prioritisation and reprioritisation of interventions. The Executive do this through a range of evidence-based reports that are tailored to the nature of the decision required and time-frame within which decisions need to be made.

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## Disclaimer

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1. Using the National Minimum Data Set, this includes inpatient and day patient public casemix hospitalisations, see the Hospital Events section below for further detail. [↑](#footnote-ref-1)
2. May be an over-estimate since other conditions (i.e. proteinuria, some liver diseases, etc.) also require HTN medications [↑](#footnote-ref-2)
3. For more information, see the Public Health section of this report [↑](#footnote-ref-3)
4. Available at http://nhc.health.govt.nz/committee-publications/new-and-emerging-cardiac-technologies-australian-and-new-zealand-public [↑](#footnote-ref-4)
5. A base population of 4,405,200 was assumed. Source: 25. Statistics New Zealand. National Population Estimates. Wellington 2012. [↑](#footnote-ref-5)