

# Strategic Overview

## Respiratory Disease in New Zealand

December 2013

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### Executive Summary

Respiratory disease places a major burden on the New Zealand health system. In 2011/12, it accounted for \$265 million worth of public casemix hospital discharges. 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 existing health technologies. It does this by assessing 'value for money' in terms of health outcomes and cost to the health sector. By recommending 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. This document is the first of its kind in that process.

Because of the large burden respiratory disease places on health outcomes and the health budget, it is a potential source of significant health gains through the improvement of health services across the continuum of care. As respiratory disease is a broad area, the NHC has adopted a 'tiered' approach to establish what work should be undertaken within respiratory disease.

This 'Tier 1' document presents a high-level overview of each respiratory 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 tier in the process is to develop an implementation and monitoring/evaluation plan for the recommendations. Based on the evidence in this report, it is recommended that Chronic Obstructive Pulmonary Disease (COPD) is assessed for the 2013/14 year as per the tiered approach.

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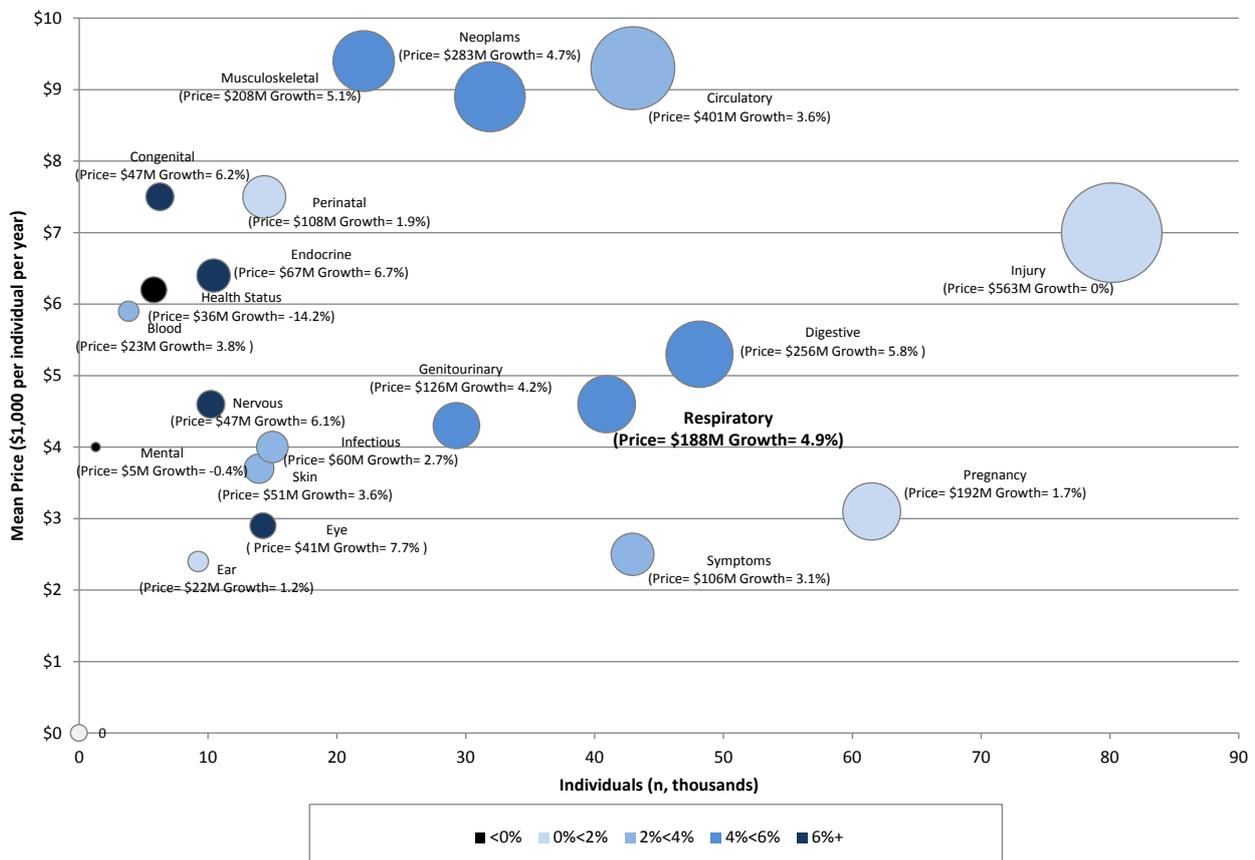
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## Introduction

Respiratory disease is a general term for a complex set of conditions that affect the lungs and respiratory tract. Globally, it is responsible for a large proportion of both negative health outcomes and economic burden. In New Zealand, the case is no different.

Figure 1 shows the economic burden relative to other disease areas based on original programme budget analysis from 2010/11. The figure uses the national minimum dataset (NMDS) of public casemix hospitalisations (inpatient and day patient) to illustrate the relative spends on different diseases and the numbers of people affected. After further analysis on data from 2011/12 using a modified disease classification system, it is now believed that respiratory disease hospitalisations account for \$265 million or about 10% of all public casemix hospitalisation costs (Appendix 1). A further breakdown of these costs is available in Appendix 2.

**Figure 1: Programme Budget (public casemix hospitalisations) by ICD Code**



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

**Source: 2012 NHC Executive Analysis of 2010–2013 NMDS**

Because of the large burden that respiratory disease places on the health system, the National Health Committee (NHC) has flagged it as a priority disease area for the 2013/14 financial year. Using the tiered approach, the NHC will further explore respiratory disease as per the process outlined in the Executive Summary. This report is the first document in a series of documents that

provides a broad overview of respiratory disease with the intention of highlighting priority areas within respiratory disease through the perspectives of prevalence and incidence, health outcomes and health utilisation/costs. The document is divided into individual disease sections:

- Asthma
- Chronic Obstructive Pulmonary Disease (COPD)
- Lung Cancer
- Obstructive Sleep Apnoea (OSA)
- Lower Respiratory Tract Infections (LRTI) and Influenza
- Cystic Fibrosis (CF)
- Bronchiectasis
- Interstitial Lung Disease (ILD) and Sarcoidosis
- Tuberculosis (TB)
- Pulmonary Arterial Disease/Hypertension (PAD/H)
- Other Respiratory 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 respiratory 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. Two main sources of information were used-- the National Minimum Dataset (NMDS) for hospital events (used to estimate the financial burden) and existing published studies for information on prevalence/incidence and outcomes.

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 respiratory disease. All mortality and disability-adjusted life year (DALY) figures used in this report are 2006 based, the most recent available with 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 lung cancer, lower respiratory tract infections/influenza, tuberculosis and pulmonary artery disease have been included

with respiratory conditions as these are all conditions that primarily affect the lungs and/or respiratory tract.

## Literature Searches

Between April 2013 and June 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 information. Where New Zealand population-based surveys were unavailable, New Zealand-based epidemiological studies were searched and international epidemiological studies were used where New Zealand ones did not suffice. Because of this search strategy some disease sections contain more information than others, a reflection of the amount of evidence easily available for various diseases.

## Hospital Events

The filtered (to exclude non-publically funded and/or non-casemix purchased events) 2011/12 NMDS was used for the hospitalisation event (inpatient and day patient) data. 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.

Price has been used as a proxy for cost as it is more readily available and is highly 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 health care based on the diagnosis code (derived using Weighted Inline Equivalent Separation methodology). For this analysis the WIESNZ10 caseweight has been multiplied by the purchase unit price for 2011/12 (\$4,567.49).

The National Health Index is a unique alpha-numeric identifier assigned to each person accessing New Zealand's health services. The National Health Index 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 caseweight price data, 2009/10, 2010/11, and 2011/12; price consistency has been controlled using the one purchase unit price for all years.

# Asthma

## Disease Description

Asthma is a chronic disease of the airways characterised by inflammation and bronchial hyper-responsiveness resulting in intermittent episodes of reversible airway obstruction<sup>(1)</sup>. There are numerous factors thought to be responsible for the development of asthma, but its exact aetiology remains unclear<sup>(2)</sup>. During an exacerbation, patients present with wheezing, shortness of breath and may require hospitalisation<sup>(1)</sup>. Treatment may include inhaled corticosteroids and bronchodilators. The key distinction between asthma and other chronic airway diseases is that the airflow obstruction is reversible in the initial stages of the disorder, but as time goes on, and as a consequence of remodelling some patients will develop COPD.

## Prevalence and Incidence

One in nine New Zealand adults suffers from asthma (11.2% in 2006/07; 11.0% in 2011/12)<sup>(3, 4)</sup>. One in seven children aged under 16 years suffers from asthma (14.2% in 2006/07; 14.0% in 2011/12). In 2006/07, this equated to 109,900 children and 348,400 adults, or nearly 460,000 New Zealanders in total. Women are more likely to suffer from asthma than men, and Māori and New Zealand Europeans are more likely to have asthma than Pacific peoples and Asian people. Asthma is more common among women who live in an area of higher deprivation than the rest of the population. Asthma rates also did not differ significantly by District Health Board (DHB).

## Health Outcomes

Asthma was responsible for approximately 68 deaths in 2006. Over half of all asthma deaths (57.4%) occurred in individuals aged over 65 years. Although asthma mortality was small relative to other respiratory diseases, its impact on quality of life was pronounced, especially in younger individuals. Asthma resulted in the loss of 15,084 DALYs with approximately 27% occurring in individuals aged less than 20 years.

## Health Utilisation and Cost

Asthma hospitalisation rates are highest among 2-16 year olds. In 2011/12, there were 4,618 hospitalisations with asthma listed as the primary diagnosis, up from 4,430 and 3,524 in the two previous financial years<sup>(5)</sup>. Table 1 shows hospitalisation rates for Māori and non-Māori individuals aged 5-34 years (Ministry of Health 2010); hospitalisation rates are almost twice as high for Māori.

**Table 1: Asthma Hospitalisation Rates per 100,000 Individuals Aged 5–34 Years by Gender and Ethnicity**

Māori			non-Māori		
Males	Females	Total	Males	Females	Total
216.3 (200.2–233.7)	269.6 (252.6–287.7)	245.1 (233.2–257.6)	122.2 (114.6–130.5)	129.7 (121.9–138.0)	126.4 (120.8–132.2)

Source: Tautau Kahukura: Māori Health Chart Book 2010, 2<sup>nd</sup> Edition, NMDS 2006-2008

According to a New Zealand study, the economic costs of asthma were estimated to be around \$825 million per year in the late 1990s<sup>(6)</sup>. This comprised about \$125 million in direct medical costs and about \$700 million in indirect non-medical costs, including days off work, premature disability, and death from asthma. The small proportion of asthmatics with chronic severe and/or poorly controlled disease is responsible for a disproportionately large portion of the cost. Additionally, asthma accounted for between 2%-3% of all avoidable respiratory deaths and 7.4% of all avoidable hospitalisations<sup>(7, 8)</sup>.

Of the estimated 524,176 asthma sufferers, 6,600 individuals contributed to 8,400 hospitalisations for a hospitalisation rate of 1.3% with an average hospitalisation cost of \$2,500. Their average length of stay was 1.3 days. In total, asthma hospitalisations contributed to \$17 million worth of costs (6.4% of all respiratory casemix hospitalisation costs).

## Chronic Obstructive Pulmonary Disease (COPD)

### Disease Description

COPD is a chronic disease characterised by airway obstruction that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lung to noxious particles or gases<sup>(9)</sup>. Small-airway narrowing (with or without chronic bronchitis) and emphysema caused by smoking are the most common conditions resulting in COPD.

COPD is characterised by the gradual development of symptoms (over many years), and an estimated 70%-80% of cases are caused by tobacco smoke<sup>(10)</sup>. Environmental smoke inhalation and genetic abnormalities are rarer causes. Patients with COPD typically present with shortness of breath, but symptoms are less easily controlled in contrast to asthma and patients often recover more slowly due to poor underlying lung function. Increasing disease severity leads to multi-organ complications and eventually death<sup>(1)</sup>.

Treatment is multi-disciplinary with a variety of interventions that may include pulmonary rehabilitation, long-term oxygen therapy and medications. Exacerbations are typically managed in the primary care setting using medical management, but hospitalisations also occur. There is a limited role for surgical management<sup>(1)</sup>.

## Prevalence and Incidence

COPD is a major respiratory disease in New Zealand in terms of prevalence. In the 2006/2007 New Zealand Health Survey, the prevalence rate of 6.6% of adults equated to 96,100 adults or 1 in every 15 individuals over 45 years. These prevalence figures are likely to underestimate the true rate of disease since many COPD patients are undiagnosed as signs and symptoms of the disease only appear later in the disease course and GPs do not always use spirometry (only 50% are believed to own a spirometer<sup>1</sup>) to screen for the condition even in smokers with a large smoking history. One published study from New Zealand found the GOLD (Global initiative for Chronic Obstructive Lung Disease)-defined, age-adjusted prevalence (95% confidence interval) for adults aged over 40 years was 14.2 (11.0–17.0)% compared with an LLN (Lower Limit of Normal)-defined, age-adjusted, post-bronchodilator prevalence in the same group of 9.0 (6.7–11.3)%<sup>(11)</sup>. In a recent evaluation of lung cancer in the Auckland region 47% of lung cancer patients were found to have COPD<sup>(12)</sup>.

COPD is very uncommon in individuals aged under 45 years. However, damage to the small airways can affect younger patients and probably affects another 5-10% of the population, many of whom acquire the condition in the first few years of life and as a consequence of passive smoking and infections in the first few years of life. Whilst not affecting lung function substantially, the condition often resurfaces in later life and can be the cause of recurrent or persistent bronchitis in patients over 45 years. These patients are often wrongly diagnosed and managed as having late onset asthma.

COPD disproportionately affects Māori and women, with Māori having a prevalence that is twice that of people of other ethnic groups. Women from areas with high deprivation were also more likely than women from more affluent areas to have COPD.

## Health Outcomes

COPD accounted for 1,523 deaths in 2006. COPD deaths tend to occur in individuals aged over 65 years. COPD was responsible for 35,339 DALYs in 2006. Of all of the respiratory diseases, COPD was the biggest cause of both deaths and DALYs. Nearly 75% of those DALYs were lost in individuals aged over 60 years.

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<sup>1</sup> Source: Personal Communication, 2013

## Health Utilisation and Cost

COPD hospitalisation rates were highest in individuals aged over 50 years. In the 2006-2009 years, ethnic-standardised hospitalisation rates were as follows in Tables 2 and 3 (Ministry of Health 2011):

**Table 2: COPD Hospitalisation Rates per 100,000 for Adults Aged over 45 Years by Gender and Ethnicity**

Māori			non-Māori		
Males	Females	Total	Males	Females	Total
1800.7 (1683.6–1925.9)	2217.6 (2095.9–2346.4)	2021.7 (1936.3–2110.9)	549.8 (532.1–568.1)	439.3 (422.6–456.7)	484.1 (471.9–496.5)

Source: Tatau Kura Tangata: Health of Older Māori Chart Book, NMDS 2006-2008

**Table 3: COPD Hospitalisation Rates per 100,000 Adults Aged over 50 Years by Age, Gender and Ethnicity**

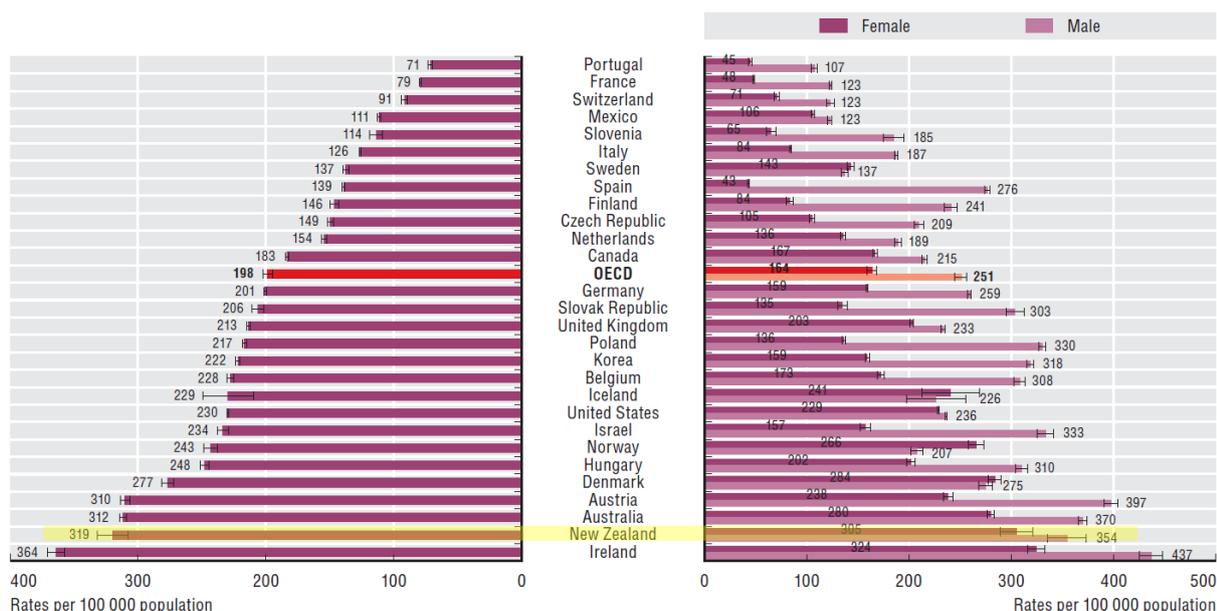
Males				Females			
50–64 years		65+ years		50–64 years		65+ years	
Māori	non-Māori	Māori	non-Māori	Māori	non-Māori	Māori	non-Māori
991.8 (916.7– 1073.0)	201.6 (190.0– 213.8)	3333.9 (3074.4– 3615.4)	1010.1 (969.4– 1052.5)	1560.6 (1466.6– 1660.7)	232.3 (218.5– 246.9)	3823.0 (3542.6– 4125.6)	803.2 (764.2– 844.2)

Source: Tatau Kura Tangata: Health of Older Māori Chart Book, NMDS 2006-2008

As evident in the data, hospitalisations are more common in both women and Māori (with the exception of non-Māori women aged over 65 years), a reflection of the prevalence burden. In terms of ambulatory sensitive hospitalisations (avoidable), COPD ranks among the top 20 causes accounting for about 10% of avoidable hospitalisations in Australia<sup>(8)</sup>. COPD accounts for 95% of all avoidable respiratory deaths<sup>(7)</sup>; however, the disease classification in the cited report did not include lung cancer which is a significant cause of avoidable mortality. Internationally, New Zealand has the second highest rate of hospitalisations due to COPD in the OECD (Figure 2)<sup>(13)</sup>, which may be due to fewer barriers to emergency department access than GP access in New Zealand<sup>2</sup>.

<sup>2</sup> Source: Personal Communication, 2013

**Figure 2: COPD Hospitalisation Rates in the OECD**



Note: Rates are age-sex standardised to 2005 OECD population. 95% confidence intervals are represented by I—I.

Source: OECD Health Data 2011.

StatLink <http://dx.doi.org/10.1787/888932525058>

**Source:** OECD Health Data 2011

The main costs to the health system in New Zealand attributable to COPD include medications, hospital care and primary care visits. Additional costs accrue from laboratory services, emergency department visits, smoking cessation programmes, other laboratory testing and the provision of rehabilitation services.

Depending on the number of prevalent cases, the direct costs in New Zealand have been estimated at \$102 million to \$192 million per annum<sup>(14)</sup>. The average cost per patient per year is estimated at \$2,566 without considering loss of income, the costs to family or loss of quality of life.

In terms of hospitalisations, 7,716 individuals with COPD were hospitalised an average of 1.5 times for a total of 11,619 discharges. This translates to a hospitalisation rate of about 0.08% of all COPD patients with a 30 day readmission rate of 17.9%. Hospitalisations were relatively long at an average of 4.2 days whilst the average cost per hospitalised patient was about \$7,700. Overall, COPD contributed to \$54 million in hospitalisation costs (20.3% of total respiratory hospitalisation costs).

# Lung Cancer

## Disease Description

The broad term lung cancer refers to a number of conditions characterised by the malignant transformation of cells of lung origin<sup>(1)</sup>. The nature of the particular type of cancer is derived from the type of cell which has become cancerous. The two most common forms are non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC) with rare variants including carcinoid tumours and mesothelioma<sup>(1)</sup>.

Tobacco smoking is the predominant cause of lung cancer, accounting for 80% to 90% of cases. Other significant causes include asbestos, air pollution, radon gas exposure, previous radiotherapy and genetic predisposition<sup>(1)</sup>. Lung conditions such as COPD, bronchiectasis and interstitial lung diseases increase the risk of lung cancer 2-3 fold. Diagnosis is aimed at determining the type of cancer and the extent of spread (stage). Survival in advanced disease varies but is approximately one year on average<sup>(15)</sup>.

Localised disease is treated with curative intent; surgery is the first line therapy. Combined chemotherapy and radiotherapy is used with curative intent for localised disease for patients who are not surgical candidates. Up to half of these patients with localised disease later relapse<sup>(1)</sup>. Advanced disease is incurable and treatment is aimed at decreasing symptoms, improving quality of life and extending survival. Radiotherapy and chemotherapy are the main treatments as is palliative care toward end of life<sup>(1)</sup>.

## Prevalence and Incidence

Lung cancer has an incidence of about 30/100,000 individuals each year<sup>(16)</sup>. Lung cancer is often diagnosed in the late stages of the disease and affects older individuals (60+ years) more than younger individuals. In 2009, males had a slightly higher incidence than females (55% versus 45%). Māori represented about 18.3% of all cases.

## Health Outcomes

In 2006, lung cancer was responsible for 1,481 deaths, 15.8% of which occurred in individuals aged between 70-75 years. It is the biggest cause of death among cancers and was attributable to 2,857 lost DALYs, second only to COPD among respiratory diseases. New Zealand has poor survival figures compared with other developed countries which is thought to be mainly due to delays in diagnosis rather than access to therapy<sup>(12)</sup>.

## Health Utilisation and Cost

Hospitalisations are the main costs to the health system in New Zealand for lung cancer, with General Practitioner (GP) visits the second largest<sup>(17)</sup>. Medications, outpatient care and specialist visits are also major cost items. The direct costs to the New Zealand health care system for lung

cancer amounted to at least \$18.0 million in the year 2002, but may be as much as \$28.1 million<sup>(17)</sup>. Costs per patient per year are estimated at \$7,500 on average.

Nearly 95% of yearly lung cancer patients (1,401 individuals) were hospitalised an average of 1.4 times for a total of 1,908 hospital discharges. Hospitalisations lasted for an average of 7 days and the mean price per hospitalised individual was \$9,300. Total hospitalisation costs were \$13 million (4.9% of total respiratory hospitalisation costs).

## **Obstructive Sleep Apnoea (OSA)**

### **Disease Description**

OSA is characterised by obstruction of the upper airway during sleep preventing normal breathing<sup>(1)</sup>. It is generally thought that the obstruction is the result of upper airway muscles failing to maintain sufficient upper airway patency thereby limiting or obstructing normal airflow.

Obesity is a main cause. Other causes include abnormal upper airway anatomy or other obstructions of the upper airways. Patients with OSA hypopnoea syndrome (OSAHS) experience snoring, apnoeas (periods of breathing cessation) and significant sleep disturbance caused by repeated arousals related to the obstructive events that are associated with desaturation (fall in oxygen levels)<sup>(1)</sup>. This results in daytime sleepiness, which may result in motor vehicle accidents and poor work performance in addition to adversely impacting quality of life. Other physical complications of OSA include high blood pressure, mood change, sexual dysfunction and heart failure. Continuous positive airway pressure (CPAP) devices are used to treat OSA by maintaining a patent airway during sleep.

For children, snoring is the most common presentation along with diaphoresis, restlessness and frequent awakening<sup>(18)</sup>. Compared to adults children report less daytime drowsiness; many of the signs and symptoms are behavioural<sup>(19)</sup>. One study found that many children treated for hyperactivity/inattentiveness also had underlying sleep-disordered breathing<sup>(20)</sup>. Because of its similarities with behavioural problems, sleep-disordered breathing disorders are thought to be underdiagnosed in children<sup>(21)</sup>. Treatment for children is with CPAP, adenotonsillectomy and allergy management<sup>(18)</sup>.

### **Prevalence and Incidence**

OSA is the most common sleep-related breathing disorder. According to a New Zealand-based population survey, OSA is likely to affect about 4.4% and 4.1% of Māori and non-Māori men, respectively. For Māori and non-Māori women, the rates are 2.0% and 0.7%, respectively<sup>(22)</sup>. In children, the prevalence of sleep-disordered breathing has been estimated at 1%-10%<sup>(18, 23-25)</sup>.

## Health Outcomes

Eleven deaths were attributable to OSA in 2006 resulting in a loss of 3,055 DALYs. Individuals aged 40-65 years carried about 50% of the DALY burden.

## Health Utilisation and Cost

Total annual societal costs of OSA for New Zealanders aged 30–60 years were estimated at \$40 million (range \$33–\$90 million) or \$419 per case, with accidents being the major contributor. This included 58% direct medical, 13% direct non-medical, 25% indirect, and 3% intangible costs<sup>(26)</sup>.

OSA patients had a 0.5% chance of requiring a hospitalisation. For the 721 hospitalised individuals, there was about 1 hospitalisation per patient (736 total discharges) at an average length of stay of 2 days. The \$3 million worth of hospitalisations (1.1% of total costs) averaged to about \$4,500 per hospitalised patient.

## Lower Respiratory Tract Infections (LRTI) and Influenza

### Disease Description

These diseases vary and may include certain hospital or community-acquired infections such as pneumonia. It also includes common infections such as bronchitis and bronchiolitis. The causes of these infections are wide-ranging and they may impact on any part of the lower respiratory tract. These diseases may affect anyone, but children and the elderly are especially vulnerable to complications with bronchiolitis being the most common paediatric respiratory admission among infants<sup>(27, 28)</sup>.

Influenza is a term that describes both the influenza virus and the illness it causes. It is a highly contagious, airborne virus that is one of the most common human infections<sup>(1)</sup>. The symptoms are typically a high fever, muscle aching, sore throat, headache, cough and other respiratory symptoms but may result in several other symptoms depending on the severity of the infection<sup>(1)</sup>. There are various subtypes of influenza and the virus is characterised by genetically "lability", i.e. the virus' genetic code is relatively unstable and mutations that alter the virulence and infectivity are not uncommon. Over recent years there have been several reports of highly virulent strains of influenza (e.g. "swine flu", "avian flu"), resulting in a limited number of deaths<sup>(29, 30)</sup>.

Treatment is usually supportive for mild infections (pain relief, paracetamol and fluids), but antiviral therapy is often used for more severe infections. Seasonal flu vaccines are available to help prevent infection. Severe infections may result in pneumonia, either directly or due to secondary bacterial infection, and require hospitalisation<sup>(1)</sup>.

### Prevalence and Incidence

The estimated incidence of lower respiratory tract infection (LRTI) is 30 per 1,000 children per year in the UK<sup>(31)</sup>. LRTIs are also very prevalent in older patients in hospital. The incidence of lower

respiratory tract infections among persons aged 85–90 years was 94 per 1000 person years in the Netherlands<sup>(32)</sup>. GP consultation rates in the UK suggest the overall incidence of LRTI is 1,581 per 100,000 individuals of all ages<sup>(33)</sup>.

Influenza has a seasonal pattern with a peak between May and September. In 2010, it was estimated that about 1,036/100,000 individuals experienced flu-like symptoms during the influenza season<sup>(34)</sup>. For the rest of the year, this rate dropped to about 49/100,000 individuals. Children under 4 years of age were more likely to experience influenza than other age groups.

### **Health Outcomes**

Nearly 460 deaths occurred as the result of LRTIs in 2006. The majority of these deaths (67.2%) occurred in individuals aged over 85 years. These infections also contributed to 1,106 DALYs with a sizeable proportion lost in newborns (20.1%). Only individuals aged over 85 years had more DALYs lost than newborns (about 1388 compared to 1106).

Influenza was responsible for 14 deaths in 2006 with about 57.1% of those deaths occurring in individuals aged over 85 years. DALYs were relatively modest at about 310 spread fairly evenly over all age groups.

### **Health Utilisation and Cost**

These two conditions contributed to over 28,000 hospitalisations for about 24,000 individuals (1.2 hospitalisations per hospitalised individual). In 2011/12, LRTI/influenza patients had a combined probability of requiring a hospitalisation of about 36%. The average length of stay was about 3.5 days and the average price per hospitalised individual was \$4,700. This aggregated to \$112 million or 42.3% of all respiratory hospitalisation costs.

## Cystic Fibrosis (CF)

### Disease Description

CF is New Zealand's most common life-threatening genetically inherited condition. One in twenty-five Caucasian New Zealanders is a carrier of the 'faulty' gene<sup>(35)</sup>. The disease has a recessive inheritance pattern, i.e. affected children are born to parents who both carry the abnormal gene but do not have the disease. The abnormal gene results in a malfunctioning chloride channel, preventing normal movement of salt and water across cells<sup>(1)</sup>.

It affects the lungs by reducing water secretion and preventing the production of normal airway mucus<sup>(36)</sup>. This interferes with the normal lung defence mechanisms thereby creating an environment conducive to bacterial growth and leading to recurrent chest infections. CF patients typically suffer from chronic cough and sputum production. The recurrent infections lead to progressive lung damage over time and ultimately patients are limited by shortness of breath<sup>(1)</sup>.

The mainstays of therapy are chest physiotherapy, medications to enhance mucus clearance and control of infection and nutritional supplementation. Most CF patients will develop respiratory failure as disease progresses and lung transplantation is typically considered the only remaining treatment option.

### Prevalence and Incidence

CF is a relatively rare condition. In New Zealand, the Port CFNZ registry captures a significant proportion of all CF patients in New Zealand<sup>(35)</sup>. With 415 registered patients, it is estimated that this registry captures about 85% of all CF patients in New Zealand. Extrapolating from this estimate, it is possible that there are approximately 488 CF patients in New Zealand. The median age of registry patients is about 16 years due to the shortened lifespan of patients with CF.

### Health Outcomes

CF deaths numbered about 7 in 2006 with the vast majority of deaths occurring in individuals aged between 15-24 years (71.4%). No deaths occurred after 44 years in 2010. The 517 DALYs associated with CF were borne mostly by 15-24 year olds.

### Health Utilisation and Cost

Over half (51.1%) of CF patients required an average of 2.5 hospitalisations in 2011/12. Hospitalised CF patients had an average length of stay of 9.6 days per discharge and an average cost of \$28,100, the highest average cost of any respiratory condition. In total, CF hospitalisations cost the health system about \$6 million (2.3% of respiratory hospitalisation costs).

## Bronchiectasis

### Disease Description

Bronchiectasis is an airway disease characterised by damage to small and medium sized airways that results in impaired mucus clearance and airflow obstruction. Pathologically there is abnormal dilatation of bronchi<sup>(1)</sup>. While the disease can be secondary to an underlying immune deficiency, in most cases of bronchiectasis a specific cause cannot be identified; these cases are termed idiopathic. Conventional wisdom is that most idiopathic cases are due to severe viral infection or whooping cough occurring in early childhood years leading to an initial insult to small airways. In almost half the cases a specific aetiology can be identified such as previous pulmonary tuberculosis, smoking related COPD, allergic bronchopulmonary aspergillosis or pneumonia<sup>(37)</sup>.

Patients typically present with recurrent chest infections due to impaired mucus clearance which can lead to excessive airway inflammation and chronic bacterial colonisation of the abnormal bronchi. Treatment for bronchiectasis includes airway clearance techniques to remove mucus from airways, bronchodilators and antibiotics to treat inter-current infections. There is an emerging role for anti-inflammatory therapy to dampen the excessive airway inflammation<sup>(1)</sup>.

### Prevalence and Incidence

In 2000, a retrospective review of children attending the bronchiectasis clinic found a crude prevalence rate of about 17/100,000 in the Auckland paediatric population<sup>(38)</sup>. A prospective, national study reporting all new cases diagnosed in 2001-2003 using the NZ Paediatric Surveillance Unit gave an incidence of 3.7/100,000 children per year<sup>(39)</sup>. Eighty percent of the children were Māori or Pacific peoples indicating a disproportionate prevalence of bronchiectasis at 52/100,000 for Pacific peoples, 24/100,000 for Māori and 4/100,000 for European groups. Overall, the prevalence of bronchiectasis has been estimated at 51/100,000 individuals in the United States and is likely to be higher in New Zealand due to the higher relative proportion of Pacific and Māori when compared to the United States<sup>(40)</sup>. Clinical estimates of bronchiectasis in New Zealand are between 272 and 341 per 100,000. This disparity between published estimates and clinical estimates may be due to the fact that bronchiectasis is often miscoded or misdiagnosed in data sets.

### Health Outcomes

Although bronchiectasis is often diagnosed in childhood, in many it is not diagnosed until adulthood and is often wrongly diagnosed as asthma for many years first<sup>(41)</sup>. The majority of the 273 deaths associated with the disease occurred in adults aged over 60 years. Individuals aged less than 60 years bore a sizeable DALY burden, estimated at 8,629 DALYs.

## Health Utilisation and Cost

Of the 682 hospitalised patients, they required an average of 1.6 hospitalisations for a total of 1,065 discharges. These hospitalisations lasted an average of 5.5 days and contributed to an average cost of \$7,300 per hospitalised patient. Total hospitalisation costs summed to \$5 million (1.9% of total costs). These numbers may be an underestimate due to the difficulty coding bronchiectasis.

## Interstitial Lung Disease (ILD) and Sarcoidosis

### Disease Description

ILD is a term that describes a large group of diseases that affects the interstitium (the tissue and space around the alveoli)<sup>(1)</sup>. This classification is used to separate it from obstructive chronic lung diseases since the mechanism of disease causes restricted lung movement and impaired gas transfer and does not result in airway obstruction. Many diseases fall into this category with a variety of possible causes including drug induced and environmental exposures. Often no cause is identified; these are termed idiopathic interstitial pneumonias. Treatment is varied and includes corticosteroids or other immune suppressant medications<sup>(42)</sup>. Related to ILD is sarcoidosis.

Sarcoidosis is a multi-system inflammatory disease of unknown cause characterised by the development of granulomas (chronic inflammatory cell deposits) in various organs<sup>(1)</sup>. The lungs are the most common site and patients tend to exhibit dry cough and shortness of breath<sup>(1)</sup>. This is due in large part to the inflammatory response in the lungs. While the cause of sarcoidosis is not fully known, genetics and environmental factors are thought to influence a person's susceptibility for contracting the disease<sup>(43)</sup>. Treatment is with corticosteroids although observation alone is often used because the disease can resolve on its own.

### Prevalence and Incidence

ILD is a grouping of diseases considered by the European Union Committee of Experts on Rare Diseases (EUCERD) as a rare disease. A study in the Czech Republic reported 7-12 cases per 100,000 population while data from a Finnish registry indicated 16-18 cases per 100,000 population<sup>(44)</sup>. Since no prevalence data is available for New Zealand, this report assumes that prevalence of ILD is 5–18 per every 10,000 individuals, the EUCERD threshold for rare diseases and the upper Finnish estimation<sup>(45)</sup>.

There are no New Zealand specific estimates of sarcoidosis as at May 2013. Using data from the United Kingdom (UK), sarcoidosis may affect about 1 in every 10,000 individuals in the New Zealand population or about 442 individuals<sup>(46)</sup>. It mostly affects individuals aged 20-40 years. Additionally, it is more prevalent in women than in men.

## Health Outcomes

ILD contributed to about 123 deaths in 2006 with most of these deaths occurring in individuals aged over 75 years. The majority of the 1,755 DALYs occurred in individuals aged over 70.

In 2006, 11 deaths occurred as the result of sarcoidosis. With 633 DALYs lost, this disease mostly impacted individuals aged over 30 years.

## Health Utilisation and Cost

There were 454 hospitalisations spread over 352 individuals in 2011/12 (average 1.3 hospitalisations per person). As a proportion of total ILD/sarcoidosis patients, this equated to a hospitalisation rate of between 4.2% and 13.3%. Average length of stay and cost per hospitalised patient was 7.3 days and \$8,700, respectively. In total, \$3 million was spent on hospitalisations attributable to these conditions or 1.1% of total respiratory hospitalisation costs.

## Tuberculosis (TB)

### Disease Description

Tuberculosis is an infection caused by the bacteria *Mycobacterium tuberculosis* (MTb)<sup>(1)</sup>. It is the most common cause of disease-related morbidity worldwide<sup>(47)</sup>. Although it characteristically affects the lungs, it is a multisystem disease which can affect the brain, meninges, gastrointestinal tract, genitourinary organs and bones<sup>(48)</sup>.

TB is usually acquired through exposure of the lungs or mucous membranes to infected air-borne particles. Following initial infection with MTb it can either be cleared, suppressed by the immune system (latent TB) or cause active disease<sup>(1)</sup>. Symptoms of disease depend on the site affected but are most commonly cough (at times with blood stained sputum), weight loss, night sweats, fevers, chest pain or symptoms localised to other affected areas. Latent infection has the potential to re-activate many years later.

A full recovery would be expected with non-drug resistant TB and an adequately adhered to treatment course. TB is usually treated with a four-drug antibiotic combination, but increasingly strains of *M. tuberculosis* are showing varying degrees of drug resistance<sup>(1)</sup>. Multi-drug resistant TB (MDR-TB) and extensively-drug resistant TB (XDR-TB) are presenting new challenges to current treatment regimens internationally.

## Prevalence and Incidence

There were 626 cases of TB notified in 2011 or about 7 cases per 100,000 individuals<sup>(49)</sup>. These notifications comprised 308 cases of TB disease (new and relapse/reactivation cases) and 318 cases of TB infection (treatment of latent infection and old disease on preventive treatment). Annual TB disease notification rates have more than halved between 1980 (15.1 per 100,000 population) and 2011 (7.0 per 100,000 population), although there has been little change in rates over the last five years. Disease notification rates in 2011 were highest in those aged 20 to 29 years and in the Middle Eastern/Latin American/African ethnic group. More than half of the disease notifications were reported by the three District Health Boards (DHBs) in the Auckland region possibly related to the high population of immigrant communities from TB prevalent countries. The highest rates of TB disease were in Auckland DHB, followed by Capital and Coast and Hawke's Bay DHBs.

## Health Outcomes

Seventy-eight deaths were recorded as TB-related in 2006. About 70.4% of those deaths occurred in individuals aged over 70 years for a DALY loss of 370.

## Health Utilisation and Cost

TB has an expensive average cost of \$14,100 per hospitalised patient. For the 150 hospitalised individuals (24% of incident TB patients), they had an average of 1.2 hospitalisations (185 in total) with an average length of stay of 14 days per hospitalisation. Total costs were \$2 million (0.8% of all costs).

## Pulmonary Arterial Disease/Hypertension (PAD/H)

### Disease Description

Pulmonary arterial disease (PAD) comprises a multitude of diseases that obstruct blood flow through the pulmonary arteries such as cor pulmonale and pulmonary arterial hypertension (PAH). Cor pulmonale is failure of the right side of the heart brought on by long-term high blood pressure in the pulmonary arteries and right ventricle of the heart<sup>(50)</sup>.

PAH is an abnormal elevation of the blood pressure within the pulmonary arteries<sup>(1)</sup>. It may be caused by left heart failure, pulmonary parenchymal disease, pulmonary vascular disease, thromboembolism or a combination of these factors<sup>(51)</sup>. The most common presenting symptom is exertional breathlessness, but fatigue, angina, syncope and peripheral oedema are also common. Diagnosis is usually achieved through echocardiography and right heart catheterisation to establish the pulmonary artery pressure and right ventricular function<sup>(51)</sup>.

PAD comprises a heterogeneous group of disorders and treatment varies depending on the exact diagnosis. Treatment is initially with medicines (e.g. calcium channel blockers, prostanoids,

phosphodiesterase inhibitors or iloprost), but occasionally more invasive procedures are required with some patients eventually requiring heart and lung transplant<sup>(51)</sup>. The prognosis is poor with approximately 15% mortality at 1 year on modern therapy and a 2-3 year median survival<sup>(52, 53)</sup>.

### **Prevalence and Incidence**

There are very few reliable estimates for the diseases that comprise PAD due to the relative difficulty of diagnosing large populations for the purpose of a population study using invasive right heart catheterisation. Additionally, PAD usually presents with other chronic diseases such as COPD and is difficult to separate from concomitant conditions<sup>(54)</sup>. For PAH, there are some prevalence estimates.

Although previously thought to be uncommon, data from a French registry suggests the prevalence is approximately 15 per million<sup>(55)</sup>. Idiopathic pulmonary arterial hypertension (IPAH) has a global incidence of about 2-3 per million per year and a prevalence of about 15 per million<sup>(56)</sup>. Adult females are almost three times more likely to present with IPAH than adult males. The presentation of IPAH within children is more evenly split along gender lines.

### **Health Outcomes**

Pulmonary arterial disease was responsible for 34 deaths in 2006. A total DALY loss of 1,213 was fairly evenly split among all age groups with a lower figure in the 35–39 year population.

### **Health Utilisation and Cost**

There were 1,273 individuals hospitalised for PAD. They each had an average of 1.1 hospitalisations (1,421 in total) that were an average of 2.6 days in length. Each hospitalised individual cost about \$3,300 for a total of \$4 million in hospitalisations (1.5% of total costs).

## **Other Respiratory Diseases**

### **Disease Description**

This final category includes any other respiratory disease not mentioned above. These diseases may be the result of trauma (pneumothorax), a procedure-related illness (pulmonary effusion) or primarily affect newborns (pulmonary hyperplasia). Treatment is most varied for this group as well as the range of causes.

### **Prevalence and Incidence**

As there are many diseases categorised in this category, there are no prevalence or incidence estimates to adequately describe this group.

### **Health Outcomes**

These conditions accounted for 54 deaths and 1,716 DALYs.

## Health Utilisation and Cost

These respiratory diseases were responsible for the 11,089 hospitalisations of 10,190 people (average of 1.1 hospitalisations). These hospitalisations had an average length of stay of 2.2 days and an average cost per hospitalised individual of \$4,400 totalling \$45 million or nearly 17% of all respiratory hospitalisation costs.

## Public Health

Most respiratory diseases are associated with smoking. As such, public health in respiratory disease tends to focus on smoking cessation. The Health Promotion Agency (HPA) in partnership with the Ministry of Health has created various campaigns and tools to help curb tobacco use and track progress<sup>(57)</sup>.

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. Given that these programmes were implemented concurrently with tax increases and pictorial warnings, the exact proportion of this reduction attributable to public health campaigns is unknown.

In addition to anti-smoking campaigns, the health sector has also provided support for reducing obesity (a leading cause of OSA) and increasing influenza vaccine uptake. Lastly, public health initiatives to reduce air pollution are also underway. It is thought that air pollution contributes to over 600 extra respiratory and cardiac hospitalisations and may partially explain why New Zealand has relatively high rates of certain respiratory diseases<sup>(58)</sup>.

## New and Growing

In addition to the information above, various disease areas are growing in terms of economic burden. This section highlights those areas.

Over the 3 financial years 2009/10 to 2011/12, five disease areas decreased in terms of hospitalisation cost burden whilst six grew. TB has seen the biggest decline in costs at 19.5% and ILD/sarcoidosis has been growing the fastest at 6.1% on average followed by bronchiectasis at 4.5%. As far as the significance of growth goes, the non-aggregated disease category with the largest nominal hospitalisation cost growth was COPD which grew 1.5% during the 2009/10 to 2011/12 period equating to an increase of \$810,000.

## 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 of the limitations of this report. It is divided into a section for each of the Committee's relevant decision-making criteria:

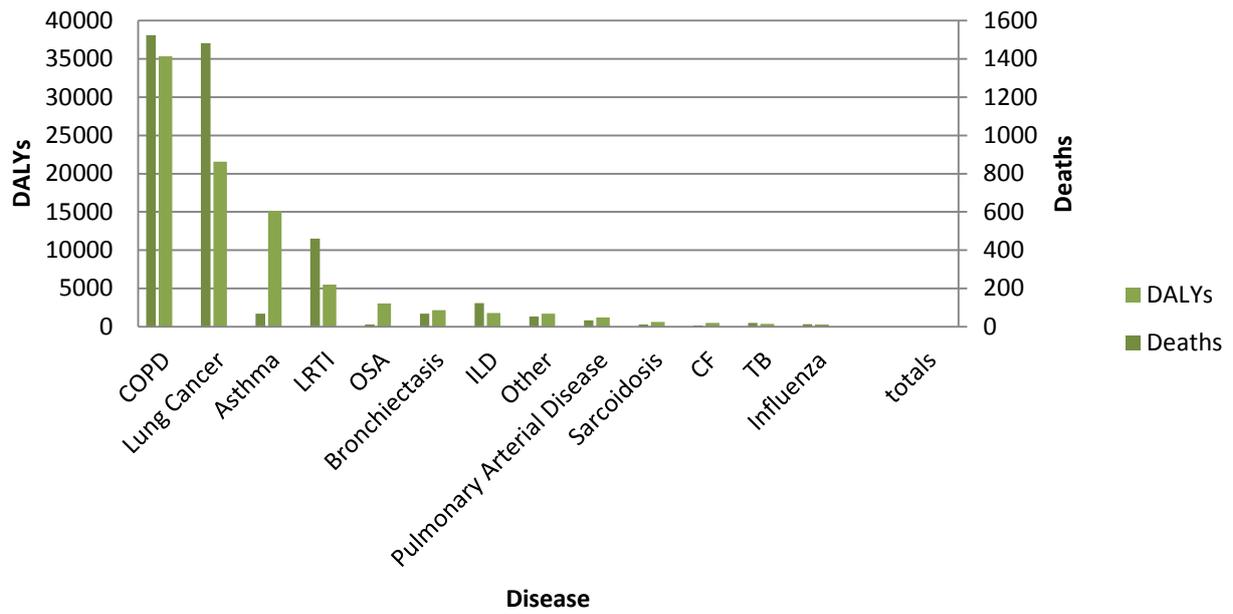
- Health and Independence Gain
- Equity
- Materiality
- Policy Congruence
- Risk

Since 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.

### Health and Independence Gain

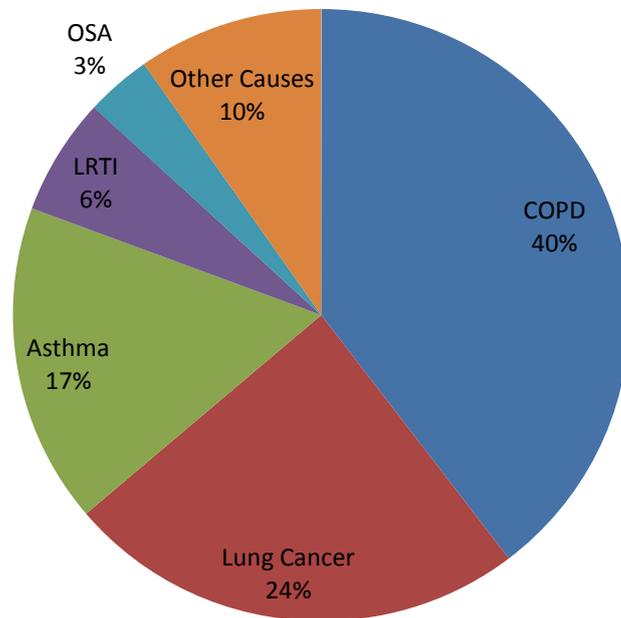
Deaths and DALYs were the main health outcomes reported. As evident in Figure 3, COPD, lung cancer and asthma accounted for the highest proportion of both deaths and DALYs. In fact, COPD and lung cancer accounted for 64% and 77% of DALYs and deaths, respectively (Figures 4 and 5). Asthma also had a large DALY burden. These results are significant in that the Committee considers the potential health and independence gain in a particular disease area. Areas with the highest mortality and DALY burden have the most potential improvement for health and independence gains. Of course, the distribution of DALYs and deaths is also an important indicator of equity.

**Figure 3: Total deaths and DALYs**



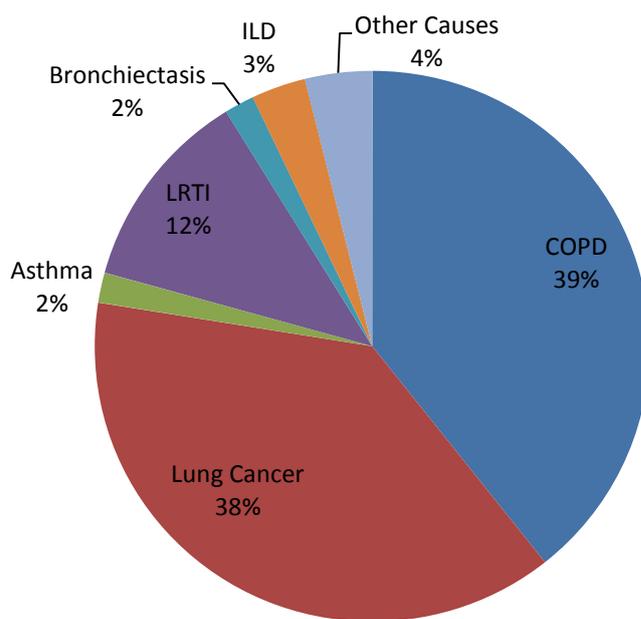
Source: NZBDS 2013

**Figure 4: DALY Breakdown by Percentage**



Source: NZBDS 2013

**Figure 5: Death Breakdown by Percentage**

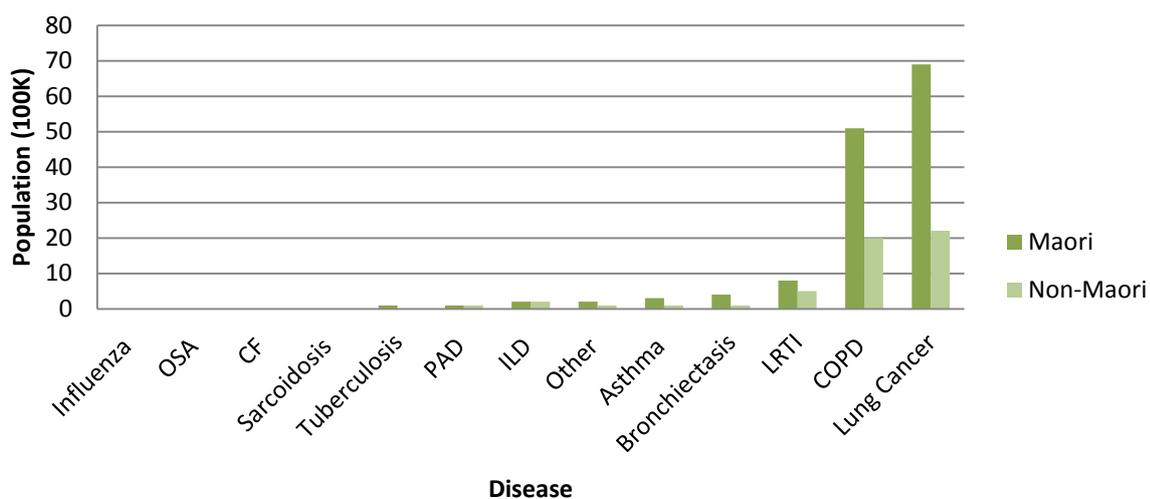


Source: NZBDS 2013

## Equity

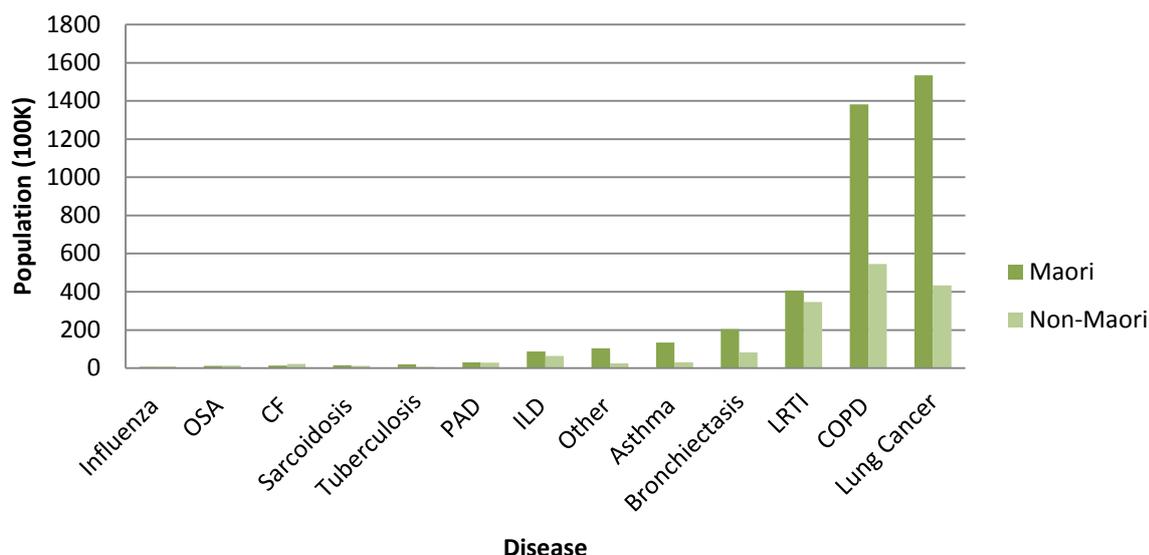
For nearly every disease, Māori were affected more than the general population with the exception of influenza, CF and PAD (Figures 6 and 7). As such, a focus on any of the conditions where inequity exists either in terms of deaths or DALYs would stand to benefit Māori. Based on age-standardised death and DALY rates, a focus on lung cancer and COPD has the most potential to increase equity.

**Figure 6: Death Rate per 100,000 Individuals**



Source: NZBDS 2013

Figure 7: DALY Rate per 100,000 Individuals



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 recommending investment 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 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<sup>3</sup> 4 and 5 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.

<sup>3</sup> A base population of 4,405,200 was assumed. Source: 59.Statistics New Zealand. National Population Estimates. Wellington2012.

**Table 4: Prevalent Diseases: Efficiency Gains Required to Reach \$5 million**

Disease	Population	Savings required (Per Person)	Savings required (Per Hospitalisation)	Percentage of Average Hospitalisation Cost
Asthma	524,176	\$10	\$595	38.8%
COPD	96,100	\$52	\$430	9.2%
OSA	132,400	\$38	\$6,800	167%
CF	488	\$10,250	\$8,800	83.3%
Bronchiectasis	13,250	\$377	\$4,700	100%
ILD/Sarcoidosis	2,645-8,371	\$600-\$1,890	\$11,000	166%
PAD	1,273 <sup>4</sup>	\$3,900	\$3,500	124%

Per Person gains were calculated by dividing \$5 million by the patient 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.  
2013 NHC Executive Analysis of 2011/2012 NMDS

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

Disease	Population	Savings required (Per Person)	Savings required (Per Hospitalisation)	Percentage of Average Hospitalisation Cost
LRTI/Influenza	77,716	\$64	\$177	4.4%
Lung Cancer	1,322	\$3,780	\$2,620	38.5%
TB	626	\$7,990	\$27,000	250%

2013 NHC Executive Analysis of 2011/2012 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 (inpatient or day patient) 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. There is not enough efficiency potential in OSA, CF, ILD/sarcoidosis, PAD or TB as it would take a reduction in hospitalisation costs greater than or virtually equal to total cost to reach the \$5 million mark. This leaves asthma, COPD, LRTI/influenza and lung cancer as possible candidates for improved health service provision.

For asthma and lung cancer, it would require a nearly 40% reduction in hospitalisation costs to reach the \$5 million target. This could be accomplished either by reducing the average cost of each hospitalisation by 40% (i.e. cut length of stay in half), reducing the total number of hospitalisations

<sup>4</sup> The prevalence estimate for PAD was taken from the NMDS hospitalisation due to the paucity of a suitable population estimate. It is likely the actual population is larger than the NMDS estimate.

by about 40% or a combination of the two. Given that the relative rate of asthma for children and adults in Canada<sup>(60)</sup> is similar to that of New Zealand's (15.6% and 8.3% versus 14.2% and 11.2%), a suitable reduction in hospitalisations seems plausible since Canadian hospitalisation rates are well below that of New Zealand<sup>(60)</sup>.

Canadian asthma hospitalisation rates from 2004/05 were 9 to 134 per 100,000 for individuals aged 5–44 years whilst New Zealand estimates were 122 to 270 per 100,000 for individuals aged 5–34 years. Reducing the upper New Zealand hospitalisation rate by 40% would equate to a rate of 162 per 100,000 individuals, well above the highest Canadian estimate. While it may be possible to reduce asthma hospitalisations significantly, COPD seems like a more likely candidate if the goal is to have the greatest positive impact on health outcomes while improving value for money.

Although Canadian COPD estimates for adults aged over 34 are about 50% less than New Zealand's rate for individuals over 45 years (4.4% versus 6.6%), it has been suggested that Canada's prevalence rate could underestimate actual prevalence by at least 50% which would make the prevalence rate similar to New Zealand's rate<sup>(61)</sup>. Reducing COPD hospitalisations by 9.2% seems achievable since a 9.2% reduction in COPD hospitalisations would reduce the total number of discharges to 10,550. Assuming the majority of these hospitalisations occur in individuals aged over 40 years; the non-standardised rate would reduce to 522 per 100,000 which is significantly higher than the average Canadian rate of 295 per 100,000 individuals aged 55–64 years. Because of the disparity between New Zealand and Canadian hospitalisation rates, there appears to be room for improvement in COPD care.

Lung cancer hospitalisation rates are not disparate enough to expect such a reduction, yet the difference in lung cancer incidence rates implies there is room for improvement. A nearly 40% reduction in lung cancer hospitalisations seems unlikely since the New Zealand non-standardised rate of 9.4 per 100,000 individuals aged over 40 is similar to the equivalent Canadian rate. However, the Canadian lung cancer incidence rate is more than double the New Zealand rate (70 versus 30 per 100,000) which implies that Canadian lung cancer patients may be hospitalised less often than New Zealand patients. More information would be needed to assess whether or not a reduction in hospitalisations would be plausible given New Zealand's lower incidence rate.

Perhaps most achievable of all of these options is a reduction in hospitalisation rates for LRTI and influenza. A 4.4% reduction in influenza and LRTI hospitalisation rates seems achievable; hence, there has been a 0.9% decline in hospitalisation costs already during the 2009-2012 periods. Moreover, there are already a range of sector initiatives devoted to reducing these figures further. On this basis, the NHC may only add marginal value to a highly saturated research area that is already in decline.

## Policy Congruence

The government has established various health targets for the health system. Relevant to respiratory disease are the health targets of smoking reduction, reduced emergency department (ED) wait times and reduced cancer treatment wait times.

Most respiratory diseases are affected by smoking. As such, any attempt to lower respiratory disease rates will likely focus on smoking cessation. In terms of this health target, lung cancer and COPD are most closely associated with smoking rates and align well with government policy.

Diseases that may present in the ED, most notably asthma, COPD, LRTI and influenza, align well with the target to reduce ED wait times.

Lastly, reduced cancer treatment wait times most closely aligns with lung cancer.

## Risk

Respiratory 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 large impact. Thus, risk has been interpreted as the risk of both conducting further analysis on a particular disease and 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, CF is a relatively expensive disease to treat and significantly impacts individual health outcomes. Compared to the whole of respiratory disease, though, it represents a relatively small health and economic burden. So while potential population health gain may be greater for COPD than for CF, potential individual health gain may be greater for CF.

## 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. 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.

Indirect costs (i.e. lost productivity, costs to sectors other than health) were not considered for every disease. There is a great disparity in how different studies measure these costs, so the decision was made to compare disease costs primarily on NMDS hospitalisation costs as those are consistently applied to each disease. 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. This limitation was further compounded by the lack of respiratory disease prevalence data in New Zealand. Clinical opinion is that COPD and bronchiectasis have especially sparse data. OSA is also thought to be underdiagnosed in New Zealand <sup>(62)</sup>. To mitigate these risks, multiple sources were checked to gauge accuracy and where no suitable evidence was available this was clearly stated and supplemented with clinical opinion.

Lastly, a general limitation of this report is the focus on specific diseases as opposed to a more integrated look at respiratory disease. Many patients with one disease have other co-morbidities that were not included in the health outcomes calculation. Whilst this may limit the full impact of analysis, further work conducted in one area will likely have positive impacts on other diseases with similar risk factors. Consultation in subsequent tiers will ensure co-morbidities and their relation to patient outcomes will be discussed. 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 COPD during the 2013/14 financial year.

COPD fits the established decision-making criteria most fully and has the greatest potential for health gain and material savings. Subsequent years may include further work on asthma and lung cancer as they, too, fit the Committee's decision-making criteria reasonably well. Figure 8 graphically summarises how each disease compares to the decision-making criteria used in this report.

Figure 8: Appraisal of different respiratory disease against selected NHC decision-making criteria

Disease	Health/Independence	Materiality	Policy Congruence	Equity	Risk
COPD	Green	Green	Green	Green	Green
Asthma	Green	Green	Light Green	Green	Green
Lung Cancer	Green	Light Green	Green	Green	Green
LRTI and Influenza	Yellow	Green	Light Green	Yellow	Orange
OSA	Orange	Red	Red	Yellow	Orange
Cystic Fibrosis	Yellow	Red	Red	Red	Orange
PAD	Red	Red	Red	Red	Red
ILD/Sarcoidosis	Red	Red	Red	Red	Red
Tuberculosis	Red	Red	Red	Red	Red
Bronchiectasis	Red	Red	Red	Yellow	Red
Other	Red	Red	Red	Red	Red

Key	Fit
Green	Very Well/Low Risk of Assessment/High Risk of No Assessment
Light Green	Well/Some Risk of Assessment or No Assessment
Yellow	Somewhat/Some Risk of Assessment/Low Risk of No Assessment
Orange	Not Really/Some Risk of Assessment/High Risk of No Assessment
Red	None/High Risk of Assessment/Low Risk of No Assessment

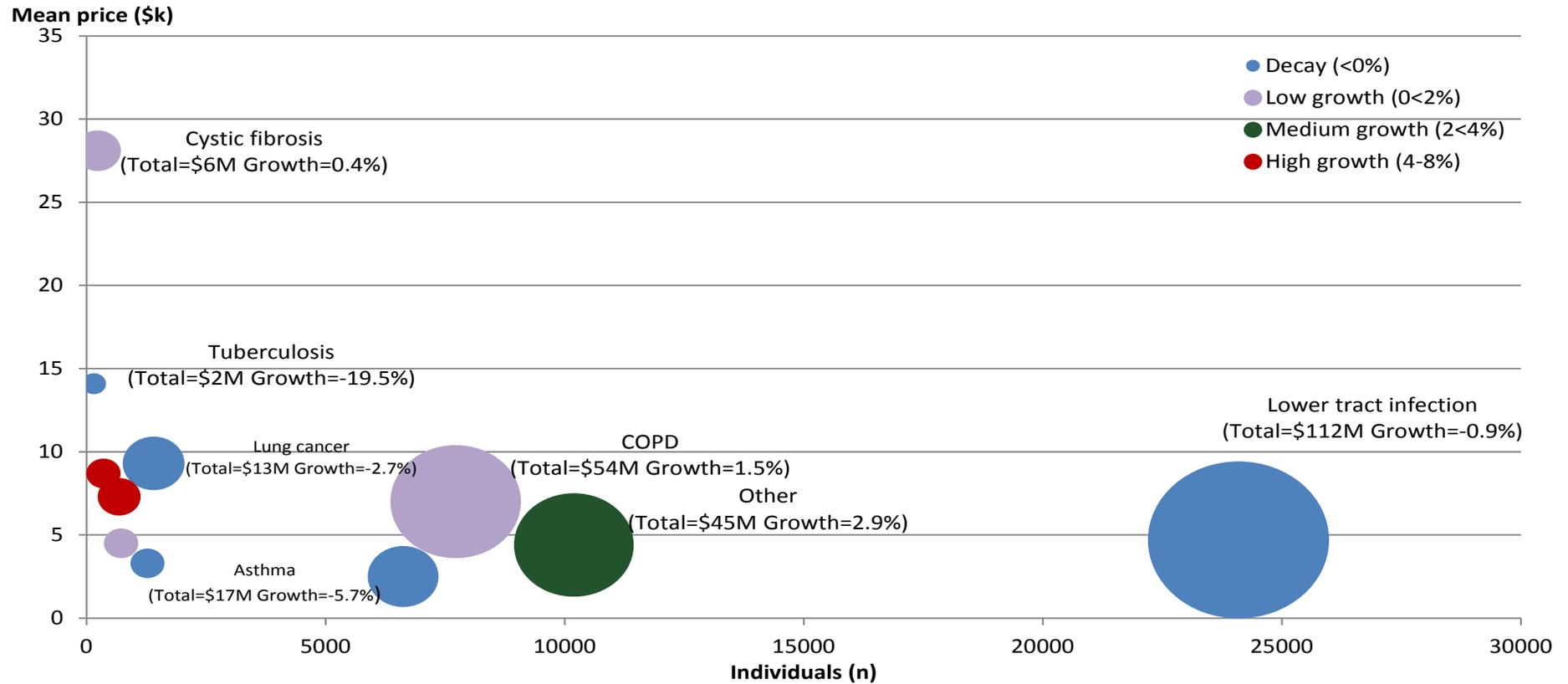
Source: 2013 NHC Executive Appraisal

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

	Total Price (\$M)	Mean Price (\$k)	Individuals (n)	Mean growth (%)	Discharges (n)	30 Day Acute Readmission (%)	2010 Mortality (n)	2010 Years of Life Lost (YLL)	Time in Care (Years)
<b>Tuberculosis</b>	2	14.1	150	-19.5	185	16.8	17	261	7
<b>Obstructive Sleep Apnoea</b>	3	4.5	721	0.3	736	0.8	11	328	4
<b>ILD/Sarcoidosis</b>	3	8.7	352	6.1	454	12.6	156	2,110	7
<b>Pulmonary Artery Disease</b>	4	3.3	1,273	-0.8	1,421	7.6	39	730	10
<b>Bronchiectasis</b>	5	7.3	682	4.5	1,065	17.4	94	1,560	16
<b>Cystic Fibrosis</b>	6	28.1	229	0.4	568	14.1	8	421	15
<b>Lung Cancer</b>	13	9.3	1,401	-2.7	1,908	15.3	1,622	29,828	27
<b>Asthma</b>	17	2.5	6,619	-5.7	8,403	9.6	57	1,625	34
<b>Other Respiratory Disorders</b>	45	4.4	10,190	2.9	11,089	6.1	82	878	68
<b>COPD</b>	54	7	7,716	1.5	11,619	17.9	1,588	20,121	134
<b>Lower Resp Tract Infection /Influenza</b>	112	4.7	24,092	-0.9	28,261	9.3	554	5,537	270
<b>TOTAL</b>	<b>265</b>	<b>5.2</b>	<b>50,664</b>	<b>-0.3</b>	<b>65,709</b>	<b>10.6</b>	<b>4,228</b>	<b>63,397</b>	<b>592</b>

Source: 2013 NHC Executive analysis of 20010–2011/12 NMDS and 2010 National Mortality Collection

## Appendix 2: Respiratory 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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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 prioritisation and reprioritisation of interventions. They do this through a range of evidence-based reports tailored to the nature of the decision required and time-frame within which decisions need to be made.

Citation: National Health Committee. 2013. Strategic Overview: Respiratory Disease in New Zealand (Working Draft). Wellington: National Health Committee.

Published in December 2013 by the National Health Committee  
PO Box 5013, Wellington, New Zealand

This document is available on the National Health Committee's website:  
<http://www.nhc.health.govt.nz/>

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