Priorities for Mäori and Pacific Health:

Evidence from epidemiology

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Foreword

This report presents the results of a study of the burden of disease experienced by Mäori and Pacific peoples in New Zealand. It builds on the New Zealand Burden of Disease Study carried out by the Ministry of Health in 1999, and focuses on inequalities in the distribution of the disease and injury burden between major ethnic groups in New Zealand.

The study was carried out primarily to inform work undertaken by the Ministry of Health on inequalities in health, the Mäori Health Strategy and the Pacific Health and Disability Action Plan. As with health policy in general, each of these major strategies requires prioritisation of health issues so that health gains can be maximised for the resources available. This report presents an epidemiological approach to prioritising health issues among Mäori and Pacific peoples, based on the burden of disease, its modifiability, and the contribution of specific causes of the burden to ethnic inequalities in health.

This report is intended to serve as a resource for a wide range of users, including policy analysts, public health workers, health service funders and providers, community groups and all others with an interest in ethnic inequalities in health. Comments should be sent to Public Health Intelligence, Public Health Directorate, Ministry of Health, PO Box 5013, Wellington.

Don Matheson
Deputy Director-General
Public Health Directorate

Acknowledgements and Disclaimer

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Executive Summary

This report presents the results of a study of the burden of disease experienced by Mäori and Pacific peoples in New Zealand, extending the New Zealand Burden of Disease Study reported in *Our Health Our Future: The Health of New Zealanders 1999* (Ministry of Health 1999a) and in more detail in a separate report (Ministry of Health 2001a).

The study was designed as an epidemiological approach to defining priority health issues among Mäori and Pacific peoples in New Zealand, and aims to inform the Ministry of Health's work on reducing inequalities in health, as well as the Mäori Health Strategy and the Pacific Health and Disability Action Plan, currently under development within the Ministry of Health.

Previous work in New Zealand to develop health goals and targets has used mortality, morbidity and disability statistics to identify priority health issues in relation to overall health impact. Few tools have been available to develop combined measures from these statistics. This study uses disability adjusted life years (DALYs), calculated according to the methodology proposed in the Global Burden of Disease study (Murray and Lopez 1996), to develop a unitary scale of disease burden to help rank health issues among Mäori and Pacific peoples.

DALYs were calculated by combining the number of years of life lost by each ethnic group (as a result of fatal diseases and injuries) with the equivalent number of years lost to disability adjusted for severity (as a result of non-fatal diseases and injuries). One DALY thus represents one year of *healthy* life lost. DALYs were calculated for approximately 85 diseases and injuries, and for eight selected risk factors – those for which reliable recent prevalence data was available, and for which solid evidence exists for causality with respect to fatal and/or non-fatal health outcomes.

DALYs were calculated using 1996 and 1997 data for Pacific peoples (because of small numbers) and 1996 data alone for Mäori and European/Other ethnic groups. Data on fatal outcomes was taken from mortality statistics compiled by the New Zealand Health Information Service (NZHIS). Data on non-fatal outcomes were aggregated from hospital discharge data, cancer registrations, the 1996–97 New Zealand Health Survey (Ministry of Health 1999b) and other sources. Risk factor prevalence information was taken from the 1996–97 New Zealand Health Survey, the 1997 National Nutrition Survey (Ministry of Health 1999c), and other sources. Modelling was used to estimate missing data, particularly among Pacific peoples.

The total annual health loss in 1996 was estimated to be 80,555 DALYs among Mäori (age-standardised rate 197 per 1000) and 23,187 DALYs among Pacific peoples (169 per 1000). In comparison, European/Other populations lost 439,387 DALYs (113 per 1000). Inequality in age-specific male and female rates of DALY loss peaked in the 45–64 age group among both Mäori and Pacific peoples.

Cardiovascular diseases made the largest contribution to health loss in Mäori and Pacific populations, followed by cancers. Ischaemic heart disease was the leading individual disease cause of DALYs lost among Mäori males and females and Pacific males. Smoking was the leading risk factor cause of DALYs lost among Mäori males and females and Pacific males. Diabetes was the leading risk factor and individual disease cause of DALYs lost among Pacific females.

DALYs were then adjusted for potential modifiability. On a scale combining individual diseases and risk factors, smoking was the leading cause of modifiable DALYs lost by Pacific males and Mäori males and females, while diabetes was the leading cause of modifiable DALYs lost by Pacific females. These rankings were retained after further adjusting for contribution to relative inequality, with the exception of Pacific males, among whom ischaemic heart disease rather than smoking made the greatest contribution to equity-adjusted modifiable DALYs lost.

The burden of disease method used in this report has limitations due to uncertainties in the data and disability weights, and the reductionist epidemiological framework used. This approach remains valid, however, as one contribution to the process of identifying key health issues to be addressed to reduce the health disparities between Mäori and Pacific peoples and other ethnic groups in New Zealand.

1 Introduction

The Ministry of Health has a statutory responsibility to advise the Government on policies to reduce health inequalities, including those experienced by Mäori and Pacific peoples in New Zealand (King 2000). To achieve this objective, the Ministry has initiated a process to identify the causes of health inequalities that should be addressed as a priority. This report provides an epidemiological input to this process by ranking diseases, injuries and risk factors in terms of their relative contribution to the overall health inequality experienced by Mäori and Pacific peoples, and their potential for change.

Identification of priority health issues

International efforts to identify particular health issues as national targets for action, along with benchmarks against which progress may be measured, began in 1981 with the World Health Organization's *Global Strategy for Health for All by the Year 2000* (WHO 1981). WHO called on member countries to undertake health goal and target setting as the framework for strategic planning to improve health. This approach was endorsed as a way of introducing strategic management to health policy in an era characterised by concern for health expenditure, and at a time when many governments were withdrawing from delivery of health services.

In response to the *Global Strategy for Health for All by the Year 2000*, several rounds of health goal and target setting occurred in New Zealand: ten *New Zealand Health Goals and Targets* were released by the then Minister of Health, the Hon Helen Clark, in 1989 (Minister of Health 1989); *A Strategic Direction to Improve and Protect the Public Health* was released by the Public Health Commission in 1994 (Public Health Commission 1994); and *Strengthening Public Health Action* was released by the Ministry of Health in 1997 (Ministry of Health 1997a).

The criteria for prioritising health issues have undergone little change throughout these successive iterations. In particular, each incarnation has singled out the impact of a health issue as 'an important cause of death, disease, or chronic disability' as a key criterion for prioritisation (Beaglehole and Davis 1992; Public Health Commission 1994, Ministry of Health 1997a).

Despite recognising the importance of health impact, those setting health goals and targets had – until recently – few tools at their disposal to combine the mortality, morbidity and disability components of health impact into a unitary scale to facilitate ranking. An approach to this problem of integrating multiple outcomes was proposed in the Global Burden of Disease study by Murray and Lopez (1996). This approach employs a time-based summary measure of population health that falls within the general category known as 'health gap' measures. The aim is to estimate the impact (social burden) of diseases and injuries or risk factors in terms of their associated loss of years of healthy life. Non-fatal health states are assigned values (disability weights) based on social preference for these states. By combining these weights with estimates of the incidence and duration of each state, the number of years 'lost' to disability (adjusted for severity) can be calculated. When combined with the years of life lost to fatal outcomes of the disease (or risk factor), the number of disability adjusted life years (DALYs) lost can be calculated for each disease or risk factor.

This 'burden of disease' approach was first used in New Zealand in 1999. Key results from the New Zealand Burden of Disease Study were published in *Our Health Our Future: The Health of New Zealanders 1999* (Ministry of Health 1999a), and more detailed results have since been published in a separate report (Ministry of Health 2001a). The results were used as a basis for the identification of priority health issues for the New Zealand Health Strategy (King 2000; see also Ministry of Health 2001b).

The current report provides more detailed information on the contributions of specific causes of disease and injury to the overall inequalities in disease burden experienced by Mäori and Pacific peoples in New Zealand, and applies this information to the prioritisation of health issues for these ethnic groups.

Inequalities in health affecting Mäori and Pacific peoples

Evidence that the health experience of New Zealanders is sharply divided along ethnic lines has been steadily accruing over the last 20 years. A clear pattern has emerged demonstrating poorer health among Mäori compared with non-Mäori (Pomare et al 1995). More recently, research has shown that Pacific peoples also experience poorer health than European/Other New Zealanders (Ministry of Health 1999a).

The unequal position of Mäori health results from a combination of factors (National Health Committee 1998), including poorer social and economic status; the impact of discrimination (including institutional and personal racism (Jones 2000)); higher levels of behavioural risk factors, such as smoking; and lower access to or effectiveness of some health services (Pomare and de Boer 1988). Significant interrelationships exist among these factors, and a fuller understanding of the determinants of Mäori health continues to evolve.

Factors impacting on the health of Pacific peoples are less well studied but are likely to be similar to those affecting Mäori. Poorer social and economic circumstances are likely to account for a substantial proportion of excess ill health affecting Pacific peoples (Ministry of Health 1997b).

In a paper developed for the National Health Committee, Woodward and Kawachi identified four major arguments in favour of reducing health inequalities due to social, cultural and economic factors (Woodward and Kawachi 1998):

- Inequalities in health are inherently unfair, especially in circumstances where personal responsibility is least relevant. The Treaty of Waitangi places further emphasis on the health of Mäori (Durie 1998).
- Reduction in health inequalities benefits everyone, largely because the conditions that lead to health inequalities are detrimental to all society, but also because some consequences of health inequalities have obvious spill-over effects (for example, infectious diseases).
- Health inequalities are largely avoidable.
- Interventions to reduce health inequalities may be cost-effective (although further information on this issue is required).

In response to evidence of the effects of social inequalities on the health of Mäori and Pacific peoples, the Ministry of Health is developing a Mäori Health Strategy and a Pacific Health and Disability Action Plan under the umbrella of the New Zealand Health Strategy (King 2000). To assist in the development of these strategies, the Ministry of Health has initiated a process to identify the health issues affecting Mäori and Pacific peoples that should receive priority policy attention. The epidemiological analysis reported here, describing the burden of disease experienced by Mäori and Pacific peoples, is one input to this process.

2 Method

The burden of disease approach used in this study attempts to make a comprehensive estimate of the impact of disease and injury on the population, in terms of the burdens of premature mortality and disability adjusted for severity. The methods used in this study closely follow those described in *The Burden of Disease and Injury in New Zealand* (Ministry of Health 2001a), which should be consulted for details of data sources and methods.

Overview

Burden of disease calculations are complex, but the underlying principle is straightforward. The burden of disease estimate combines three types of information about the health of populations:

- the number of deaths, diseases or injuries occurring in the population (mortality and morbidity)
- the number of potential years of life lost by people who died (years of life lost to fatal outcomes of disease or injuries: YLL)
- the impact of disability resulting from non-fatal diseases or injuries (measured in terms of the equivalent number of years lost to disability adjusted for severity: YLD).

These three types of information are combined into a single measure of disease burden, the disability adjusted life year (DALY). The number of DALYs thus represents the total number of healthy years of future life lost due to deaths, diseases or injuries occurring in the population in one year – the annual disease burden. DALYs may also be presented as a rate per 1000 population, either for each age group or age standardised (for example, to Segi's world population) to enable comparisons of groups differing in age structure. Total DALY numbers and DALY rates have been discounted at 3% per annum for consistency with *Our Health Our Future: the Health of New Zealanders 1999* (Ministry of Health 1999a) and the Global Burden of Disease study (Murray and Lopez 1996). Discounting is intended to convert the future stream of health loss to its net present value.

Data sources

The data for these analyses has been drawn from the New Zealand Health Information Service (NZHIS). Data on fatal outcomes is taken from mortality statistics compiled from death certificates, post mortem reports, coroner's certificates and death registrations. The New Zealand Burden of Disease Study (NZBDS) dataset was used to provide data on non-fatal outcomes for Mäori and European/Other ethnicities (excluding Pacific). This data was aggregated from hospital discharge data, cancer registrations, the 1996–97 New Zealand Health Survey (Ministry of Health 1999b) and other sources (Ministry of Health 1999a).

Data on non-fatal outcomes among Pacific peoples was not contained within the NZBDS dataset, and time constraints did not permit intensive collection of Pacific morbidity data from other sources for this report. Rates of non-fatal outcomes among Pacific peoples were estimated by assuming that the ratio of morbidity to mortality among Mäori (for each cause and age/sex group) was similar to that among Pacific peoples:

$$YLD_{Pacific} = YLD_{Mäori} \times (YLL_{Pacific} / YLL_{Mäori})$$

This approach could not be used for conditions with low mortality (mainly musculoskeletal and mental health conditions). Instead, the Mäori YLD rates were used as best available estimates of the corresponding Pacific rates for these conditions. For these reasons, *the Pacific YLD and DALY estimates are less robust than those of the Mäori or European/Other ethnic groups*. This limitation should be borne in mind when using the results presented in this report.

All diagnoses were coded according to the International Classification of Diseases, 9th Revision, Clinical Modification, Australian version (ICD 9 CMA).

Mäori and European/Other (excluding Pacific) analyses used data collected on fatal and non-fatal outcomes occurring in 1996. The Pacific analyses used data for 1996 and 1997 combined, to compensate for the small Pacific population size in New Zealand. All Pacific results are, however, presented as annualised counts and rates.

Mäori and European/Other (excluding Pacific) DALY rates were calculated using the 1996 usually-resident census population as a denominator. The denominator for Pacific DALY rates was calculated by taking an average of the 1996 usually-resident census population and the 1997 population (projected by Statistics New Zealand). Averages were calculated for age- and sex-specific groups.

For both numerator and denominator data, ethnicity was coded using the 'prioritised output' system adopted by Statistics New Zealand. All individuals identifying as Mäori (including those also identifying with other ethnic groups) are coded as Mäori. All those identifying as Pacific, other than those also identifying as Mäori, were coded as Pacific. Only 'total ethnic group' (as opposed to 'sole ethnic group') analyses are reported here.

Calculating DALYs

The burden of disease is estimated by combining the years of potential life lost to fatal diseases and injuries with the equivalent years lost to disability adjusted for severity (non-fatal diseases and injuries). Both measures are built up using a disease-by-disease approach, for each age/gender/ethnic cell.

Years of life lost

Years of (potential) life lost (YLL) represent an estimate of the burden of fatal outcomes imposed by specific diseases and injuries, calculated by estimating the number of further years of life each person who died in 1996 (Mäori and European/Other) or 1996–97 (Pacific) could potentially have lived, had he/she lived a life of 'ideal' duration. This type of analysis therefore takes into account the 'prematurity' of death. The 'ideal' life expectancy at each age of death is taken from an international standard – in this case, the Coale and Demeny model lifetable West Level 26 for females and West Level 25 for males (selected to provide a life expectancy at birth of 80.0 and 82.5 years for males and females respectively, the difference reflecting the gender differential in survival potential).

Years of healthy life lost to disability

Equivalent years of life lost to disability adjusted for severity (YLD) was calculated for each condition included in the New Zealand Burden of Disease Study by estimating the incidence of each condition in New Zealand in 1996–97, the duration of disability associated with each incident case, and the average severity of the disability (differentiated by age, sex and ethnicity). A detailed description of this method and the data sources used is provided in a separate report (Ministry of Health 2001a). The disability weights were derived from social preferences for health states obtained in a Dutch study (Stouthard et al 1997), those used in the Australian Burden of Disease Study (Mathers et al 1999), and those used in the Global Burden of Disease study (Murray and Lopez 1996).

Disability-adjusted life years

The YLL and YLD results were combined into a single unit used to quantify disease (or risk factor) burden: the disability adjusted life year (DALY). The DALY therefore integrates both fatal and non-fatal health outcomes. One DALY represents one year of healthy life lost. For each condition, the burden of premature mortality (in years of life lost or YLL) is added to the equivalent years lost to disability adjusted for severity (YLD):

$$DALY = YLL + YLD$$

The numbers and rates of DALYs lost by each ethnic group differ slightly from those previously reported for Mäori and non-Mäori (Ministry of Health 2001a). This is because the estimates reported here have not been corrected for deaths from unknown causes, since the main purpose of the current analysis is to identify causes for priority attention.

The burden of disease associated with risk factors

Three criteria were used to select risk factors for inclusion in the study:

- the presence of a solid evidence base for the causal relationship of the risk factor to at least one major category of disease or injury
- the existence of sound relative risk estimates (estimates of the excess risk of the outcome of interest in those exposed to the risk factor compared to those not so exposed) from studies undertaken in New Zealand or in similar populations elsewhere
- the existence of recent ethnic-specific prevalence estimates for the risk factor in New Zealand.

The risk factor analysis was based on application of attributable fractions to the DALYs calculated for each disease outcome – that is, the proportion of each disease outcome that would not occur if the risk factor were to be eliminated. Attributable fractions were calculated using standard population attributable risk methods, which combine the age-specific prevalence of the risk factor with the relative risk for the disease outcome.

The overall contribution of each risk factor was then calculated by adding together the contribution of the risk factor to each disease or injury outcome. Attributable fractions are not mutually exclusive: the contributions of different risk factors to disease burden are not independent of each other and cannot be added together (unlike the shares of the same risk factor across different diseases).

Several assumptions underlie the risk factor analysis. In the absence of data to the contrary, relative risk estimates for Mäori and Pacific peoples were assumed to be similar to those of the European/Other ethnic group. Risks were also assumed to be dichotomous – either present or absent (except in the case of smoking, where a category of 'ex-smoker' was introduced). In reality, risks tend to be continuously distributed. Recognising only two or three categories therefore loses some information, but was a necessary step in order to align prevalence and risk categories. Since current prevalences are used, no allowance is made for the time lag between exposure to a risk factor and the onset of the corresponding disease.

Estimates of the prevalences of risk factors in New Zealand were obtained from the 1996–97 New Zealand Health Survey (Ministry of Health 1999b), the 1997 National Nutrition Survey (Ministry of Health 1999c) and other sources. Prevalence of selected cardiovascular risk factors among Pacific peoples were obtained from the South Auckland Diabetes Project and the Samoan Ola Fa'autuata Project (Bell et al in press). The Pacific disease burden associated with inadequate fruit and vegetable consumption was not estimated because no robust data was available on fruit and vegetable consumption among Pacific peoples. Estimates of the relative risk of disease conditional on exposure to the risk factor were obtained through a systematic review of the scientific literature (Ministry of Health 1999a).

Modifiability-adjusted DALYs

The basic DALY analysis presents an estimate of the burden of disease – the size of health issues. But prioritisation must also take into account the potential *modifiability* of the disease burden through health sector interventions (including any mix of health promotion, disease prevention, treatment and rehabilitation), based on current knowledge. Estimates of the modifiability of each disease were informed by literature review and expert opinion, allowing in each case for resource realism and a time horizon of 10 years, and were rated simply as either:

- highly modifiable (burden potentially reducible by 50% or more)
- moderately modifiable (burden potentially reducible by 25–50%)
- slightly modifiable (burden potentially reducible by 10–25%).

Modifiability factors of 0.5, 0.25 and 0.125 were assigned to each condition (disease, injury or risk factor) as appropriate. The modifiability multipliers were then applied to the DALY estimates to rank conditions in terms of the scope each provides for health gain (in terms of 'modifiable DALYs'). The modifiable DALYs estimated for individual diseases and risk factors were ranked on a single scale to permit comparison, despite the overlaps inherent in so doing.

Equity-adjusted DALYs

Inequality in the distribution of DALYs among ethnic groups was assessed from the age-standardised DALY rate ratios (calculated by dividing the DALY rates of Mäori and Pacific peoples by those of European/Other ethnic groups) for each disease. Standardised prevalence rate ratios were used for risk factors, as these provide a more direct measure of exposure.

The 'equity gain' dimension[1] was contrasted with the 'health gain' dimension by graphically plotting the age-standardised DALY rate ratio (or prevalence rate ratio) for Mäori and Pacific males and females against the corresponding modifiable DALY rate for each condition. This analysis reflects the reality that equity and health may need to be traded off against each other.

In addition to this analysis, equity and health-gain dimensions were combined into a composite index using an 'impact share' model. The impact share model takes into account both the degree of variation in the distribution of the burden associated with each condition between ethnic groups, and the extent to which that condition contributes to the total difference in DALYs between the groups. The model (formally equivalent to a population attributable risk) used to calculate the equity adjuster was:

$$\text{Equity Adjuster} = p\,(RR - 1) / [1 + p\,(RR - 1)]$$

where RR is the age-standardised DALY rate ratio (diseases and injuries) or prevalence rate ratio (risk factors); and p is the proportion of the total difference between Mäori or Pacific and European/Other standardised DALY rates for all causes combined accounted for by the condition of interest.

[1] The term 'equity' is used here for consistency with international practice. We recognise that 'equality' may be considered a more accurate descriptor as it is free from the connotation of fairness or social justice inherent in 'equity'.

For each condition, the equity adjustor was applied to the corresponding age-adjusted, modifiable DALY rate. The resulting Mäori and Pacific equity-adjusted modifiable DALY rates provide a basis for ranking conditions (ie, diseases, injuries or risk factors) in terms of their potential to contribute to Mäori and Pacific health *and* equity gain.

3 Results

The total health loss sustained by Mäori in New Zealand in 1996 was estimated to be 80,555 DALYs, a crude rate of approximately 147 per 1000 and an age-standardised rate of approximately 197 per 1000 (using Segi's world population as the reference population). The annual health loss sustained by Pacific peoples in New Zealand, averaged from 1996 and 1997, was estimated to be 23,187 DALYs, a crude rate of approximately 126 per 1000 and an age-standardised rate of approximately 169 per 1000. The European/Other ethnic group lost 439,387 DALYs in 1996, a crude rate of approximately 150 per 1000 and an age standardised rate of approximately 113 per 1000. The age-standardised Mäori and Pacific DALY rates were, respectively, 75% and 50% greater than the age-standardised DALY rate for the European/Other ethnic group (see Table 1).[2]

Of the total DALYs lost by each ethnic group, 56% represent fatal outcomes (YLL) and 44% non-fatal outcomes (YLD) among Mäori, identical to the respective shares among the European/Other ethnic group. The shares differed slightly among the Pacific ethnic group at 54% and 46% respectively.

The increased burden of disease experienced by Mäori and Pacific peoples in comparison with European/Others appears to be partly due to the younger age distribution of the lost DALYs. DALYs are age-dependent, so fatal or non-fatal outcomes occurring at a younger age accrue more DALYs than similar events occurring at older ages. Among both Mäori and Pacific populations there are two noticeable peaks in DALYs lost – firstly among children, and then in middle age. Among Mäori, 19% of DALYs are lost by children aged under 15, and a further 29% by middle-aged adults (45–64 years). Among Pacific peoples 18% of DALYs are lost by children under age 15 and 28% are lost between 45 and 64 years. In comparison, DALY loss among European/Other children aged under 15 is only 7% of the total, and 25% are lost by middle-aged adults. The bulk of DALY loss by the European/Other ethnic group (47%) occurs in old age (over 65).

These findings can be partly explained by the younger age distribution of the Mäori and, particularly, the Pacific ethnic groups. Age-specific comparisons between Mäori and European/Other ethnic groups show, however, that Mäori rates of DALY loss exceed those of European/Other ethnicity in each age group. The excess rates among Mäori were greatest among males, and peaked in the 45–64 age group among both males (120% excess) and females (118% excess). The peak excess rate of DALY loss among both Pacific females and males also occurred in the 45–64 age group, with an excess of 67% among Pacific females and 77% among Pacific males, in comparison with European/Other females and males respectively. In both ethnic groups the highest *absolute* age-specific rate of DALY loss was greatest among those aged 65 or older (759 per 1000 among Mäori and 773 per 1000 among Pacific peoples), as is also the case for the European/Other ethnic group. Full age-specific results are shown in Table 1.

[2] The numbers and rates of DALYs lost by each ethnic group differ slightly from those previously reported for Mäori and non-Mäori (Ministry of Health 2001a). This is because the estimates reported here have not been corrected for deaths from unknown causes, since the main purpose of the current analysis is to identify causes for priority attention.

Table 1: Age-specific and age-standardised DALY rates (per 1000)

Ethnic group	Sex	Age group					Total*
		0–14	15–24	25–44	45–64	65+	
Mäori	Female	72.4	94.2	103.7	322.3	730.9	180.6
	Male	81.0	109.2	126.1	406.2	799.4	213.0
	Total	76.8	101.6	114.4	363.3	759.3	196.8
Pacific	Female	20.3**	71.1	86.1	247.0	695.6	137.9
	Male	107.8**	79.9	100.6	325.8	883.2	200.5
	Total	65.4	75.5	93.0	285.9	773.4	169.2
European/Other	Female	49.3	79.6	70.8	148.1	491.3	106.8
	Male	49.5	79.4	67.1	184.4	518.5	118.6
	Total	49.4	79.5	69.0	166.2	503.1	112.7

* Age standardised to Segi's world population.
** Pacific age/sex specific rates, especially for children, are unstable because of small numbers.

Cardiovascular diseases accounted for the highest male and female rates of DALY loss due to any single disease group among Mäori and Pacific peoples. Cancers accounted for the second-highest male and female rates of DALY loss, again in both ethnic groups (Tables 2, 3 and 4).

Table 2: DALY burden, by disease groups: females

Disease group	Mäori			Pacific			European/Other		
	n	Rate per 1000	RR	n	Rate per 1000	RR	n	Rate per 1000	RR
Infection	1,773	7.2	1.9	226	3.9	1.1	9,190	3.7	1.0
Infant	3,493	11.8	1.5	122	1.2	0.2	6,386	7.7	1.0
Injury	3,086	10.9	1.5	644	7.1	1.0	11,076	7.1	1.0
Cancer	5,908	33.5	1.6	1725	24.9	1.2	46,871	20.6	1.0
Endocrine	3,414	18.0	4.7	1094	19.2	5.0	8,455	3.9	1.0
Cardiovascular	6,483	40.6	2.4	1789	30.2	1.8	54,564	16.8	1.0
Respiratory	3,469	15.9	1.7	746	10.1	1.1	16,942	9.5	1.0
Musculoskeletal	1,004	5.1	1.0	351*	5.1*	1.0	9,626	4.9	1.0
Neurosensory	1,434	8.4	1.2	559	8.9	1.3	19,379	6.9	1.0
Psychiatric	6,021	20.9	1.1	2063*	20.9*	1.1	28,920	19.2	1.0
Other chronic	1,887	8.3	1.2	351	6.4	1.0	14,338	6.6	1.0
Total	37,972	180.6		9671	137.9		225,747	106.9	

* The Pacific DALY burden for these disease groups is based on the respective Mäori DALY burdens, age adjusted.
Notes: For explanation of disease groups, see Appendix 3; RR = ratio of Mäori or Pacific to European/Others rate (rate ratio); rates are age-standardised to Segi's world population.

Table 3: DALY burden, by disease groups: males

Disease group	Mäori			Pacific			European/Other		
	n	Rate per 1000	RR	n	Rate per 1000	RR	n	Rate per 1000	RR
Infection	1,523	6.7	1.9	537	7.6	2.2	6,300	3.5	1.0
Infant	4,032	12.8	2.1	2,508	24.5	4.1	5,010	6.0	1.0
Injury	7,790	28.1	1.6	1,908	19.8	1.1	25,471	17.3	1.0
Cancer	5,131	33.0	1.5	1,538	28.7	1.3	44,492	21.7	1.0
Endocrine	3,358	19.0	4.0	836	16.7	3.5	8,865	4.8	1.0
Cardiovascular	9,156	59.2	2.2	2,541	48.0	1.8	57,278	26.7	1.0
Respiratory	3,829	19.2	1.8	946	18.2	1.7	18,511	10.9	1.0
Musculoskeletal	544	2.8	0.9	188*	2.8*	0.9	5,925	3.2	1.0
Neurosensory	1,823	10.9	1.4	576	10.4	1.4	15,376	7.5	1.0
Psychiatric	4,289	15.0	1.1	1,457*	15.0*	1.1	18,519	13.1	1.0
Other chronic	1,109	6.1	1.6	485	9.0	2.3	7,892	3.9	1.0
Total	42,584	212.8		13,517	200.5		213,639	118.6	

* The Pacific DALY burden for these disease groups is based on the respective Mäori DALY burdens, age adjusted.
Notes: For explanation of disease groups, see Appendix 3; RR = ratio of Mäori or Pacific to European/other rate (rate ratio); rates are age-standardised to Segi's world population.

Table 4: DALY burden, by disease groups: all persons

Disease group	Mäori			Pacific			European/Other		
	n	Rate per 1000	RR	n	Rate per 1000	RR	n	Rate per 1000	RR
Infection	3,296	6.9	1.9	763	5.7	1.6	15,490	3.6	1.0
Infant	7,525	12.3	1.8	2,631	12.8	1.9	11,396	6.8	1.0
Injury	10,876	19.5	1.6	2,552	13.4	1.1	36,547	12.2	1.0
Cancer	11,039	33.3	1.6	3,264	26.8	1.3	91,362	21.1	1.0
Endocrine	6,772	18.5	4.3	1,930	17.9	4.2	17,319	4.3	1.0
Cardiovascular	15,639	49.9	2.3	4,329	39.1	1.8	111,843	21.8	1.0
Respiratory	7,298	17.5	1.7	1,691	14.1	1.4	35,453	10.2	1.0
Musculoskeletal	1,548	4.0	1.0	539*	4.0*	1.0	15,552	4.0	1.0
Neurosensory	3,257	9.7	1.3	1,135	9.7	1.3	34,755	7.2	1.0
Psychiatric	10,310	18.0	1.1	3,520*	18.0*	1.1	47,440	16.1	1.0
Other chronic	2,996	7.2	1.4	836	7.7	1.5	22,230	5.3	1.0
Total	80,556	196.8		23,187	169.2		439,387	112.6	

* The Pacific DALY burden for these disease groups is based on the respective Mäori DALY burdens, age adjusted.
Notes: For explanation of disease groups, see Appendix 3; RR = ratio of Mäori or Pacific to European/other rate (rate ratio); rates are age standardised to Segi's world population.

Figures 1a to 1f show individual disease causes of DALY loss, ranked in order of age-standardised DALY rates. Ischaemic heart disease accounts for the highest rate of DALYs lost by Mäori males, Mäori females, and Pacific males. It accounted for 13% of DALYs lost by Mäori males, 9% of DALYs lost by Mäori females, 11% of DALYs lost by Pacific males, and 7% of DALYs lost by Pacific females. Diabetes (as a disease, not as a risk factor – that is, including only deaths and disability directly coded to ICD9 250) made the second largest contribution to rates of DALYs lost in all groups except Pacific females, among whom it was the leading disease cause. Road traffic injuries were a particularly important cause of DALYs lost among Mäori males, accounting for the fourth highest number of DALYs lost by this group. Cancers, in particular lung cancer and breast cancer, also accounted for high rates of DALYs lost among all ethnic groups.

Chronic disease risk factors account for much of the burden of disease, as shown in Figures 2a to 2f. Among those risk factors for which prevalence and relative risk data were available, tobacco smoking accounted for the highest rate of DALY loss among Mäori males, Mäori females and Pacific males. The contribution of diabetes as a risk factor was also very high, accounting for the highest rate of DALY loss among Pacific females and the second highest among Mäori males and females and Pacific males.

DALY rates were then adjusted for modifiability. Figures 3a to 3d show modifiable DALY rates for risk factors and individual diseases on the same chart. This ignores the overlap inherent in different levels of causation – for example, ischaemic heart disease makes a substantial contribution to the loss of DALYs attributed to smoking, and so on. This overlap should be borne in mind when interpreting or using these results. The major contribution of risk factors to the modifiable burden of disease (the scope for health gain) becomes clear from the ranking. Smoking, diabetes (as a risk factor – that is, including deaths and disability coded to other causes but attributable to diabetes), hypertension, high blood cholesterol and low physical activity all rank highly as contributors to the burden of disease. Obesity ranks less highly, however, because of its low modifiability (either through prevention or treatment).

The results of mapping equity and health gain dimensions as a grid are shown in Figures 4a to 4d. Equity is considered in a different way in the final set of figures (5a to 5d), which show the result of adjusting modifiable DALY rates according to the contribution of each condition (disease or risk factor) to overall inequality. The resulting 'equity-adjusted modifiable DALY' rates do not indicate any major changes in condition ranking, however, as can be seen by comparing these results with those for modifiable DALYs without equity adjustment (Figures 3a to 3d).

Figure 1a: Top 20 disease causes of DALYs lost: Mäori males

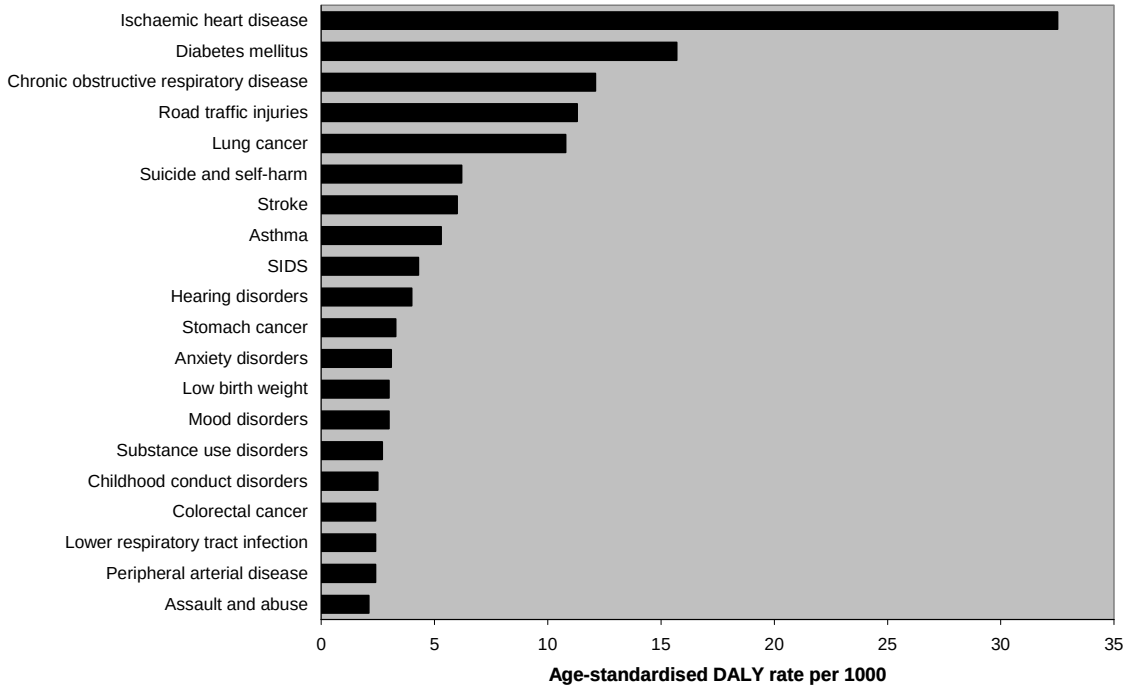


Figure 1b: Top 20 disease causes of DALYs lost: Mäori females

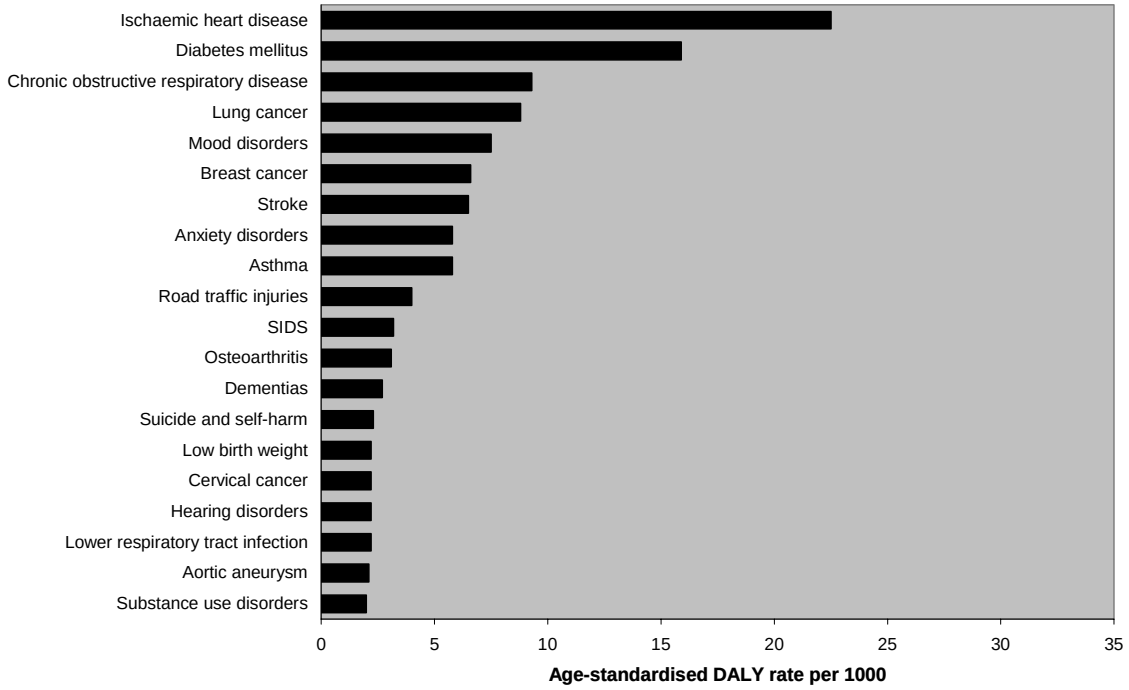


Figure 1c: Top 20 disease causes of DALYs lost: Pacific males

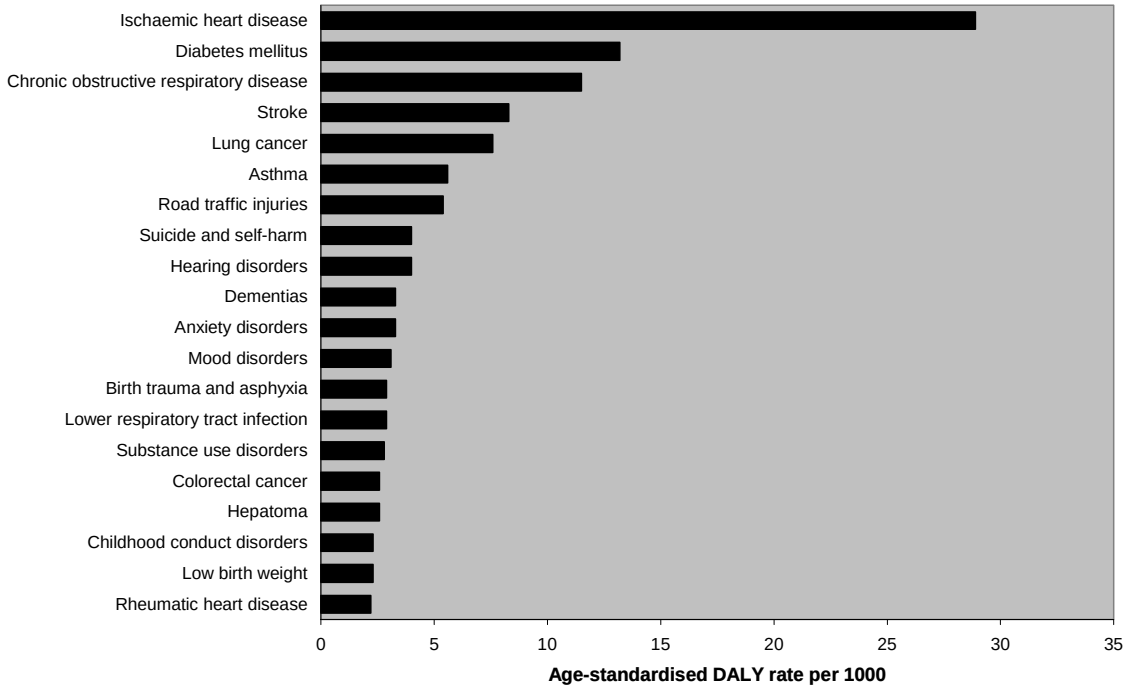


Figure 1d: Top 20 disease causes of DALYs lost: Pacific females

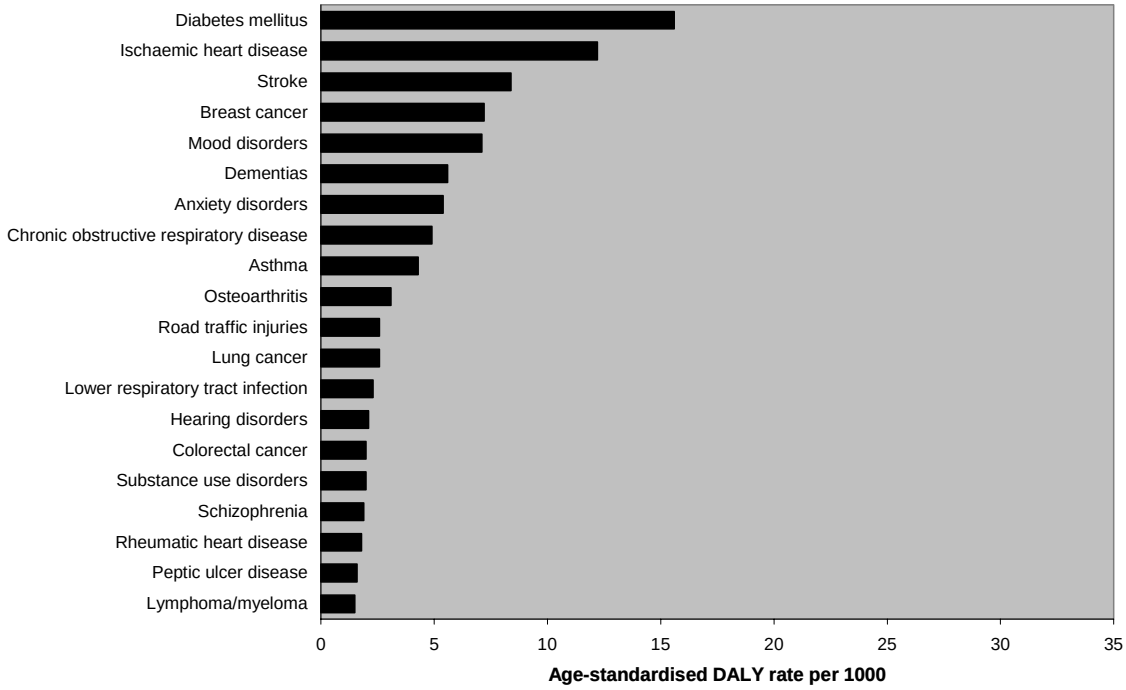


Figure 1e: Top 20 disease causes of DALYs lost: European/Other males

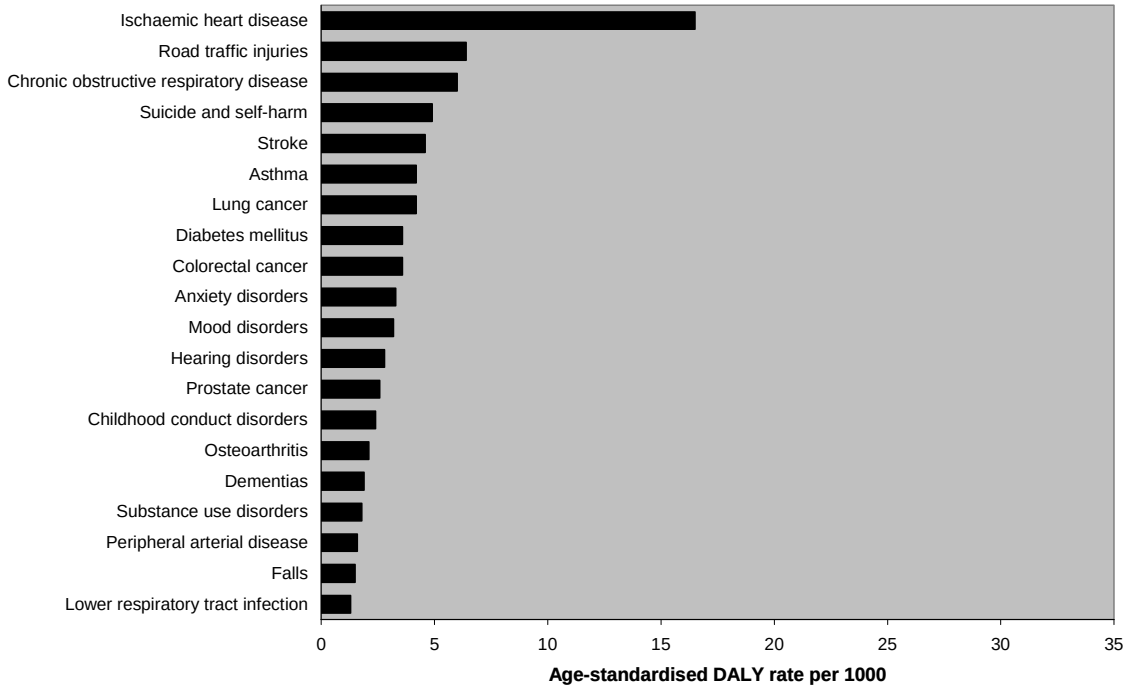


Figure 1f: Top 20 disease causes of DALYs lost: European/Other females

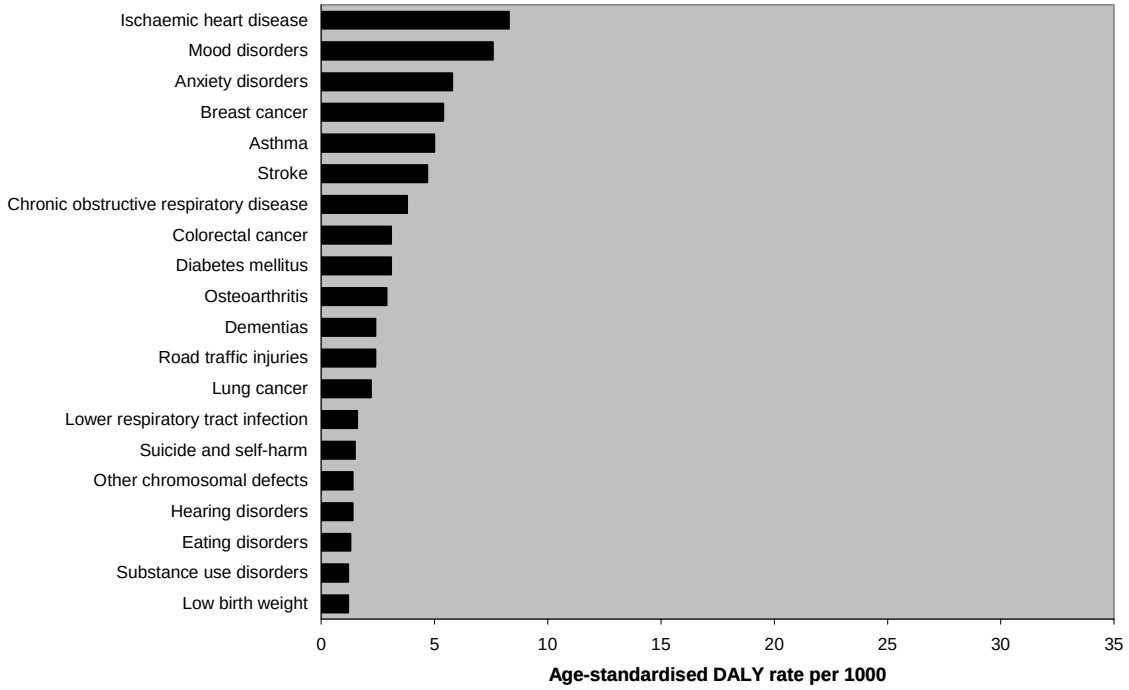


Figure 2a: Risk factor causes of DALYs lost: Mäori males

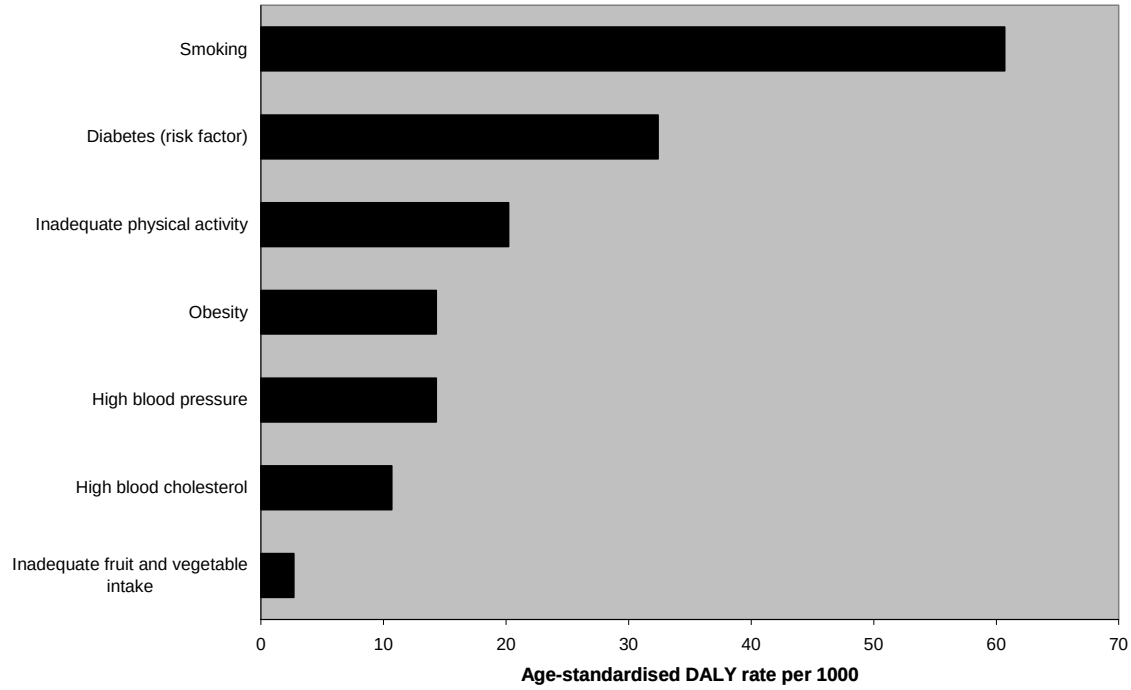


Figure 2b: Risk factor causes of DALYs lost: Mäori females

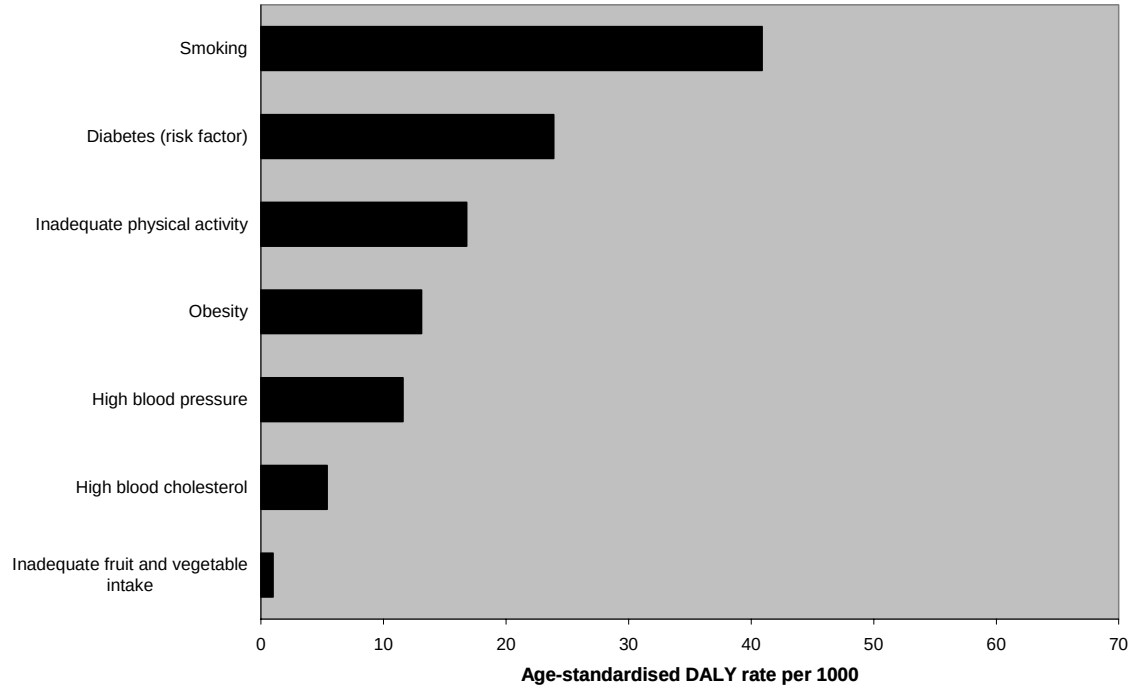


Figure 2c: Risk factor causes of DALYs lost: Pacific males

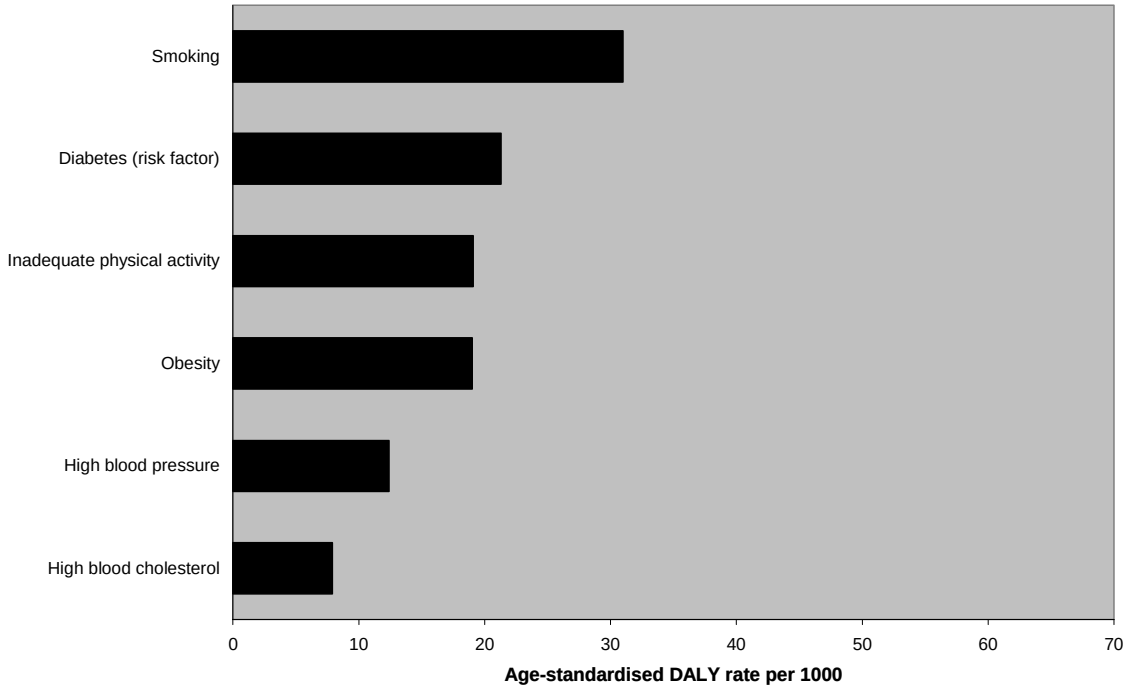


Figure 2d: Risk factor causes of DALYs lost: Pacific females

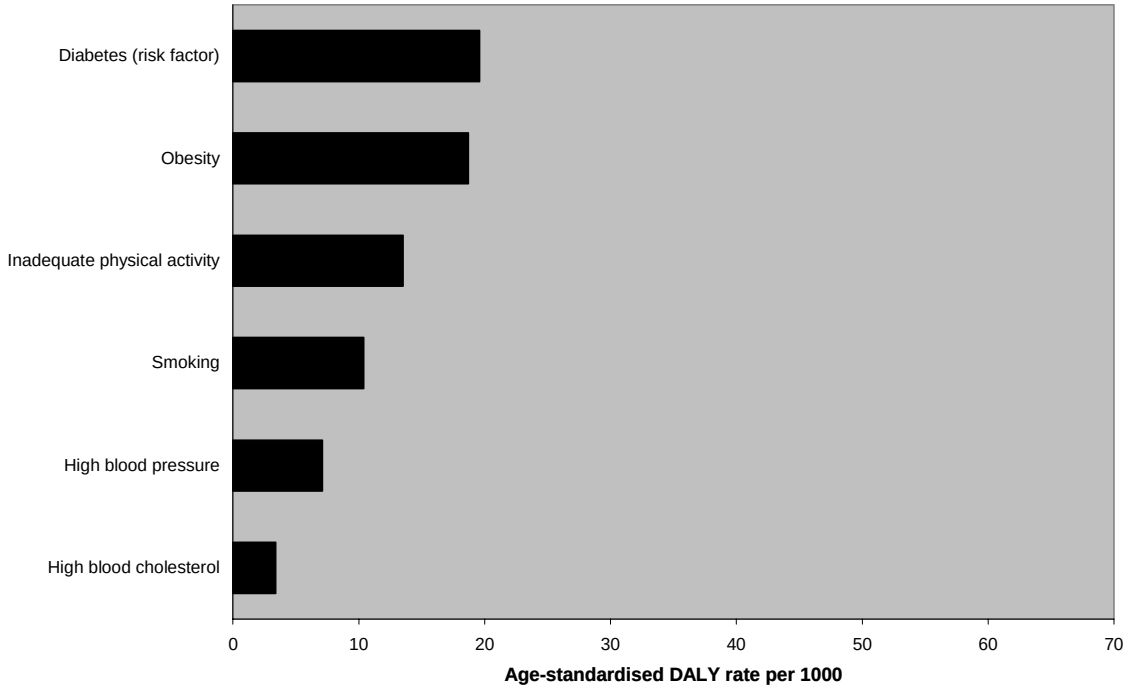


Figure 2e: Risk factor causes of DALYs lost: European/Other males

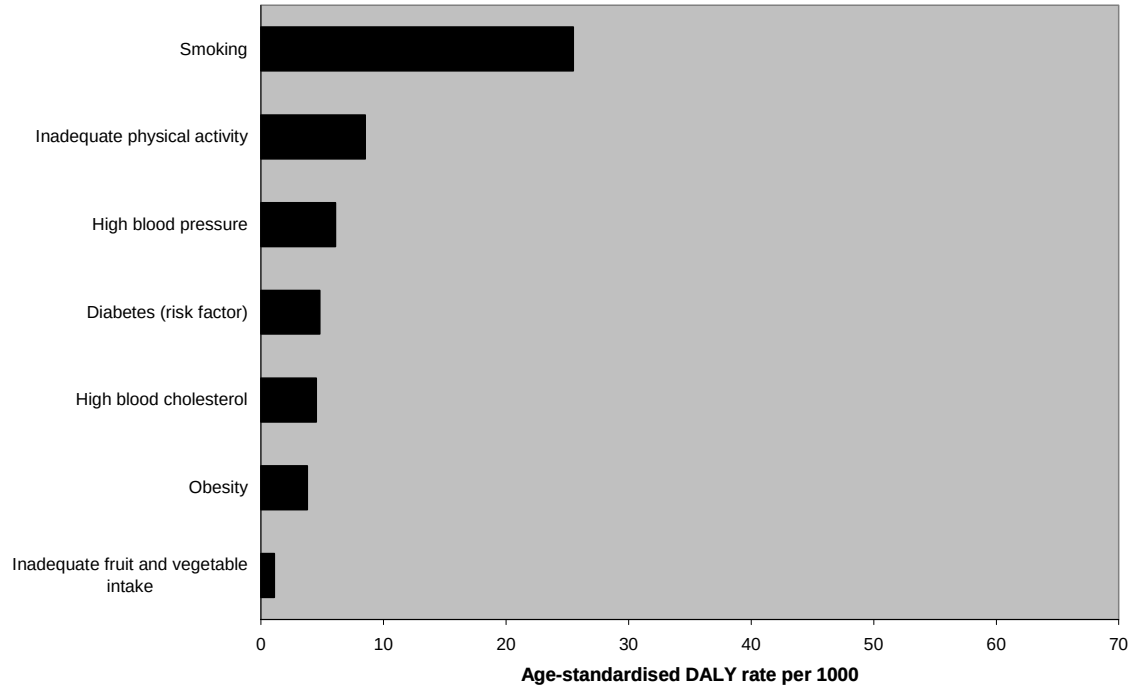


Figure 2f: Risk factor causes of DALYs lost: European/Other females

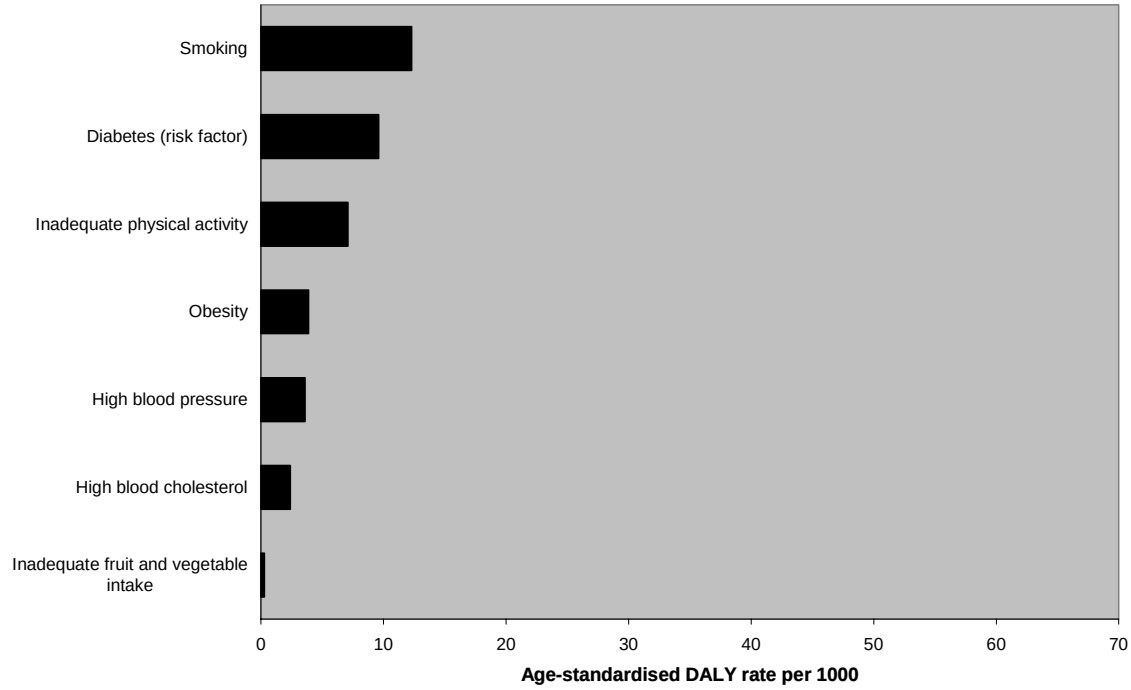


Figure 3a: Top 20 causes of modifiable DALYs lost: Mäori males

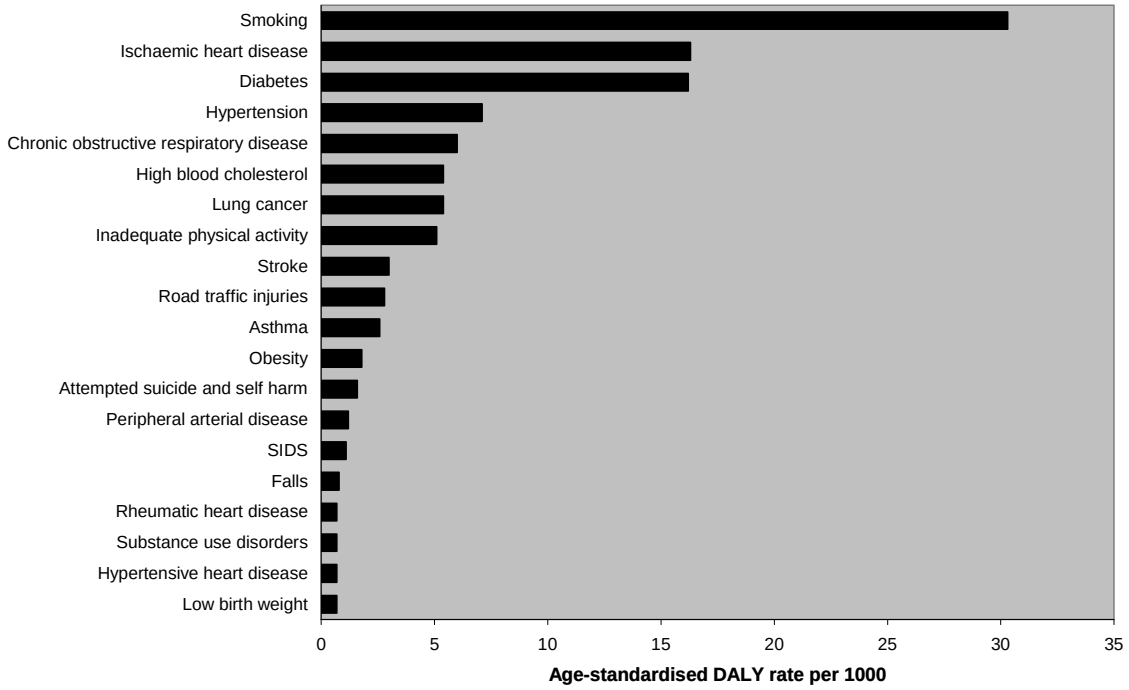


Figure 3b: Top 20 causes of modifiable DALYs lost: Mäori females

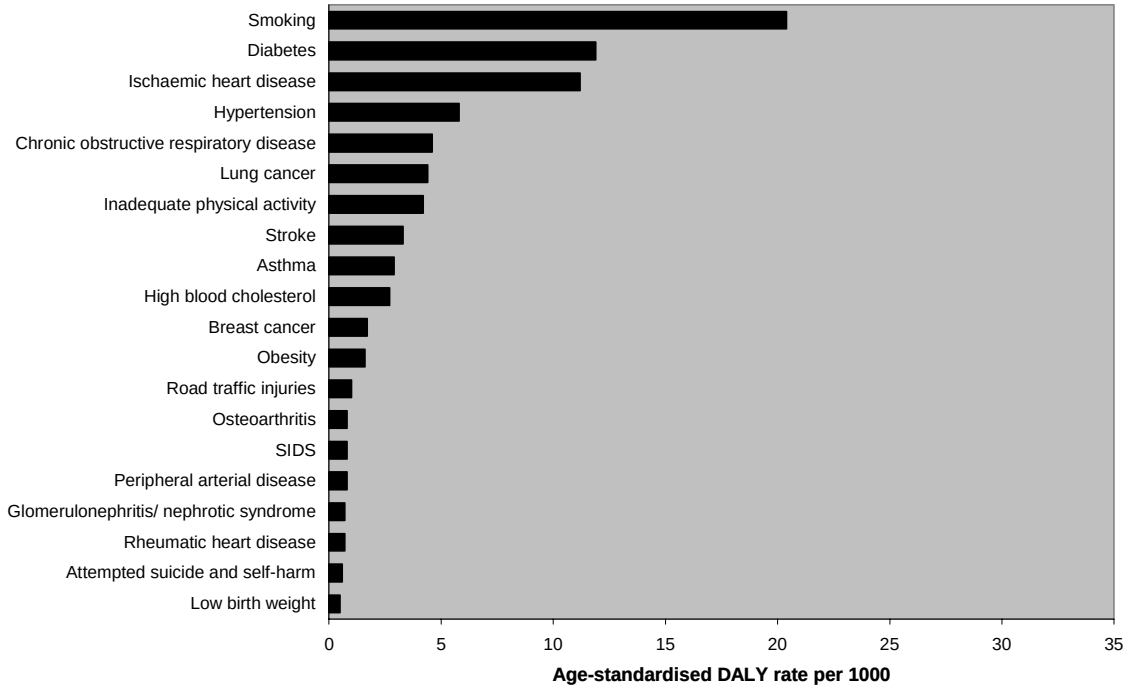


Figure 3c: Top 20 causes of modifiable DALYs lost: Pacific males

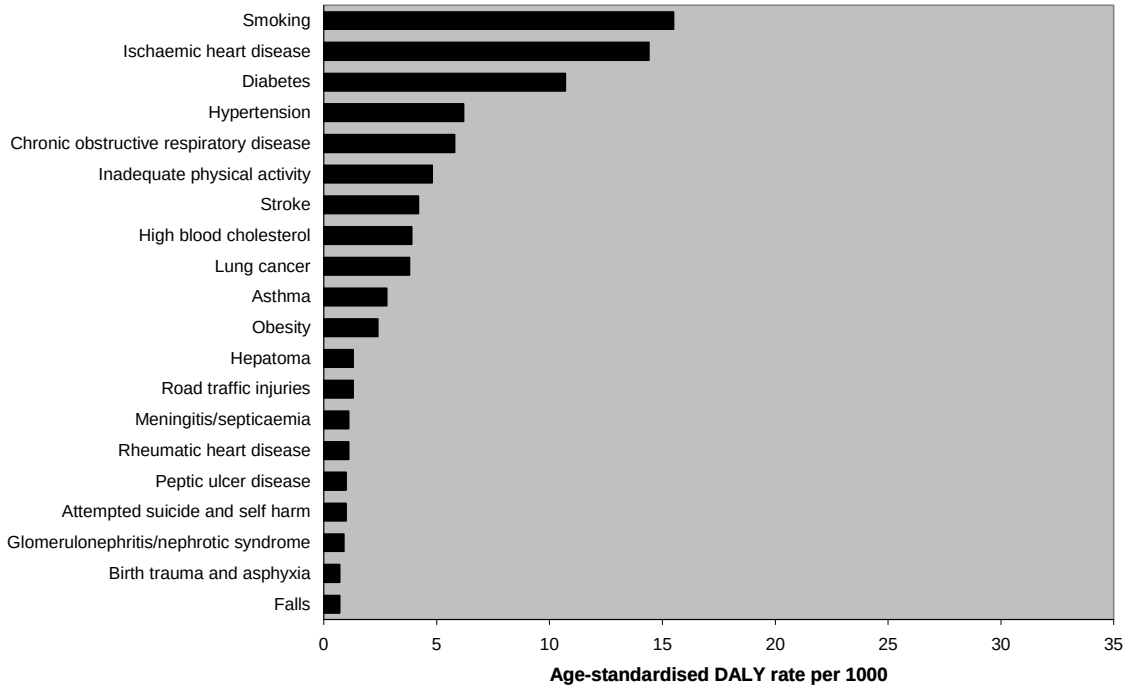


Figure 3d: Top 20 causes of modifiable DALYs lost: Pacific females

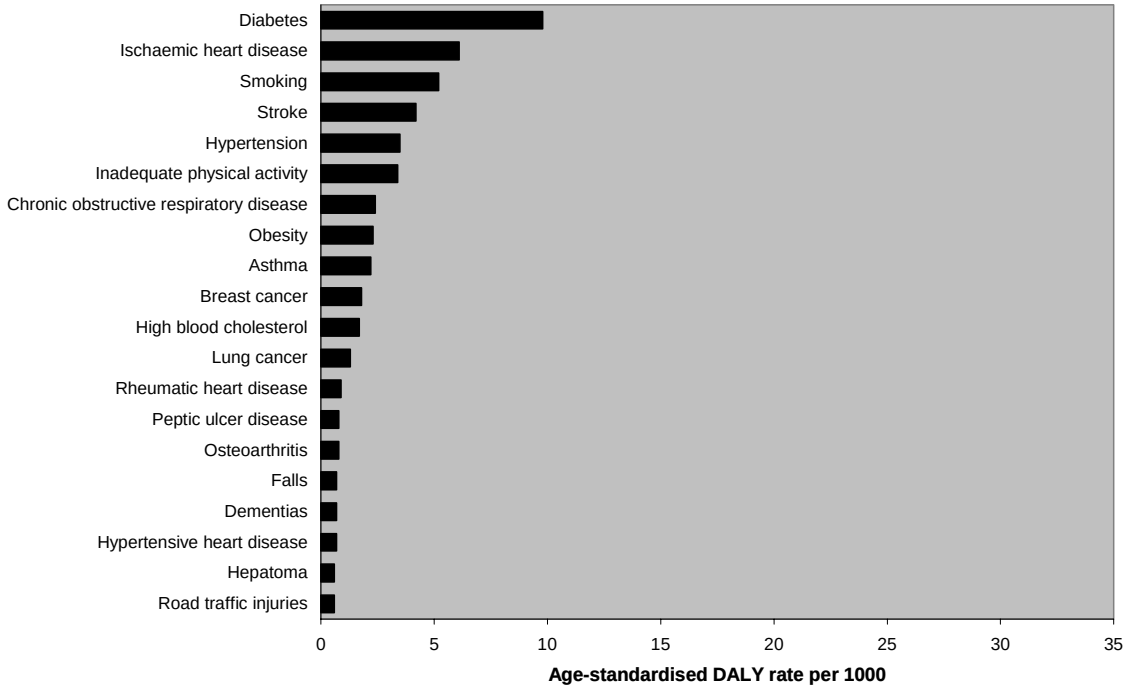
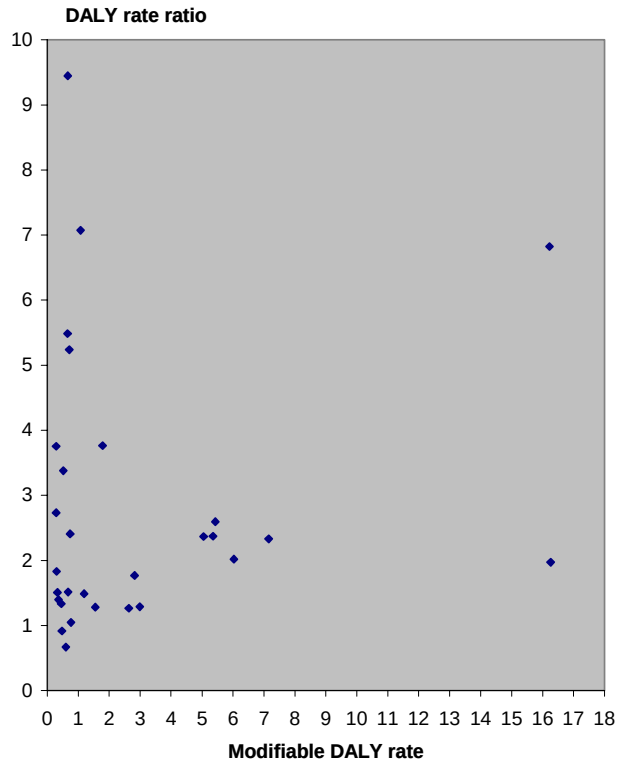
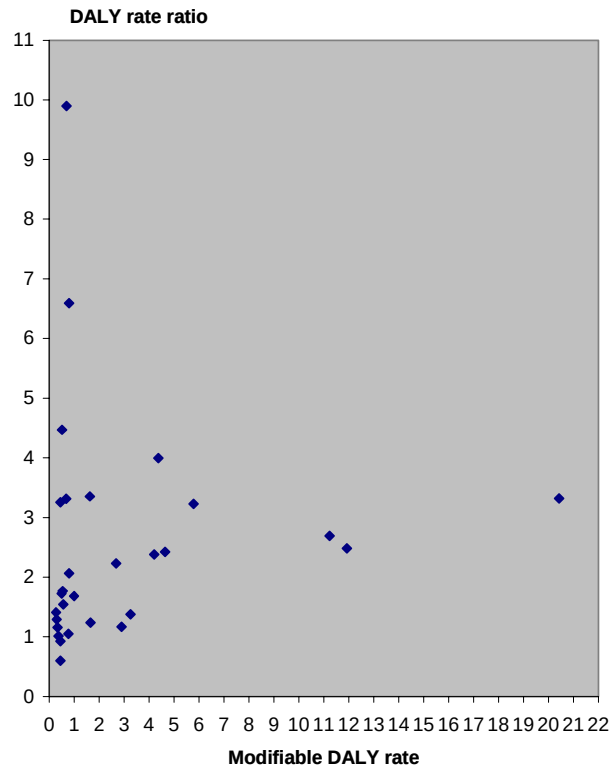


Figure 4a: Grid of equity versus health gain dimensions: Mäori males



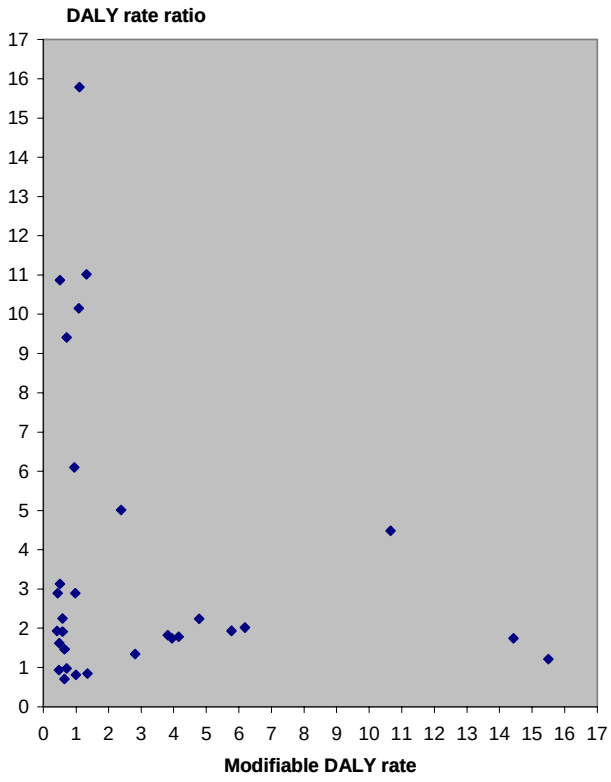
	Age-standardised modifiable DALY rate per 1000	Rate ratio
Birth trauma and asphyxia	0.3	3.8
Meningitis/septicaemia	0.3	2.7
Lower respiratory tract infection	0.3	1.8
Aortic aneurysm	0.3	1.5
Mouth and oropharyngeal cancer	0.4	1.4
Peptic ulcer disease	0.5	1.3
Osteoarthritis	0.5	0.9
Glomerulonephritis/nephrotic syndrome	0.5	3.4
Colorectal cancer	0.6	0.7
Hepatoma	0.7	5.5
Rheumatic heart disease	0.7	9.4
Substance use disorders	0.7	1.5
Hypertensive heart disease	0.7	5.2
Low birth weight	0.7	2.4
Falls	0.8	1.0
SIDS	1.1	7.1
Peripheral arterial disease	1.2	1.5
Attempted suicide and self-harm	1.6	1.3
Obesity	1.8	3.8
Asthma	2.6	1.3
Road traffic injuries	2.8	1.8
Stroke	3.0	1.3
Physical inactivity	5.1	2.4
High blood cholesterol	5.4	2.4
Lung cancer	5.4	2.6
Chronic obstructive respiratory disease	6.0	2.0
Hypertension	7.1	2.3
Diabetes	16.2	6.8
Ischaemic heart disease	16.3	2.0
Smoking [off scale – not drawn]	30.3	2.4

Figure 4b: Grid of equity versus health gain dimensions: Mäori females



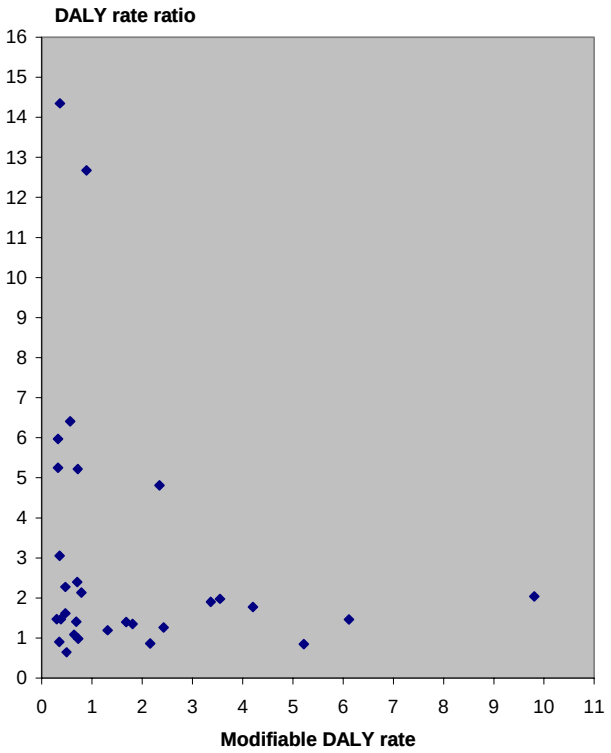
	Age-standardised modifiable DALY rate per 1000	Rate ratio
Lower respiratory tract infection	0.3	1.4
Meningitis/septicaemia	0.3	1.3
Dementias	0.3	1.2
Peptic ulcer disease	0.4	1.0
Hypertensive heart disease	0.4	3.3
Falls	0.5	0.9
Colorectal cancer	0.5	0.6
Substance use disorders	0.5	1.7
Aortic aneurysm	0.5	4.5
Low birth weight	0.5	1.8
Attempted suicide and self-harm	0.6	1.5
Glomerulonephritis/nephrotic syndrome	0.7	3.3
Rheumatic heart disease	0.7	9.9
Osteoarthritis	0.8	1.0
SIDS	0.8	6.6
Peripheral arterial disease	0.8	2.1
Road traffic injuries	1.0	1.7
Obesity	1.6	3.4
Breast cancer	1.7	1.2
High blood cholesterol	2.7	2.2
Asthma	2.9	1.2
Stroke	3.3	1.4
Physical inactivity	4.2	2.4
Lung cancer	4.4	4.0
Chronic obstructive respiratory disease	4.6	2.4
Hypertension	5.8	3.2
Ischaemic heart disease	11.2	2.7
Diabetes	11.9	2.5
Smoking	20.4	3.3

Figure 4c: Grid of equity versus health gain dimensions: Pacific males



	Age-standardised modifiable DALY rate per 1000	Rate ratio
Aortic aneurysm	0.4	1.9
SIDS	0.4	2.9
Osteoarthritis	0.5	0.9
Lymphoma/myeloma	0.5	1.6
Parkinson's disease	0.5	3.1
Hepatitis	0.5	10.9
Mouth and oropharyngeal cancer	0.6	2.3
Low birth weight	0.6	1.9
Colorectal cancer	0.6	0.7
Substance use disorders	0.7	1.5
Birth trauma and asphyxia	0.7	9.4
Falls	0.7	1.0
Glomerulonephritis/nephrotic syndrome	0.9	6.1
Peptic ulcer disease	1.0	2.9
Attempted suicide and self harm	1.0	0.8
Meningitis/septicaemia	1.1	10.1
Rheumatic heart disease	1.1	15.8
Hepatoma	1.3	11.0
Road traffic injuries	1.3	0.8
Obesity	2.4	5.0
Asthma	2.8	1.4
Lung cancer	3.8	1.8
High blood cholesterol	3.9	1.7
Stroke	4.2	1.8
Physical inactivity	4.8	2.2
Chronic obstructive respiratory disease	5.8	1.9
Hypertension	6.2	2.0
Diabetes	10.7	4.5
Ischaemic heart disease	14.4	1.7
Smoking	15.5	1.2

Figure 4d: Grid of equity versus health gain dimensions: Pacific females



	Age-standardised modifiable DALY rate per 1000	Rate ratio
Lower respiratory tract infection	0.3	1.5
Pancreatitis	0.3	6.0
Mouth and oropharyngeal cancer	0.3	5.3
Peripheral arterial disease	0.4	0.9
Aortic aneurysm	0.4	3.1
Hepatitis	0.4	14.3
Lymphoma/myeloma	0.4	1.5
Substance use disorders	0.5	1.6
Glomerulonephritis/nephrotic syndrome	0.5	2.3
Colorectal cancer	0.5	0.6
Hepatoma	0.6	6.4
Road traffic injuries	0.6	1.1
Falls	0.7	1.4
Dementias	0.7	2.4
Hypertensive heart disease	0.7	5.2
Osteoarthritis	0.7	1.0
Peptic ulcer disease	0.8	2.1
Rheumatic heart disease	0.9	12.7
Lung cancer	1.3	1.2
High blood cholesterol	1.7	1.4
Breast cancer	1.8	1.4
Asthma	2.2	0.9
Obesity	2.3	4.8
Chronic obstructive respiratory disease	2.4	1.3
Physical inactivity	3.4	1.9
Hypertension	3.5	2.0
Stroke	4.2	1.8
Smoking	5.2	0.8
Ischaemic heart disease	6.1	1.5
Diabetes	9.8	2.0

Figure 5a: Top 20 causes of equity-adjusted modifiable DALYs lost: Mäori males

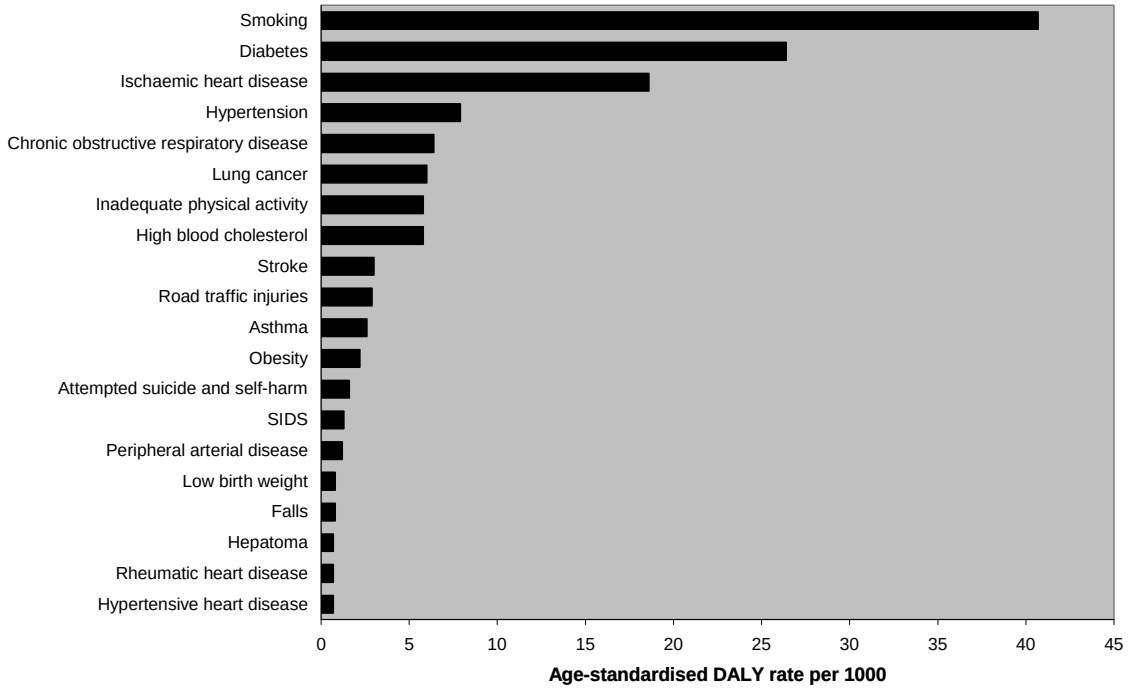


Figure 5b: Top 20 causes of equity-adjusted modifiable DALYs lost: Mäori females

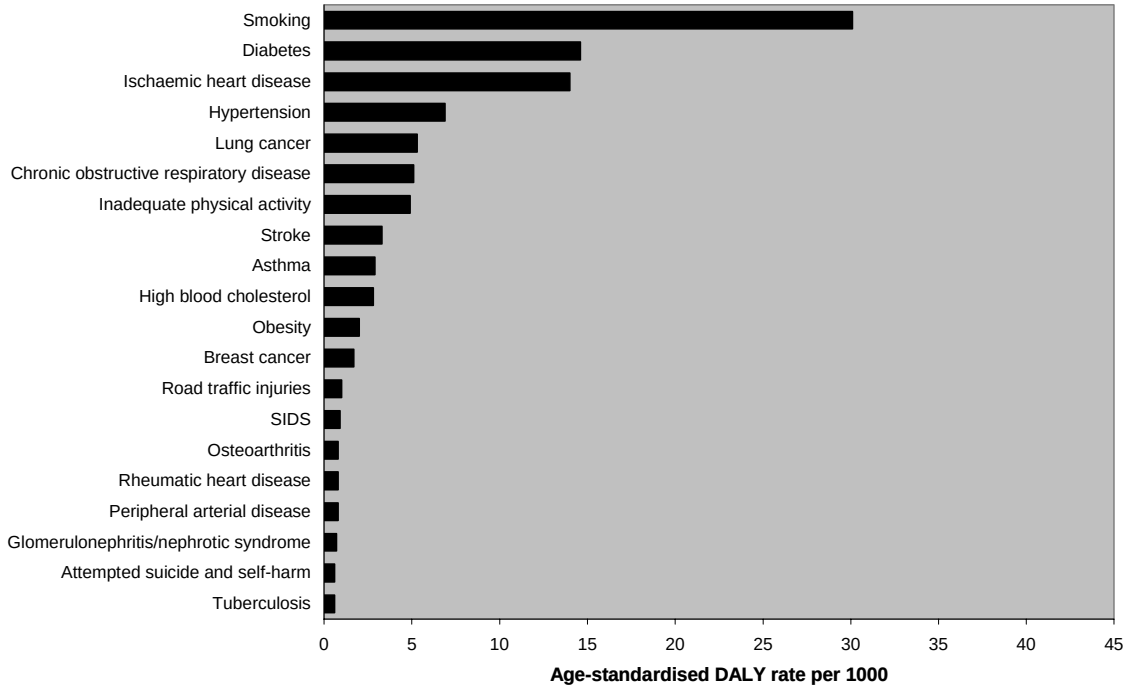


Figure 5c: Top 20 causes of equity-adjusted modifiable DALYs lost: Pacific males

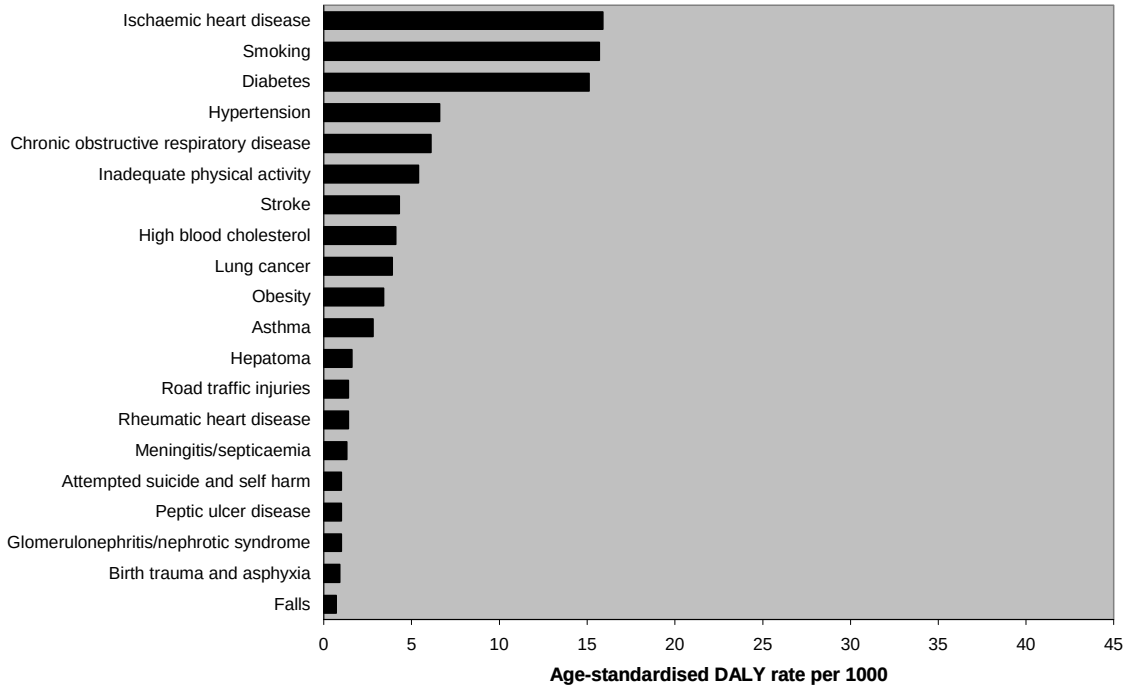
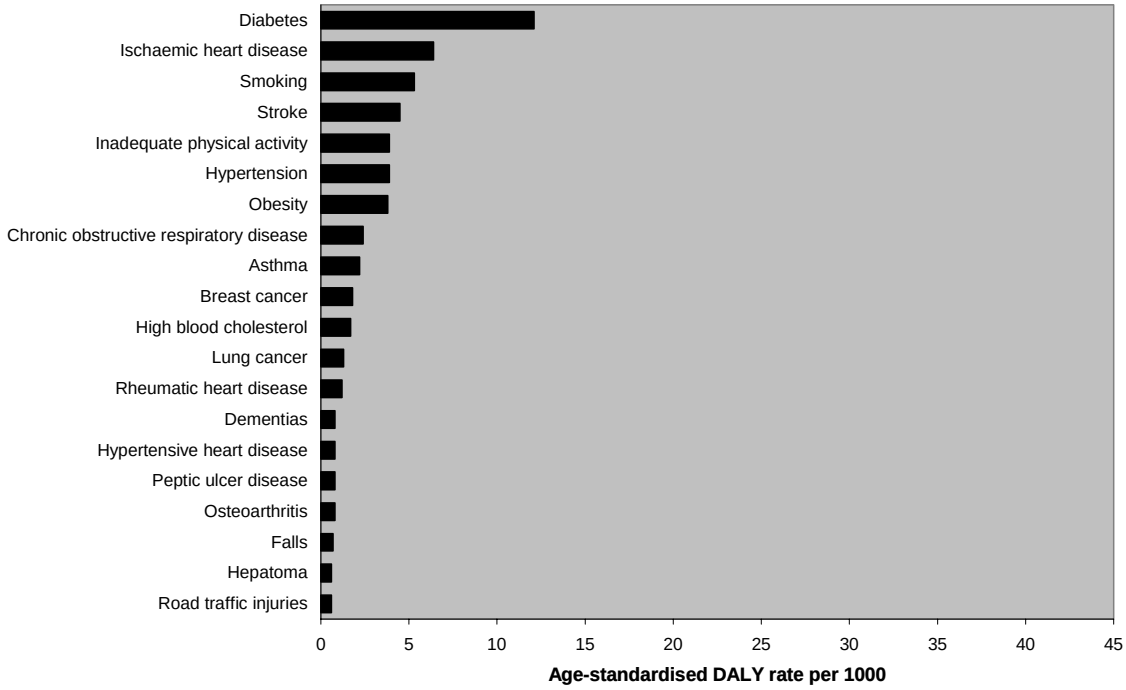


Figure 5d: Top 20 causes of equity-adjusted modifiable DALYs lost: Pacific females



4 Discussion

The burden of disease analysis presented in this report provides a unique perspective on the health of Mäori and Pacific peoples in New Zealand today. By integrating the impacts of fatal and non-fatal outcomes, the relative impacts of different diseases, injuries and risk factors can be measured using a single scale, allowing these causes of health and equity loss to be compared and ranked.

Results of this type of analysis of the health of Mäori and Pacific peoples have not been previously reported at the level of detail contained within this report. Acceptance of the findings must, however, be constrained by two limitations: uncertainties in the data, and the limited scope of epidemiology, in general, to contribute to prioritisation of health issues within and between ethnic groups.

Data limitations

The analysis has been extremely demanding of epidemiological data. Although calculation of the burden of fatal outcomes of disease and injury was relatively straightforward, extensive modelling was required to estimate the burden associated with non-fatal outcomes.

Morbidity among Pacific peoples was not assessed in the initial New Zealand Burden of Disease Study (Ministry of Health 1999a; Ministry of Health 2001a), and time and data constraints precluded such an assessment for this report. Instead, non-fatal outcomes among Pacific peoples were estimated from Mäori rates, regressing against their respective fatal outcomes where possible. This method is valid if the ratio of non-fatal to fatal outcomes among Mäori can be assumed to be similar for Pacific peoples. The DALY estimates for Pacific peoples cannot, however, be considered to be as robust as those for the Mäori or European/Other ethnic groups.

The analysis of burden of disease associated with fatal outcomes of disease or injury is based on 1996 mortality data for Mäori and 1996–97 data for Pacific peoples. The numerator data (details from death certificates) and denominator data (1996 census population) should both code ethnicities based on ethnic identification, with allowance for multiple ethnic identities, although there is some evidence of inconsistency in ethnicity coding on death registration and in hospital discharge records (Statistics New Zealand 1999).

All individuals identifying as Mäori are coded as such, regardless of other ethnic identification. Similarly, all individuals identifying as Pacific other than those also identifying as Mäori are coded as Pacific. The overall burden of disease among Mäori and Pacific peoples coded in this way is therefore substantially greater than the burden of disease that would have been estimated had a 'sole-Mäori' or 'sole-Pacific' coding system been applied, but the respective rates are likely to be lower. On the other hand, use of 'sole' instead of 'total' ethnic group denominators would over-estimate the rates for Mäori and Pacific ethnic groups. Whichever ethnic classification – total or sole – is used, bias is thus likely to be introduced. This bias is, however, unlikely to affect the relative ranking of different disease or risk factor causes.

Ethnic-specific risk factor prevalence data, predominantly taken from the 1996–97 New Zealand Health Survey and the 1997 National Nutrition Survey, were used to calculate the disease burden associated with selected risk factors. The 1997 National Nutrition Survey does not have robust age-specific data on Pacific populations, so data was taken from separate studies (Bell et al in press). This data reflects church-based Auckland populations, so may not be representative of the national Pacific population. Better estimates of risk factor burden among Pacific peoples will require more comprehensive risk factor prevalence data. Furthermore, this report has treated Pacific peoples as a single homogenous group, despite recognising that considerable diversity exists between Pacific populations. The quality of routinely collected mortality and morbidity data is currently insufficient to permit robust analyses for separate Pacific populations.

As discussed in *Our Health Our Future* (Ministry of Health 1999a), the exact contribution of non-fatal outcomes is less certain than that of fatal outcomes. Almost half the burden of non-fatal outcomes among Mäori and Pacific peoples was contributed by a small number of major diseases and injuries (including asthma, diabetes, ischaemic heart disease, stroke and cancers) for which New Zealand data were available. New Zealand data to estimate the burden of non-fatal outcomes associated with two major disease groups, mental illness and musculoskeletal disorders, was unfortunately not available; estimates based on Australian data were used to make up the shortfall. The burden of disease among Mäori and Pacific peoples associated with these disease groups should therefore be considered provisional until future analyses can incorporate data from New Zealand surveys of mental illness and musculoskeletal disease. These surveys are currently being developed.

Preference weights have been applied to non-fatal outcomes among both Mäori and Pacific peoples to estimate the contribution of these outcomes to the burden of disease. The preference weights have been derived from overseas studies (sources referenced fully in Ministry of Health 1999a), and may not accurately reflect the social preferences of Mäori and Pacific peoples. For burden of disease analysis to be accepted as a reliable tool for prioritising key health issues among Mäori and Pacific peoples, a valuation exercise to obtain Mäori and Pacific disability preference weightings should be considered.

The burden of disease analysis described in this report presents DALYs that have been discounted at a rate of 3% per annum, for consistency with the New Zealand Burden of Disease Study (Ministry of Health 1999a). Discounting has been applied so that the results can be readily incorporated into policy. Without discounting, delaying expenditure to address causes of disease burden will always appear to yield greater benefit-to-cost ratios than similar expenditure in the present, leading to the logical conclusion that expenditure should always be delayed. Discounting avoids this untenable policy position, at the expense of undervaluing benefits of strategies likely to yield long-term improvements in disease burden (for example, among children). A low (3%) discount rate was chosen to mitigate this effect, as recommended by the International Panel on Cost Effectiveness in Medicine (Gold et al 1996) and for consistency with the Global Burden of Disease study (Murray and Lopez 1996).

The burden of disease analysis values years of healthy life equally, regardless of the age of the individual. Diseases and risk factors that disproportionately impact on younger people therefore make a larger contribution to overall disease burden than diseases or risk factors predominantly affecting older people. This tendency may not accurately reflect the relative value placed by society on older people in comparison with younger, particularly among Mäori and Pacific populations, although this problem is partly addressed by discounting. Conversely, the method may over-estimate the non-fatal burden experienced by older people, as it currently lacks full adjustment for co-morbidity (co-disability).

To improve on the estimates of the Mäori and Pacific disease burden presented in this report, there is a need to:

- perform an analysis of morbidity data among Pacific peoples to estimate Pacific YLD accurately
- collect comprehensive data on risk factor prevalence among Pacific peoples
- collect data on prevalence of disability due to mental health and musculoskeletal conditions for all ethnic groups
- obtain non-fatal outcome ('disability') weightings that are consistent with the preferences of Mäori and Pacific peoples.

Limitations of the epidemiological burden of disease approach

By tightly focusing on the fatal and non-fatal outcomes of disease and injury, the burden of disease approach provides a quantitative method for comparing and ranking different diseases, injuries and risk factors. However, this approach has limited ability to incorporate and quantify the impacts of factors outside a relatively reductionist frame. This has three important limitations.

Firstly, the burden of disease approach currently quantifies the effect of proximal risk factors only. Several influential reports, both internationally (Benzeval et al 1995) and in New Zealand (Ministry of Health 2000b), have highlighted the importance of more distal social, economic and cultural factors in generating observed patterns of ill health. Burden of disease analyses could include these determinants in the same way as shown above for risk factors, but data on exposure and relative risk are not yet available. Exclusion of social determinants of health from this report simply reflects the fact that the necessary data to include these factors is unavailable at the present time.

Secondly, the burden of disease analysis may have limited applicability for prioritising different treatment and prevention strategies to reduce the health inequalities affecting Mäori and Pacific peoples. Prioritisation will be possible for strategies that target one, or several, discrete risk factors, injuries or diseases, such as breast cancer screening or smoking cessation strategies. The approach cannot be easily used to prioritise strategies that have more general impacts on health, such as those aimed at increasing primary care effectiveness or community development. Inability to prioritise these strategies within the burden of disease framework does not imply that such strategies lack policy relevance.

Finally, the burden of disease approach assumes a relatively narrow and reductionist construct of health. A more holistic view would be more compatible with Mäori and Pacific cultural understandings of health and would allow a wider range of policy options to be considered.

The burden of disease approach is, nevertheless, highly relevant to policy development and evaluation. The approach is compatible with many prevention and treatment services that remain focused on specific diseases, injuries and risk factors. It is compatible with existing health goals and targets, many of which are disease- and risk factor-focused. At the same time, it should be emphasised that the burden of disease approach described in this report is only one input to the process for selecting and prioritising strategies to reduce ethnic inequalities in health.

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Appendix 1:
Equity and Modifiability Factors

Table A1.1: Equity adjustment factors used in this report

Cause of DALY	Mäori			Pacific		
	Female	Male	Total	Female	Male	Total
Diabetes	1.22	1.63	1.42	1.24	1.30	1.30
Smoking	1.47	1.34	1.39	1.01	1.00	1.00
Obesity	1.23	1.23	1.23	1.63	1.50	1.50
SIDS	1.17	1.19	1.18	1.00	1.01	1.01
Ischaemic heart disease	1.24	1.14	1.18	1.05	1.08	1.08
Inadequate physical activity	1.15	1.14	1.15	1.15	1.14	1.14
Lung cancer	1.21	1.10	1.14	1.00	1.02	1.02
Hypertensive heart disease	1.19	1.10	1.14	1.09	1.08	1.08
Rheumatic heart disease	1.13	1.10	1.11	1.37	1.30	1.30
CORD	1.10	1.06	1.07	1.01	1.04	1.04
Stomach cancer	1.05	1.09	1.07	1.05	1.03	1.03
High blood cholesterol	1.05	1.08	1.07	1.01	1.02	1.02
Tuberculosis	1.25	1.00	1.07	1.00	1.02	1.02
Cervical cancer	1.07		1.03	1.00		1.00
Hypertensive heart disease	1.02	1.05	1.03	1.13	1.04	1.04
Road traffic injuries	1.01	1.04	1.03	1.00	1.00	1.00
Assault and abuse	1.02	1.03	1.03	1.00	1.00	1.00
Inadequate fruit and vegetable intake	1.03	1.03	1.02	1.01	1.01	1.01
Glomerulonephritis/nephrotic syndrome	1.03	1.02	1.02	1.02	1.05	1.05
Hepatoma	1.00	1.05	1.02	1.13	1.19	1.19
Aortic aneurysm	1.07	1.00	1.02	1.06	1.02	1.02
Low birth weight	1.01	1.03	1.02	1.00	1.00	1.00
Valvular heart disease	1.01	1.02	1.01	1.02	1.01	1.01
Schizophrenia	1.02	1.01	1.01	1.03	1.01	1.01
Hepatitis	1.02	1.01	1.01	1.21	1.13	1.13
Thyroid cancer	1.04	1.00	1.01	1.06	1.01	1.01
Birth trauma and asphyxia	1.00	1.02	1.01		1.03	1.03
Melanoma	1.01	1.01	1.01	1.00	1.00	1.00
Motor neurone disease	1.01	1.01	1.01	1.01	1.00	1.00
Peripheral arterial disease	1.01	1.00	1.01	1.00	1.01	1.01
Lower respiratory tract infection	1.00	1.01	1.01	1.01	1.02	1.02
Substance use disorders	1.01	1.00	1.01	1.01	1.01	1.01
Stroke	1.01	1.00	1.01	1.08	1.05	1.05
Cholecystitis/calculi	1.01	1.00	1.01		1.00	1.00
Colorectal cancer	1.01	1.00	1.01	1.01	1.01	1.01
Hearing disorders	1.01	1.01	1.01	1.01	1.01	1.01
Upper respiratory tract infection	1.01	1.00	1.00			
Burns/fires/scalds	1.00	1.01	1.00		1.00	1.00
Attempted suicide and self harm	1.01	1.00	1.00	1.02	1.00	1.00

Cause of DALY	Mäori			Pacific		
	Female	Male	Total	Female	Male	Total
Pancreatic cancer	1.01	1.00	1.00	1.02	1.00	1.00
Uterine cancer	1.01		1.00	1.05		1.01
Bone and connective tissue cancer	1.00	1.01	1.00	1.05	1.02	1.02
Asthma	1.00	1.00	1.00	1.00	1.00	1.00
Meningitis/septicaemia	1.00	1.01	1.00	1.00	1.05	1.05
Down syndrome	1.01	1.00	1.00			
Breast cancer	1.00		1.00	1.02		1.01
Leukaemia	1.01	1.00	1.00	1.00	1.00	1.00
Acute abdomen	1.00	1.00	1.00		1.00	1.00
Epilepsy	1.00	1.00	1.00		1.01	1.01
Urogenital tract defects	1.00	1.00	1.00		1.00	1.00
Oesophageal cancer	1.01	1.00	1.00	1.00	1.00	1.00
Non-melanotic skin cancer	1.00	1.00	1.00			
STDS/PID/ectopic	1.00	1.00	1.00			
Bladder cancer	1.00	1.00	1.00	1.00	1.00	1.00
Sports injuries	1.00	1.00	1.00			
Pancreatitis	1.00	1.00	1.00	1.14	1.09	1.09
Lymphoma/myeloma	1.00	1.00	1.00	1.01	1.01	1.01
Digestive defects	1.00	1.00	1.00		1.00	1.00
Congenital heart defects	1.00	1.00	1.00	1.01	1.01	1.01
Cirrhosis/other chronic liver disease	1.00	1.00	1.00	1.00	1.00	1.00
Brain cancer	1.00	1.00	1.00	1.02	1.01	1.01
Multiple sclerosis	1.00	1.00	1.00	1.00	1.00	1.00
Maternal hypertensive disorders	1.00		1.00			
Ovarian cancer	1.00		1.00	1.00	1.00	1.00
Kidney cancer	1.00	1.00	1.00	1.01	1.00	1.00
Peptic ulcer disease	1.00	1.00	1.00	1.03	1.03	1.03
Suffocation	1.00	1.00	1.00		1.00	1.00
Dementias	1.00	1.00	1.00	1.12	1.04	1.04
Parkinson's disease	1.00	1.00	1.00	1.01	1.01	1.01
HIV/AIDS	1.00	1.00	1.00		1.00	1.00
Rheumatoid arthritis	1.00	1.00	1.00	1.00	1.00	1.00
Adverse effects of medical treatment	1.00	1.00	1.00			
Mouth and oropharyngeal cancer	1.00	1.00	1.00	1.06	1.02	1.02
Inflammatory bowel disease	1.00	1.00	1.00			
Poisoning	1.00	1.00	1.00		1.00	1.00
Chronic back pain	1.00	1.00	1.00	1.00	1.00	1.00
Childhood conduct disorders	1.00	1.00	1.00	1.00	1.00	1.00
Obstructed labour	1.00		1.00			
Anxiety disorders	1.00	1.00	1.00	1.00	1.00	1.00
Slipped disc	1.00	1.00	1.00	1.00	1.00	1.00
Mood disorders	1.00	1.00	1.00	1.00	1.00	1.00
Glaucoma	1.00	1.00	1.00	1.00	1.00	1.00
Osteoporosis	1.00	1.00	1.00	1.00	1.00	1.00
Cataract	1.00	1.00	1.00	1.00	1.00	1.00
Bipolar affective disorder	1.00	1.00	1.00	1.00	1.00	1.00
Spina bifida	1.00	1.00	1.00			

Cause of DALY	Mäori			Pacific		
	Female	Male	Total	Female	Male	Total
Eating disorders	1.00	1.00	1.00	1.00	1.00	1.00
Osteoarthritis	1.00	1.00	1.00	1.00	1.00	1.00
Maternal haemorrhage	1.00		1.00	1.01		1.00
Facial clefts	1.00	1.00	1.00			
Other chromosomal defects	1.00	1.00	1.00			
Falls	1.00	1.00	1.00	1.00	1.00	1.00
OOS	1.00	1.00	1.00	1.00	1.00	1.00

Table A1.2: Modifiability factors (individual diseases)

Disease	Modifiability
Asthma	0.5
Chronic obstructive respiratory disease	0.5
Diabetes mellitus	0.5
Falls	0.5
Glomerulonephritis/nephrotic syndrome	0.5
Hepatitis	0.5
Hepatoma	0.5
Hypertensive heart disease	0.5
Ischaemic heart disease	0.5
Lung cancer	0.5
Meningitis/septicaemia	0.5
Mouth and oropharyngeal cancer	0.5
Peptic ulcer disease	0.5
Peripheral arterial disease	0.5
Rheumatic heart disease	0.5
Stroke	0.5
Tuberculosis	0.5
Aortic aneurysm	0.25
Attempted suicide and self harm	0.25
Birth trauma and asphyxia	0.25
Breast cancer	0.25
Cirrhosis/other chronic liver disease	0.25
Colorectal cancer	0.25
Low birth weight	0.25
Lymphoma/myeloma	0.25
Osteoarthritis	0.25
Pancreatitis	0.25
Parkinson's disease	0.25
Road traffic injuries	0.25
SIDS	0.25
Substance use disorders	0.25
Dementias	0.125
Lower respiratory tract infection	0.125
Prostate cancer	0.125

Table A1.3: Modifiability factors (risk factors)

Risk factor	Modifiability
Diabetes (as a risk factor)	0.50
Obesity	0.125
Inadequate physical activity	0.25
Smoking	0.50
Hypertension	0.50
High blood cholesterol	0.50

Appendix 2:
Additional Burden of Disease Data

Table A2.1: DALY burden, top 20 individual diagnoses: Mäori females

Disease	Number of DALYs	DALY rate per 1000	RR*
Ischaemic heart disease	3421	22.5	2.7
Diabetes mellitus	2947	15.9	5.2
Chronic obstructive respiratory disease	1659	9.3	2.4
Lung cancer	1367	8.8	4.0
Mood disorders	2159	7.5	1.0
Breast cancer	1278	6.6	1.2
Stroke	1012	6.5	1.4
Asthma	1640	5.8	1.2
Anxiety disorders	1612	5.8	1.0
Road traffic injuries	1200	4.0	1.7
SIDS	940	3.2	6.6
Osteoarthritis	543	3.1	1.0
Dementias	376	2.7	1.2
Attempted suicide and self harm	671	2.3	1.5
Lower respiratory tract infection	467	2.2	1.4
Hearing disorders	345	2.2	1.5
Cervical cancer	453	2.2	4.5
Low birth weight	644	2.2	1.8
Aortic aneurysm	312	2.1	4.5
Substance use disorders	584	2.0	1.7

* Rate ratio, compared with European/Other females.
Rates are age-standardised to Segi's world population.

Table A2.2: DALY burden, top 20 individual diseases: Mäori males

Disease	Number of DALYs	DALY rate per 1000	RR*
Ischaemic heart disease	5421	32.5	2.0
Diabetes mellitus	3008	15.7	4.4
Chronic obstructive respiratory disease	2220	12.1	2.0
Road traffic injuries	3219	11.3	1.8
Lung cancer	1649	10.8	2.6
Attempted suicide and self harm	1899	6.2	1.3
Stroke	976	6.0	1.3
Asthma	1455	5.3	1.3
SIDS	1266	4.3	7.1
Hearing disorders	716	4.0	1.4
Stomach cancer	615	3.3	4.6
Anxiety disorders	899	3.1	0.9
Mood disorders	836	3.0	1.0
Low birth weight	872	3.0	2.4
Substance use disorders	800	2.7	1.5
Childhood conduct disorders	775	2.5	1.1
Colorectal cancer	395	2.4	0.7
Lower respiratory tract infection	507	2.4	1.8
Peripheral arterial disease	436	2.4	1.5
Assault and abuse	613	2.1	3.1

* Rate ratio, compared with European/Other males.
Rates are age-standardised to Segi's world population.

Table A2.3: DALY burden, top 20 individual diseases: Pacific females

Disease	Number of DALYs	DALY rate per 1000	RR*
Diabetes mellitus	861	15.6	5.1
Ischaemic heart disease	690	12.2	1.5
Stroke	460	8.4	1.8
Breast cancer	535	7.2	1.4
Mood disorders	742	7.5	1.0
Dementias	353	5.6	2.4
Anxiety disorders	559	5.8	1.0
Chronic obstructive respiratory disease	301	4.9	1.3
Asthma	394	4.3	0.9
Osteoarthritis	191	3.1	1.0
Lung cancer	152	2.6	1.2
Road traffic injuries	232	2.6	1.1
Lower respiratory tract infection	131	2.3	1.5
Hearing disorders	116	2.1	1.4
Colorectal cancer	137	2.0	0.6
Substance use disorders	188	1.9	1.6
Schizophrenia	199	1.9	2.2
Rheumatic heart disease	142	1.8	12.7
Peptic ulcer disease	80	1.6	2.1
Lymphoma/myeloma	118	1.5	1.5

* Rate ratio, compared with European/Other females.
Rates are age-standardised to Segi's world population.

Table A2.4: DALY burden, top 20 individual diseases: Pacific males

Disease	Number of DALYs	DALY rate per 1000	RR*
Ischaemic heart disease	1520	28.9	1.7
Diabetes mellitus	632	13.2	3.7
Chronic obstructive respiratory disease	520	11.5	1.9
Stroke	382	8.3	1.8
Lung cancer	375	7.6	1.8
Asthma	389	5.6	1.4
Road traffic injuries	520	5.4	0.8
Hearing disorders	224	4.0	1.4
Attempted suicide and self harm	405	4.0	0.8
Dementias	176	3.3	1.7
Anxiety disorders	310	3.1	1.0
Lower respiratory tract infection	173	2.9	2.2
Mood disorders	288	3.0	1.0
Birth trauma and asphyxia	294	2.9	9.4
Hepatoma	155	2.6	11.0
Substance use disorders	256	2.6	1.5
Colorectal cancer	127	2.6	0.7
Low birth weight	242	2.3	1.9
Childhood conduct disorders	239	2.3	1.0
Rheumatic heart disease	178	2.2	15.8

* Rate ratio, compared with European/Other males.
Rates are age-standardised to Segi's world population.

Table A2.5: DALY burden, top 20 individual diseases: European/Other females

Disease	Number of DALYs	DALY rate per 1000
Ischaemic heart disease	27,882	8.3
Mood disorders	11,559	7.6
Anxiety disorders	9,487	5.8
Breast cancer	11,512	5.4
Asthma	5,898	5.0
Stroke	15,987	4.7
Chronic obstructive respiratory disease	9,726	3.8
Diabetes mellitus	6,763	3.1
Colorectal cancer	7,382	3.1
Osteoarthritis	6,077	2.9
Road traffic injuries	3,329	2.4
Dementias	8,670	2.4
Lung cancer	5,194	2.2
Lower respiratory tract infection	6,089	1.6
Attempted suicide and self harm	2,187	1.5
Hearing disorders	2,983	1.4
Other chromosomal defects	1034	1.4
Eating disorders	1,625	1.3
Low birth weight	931	1.2
Substance use disorders	1,615	1.2

Rates are age-standardised to Segi's world population.

Table A2.6: DALY burden, top 20 individual diseases: European/Other males

Disease	Number of DALYs	DALY rate per 1000
Ischaemic heart disease	35,476	16.5
Road traffic injuries	9,001	6.4
Chronic obstructive respiratory disease	12,490	6.0
Attempted suicide and self harm	7,648	4.9
Stroke	10,694	4.6
Lung cancer	8,679	4.2
Asthma	4,736	4.2
Colorectal cancer	7,380	3.6
Diabetes mellitus	6,769	3.6
Anxiety disorders	5,122	3.3
Mood disorders	4,977	3.2
Hearing disorders	5,044	2.8
Prostate cancer	6,027	2.6
Childhood conduct disorders	2,067	2.4
Osteoarthritis	4,002	2.1
Dementias	4,820	1.9
Substance use disorders	2,612	1.8
Peripheral arterial disease	3,144	1.6
Other chromosomal defects	1,171	1.5
Falls	2,276	1.5

Rates are age-standardised to Segi's world population.

Table A2.7: DALY burden, risk factors: females

Risk factor	Mäori			Pacific			Other		
	n	Rate per 1000	RR*	n	Rate per 1000	RR*	n	Rate per 1000	RR*
Diabetes (risk factor)	3927	23.9	2.5	1122	19.6	2.0	26,339	9.6	1.0
Inadequate fruit and vegetable intake**	165	1.0	3.7				543	0.3	1.0
High blood cholesterol	817	5.4	2.2	182	3.4	1.4	7,569	2.4	1.0
High blood pressure	1819	11.6	3.2	418	7.1	2.0	10,307	3.6	1.0
Obesity	2470	13.1	3.4	1268	18.7	4.8	10,089	3.9	1.0
Inadequate physical activity	3286	16.8	2.4	943	13.5	1.9	17,471	7.1	1.0
Smoking	7047	40.9	3.3	620	10.4	0.8	30,411	12.3	1.0

* Rate ratio, compared with European/Other females.
** The burden associated with inadequate fruit and vegetable consumption was not calculated for Pacific people because of unavailability of data.
Rates are age-standardised to Segi's world population.

Table A2.8: DALY burden, risk factors: males

Risk factor	Mäori			Pacific			Other		
	n	Rate per 1000	RR*	n	Rate per 1000	RR*	n	Rate per 1000	RR*
Diabetes (risk factor)	5078	32.4	6.8	1206	21.3	4.5	11,283	4.8	1.0
Inadequate fruit and vegetable intake**	460	2.7	2.5				2,155	1.1	1.0
High blood cholesterol	1720	10.7	2.4	450	7.9	1.7	9,758	4.5	1.0
High blood pressure	2252	14.3	2.3	662	12.4	2.0	13,290	6.1	1.0
Obesity	2510	14.3	3.8	1125	19.0	5.0	8,452	3.8	1.0
Inadequate physical activity	3894	20.2	2.4	1134	19.1	2.2	17,675	8.5	1.0
Smoking	9781	60.7	2.4	1541	31.0	1.2	53,850	25.5	1.0

* Rate ratio, compared with European/Other males.
** The burden associated with inadequate fruit and vegetable consumption was not calculated for Pacific people because of unavailability of data.
Rates are age-standardised to Segi's world population.

Table A2.9: Top 20 causes of modifiable DALYs: Mäori females

Cause of DALY	Number of modifiable DALYs	Modifiable DALY rate per 1000
Smoking	3524	20.4
Diabetes	1964	11.9
Ischaemic heart disease	1711	11.2
Hypertension	910	5.8
Chronic obstructive respiratory disease	829	4.6
Lung cancer	683	4.4
Inadequate physical activity	821	4.2
Stroke	506	3.3
Asthma	820	2.9
High blood cholesterol	409	2.7
Breast cancer	319	1.7
Obesity	309	1.6
Road traffic injuries	300	1.0
Peripheral arterial disease	139	0.8
SIDS	235	0.8
Osteoarthritis	136	0.8
Rheumatic heart disease	150	0.7
Glomerulonephritis/nephrotic syndrome	118	0.7
Attempted suicide and self harm	168	0.6
Low birth weight	161	0.5

Rates are age-standardised to Segi's world population.

Table A2.10: Top 20 causes of modifiable DALYs: Mäori males

Cause of DALY	Number of modifiable DALYs	Modifiable DALY rate per 1000
Smoking	4891	30.3
Ischaemic heart disease	2710	16.3
Diabetes	2539	16.2
Hypertension	1126	7.1
Chronic obstructive respiratory disease	1110	6.0
Lung cancer	825	5.4
High blood cholesterol	860	5.4
Inadequate physical activity	973	5.1
Stroke	488	3.0
Road traffic injuries	805	2.8
Asthma	728	2.6
Obesity	314	1.8
Attempted suicide and self harm	475	1.6
Peripheral arterial disease	218	1.2
SIDS	317	1.1
Falls	192	0.8
Low birth weight	218	0.7
Hypertensive heart disease	133	0.7
Substance use disorders	200	0.7
Rheumatic heart disease	134	0.7

Rates are age-standardised to Segi's world population.

Table A2.11: Top 20 causes of modifiable DALYs: Pacific females

Cause of DALY	Number of modifiable DALYs	Modifiable DALY rate per 1000
Diabetes	561	9.8
Ischaemic heart disease	345	6.1
Smoking	310	5.2
Stroke	230	4.2
Hypertension	209	3.5
Inadequate physical activity	236	3.4
Chronic obstructive respiratory disease	151	2.4
Obesity	159	2.3
Asthma	197	2.2
Breast cancer	134	1.8
High blood cholesterol	91	1.7
Lung cancer	76	1.3
Rheumatic heart disease	71	0.9
Peptic ulcer disease	40	0.8
Osteoarthritis	45	0.8
Hypertensive heart disease	42	0.7
Dementias	44	0.7
Falls	48	0.7
Road traffic injuries	58	0.6
Hepatoma	36	0.6

Rates are age-standardised to Segi's world population.

Table A2.12: Top 20 causes of modifiable DALYs: Pacific males

Cause of DALY	Number of modifiable DALYs	Modifiable DALY rate per 1000
Smoking	770	15.5
Ischaemic heart disease	760	14.4
Diabetes	603	10.7
Hypertension	331	6.2
Chronic obstructive respiratory disease	260	5.8
Inadequate physical activity	284	4.8
Stroke	191	4.2
High blood cholesterol	225	3.9
Lung cancer	187	3.8
Asthma	195	2.8
Obesity	141	2.4
Road traffic injuries	130	1.3
Hepatoma	78	1.3
Rheumatic heart disease	89	1.1
Meningitis/septicaemia	104	1.1
Attempted suicide and self harm	101	1.0
Peptic ulcer disease	41	1.0
Glomerulonephritis/nephrotic syndrome	51	0.9
Falls	47	0.7
Birth trauma and asphyxia	74	0.7

Rates are age-standardised to Segi's world population.

Table A2.13: Top 20 causes of equity-adjusted modifiable DALYs: Mäori females

Cause of DALYs	Equity-adjusted modifiable DALY number	Equity-adjusted modifiable DALY rate per 1000
Smoking	5190	30.1
Diabetes	2401	14.6
Ischaemic heart disease	2129	14.0
Hypertension	1087	6.9
Lung cancer	827	5.3
Chronic obstructive respiratory disease	908	5.1
Inadequate physical activity	949	4.9
Stroke	511	3.3
Asthma	822	2.9
High blood cholesterol	428	2.8
Obesity	379	2.0
Breast cancer	321	1.7
Road traffic injuries	304	1.0
SIDS	275	0.9
Peripheral arterial disease	140	0.8
Rheumatic heart disease	170	0.8
Osteoarthritis	136	0.8
Glomerulonephritis/nephrotic syndrome	122	0.7
Tuberculosis	90	0.6
Attempted suicide and self harm	169	0.6

Rates are age-standardised to Segi's world population.

Table A2.14: Top 20 causes of equity-adjusted modifiable DALYs: Mäori males

Cause of DALYs	Equity-adjusted modifiable DALY number	Equity-adjusted modifiable DALY rate per 1000
Smoking	6556	40.7
Diabetes	4140	26.4
Ischaemic heart disease	3093	18.6
Hypertension	1242	7.9
Chronic obstructive respiratory disease	1178	6.4
Lung cancer	908	6.0
High blood cholesterol	931	5.8
Inadequate physical activity	1114	5.8
Stroke	490	3.0
Road traffic injuries	836	2.9
Asthma	730	2.6
Obesity	387	2.2
Attempted suicide and self harm	477	1.6
SIDS	377	1.3
Peripheral arterial disease	219	1.2
Falls	192	0.8
Low birth weight	223	0.8
Hypertensive heart disease	139	0.7
Rheumatic heart disease	147	0.7
Hepatoma	127	0.7

Rates are age-standardised to Segi's world population.

Table A2.15: Top 20 causes of equity-adjusted modifiable DALYs: Pacific females

Cause of DALYs	Equity-adjusted modifiable DALY number	Equity-adjusted modifiable DALY rate per 1000
Diabetes	695	12.1
Ischaemic heart disease	363	6.4
Smoking	313	5.3
Stroke	248	4.5
Hypertension	229	3.9
Inadequate physical activity	271	3.9
Obesity	258	3.8
Chronic obstructive respiratory disease	152	2.4
Asthma	198	2.2
Breast cancer	136	1.8
High blood cholesterol	92	1.7
Lung cancer	76	1.3
Rheumatic heart disease	97	1.2
Peptic ulcer disease	41	0.8
Hypertensive heart disease	48	0.8
Dementias	50	0.8
Osteoarthritis	45	0.8
Falls	48	0.7
Road traffic injuries	58	0.6
Hepatoma	41	0.6

Rates are age-standardised to Segi's world population.

Table A2.16: Top 20 causes of equity-adjusted modifiable DALYs: Pacific males

Cause of DALYs	Equity-adjusted modifiable DALY number	Equity-adjusted modifiable DALY rate per 1000
Ischaemic heart disease	837	15.9
Smoking	781	15.7
Diabetes	852	15.1
Hypertension	355	6.6
Chronic obstructive respiratory disease	275	6.1
Inadequate physical activity	323	5.4
Stroke	197	4.3
High blood cholesterol	232	4.1
Lung cancer	194	3.9
Obesity	201	3.4
Asthma	196	2.8
Hepatoma	95	1.6
Rheumatic heart disease	113	1.4
Road traffic injuries	130	1.4
Meningitis/septicaemia	123	1.3
Glomerulonephritis/nephrotic syndrome	56	1.0
Peptic ulcer disease	42	1.0
Attempted suicide and self harm	101	1.0
Birth trauma and asphyxia	89	0.9
Falls	47	0.7

Rates are age-standardised to Segi's world population.

Appendix 3: New Zealand Burden of Disease Study: Conditions, Stages and Disability Weights

Level 1

Condition group	Description
A	Infectious diseases
B	Maternal conditions
C	Perinatal and infant disorders
D	Birth defects, chromosomal disorders and hereditary conditions
E	Unintentional injuries and adverse effects of health care
F	Intentional injuries including self harm
G	Cancers (benign and malignant neoplasms)
H	Endocrine, metabolic, haematologic and immunological conditions
I	Cardiovascular disorders
J	Chronic respiratory disorders
K	Digestive disorders (gastrointestinal and hepatic disorders)
L	Genitourinary disorders (disorders of the kidney and urinary tract and the reproductive system)
M	Musculoskeletal disorders (disorders of bones, muscles, tendons, joints and connective tissue)
N	Neurological disorders (including the dementias)
O	Sense organ disorders (vision and hearing loss)
P	Psychiatric conditions

Note: for certain analyses, several of the above categories have been combined to create a smaller number of 'supercategories'.

Level 2

NZBDS Code	Condition description	ICD 9 CM A codes	Stage	Disability weight	Source of weight
A1	Upper respiratory tract infection/otitis media	460–465, 381–382	Acute nasopharyngitis	0.014	EQ-5D+
			Acute sinusitis	0.061	EQ-5D+
			Pharyngitis/tonsillitis	0.061	EQ-5D+
			Otitis media – acute episode	0.090	Dutch
			Otitis media – chronic (glue ear)	0.110	Dutch
			Otitis media – deafness	0.233	Dutch
A2	Lower respiratory tract infection (pneumonia and influenza)	466, 480–487	Influenza episode	0.047	EQ-5D+
			Acute bronchitis episode	0.132	EQ-5D+
			Pneumonia episode	0.373	EQ-5D+
A3	Tuberculosis	010–018, 137	Case	0.295	GBD
A4	STDs/PID/ectopic	090–099, 614–616, 633	Case (uncomplicated)	0.067	GBD weight for urethritis
			PID	0.420	GBD
			Chronic pelvic pain	0.122	GBD
			Ectopic pregnancy	0.549	GBD
A5	HIV/AIDS	042	HIV infection	0.200	Dutch
			AIDS	0.560	Dutch
			AIDS – terminal phase	0.950	Dutch
A6	Hepatitis	070	Acute hepatitis	0.210	Dutch
			Chronic hepatitis (B or C)	0.360	Dutch
			Cirrhosis	0.310	Dutch
			Hepatic failure	0.840	Dutch
A7	Meningitis/ septicaemia	036, 320–323, 038	Acute episode	0.894	EQ-5D+
			Deafness	0.370	Dutch
			Seizure disorder	0.110	Dutch
			Motor deficit	0.170	Dutch
			Cognitive deficit	0.250	Dutch
			Combined neurological deficit	0.760	Dutch
A8	Infectious diseases NEC	Rest of 001–139, 680–686, 390–392	Cases	*	
B1	Maternal haemorrhage	640 641, 666	Case	0.011	GBD
B2	Maternal hypertensive disorders	642	Episode	0.117	EQ-5D+
			Neurological sequelae	0.388	GBD
B3	Obstructed labour	660	Episode	0.108	ABDS
B4	Obstetric conditions NEC	Rest of 630–677		*	

NZBDS Code	Condition description	ICD 9 CM A codes	Stage	Disability weight	Source of weight
C1	Birth trauma and asphyxia	767–768	Cerebral palsy without intellectual disability	0.170	Dutch
			Intellectual disability (ID)		
			– mild	0.290	Dutch
			– moderate	0.430	Dutch
			– severe	0.820	Dutch
C2	Low birth weight	764–765, 769	Hearing loss		
			– mild	0.110	Dutch
			– severe	0.370	Dutch
			Vision loss	0.170	Dutch
			Seizure disorder	0.110	Dutch
			Cerebral palsy without ID	0.170	Dutch
			ID		
			– mild	0.290	Dutch
			– moderate	0.430	Dutch
			– severe	0.820	Dutch
C3	SIDS	SIDS indicator	Case	Not applicable	Fatal only
C4	Perinatal conditions NEC	Rest of 760–779		*	
D1	Spina bifida	741	Low level	0.160	Dutch
			Medium level	0.500	Dutch
			High level	0.680	Dutch
D2	Congenital heart defects	745–746	Surgically corrected	0.030	Dutch
			Permanent stage after partial surgical correction	0.200	Dutch
			Complex not surgically correctable	0.720	Dutch
D3	Down's syndrome	7580	Child without other malformations	0.510	Dutch
			Child with other malformations	0.690	Dutch
			Young adult	0.350	Dutch
			Adult > 40 years	0.650	Dutch
D4	Other chromosomal defects	7581–7589	Mild ID	0.290	Dutch
			Moderate ID	0.430	Dutch
			Severe ID	0.820	Dutch
D5	Facial clefts	749	Cleft palate – corrected	0.015	GBD
			Cleft palate – uncorrected	0.231	GBD
			Cleft lip – corrected	0.016	GBD
			Cleft lip – uncorrected	0.098	GBD
D6	Digestive defects	750–751	Case – not correctable	0.850	GBD
			Case – partially correctable	0.037	ABDS
D7	Urogenital tract defects	752–753	Case – not correctable	0.850	GBD
			Case – partially correctable	0.037	GBD
			Renal failure	0.294	Dutch
D9	Abdominal wall defects	7567	Case – not correctable (or prior to surgery)	0.850	GBD
			Case – long-term disability after correction	0.200	Dutch

NZBDS Code	Condition description	ICD 9 CM A codes	Stage	Disability weight	Source of weight
D10	Birth defects NEC	Rest of 740–759		*	
E1	Road traffic injuries/ other transport injuries	E810–829, E929.0, E800–807, E830–848, E929.1	Case	0.149	GBD**
E2	Suffocation	E911–915	Case	0.162	GBD**
E3	Sports injuries	E886.0, E917.0, E927	Case	0.118	GBD**
E4	Falls	E880–885, E886.9, E887–888, E929.3	Case	0.141	GBD**
E5	Burns/fires/scalds	E890–899, E924.0, E924.8–E924.9, E929.4	Case	0.172	GBD**
E6	Drowning	E910	Case	0.211	GBD**
E7	Poisoning	E850–869, E929.2	Case	0.593	GBD**
E8	Adverse effects (surgical, medical, pharmaceutical)	E870–879, 996–999 (not E), 429.4	Case	0.433	GBD**
E9	Unintentional injuries NEC	Rest of E80–869, E880–949, rest of 800–995 (not E)		*	
F1	Attempted suicide and self harm	E950–959, E980–989 (unspecified intent)	Case	0.477	GBD**
F2	Assault and abuse	E960–979, E990–999	Case	0.166	GBD**
G1	Lung cancer	162	Treated weight	0.680	All cancers: ABDS standard model (based on Dutch weights)
			Untreated weight	0.470	
			Terminal phase weight	0.910	
G2	Colorectal cancer	153–154	Treated weight	0.430	
			Untreated weight	0.200	
			Terminal phase weight	0.830	
G3	Breast cancer	174	Treated weight	0.690	
			Untreated weight	0.260	
			Terminal phase weight	0.790	
G4	Prostate cancer	185	Primary therapy	0.270	
			Disease free	0.180	
			Disseminated	0.640	
G5	Lymphoma/ myeloma	200–202, 203	Treated weight	0.057	
			Untreated weight	0.089	
			Terminal phase weight	0.809	

NZBDS Code	Condition description	ICD 9 CM A codes	Stage	Disability weight	Source of weight
G6	Leukaemia	204–208	Treated weight	0.830	
			Untreated weight	0.098	
			Terminal phase weight	0.809	
G7	Pancreas	157	Treated weight	0.237	
			Untreated weight	0.301	
			Terminal phase weight	0.809	
G8	Liver	155	Treated weight	0.239	
			Untreated weight	0.239	
			Terminal phase weight	0.809	
G9	Melanoma	172	No metastasis	0.190	
			Lymph node metastasis	0.430	
			Distant metastatsis	0.809	
G10	Non-melanotic skin cancer	173	No metastasis	0.050	
			Metastasis	0.400	
G11	Brain cancer	191, 225	Treated weight	0.730	
			Untreated weight	0.370	
			Terminal phase weight	0.809	
G12	Cervix	180	Treated weight	0.066	
			Untreated weight	0.075	
			Terminal phase weight	0.809	
G13	Stomach	151	Treated weight	0.530	
			Untreated weight	0.380	
			Terminal phase weight	0.730	
G14	Mouth and oropharynx	140–149	Treated weight	0.090	
			Untreated weight	0.145	
			Terminal phase weight	0.809	
G15	Oesophagus	150	Treated weight	0.560	
			Untreated weight	0.370	
			Terminal phase weight	0.730	
G16	Gallbladder	156	Treated weight	0.217	
			Untreated weight	0.217	
			Terminal phase weight	0.809	
G17	Bone and connective tissue	170–171	Treated weight	0.217	
			Untreated weight	0.217	
			Terminal phase weight	0.809	
G18	Uterus	179, 181–182	Treated weight	0.079	
			Untreated weight	0.066	
			Terminal phase weight	0.809	
G19	Ovary	183	Treated weight	0.097	
			Untreated weight	0.066	
			Terminal phase weight	0.809	
G20	Bladder	188	Treated weight	0.087	
			Untreated weight	0.085	
			Terminal phase weight	0.809	

NZBDS Code	Condition description	ICD 9 CM A codes	Stage	Disability weight	Source of weight
G21	Kidney	189	Treated weight	0.217	
			Untreated weight	0.217	
			Terminal phase weight	0.809	
G22	Thyroid	193	Treated weight	0.217	
			Untreated weight	0.217	
			Terminal phase weight	0.809	
G23	Cancer of other sites or unknown primary, NEC	Rest of 140–224, 226–239	Case	*	
H1	Diabetes mellitus	250	Case (weighted average)	0.175	NZ model (weights based on Dutch weights where available, otherwise GBD or ABDS)
			Uncomplicated diabetes	0.070	
			Diabetic IHD	0.330	
			Diabetic stroke	0.630	
			Diabetic foot	0.210	
			Diabetic neuropathy	0.140	
			Diabetic nephropathy	0.290	
			Diabetic retinopathy	0.430	
H2	Endocrine disorders NEC	Rest of 240–279 (excluding 250, 227.0)	Case	0.164	ABDS
I1	IHD	410–414, 427.1, 427.4, 427.5, 440.9, 429.1, 429.2, 429.9	Angina	0.178	Dutch
			Acute myocardial infarction	0.395	GBD (treated)
			Heart failure	0.353	Dutch
I2	Hypertensive heart disease	401–402	Case	0.352	Dutch (heart failure)
I3	Rheumatic heart disease	393–398	Rheumatic fever	0.047	EQ-5D+
			Rheumatic heart disease		
			– treated	0.171	GBD
			– untreated	0.323	GBD
I4	Valvular heart disease (non-rheumatic)	424	Case	0.060	Dutch (mild heart failure)
I5	Stroke	430–438	Case (weighted average including no sequelae)	0.285	NZ model (based on Dutch weights)
			Mild	0.360	
			Moderate	0.630	
			Severe	0.920	
I6	Aortic aneurysm	441	Case	0.430	ABDS
I7	Peripheral arterial disease	440.0–440.8, 442–444	Case	0.600	EQ-5D+
			Amputation	0.209	EQ-5D+
I8	Cardiovascular diseases NEC	Rest of 400–459 (excluding 416)	Case	*	
J1	CORD	416, 490–492, 494–496	Mild to moderate	0.170	Dutch
			Severe	0.530	Dutch
J2	Asthma	493	Case (weighted average)	0.057	NZ model (based on Dutch weights)
			Mild to moderate	0.030	
			Severe	0.360	

NZBDS Code	Condition description	ICD 9 CM A codes	Stage	Disability weight	Source of weight
J3	Chronic respiratory diseases NEC	470–479, 500–519	Case	*	
K1	Peptic ulcer disease	531–533, 578	Case	0.066	Dutch
K2	Inflammatory bowel disease	555–556	Case	0.244	Dutch
K3	Cholecystitis/ calculi	574–576	Case	0.463	ABDS (GBD weight for appendicitis)
K4	Pancreatitis	540–543, 550.0, 550.1, 551–552, 560, 577	Case	0.463	GBD
K5	Acute abdomen	557	Case	0.463	GBD weight for acute appendicitis
K6	Cirrhosis/other chronic liver disease	571–572	Case	0.339	Dutch
K7	Digestive diseases NEC	Rest of 520–579	Case	*	
L1	Glomerulonephritis/ nephrotic syndrome	403, 580–586	Renal failure	0.290	Dutch (dialysis)
			Transplant	0.110	GBD (treated renal failure)
L2	BPH	600	Case	0.038	GBD
L3	Genitourinary disorders NEC	592, 594, 788.3, 625.6, 587–589, 591, 593, 596–599, 617, 610–611, 601–608, rest of 618–629	Case	*	
M1	Rheumatoid arthritis	714	Mild	0.210	Dutch
			Moderate	0.370	Dutch
			Severe	0.940	Dutch
M2	Osteoarthritis	715	Grade 2	0.140	Dutch
			Grade 3–4	0.420	Dutch
M3	Chronic back pain	720–721, 723, 724.5–724.9	Episode	0.060	Dutch
M4	Slipped disc	722, 724.3–724.4	Episode	0.060	Dutch
			Excision or destruction of disc	0.060	Dutch
			Chronic pain	0.125	EQ-5D+
M5	OOS	–	Mild	0.056	EQ-5D+
			Moderate	0.293	EQ-5D+
			Severe	0.516	EQ-5D+
M6	Osteoporosis	733	Case	0.009	EQ-5D+
M7	Musculoskeletal disorders NEC	Rest of 710–739	Case	*	

NZBDS Code	Condition description	ICD 9 CM A codes	Stage	Disability weight	Source of weight
N1	Dementias	290, 330–331	Mild	0.270	Dutch
			Moderate	0.630	Dutch
			Severe	0.940	Dutch
N2	Epilepsy	345	Episode	0.110	Dutch
N3	Parkinson's disease and other movement disorders	332	Early stage	0.480	Dutch
			Intermediate stage	0.790	Dutch
			End stage	0.920	Dutch
N4	MS and other demyelinating conditions	340	Relapsing – remitting phase	0.330	Dutch
			Progressive phase	0.670	Dutch
			Progressive from onset	0.670	Dutch
N5	Motor neuron disease	335.2	Case	0.670	Dutch
N6	Neurological conditions NEC	324–329, rest of 333–339, 341–344, 347–358, 359.2–359.9	Case	*	
O1	Glaucoma	365	Mild vision loss	0.020	Dutch
			Moderate vision loss	0.170	Dutch
			Severe vision loss	0.430	Dutch
O2	Cataract	366	Mild vision loss	0.020	Dutch
			Moderate vision loss	0.170	Dutch
			Severe vision loss	0.430	Dutch
O3	Other causes of low vision, NEC	360–364, 367–379	Case	*	
O4	Hearing disorders	380–389	Mild hearing loss	0.020	Dutch
			Moderate hearing loss	0.120	Dutch
			Severe hearing loss	0.370	Dutch
P1	Anxiety disorders	300	Mild to moderate	0.170	Dutch (for GAD)
			Severe	0.600	Dutch (for GAD)
P2	Mood disorders	296.2, 296.3, 296.9, 300.4, 311	Dysthymia case	0.140	Dutch
			Major depressive episode – mild	0.140	Dutch
			Major depressive episode – moderate	0.350	Dutch
			Major depressive episode – severe	0.760	Dutch
P3	Bipolar affective disorders	296.0, 296.1, 296.4–296.8	Case	0.176	Dutch (weighted average severity)
P4	Schizophrenia	295	Case	0.434	GBD (weighted average severity)
P5	Childhood conduct disorders	314	Mild	0.020	Dutch (for ADHD)
			Moderate to severe	0.150	Dutch (ADHD)

NZBDS Code	Condition description	ICD 9 CM A codes	Stage	Disability weight	Source of weight
P6	Eating disorders	307.1, 307.5	Case	0.280	Dutch (weighted average severity)
P7	Substance use disorders	291, 303–305	Harmful drinking or other drug use	0.110	Dutch
			Drug dependence	0.330	Dutch
			Manifest alcoholism	0.550	Dutch
P8	Psychiatric syndromes NEC	Rest of 292–319	Case	*	

Note: dental disorders and dermatological conditions other than infections and cancers are excluded
* YLD estimates for NEC categories derived from group average or average YLD:YLL ratio
** average of age and severity specific GBD weights shown here.

KEY
Dutch = Stouthard et al 1997
GBD = Global Burden of Disease Study (Murray and Lopez 1996)
ABDS = Australian Burden of Disease Study, not based on EQ-5D+ regression model (Mathers et al 1999)
EQ-5D+ = ABDS, derived by regressing EQ-5D+ score against Dutch weights (Mathers et al 1999)

(Full references are in the 'References' section of the main text.)