Tracking Disparity

Trends in ethnic and socioeconomic inequalities in mortality, 1981–2004

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Foreword

In New Zealand, as elsewhere, inequalities in health exist between ethnic groups and social classes. These inequalities are not random: in all countries, socially disadvantaged and marginalised groups have poorer health, greater exposure to health hazards, and less access to high-quality health services than their more privileged counterparts. In addition, indigenous peoples and ethnic minorities tend to have poorer health. In New Zealand the extent of these inequalities is unacceptable.

Tracking Disparity: Trends in ethnic and socioeconomic inequalities in mortality, 1981–2004 is the fourth in a series of monitoring reports on health inequality in New Zealand based on linkage of mortality to census records (the New Zealand Census–Mortality Study). The first report in this series examined ethnic inequalities in mortality, while the second investigated economic inequalities, focusing in particular on differences in survival chances between income groups. The third report analysed interactions between ethnicity and socioeconomic position in shaping survival chances, and quantified the extent to which ethnic inequalities in mortality are mediated by differences in socioeconomic position. These first three reports (published as the *Decades of Disparity* series) covered the period from 1981 to 1999 – a time of great social change in our country. The current (fourth) report updates the earlier series to include the period from 2001 to 2004, thus examining trends in inequalities over nearly a quarter of a century. It is designed to stand alone, so that readers do not necessarily have to refer back to the earlier reports in the series.

The key finding of this fourth report is that inequalities in health between ethnic and income groups – after increasing steadily from the mid-1980s to the late 1990s – may have now begun to stabilise or even decrease. However, the report does not attempt to quantify the contribution of specific social and economic policies to this possible turning point.

The New Zealand Census–Mortality Study, and this updated fourth report in particular, thus provide valuable evidence supporting the Government's Reducing Inequalities initiatives and represent an important contribution to the health inequalities debate in our country. I hope that the detailed information provided in the report, including its statistical annex, will help to mobilise all sectors of government and the community – not just the health sector – to work towards greater health equity. The Ministry of Health will continue to monitor our progress towards this goal.

Comments on this report, and the monitoring of health inequality in general, are welcomed and should be sent to Public Health Intelligence, Health and Disability Systems Strategy Directorate, Ministry of Health, PO Box 5013, Wellington.

Stephen McKernan
Director-General of Health

Authors and Contributors

Tony Blakely (Director of Health Inequalities Research Programme, University of Otago, Wellington) and Martin Tobias (Public Health Intelligence, Ministry of Health) planned the report structure, and co-led the interpretation and writing of the report. June Atkinson (University of Otago, Wellington), Li-Chia Yeh (Public Health Intelligence, Ministry of Health) and Ken Huang (Public Health Intelligence, Ministry of Health) carried out the statistical analyses, and preparation of graphs and tables.

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Statistics New Zealand Security Statement

The New Zealand Census–Mortality Study is a study of the relationship between social factors and mortality in New Zealand, based on the integration of anonymised population census data from Statistics New Zealand and mortality data from the New Zealand Health Information Service.

Access to the data used in this study was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. The results presented in this study are the work of the authors, not Statistics New Zealand.

(The full security statement is available at http://www.wnmeds.ac.nz/nzcms-info.html.)

Disclaimer

Opinions expressed in this report are those of the authors only and do not necessarily reflect policy advice provided by the Ministry of Health, nor represent the views of the peer reviewers or the University of Otago.

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Glossary and Abbreviations

Term	Definition
Amenable mortality	A subset of avoidable mortality, comprising causes of death in those < 75 years of age whose case fatality could be substantively reduced by currently available health care technologies.
Asian	(See Total Asian ethnic group.)
Avoidable mortality	Causes of death in those < 75 years of age that are potentially preventable (incidence reduction) or treatable (case fatality reduction).
CPI	Consumers price index. Used to adjust all incomes in this report to 1996 dollars.
CVD	Cardiovascular disease.
Equivalised	A procedure to adjust total household income for the number of people in the household.
European/Other	(See non-Māori non-Pacific non-Asian and Pākehā.)
ICD	International Classification of Diseases.
IHD	Ischaemic heart disease.
Life expectancy	The years a person would be expected to live, on average, if the age-specific mortality rates in a given period applied throughout that person's life.
Māori	(See Total Māori ethnic group.)
Mortality rate	In this report, the number of deaths in a given three-year period for a given group, divided by the person-years observed in that group (ie, just less than three times the number of census respondents in that group).
Non-Māori non-Pacific non-Asian	This is a constructed group used for analytical reference purposes. It largely comprises people of European ethnicities (including New Zealand European), but also includes people with African, Middle Eastern and Latin American ethnicities, and other ethnicities – most notably the growing 'New Zealander' group. Throughout this report, we use the term 'European/ Other' interchangeably with non-Māori non-Pacific non-Asian.
Non-Māori	The group of people who do not self-identify as Māori.
Non-Pacific	The group of people who do not self-identify as Pacific.
P for trend	A statistical test of *linear* trend in rates, rate differences, and the natural logarithm of the rate ratios. They are routinely provided in tables in this report to assist interpretation. *However, this test must be treated with caution* – in some instances in this report there is sufficient reason and statistical precision in the rates to point to non-linear trends over time, invalidating the p for trend statistic.
Pacific	(See Total Pacific ethnic group.)
Record linkage	The process of matching records on two files. In this report, the process of linking death records back to (usually – but not always) their actual census record for the last census before their death, using anonymous and probabilistic record linkage.

Term	Definition
RII	Relative index of inequality. A relative risk or rate ratio 'type' of measure, but one that utilises mortality rates for all income groups (not just the highest and lowest income group rates) and allows for varying sizes of income groups. Used in this report as a measure of relative inequality.
SII	Slope index of inequality. An absolute risk or rate difference 'type' of measure, but one that utilises mortality rates for all income groups (not just the highest and lowest income group rates) and allows for varying sizes of income groups. Expressed in units of 'per 100,000'. Used in this report as a measure of absolute inequality.
Sole Asian ethnic group	The group of people who self-identify only as Asian. Note that such a person may self-identify with two or more specific Asian ethnic groups (eg, Chinese and Korean), but may not specify an ethnic group outside of the higher-level grouping of 'Asian'.
Sole Māori ethnic group	The group of people who self-identify only as Māori.
Sole Pacific ethnic group	The group of people who self-identify only as Pacific. Note that such a person may self-identify two or more Pacific ethnic groups (eg, Samoan and Niuean), but may not specify an ethnic group outside of the higher-level grouping of 'Pacific'.
SRD	Standardised rate difference. The absolute difference in two standardised mortality rates. Expressed in units of 'per 100,000'. Used in this report as a measure of absolute inequality.
SRR	Standardised rate ratio. The ratio of two standardised mortality rates. Used in this report as a measure of relative inequality.
Standard population	An external, and sometimes artificial, population used as the source of weights for age (or age by ethnic) standardisation. In this report, we used the WHO world population standard, with the New Zealand ethnic population structure superimposed. (See Methods.)
Standardisation	Direct standardisation, a statistical procedure whereby the age- (or age-by-ethnic) specific mortality rates of the populations of interest are weighted by the age (or age-by-ethnic) structure of the standard population to generate standardised mortality rates. This allows the populations of interest to be compared without age or ethnic confounding.
Standardised mortality rate	The mortality rate for a given group, standardised or weighted to an externally specified age structure (and sometimes also ethnic structure).
Total Asian ethnic group	The group of people who self-identify only as an Asian ethnic group, plus those who self-identify an Asian ethnic group as one of their two or more ethnic groups.
Total Māori ethnic group	The group of people who self-identify only as Māori, plus those who self-identify Māori as one of their two or more ethnic groups.
Total Pacific ethnic group	The group of people who self-identify only as a Pacific ethnic group, plus those who self-identify a Pacific ethnic group as one of their two or more ethnic groups.
WHO world population standard	(See standard population.)

Executive Summary

This monitoring report is the fourth in a series covering ethnic and socioeconomic (income) trends in mortality, and trends in inequalities in mortality, in New Zealand. The first three *Decades of Disparity* reports covered 1981–84 to 1996–99. This *Tracking Disparity* report updates trends to include the 2001–04 period. Each report employs linked mortality and census data (the New Zealand Census–Mortality Study) to analyse inequalities in mortality rates on both absolute and relative scales, using standard measures of association (rate differences and rate ratios) for ethnic disparities and more sophisticated regression-based measures (slope index of inequality and relative index of inequality) for income disparities.

Estimates of mortality rates are calculated by age group within the 1–74 years age range and by sex for four ethnic groups (Māori, Pacific, Asian and European/Other), and by either three or five income bands.

Estimates are also derived for the contribution of specific causes of death to (trends in) absolute inequality in all-cause mortality, and regression modelling is used to quantify the independent contribution of specific socioeconomic variables to (trends in) Māori: European/Other inequalities in all-cause mortality.

Ethnic inequalities in mortality

Throughout the period from 1981 to 2004, Māori experienced the highest mortality rates at all ages, followed in turn by the Pacific, European/Other and Asian ethnic groups. Percentage falls in all-cause mortality rates from 1981–84 to 2001–04 for males and females, adjusted for age within the 1–74 years age range, varied between ethnic groups as follows:

- 25% and 22% for Māori
- 14% and 10% for Pacific peoples
- 42% and 35% for European/Others
- 58% and 50% for Asian males and females, respectively.

Of particular note, from the late 1990s to the early 2000s the rate of decline in Māori and Pacific mortality increased, compared to a slowing in the European/Other rate of decline.

From the early 1980s to the late 1990s, mortality disparities between Māori and Pacific ethnic groups and the majority European/Other population increased steeply. Yet from the late 1990s to the early 2000s, relative inequality (mortality rate ratios) between Māori or Pacific ethnic groups and the European/Other ethnic group reduced slightly, and absolute inequality (mortality rate differences) declined more notably – a turnaround of major importance if it can be sustained. Among adults, this turnaround has been more pronounced for Māori than for Pacific peoples, so the mortality gap between these two ethnic groups has recently narrowed. While still intermediate, Pacific adult mortality is now closer to that of Māori than to that of the European/Other ethnic group, especially for males.

Asian rates were lower than, and decreased faster than, European/Other rates. This may reflect the rapid increase in Asian migration since the early 1990s (migrants typically have much lower mortality than the host population because of health selection). If this explanation is correct, this inequality may also begin to narrow in future as health selection pressure reduces and Asian mortality rates slow in their rate of decline – or even increase.

The decline in mortality for all ethnic groups over the observation period has resulted mainly from progressive reduction in the incidence and case fatality of cardiovascular disease (CVD) – ischaemic heart disease and stroke in particular. The reduction in CVD mortality rates for males and females (1-74 years of age) varies by ethnic group, as follows:

- 40% and 45% for Māori
- 19% and 38% for Pacific peoples
- 64% and 65% for European/Others
- 65% and 65% for Asian males and females respectively.

The percentage contribution of CVD to total inequality in mortality (1-74 years) between Māori and European/Others has remained above 40% for males, but has reduced among females from 47% in 1981–84 to 36% in 2001–04. Conversely, the contribution of cancer to Māori:European/Other inequalities has increased to about a quarter. Among male youth, suicide has emerged as an important contributor to Māori:European/Other mortality inequalities.

Turning to Pacific:European/Other inequalities, CVD contributes over one-third to the all-cause mortality gap, and cancer is again making an increasing contribution among females (up to a quarter of the total mortality inequality by 2001–04). However, unlike Māori, among Pacific peoples 'other' causes of death (a category that includes diabetes) also make a large contribution (about 40%) to the gap.

Over half of the Asian advantage in all-cause mortality compared to European/Others is due to lower cancer rates – mostly non-lung cancers.

Socioeconomic inequalities in mortality

Like all other societies, New Zealand exhibits a socioeconomic gradient in mortality, with low-income groups experiencing higher risks of dying at every age than their more privileged counterparts. Mortality fell for all income groups from 1981–84 to 2001–04, however, and at much the same rate, with the result that absolute inequality remained stable while relative inequality necessarily increased over the period as a whole.

The increase in relative inequality was greater when measured using a regression-based measure of impact, the relative index of inequality, than the rate ratio of the low- to the high-income group. This indicates that the widening of New Zealand's income distribution that occurred over the 1980s and 1990s contributed to the increase in mortality inequality.

Importantly, little further increase in relative inequality between income groups – and a possible decrease in absolute inequality – occurred from the late 1990s to the early 2000s. This mirrors the recent change in trend found for Māori and – to a lesser extent – Pacific compared to the European/Other ethnic groups.

Of particular note, among 25–44-year-olds with low income there was little if any decline in mortality rates over the whole observation period, compared to strong declines in the high-income group. This highlights an area for further research and policy attention.

The major proximal cause of the observed trend in socioeconomic inequality in mortality is similar to that found for ethnic inequality – the reduction (in all population groups, but to varying extents) in cardiovascular mortality, reflecting falling incidence and improving survival for ischaemic heart disease and stroke in particular. However, as CVD has declined in importance as a contributor to disparities in mortality by income (from one-half to one-third), cancer has emerged as a leading cause and now accounts for one-quarter of the total disparity in both sexes. To maintain and indeed accelerate the possible recent trend toward reducing inequality, more resources (financial, human, social) will need to be devoted to reducing cancer incidence and improving access to and quality of cancer treatment for all population groups, while still ensuring that CVD mortality continues to fall in all social groups.

Socioeconomic mediation of ethnic mortality inequalities

Regression modelling indicates that, on average over the study period, unequal socioeconomic position (SEP; including income, education, car access, housing tenure, neighbourhood deprivation, labour force status and occupational class) between ethnic groups was responsible for approximately one-third (older adults) to one-half (working-age adults) of the Māori:European/Other disparity in mortality. However, this is likely to be an underestimate, because not all possible dimensions of SEP have been captured, SEP has been measured at one point in time only rather than longitudinally over the life course, and there will be inevitable misclassification bias.

Nevertheless, it appears unlikely that such limitations could account for all of the remaining excess mortality – even after adjusting for all socioeconomic variables, the Māori:European/Other mortality rate ratio remains close to 2. Other factors, operating (at least in part) independently of SEP – such as racism, disparities in access to and quality of health care, and tobacco, diet and other lifestyle factors – must explain much of the residual ethnic inequality in mortality.

It has been suggested that the structural changes of the 1980s and 1990s, resulting in widening gaps in socioeconomic position between ethnic groups, might be responsible (in part) for widening ethnic inequalities in mortality. Unfortunately, non-linear trends in ethnic mortality disparities once the 2001–04 cohort was included, made it difficult to quantify this contribution. Nevertheless, our analysis suggests that at least half, and probably more, of the *widening* in the Māori: European/Other mortality rate ratio among working-age adults, and a quarter to half of the widening among older adults over the observation period, appears to have been socioeconomically mediated.

Conclusions

Our study provides evidence that the progressive increase in ethnic and socioeconomic (income) inequalities in all-cause mortality, seen from the early 1980s to the late 1990s, may not have continued into the new millennium. Instead, from 1996–99 to 2001–04, for both ethnic and income groups, relative inequality appears to have largely stabilised and absolute inequality may have begun to decline. This possible convergence of mortality rates represents a turnaround from the previous trend.

Quantification of the contribution of specific social, economic, public health and health services policies to this apparent change in trajectory of health inequalities is clearly an important topic for research – albeit a complex one. Whatever the explanations may be, it will be important to continue the NZCMS monitoring programme in order to confirm that this emerging trend continues in the next cohort (2006–09) and beyond – and if so, to determine whether this new trajectory can be sustained, or even accelerated, in future years.

However, even if disparities in mortality are no longer increasing, it is important to note that these disparities remain at relatively high levels, for both ethnic and income groups. The challenge of reducing social inequalities in health continues.

1 Introduction

1.1 Mandate

Reducing inequalities in health between socioeconomic and ethnic groups is a key policy goal in New Zealand (Minister of Health 2000; Ministry of Health 2002), driven by concern for social justice, human rights, and an overarching aim of the health and disability sector to improve Māori health outcomes and reduce Māori health inequalities.

Beyond considerations of equity, reducing socioeconomic gradients in health and health disparities between ethnic groups may also be the best strategy for improving the health status of the New Zealand population as a whole. This is because higher mortality rates in disadvantaged groups clearly point to mortality that can be prevented, thereby improving overall average health status.

How will we know if we are making progress towards this goal? Trends in social inequalities in health are difficult to monitor because information on socioeconomic position and ethnicity may not be accurately recorded (if such data are collected at all) in administrative health databases (although the quality of ethnicity data recording has improved in recent years). One solution has been to link mortality data anonymously and probabilistically to census data, so allowing use to be made of the rich socioeconomic data collected in the census, and ethnicity to be assigned on the basis of self-identification (as recorded in the census).

Using such record linkage methods, we have previously shown that both ethnic and income disparities in mortality widened in New Zealand over the 1980s and 1990s (Ajwani et al 2003; Blakely, Fawcett et al 2005; Blakely, Tobias et al 2005; Fawcett et al 2005).

1.2 The New Zealand Census–Mortality Study

The New Zealand Census–Mortality Study (NZCMS) is a record linkage study of census and mortality records, providing individual-level microdata free of numerator–denominator bias, conducted collaboratively between Statistics New Zealand, the Ministry of Health and the University of Otago, Wellington. The NZCMS was initially funded by the Health Research Council of New Zealand, and is now funded by the Ministry of Health.

The NZCMS has linked mortality records for the three years following each census back to the 1981 Census, so creating five short-term cohort studies. The follow-up is limited to three years because linkage of census to mortality records depends on residential stability, and also to allow timely reporting on inequalities in mortality. As each cohort study has essentially the same design, robust analysis of trends over the full period is possible. Previous monitoring reports in this series (Ajwani et al 2003; Blakely, Fawcett et al 2005; Fawcett et al 2006) have covered the 1981–84, 1986–89, 1991–94 and 1996–99 cohorts. The current report updates this information for the 2001–04 cohort.

1.3 Measuring socioeconomic position

In this report we have chosen income (ie, equivalised household income) as our main measure of socioeconomic position (SEP), for the following reasons.

- Income can be specified in the same way, and with the same inflation-adjusted categories, for each of the five cohorts.
- The number of income categories can be tuned according to the statistical power required for different analyses (in this report we use both a three- and a five-category classification).
- The categories are clearly hierarchical and behave as ordinal variables, which eases both the analytical and interpretational tasks.
- Income correlates strongly with other measures of SEP such as education and occupation, yet is more rapidly modifiable by redistributive policies – giving this measure particular policy relevance.
- Rising income inequality has been a major feature of New Zealand society in recent decades – the time period covered by the NZCMS.

Both social (occupational) class and educational status (qualifications) are also central to sociological theories of stratification, and some analyses included in this report employ these measures (along with others) as markers of SEP. Yet both educational status and occupational class pose measurement challenges. Changes in the classification of educational qualifications, together with changing patterns of participation in post-compulsory education and in the income returns to education, generate cohort and period effects that complicate the analysis of trends. Occupational class is only assignable in the NZCMS to people who are currently employed, thereby excluding a substantial and varying proportion of the adult population and generating severe health selection effects.

1.4 Measuring ethnicity (for analysis)

The classification of ethnicity used for analysis in this report differs slightly from earlier monitoring reports to reflect the new statistical standard for ethnicity (Statistics New Zealand 2005). The new standard rejects the notion of prioritising one ethnicity over others for people with multiple identities in favour of a 'total response' concept. The rapid growth of the Asian population in the 1990s and early 2000s also enables this ethnic grouping to be analysed separately for the first time, at least for the more recent cohorts.

Accordingly, after consultation (see Acknowledgements), the following approach has been adopted for the purposes of this report.

- Multiple ethnic group comparisons are carried out using three groupings based on total response output: Māori, Pacific, Asian (where possible).

- The remaining New Zealand population (ie, non-Māori non-Pacific non-Asian) is used as the reference group, henceforth called European/Other in this report. (As such it approximates a 'sole' European/Other group, which is mutually exclusive of the three total ethnic groups, allowing easy calculation of rate ratios and rate differences (and their 95% confidence intervals), despite the fact that the three total ethnic groups of Māori, Pacific and Asian overlap.) Note that this differs slightly from the Statistics New Zealand standard, which recommends the use of total response or single/combination output for all groups.
- Māori are compared to non-Māori to provide a further perspective (see Appendix).

For historical reasons, we present mortality rates for 'sole' Māori, Pacific and Asian ethnic groups, and 'prioritised' Pacific and Asian ethnic groups, in the Statistical Annex, (all-cause mortality only). Rates for combination categories (eg, those who identify as both Māori and European) are not presented because many of these categories are too small to generate stable mortality rate estimates, although indicative NZCMS results are presented elsewhere (Callister and Blakely 2004).

Note that it was not possible to classify a stable 'New Zealand European' or 'European' series due to changing definitions and classifications over time – hence our reliance on the 'European/Other' ethnic group (strictly speaking, non-Māori non-Pacific non-Asian).

As with any social classification, the ethnic categories represent heterogeneous groupings. Even the most coherent group, Māori, includes people who only self-identify as Māori and those who self-identify with other ethnic groups as well. The Pacific group includes people from many different Pacific Island countries and cultures. The Asian grouping is even more heterogenous, and clear differences in Indian and Chinese mortality rates have recently been shown in New Zealand (Ministry of Health 2006). Work is in progress using the NZCMS to calculate mortality rates for specific Pacific and Asian ethnic groups, including analysis by migrant status, and will be reported separately.

1.5 Measuring health

A full description of trends and contrasts in social inequalities in health would include non-fatal as well as fatal outcomes. However, the NZCMS links only mortality data. While this provides a partial rather than a comprehensive picture of social inequalities in health, mortality – and especially premature and avoidable mortality – has some advantages as a health outcome measure. Mortality is a 'hard' endpoint, so there can be little argument as to the quality or policy relevance of the data. Furthermore, mortality data are available with relatively little delay – an essential requirement for monitoring. Finally, mortality correlates strongly with morbidity, at least when summed across all causes (Murray et al 2000).

Beyond all-cause mortality, we examine avoidable and amenable causes of death separately (ie, deaths in those < 75 years of age from causes that are potentially preventable or treatable), and also compute rates by major cause of death (ie, condition) groups.

Mortality can, of course, be measured in several ways, and previous monitoring reports in this series have presented estimates of potential years of life lost and life expectancy in addition to mortality rates. However, for technical reasons, the NZCMS cannot accurately estimate (variations in) infant mortality, nor – until the 2001–04 cohort – was mortality in older people > 75 years of age on census night included. This meant that a number of assumptions had to be made in order to estimate years of life lost and life expectancy (which require estimates for infant and old-age mortality). Instead, we confine the current report to mortality rates in those aged 1–74 years only.

1.6 Measuring inequality

The strength of an association between an exposure (eg, SEP, ethnicity) and an outcome (eg, mortality) can be measured on absolute or relative scales. Absolute scales indicate the absolute difference in mortality rates, while relative scales indicate the ratio of rates.

Relative and absolute scales tell different stories, and interpretation and policy advice should be based on a consideration of both. For example, given the long-term decline in mortality rates for all population subgroups, absolute inequalities (rate differences) have tended to remain stable or decline while relative inequalities (rate ratios) have simultaneously increased. So if only rate ratios are examined, it would be concluded that health inequality has deteriorated. Yet is this important if all groups have shown absolute improvement in mortality risks? Such debates are at the heart of any interpretation of trends in social inequalities in health, and reinforce the need to present estimates on both absolute and relative scales.

In addition to the scale of measurement, the question also arises as to whether measures of inequality should be sensitive to changes in the relative sizes of the groups being compared. Does it matter if the ratio of mortality rates between the poor and the rich has worsened over time if the proportion of poor to rich in the population has simultaneously declined? The interpretation of trends in socioeconomic mortality gradients may depend on whether measures of association compare group averages (rate differences and rate ratios) or rankings (such as the regression-based slope index of inequality and relative index of inequality). The latter measures will increase if the underlying income distribution widens. Thus, the relative and slope indices of inequality serve as measures of impact in addition to being measures of association.

Table 1: Measures of socioeconomic inequality in mortality

	Absolute	**Relative**
Association	Rate difference	Rate ratio
Association and impact	Slope index of inequality	Relative index of inequality

We argue in this report, as in previous reports, that both types of measures should be presented simultaneously so that the user can gain a full picture of inequality. This generates a set of four measures of inequality along two axes (absolute versus relative scales, and measures of association versus impact; see Table 1). Note that for ethnic inequalities, there is no ordinal ranking of group, so the slope and relative indexes of inequality are not appropriate measures for analysing ethnic (as opposed to socio-economic) inequalities in health.

1.7 Objectives of this report

This report provides updated monitoring information on ethnic disparities and socioeconomic gradients in mortality in New Zealand, and on the interaction between ethnicity and socioeconomic position in determining mortality risks. This information provides evidence for the health and social sectors, researchers and analysts, and policy makers and their advisors on the progress (if any) that has been made in reducing such inequalities. It may also point to areas where corrective policy action is required.

More specifically, the analyses summarised in this report aim to estimate trends from 1981 to 2004 in mortality rates (all-cause and by-cause) among males and females aged 1–74 years (and age bands within this age range) by:

- ethnicity, including both a Māori:non-Māori analysis and (where possible) a comparison of European/Other, Māori, Pacific and Asian ethnic groups
- socioeconomic position, measured by equivalised household income
- income band within ethnic group
- ethnic group within income band.

The analyses further aim to measure inequalities in these mortality rates over the study period using:

- age-standardised rate differences and rate ratios (SRD and SRR) between ethnic groups
- age- and ethnicity-standardised rate differences, rate ratios, slope indices of inequality (SII) and relative indices of inequality (RII) between income groups.

Finally, estimates are presented for the:

- contribution of different causes of death to absolute inequalities in mortality between ethnic and income groups
- socioeconomic mediation of ethnic inequalities in mortality, estimated by stratification and regression modelling.

1.8 Guide for readers

Following this **Introduction**, the data, record linkage and statistical methods employed are briefly outlined (**Methods**). This includes a description of changes to methods used for this report compared to earlier reports in this monitoring series.

Following this, the next four chapters present the key **Results** by ethnicity, income and their interaction, including an analysis of the contribution of specific conditions to the observed mortality inequalities. The text then concludes with a brief **Discussion**.

An **Appendix** to the report presents an analysis of Māori compared to non-Māori ethnic groups for all-cause mortality only, to provide a perspective complementary to the ethnic analysis included in the body of the report.

A **Statistical Annex** is also attached to the report, presenting all mortality rates shown graphically in the body of the report (and some additional rates for alternative ethnic groupings).

The **NZCMS WebTable** (http://www.otago.ac.nz/NZCMSWebTable/) provides access to results in this report (and much more) in tabular and graphical form, including colour graphs that can be easily pasted into documents or used in presentations.

Although the 2001–04 cohort, unlike previous cohorts, linked records for all age groups beyond infancy, results for age groups > 75 years are not reported here (because trend data are not available for this age group), but will be published elsewhere.

2 Methods

2.1 Record linkage

Mortality records were assembled for people aged 1–74 years on the previous census night who died within three years of the 1981, 1986, 1991, 1996 or 2001 censuses. This yielded five short-duration follow-up studies (cohorts) spanning the period from 1981 to 2004. Because the five cohorts are large and have identical designs, valid comparisons of mortality rates between ethnic and income groups across the whole study period are possible.

Probabilistic record linkage methods were used to anonymously link these mortality records to corresponding census records (using Automatch™ and Validity™ software) (Fawcett et al 2007, in press; Hill et al 2002). The matching variables were geocoded domicile of usual residence, sex, date of birth, country of birth and ethnic group. Domicile (geocoded at meshblock or census area unit level) was the blocking variable, so individuals who changed domicile between census night and death were less likely to be successfully linked. All linkages were undertaken by Statistics New Zealand, in accordance with the Statistics Act 1975 and Statistics New Zealand protocols.

The percentages of eligible deaths at ages 1–74 years successfully linked to a census record were 70.9%, 73.7%, 76.3%, 77.6% and 79.6% for the five census cohorts, respectively. Over 96% of these linkages were estimated to be valid (ie true positives) (Blakely and Salmond 2002; Fawcett et al 2007, in press; Hill et al 2002). Both to correct for any linkage bias and to avoid underestimation of mortality rates using the linked data sets, weights were calculated for strata based on age, sex, ethnicity and small area deprivation. All analyses presented in this report use these weights, and they have been shown elsewhere to satisfactorily adjust for any linkage bias (Fawcett et al 2002).

Note that all analyses presented in this report are conducted on the linked census–mortality data sets. This marks a change in how ethnic (but not socioeconomic) mortality rates were calculated compared to the first *Decades of Disparity* report, which applied 'adjustors' for undercounting of Māori and Pacific (and over-counting of non-Māori non-Pacific) deaths to routine mortality data. One of the reasons for using these adjustors and routine mortality data in the earlier report was to demonstrate to the sector how such corrected analyses can be done.

Why do we not use these adjustment factors in this current report? First, under- (and over-) counting of ethnicity on mortality data declined after 1995, when ethnicity data collection on death certificates was aligned with that on the census (Ajwani et al 2004). Second, it is easier to conduct analyses exclusively on the linked census–mortality data sets for all periods. Third, the same analytical methods and data could then be used for the three main parts of this report: ethnic, socioeconomic and socioeconomic mediation of ethnic mortality differences.

However, this change of method means that the estimates reported here (for ethnic but not for socioeconomic inequalities) may differ slightly from those reported in the first *Decades of Disparity* report. Another limitation arising from use of the linked data sets for ethnic analyses is that we now only have three (rather than five) years of mortality data for each period, so reducing statistical power. This is problematic for less common diseases, for which use of the unlinked (but adjusted) mortality data provides a useful adjunct to results in this report (eg, for colorectal cancer [Shaw et al 2006]).

2.2 Variable definitions

Ethnicity

Given the conceptual importance of classifying ethnicity, we addressed this issue above in the Introduction.

A remaining noteworthy methodological point, however, is that the wording of the ethnicity question has varied across censuses, introducing some uncertainty into ethnic classification. In particular, we had to assume that individuals reporting any Māori or Pacific ethnic *origin* in 1981 or 1986 would have self-identified similarly with respect to ethnic *affiliation* in the 1991 and subsequent censuses. Also, the 1981 ethnicity question solicited fractionated origin (eg, ¼ Māori, ¾ European). For 1981 census data we categorised someone as Māori if any fraction Māori, and likewise Pacific and Asian, to generate total ethnic groups. The remaining census respondents were classified as 'European/Other', or more strictly non-Māori non-Pacific non-Asian.

The distribution of person-years and deaths (weighted for linkage bias) by ethnicity are shown in Tables 2 and 3 below.

Table 2: Person-years, by ethnic group

Age group	Cohort	Total person-years	Māori	Pacific	Asian	European/ Other	Missing ethnicity
Males							
1–74 years	1981–84	4,191,299	520,088 (12.4%)	147,216 (3.5%)	56,198 (1.3%)	3,441,135 (82.1%)	36,563 (0.9%)
	1986–89	4,282,082	537,716 (12.6%)	179,613 (4.2%)	73,347 (1.7%)	3,474,086 (81.1%)	40,614 (0.9%)
	1991–94	4,389,754	565,277 (12.9%)	224,226 (5.1%)	136,498 (3.1%)	3,458,987 (78.8%)	31,601 (0.7%)
	1996–99	4,585,546	700,021 (15.3%)	278,736 (6.1%)	234,359 (5.1%)	3,382,260 (73.8%)	48,007 (1.0%)
	2001–04	4,559,230	671,440 (14.7%)	302,760 (6.6%)	303,631 (6.7%)	3,282,283 (72.0%)	50,711 (1.1%)
1–14 years	1981–84	1,103,124	210,966 (19.1%)	60,759 (5.5%)	16,208 (1.5%)	811,150 (73.5%)	9,870 (0.9%)
	1986–89	1,017,256	200,737 (19.7%)	68,243 (6.7%)	21,004 (2.1%)	732,180 (72.0%)	9,148 (0.9%)
	1991–94	1,016,105	207,130 (20.4%)	84,488 (8.3%)	35,598 (3.5%)	700,108 (68.9%)	5,412 (0.5%)
	1996–99	1,079,176	259,359 (24.0%)	107,389 (10.0%)	60,265 (5.6%)	669,668 (62.1%)	14,033 (1.3%)
	2001–04	1,050,659	246,382 (23.5%)	113,775 (10.8%)	69,172 (6.6%)	639,606 (60.9%)	11,557 (1.1%)
15–24 years	1981–84	805,693	120,956 (15.0%)	28,188 (3.5%)	12,102 (1.5%)	640,156 (79.5%)	6,207 (0.8%)
	1986–89	796,595	123,167 (15.5%)	37,372 (4.7%)	15,121 (1.9%)	617,841 (77.6%)	7,740 (1.0%)
	1991–94	751,147	120,929 (16.1%)	45,465 (6.1%)	24,385 (3.2%)	561,688 (74.8%)	4,097 (0.5%)
	1996–99	702,864	134,465 (19.1%)	54,020 (7.7%)	51,202 (7.3%)	467,985 (66.6%)	7,650 (1.1%)
	2001–04	669,588	122,731 (18.3%)	55,562 (8.3%)	67,294 (10.1%)	427,696 (63.9%)	6,814 (1.0%)

Age group	Cohort	Total person-years	Māori	Pacific	Asian	European/ Other	Missing ethnicity
25–44 years	1981–84	1,211,621	125,079 (10.3%)	43,618 (3.6%)	19,708 (1.6%)	1,016,110 (83.9%)	8,875 (0.7%)
	1986–89	1,343,939	143,241 (10.7%)	53,349 (4.0%)	25,759 (1.9%)	1,112,677 (82.8%)	12,600 (0.9%)
	1991–94	1,411,612	158,531 (11.2%)	65,415 (4.6%)	55,868 (4.0%)	1,124,279 (79.6%)	11,385 (0.8%)
	1996–99	1,462,820	199,297 (13.6%)	77,848 (5.3%)	80,098 (5.5%)	1,101,060 (75.3%)	14,741 (1.0%)
	2001–04	1,381,018	185,956 (13.5%)	84,789 (6.1%)	97,730 (7.1%)	1,004,838 (72.8%)	16,182 (1.2%)
45–64 years	1981–84	817,195	53,909 (6.6%)	12,997 (1.6%)	7,166 (0.9%)	736,497 (90.1%)	6,995 (0.9%)
	1986–89	856,436	61,147 (7.1%)	18,480 (2.2%)	10,149 (1.2%)	759,064 (88.6%)	8,430 (1.0%)
	1991–94	914,188	67,764 (7.4%)	25,037 (2.7%)	18,179 (2.0%)	796,326 (87.1%)	7,736 (0.8%)
	1996–99	1,023,009	90,791 (8.9%)	33,720 (3.3%)	37,506 (3.7%)	855,447 (83.6%)	8,725 (0.9%)
	2001–04	1,137,255	98,021 (8.6%)	41,433 (3.6%)	58,252 (5.1%)	929,955 (81.8%)	12,089 (1.1%)
65–74 years	1981–84	253,666	9,178 (3.6%)	1,654 (0.7%)	1,014 (0.4%)	237,223 (93.5%)	4,617 (1.8%)
	1986–89	267,856	9,424 (3.5%)	2,169 (0.8%)	1,314 (0.5%)	252,323 (94.2%)	2,696 (1.0%)
	1991–94	296,701	10,923 (3.7%)	3,822 (1.3%)	2,469 (0.8%)	276,585 (93.2%)	2,971 (1.0%)
	1996–99	317,678	16,110 (5.1%)	5,760 (1.8%)	5,288 (1.7%)	288,099 (90.7%)	2,858 (0.9%)
	2001–04	320,710	18,350 (5.7%)	7,202 (2.2%)	11,184 (3.5%)	280,189 (87.4%)	4,070 (1.3%)
Females							
1–74 years	1981–84	4,229,565	533,532 (12.6%)	146,203 (3.5%)	53,740 (1.3%)	3,460,700 (81.8%)	45,011 (1.1%)
	1986–89	4,344,705	554,314 (12.8%)	180,515 (4.2%)	74,939 (1.7%)	3,513,766 (80.9%)	44,591 (1.0%)
	1991–94	4,489,748	597,793 (13.3%)	233,779 (5.2%)	139,891 (3.1%)	3,514,862 (78.3%)	30,962 (0.7%)
	1996–99	4,726,314	736,216 (15.6%)	289,093 (6.1%)	255,834 (5.4%)	3,458,371 (73.2%)	45,491 (1.0%)
	2001–04	4,752,266	715,532 (15.1%)	315,869 (6.6%)	339,156 (7.1%)	3,390,384 (71.3%)	43,635 (0.9%)
1–14 years	1981–84	1,061,307	205,611 (19.4%)	57,940 (5.5%)	15,665 (1.5%)	777,823 (73.3%)	9,884 (0.9%)
	1986–89	975,839	193,305 (19.8%)	64,352 (6.6%)	20,536 (2.1%)	702,138 (72.0%)	9,058 (0.9%)
	1991–94	975,916	201,904 (20.7%)	80,313 (8.2%)	34,175 (3.5%)	670,402 (68.7%)	5,239 (0.5%)
	1996–99	1,025,613	247,113 (24.1%)	100,683 (9.8%)	57,014 (5.6%)	637,839 (62.2%)	13,190 (1.3%)
	2001–04	999,312	234,151 (23.4%)	108,570 (10.9%)	66,598 (6.7%)	607,803 (60.8%)	10,721 (1.1%)
15–24 years	1981–84	792,255	127,013 (16.0%)	30,015 (3.8%)	11,050 (1.4%)	620,423 (78.3%)	5,615 (0.7%)
	1986–89	787,091	127,426 (16.2%)	39,362 (5.0%)	15,228 (1.9%)	602,422 (76.5%)	7,637 (1.0%)
	1991–94	744,727	126,998 (17.1%)	48,697 (6.5%)	24,874 (3.3%)	546,474 (73.4%)	3,516 (0.5%)
	1996–99	702,122	140,978 (20.1%)	55,861 (8.0%)	52,799 (7.5%)	459,161 (65.4%)	6,337 (0.9%)
	2001–04	663,589	128,283 (19.3%)	58,042 (8.7%)	66,815 (10.1%)	415,995 (62.7%)	5,274 (0.8%)
25–44 years	1981–84	1,245,224	134,763 (10.8%)	43,889 (3.5%)	18,859 (1.5%)	1,040,724 (83.6%)	8,788 (0.7%)
	1986–89	1,395,303	158,720 (11.4%)	55,939 (4.0%)	27,476 (2.0%)	1,144,737 (82.0%)	12,458 (0.9%)
	1991–94	1,501,502	184,370 (12.3%)	73,914 (4.9%)	60,081 (4.0%)	1,176,767 (78.4%)	10,908 (0.7%)
	1996–99	1,596,943	232,987 (14.6%)	89,817 (5.6%)	99,530 (6.2%)	1,172,432 (73.4%)	13,789 (0.9%)
	2001–04	1,554,474	225,925 (14.5%)	96,801 (6.2%)	126,386 (8.1%)	1,103,308 (71.0%)	12,049 (0.8%)
45–64 years	1981–84	824,209	56,315 (6.8%)	12,457 (1.5%)	6,638 (0.8%)	738,483 (89.6%)	10,652 (1.3%)
	1986–89	858,834	63,912 (7.4%)	18,141 (2.1%)	9,978 (1.2%)	757,783 (88.2%)	9798 (1.1%)
	1991–94	923,032	71,773 (7.8%)	26,110 (2.8%)	17,759 (1.9%)	800,712 (86.7%)	7643 (0.8%)
	1996–99	1,051,483	96,372 (9.2%)	35,570 (3.4%)	40,069 (3.8%)	874,284 (83.1%)	8466 (0.8%)
	2001–04	1,189,132	106,650 (9.0%)	43,582 (3.7%)	67,717 (5.7%)	962,925 (81.0%)	10,880 (0.9%)
65–74 years	1981–84	306,570	9,831 (3.2%)	1,902 (0.6%)	1,528 (0.5%)	283,248 (92.4%)	10,071 (3.3%)
	1986–89	327,639	10,949 (3.3%)	2,721 (0.8%)	1,720 (0.5%)	306,686 (93.6%)	5,640 (1.7%)
	1991–94	344,571	12,748 (3.7%)	4,746 (1.4%)	3,001 (0.9%)	320,507 (93.0%)	3,656 (1.1%)
	1996–99	350,153	18,765 (5.4%)	7,161 (2.0%)	6,422 (1.8%)	314,656 (89.9%)	3,708 (1.1%)
	2001–04	345,759	20,523 (5.9%)	8,875 (2.6%)	11,641 (3.4%)	300,353 (86.9%)	4,711 (1.4%)

Note: the sum of the row percentages is greater than 100% because *total* groupings are used for Māori, Pacific and Asian peoples.

Table 3: Deaths (weighted for linkage bias), by ethnic group

Age group	Cohort	Total deaths	Māori	Pacific	Asian	European/ Other	Missing ethnicity
Males							
1–74 years	1981–84	23,424	2,364 (10.1%)	372 (1.6%)	132 (0.6%)	20,223 (86.3%)	348 (1.5%)
	1986–89	22,749	2,403 (10.6%)	588 (2.6%)	147 (0.6%)	19,452 (85.5%)	204 (0.9%)
	1991–94	21,114	2,706 (12.8%)	624 (3.0%)	228 (1.1%)	17,532 (83.0%)	48 (0.2%)
	1996–99	20,070	3,453 (17.2%)	969 (4.8%)	372 (1.9%)	15,234 (75.9%)	162 (0.8%)
	2001–04	18,081	3,054 (16.9%)	966 (5.3%)	465 (2.6%)	13,455 (74.4%)	225 (1.2%)
1–14 years	1981–84	453	114 (25.2%)	42 (9.3%)	6 (1.3%)	291 (64.2%)	6 (1.3%)
	1986–89	393	108 (27.5%)	33 (8.4%)	12 (3.1%)	249 (63.4%)	6 (1.5%)
	1991–94	312	75 (24.0%)	33 (10.6%)	12 (3.8%)	195 (62.5%)	6 (1.9%)
	1996–99	318	120 (37.7%)	36 (11.3%)	15 (4.7%)	156 (49.1%)	6 (1.9%)
	2001–04	261	105 (40.2%)	27 (10.3%)	15 (5.7%)	120 (46.0%)	6 (2.3%)
15–24 years	1981–84	1,245	234 (18.8%)	48 (3.9%)	9 (0.7%)	948 (76.1%)	9 (0.7%)
	1986–89	1,314	264 (20.1%)	81 (6.2%)	15 (1.1%)	957 (72.8%)	12 (0.9%)
	1991–94	1,155	255 (22.1%)	66 (5.7%)	24 (2.1%)	822 (71.2%)	6 (0.5%)
	1996–99	942	300 (31.8%)	90 (9.6%)	30 (3.2%)	531 (56.4%)	9 (1.0%)
	2001–04	771	201 (26.1%)	81 (10.5%)	45 (5.8%)	447 (58.0%)	9 (1.2%)
25–44 years	1981–84	1,980	387 (19.5%)	60 (3.0%)	18 (0.9%)	1,494 (75.5%)	21 (1.1%)
	1986–89	2,268	420 (18.5%)	138 (6.1%)	27 (1.2%)	1,686 (74.3%)	6 (0.3%)
	1991–94	2,364	513 (21.7%)	99 (4.2%)	54 (2.3%)	1,689 (71.4%)	6 (0.3%)
	1996–99	2,361	621 (26.3%)	186 (7.9%)	72 (3.0%)	1,485 (62.9%)	18 (0.8%)
	2001–04	1,929	489 (25.3%)	162 (8.4%)	75 (3.9%)	1,203 (62.4%)	15 (0.8%)
45–64 years	1981–84	9,072	1,068 (11.8%)	135 (1.5%)	57 (0.6%)	7,716 (85.1%)	90 (1.0%)
	1986–89	8,490	1,089 (12.8%)	228 (2.7%)	57 (0.7%)	7,053 (83.1%)	66 (0.8%)
	1991–94	7,398	1,209 (16.3%)	273 (3.7%)	87 (1.2%)	5,811 (78.5%)	18 (0.2%)
	1996–99	6,999	1,494 (21.3%)	399 (5.7%)	156 (2.2%)	4,932 (70.5%)	57 (0.8%)
	2001–04	6,846	1,326 (19.4%)	408 (6.0%)	174 (2.5%)	4,884 (71.3%)	84 (1.2%)
65–74 years	1981–84	10,671	558 (5.2%)	81 (0.8%)	36 (0.3%)	9,774 (91.6%)	219 (2.1%)
	1986–89	10,287	522 (5.1%)	111 (1.1%)	36 (0.3%)	9,501 (92.4%)	117 (1.1%)
	1991–94	9,891	651 (6.6%)	153 (1.5%)	54 (0.5%)	9,018 (91.2%)	18 (0.2%)
	1996–99	9,453	918 (9.7%)	258 (2.7%)	99 (1.0%)	8,130 (86.0%)	72 (0.8%)
	2001–04	8,280	930 (11.2%)	285 (3.4%)	159 (1.9%)	6,807 (82.2%)	111 (1.3%)
Females							
1–74 years	1981–84	14,154	1,608 (11.4%)	234 (1.7%)	69 (0.5%)	11,940 (84.4%)	312 (2.2%)
	1986–89	13,857	1,653 (11.9%)	321 (2.3%)	84 (0.6%)	11,649 (84.1%)	174 (1.3%)
	1991–94	13,032	1,842 (14.1%)	432 (3.3%)	129 (1.0%)	10,614 (81.4%)	57 (0.4%)
	1996–99	12,651	2,391 (18.9%)	621 (4.9%)	234 (1.8%)	9,339 (73.8%)	120 (0.9%)
	2001–04	12,054	2,295 (19.0%)	651 (5.4%)	291 (2.4%)	8,694 (72.1%)	150 (1.2%)
1–14 years	1981–84	303	78 (25.7%)	18 (5.9%)	6 (2.0%)	201 (66.3%)	6 (2.0%)
	1986–89	249	57 (22.9%)	27 (10.8%)	6 (2.4%)	162 (65.1%)	6 (2.4%)
	1991–94	234	66 (28.2%)	36 (15.4%)	6 (2.6%)	141 (60.3%)	6 (2.6%)
	1996–99	222	84 (37.8%)	24 (10.8%)	6 (2.7%)	111 (50.0%)	6 (2.7%)
	2001–04	201	60 (29.9%)	18 (9.0%)	6 (3.0%)	117 (58.2%)	6 (3.0%)
15–24 years	1981–84	438	102 (23.3%)	24 (5.5%)	6 (1.4%)	306 (69.9%)	6 (1.4%)
	1986–89	447	99 (22.1%)	27 (6.0%)	6 (1.3%)	315 (70.5%)	6 (1.3%)
	1991–94	393	87 (22.1%)	21 (5.3%)	6 (1.5%)	282 (71.8%)	6 (1.5%)
	1996–99	378	132 (34.9%)	27 (7.1%)	18 (4.8%)	201 (53.2%)	6 (1.6%)
	2001–04	291	90 (30.9%)	33 (11.3%)	21 (7.2%)	150 (51.5%)	6 (2.1%)

Age group	Cohort	Total deaths	Māori	Pacific	Asian	European/ Other	Missing ethnicity
25–44 years	1981–84	1,236	273 (22.1%)	51 (4.1%)	12 (1.0%)	894 (72.3%)	6 (0.5%)
	1986–89	1,230	252 (20.5%)	72 (5.9%)	24 (2.0%)	882 (71.7%)	6 (0.5%)
	1991–94	1,248	264 (21.2%)	90 (7.2%)	27 (2.2%)	873 (70.0%)	6 (0.5%)
	1996–99	1,284	345 (26.9%)	129 (10.0%)	57 (4.4%)	765 (59.6%)	9 (0.7%)
	2001–04	1,236	330 (26.7%)	105 (8.5%)	60 (4.9%)	744 (60.2%)	9 (0.7%)
45–64 years	1981–84	5,217	693 (13.3%)	90 (1.7%)	30 (0.6%)	4,332 (83.0%)	69 (1.3%)
	1986–89	4,992	792 (15.9%)	129 (2.6%)	30 (0.6%)	4,011 (80.3%)	39 (0.8%)
	1991–94	4,710	957 (20.3%)	144 (3.1%)	51 (1.1%)	3,549 (75.4%)	18 (0.4%)
	1996–99	4,701	1,062 (22.6%)	243 (5.2%)	87 (1.9%)	3,294 (70.1%)	33 (0.7%)
	2001–04	4,812	1,041 (21.6%)	288 (6.0%)	108 (2.2%)	3,339 (69.4%)	48 (1.0%)
65–74 years	1981–84	6,960	459 (6.6%)	48 (0.7%)	24 (0.3%)	6,204 (89.1%)	228 (3.3%)
	1986–89	6,936	450 (6.5%)	72 (1.0%)	24 (0.3%)	6,273 (90.4%)	123 (1.8%)
	1991–94	6,447	465 (7.2%)	138 (2.1%)	39 (0.6%)	5,772 (89.5%)	39 (0.6%)
	1996–99	6,066	765 (12.6%)	192 (3.2%)	66 (1.1%)	4,968 (81.9%)	75 (1.2%)
	2001–04	5,511	777 (14.1%)	210 (3.8%)	99 (1.8%)	4,344 (78.8%)	84 (1.5%)

Note: the sum of the row percentages is greater than 100% because *total* groupings are used for Māori, Pacific and Asian peoples.

Income

Equivalised household income is the main measure of socioeconomic position (SEP) used in this report. Household income better reflects the resources available to (most) individuals than personal income, so is preferred as an indicator of SEP. However, households of different size and composition require different incomes to produce similar standards of living (because of economies of scale). The revised Jensen Index (Blakely 2002; Jensen 1988) has been used to equivalise household incomes for this report. Incomes were then further adjusted for inflation using the Consumers Price Index (CPI; base year 1996).

Tertiles or quintiles of CPI-adjusted equivalised household incomes have been used for the analyses presented in this report. The majority of analyses use tertiles, with high-, medium- and low-income groups corresponding to the following thresholds (CPI adjusted to 1996 and household equivalised as above): low < $26,109; medium $26,109 to $43,016; high ≥ $43,016.

The distribution of person-years and deaths (weighted for linkage bias) by income are shown in Tables 4 and 5 below. Between 14.2% and 19.3% of individuals could not be assigned a household income (ie, the data were missing) across the five cohorts.

Mortality rates by other indicators of SEP are included in the regression models presented later in this report. Definitions of these additional socioeconomic variables, as well as a geographic ('region') variable also used in the regression modelling, are provided elsewhere (Fawcett et al 2006). Briefly, the definitions are as follows: educational qualification (no qualification, high school or post-school qualification); housing tenure (owner occupied or not); household car access (0, 1, 2 or more); position in the labour market (not in labour force, unemployed, employed social class 4–6, employed social class 1–3). Social class was defined by the Elley–Irving occupational class (Elley and Irving 1976). Region was defined by the four former Regional Health Authority areas (rather than DHBs, because of statistical power limitations).

Table 4: Person years by income group

Age group	Cohort	Total person-years	Low income	Medium income	High income	Missing income
Males						
1–74 years	1981–84	4,191,299	1,118,206 (26.7%)	1,156,338 (27.6%)	1,199,111 (28.6%)	717,645 (17.1%)
	1986–89	4,282,082	1,219,645 (28.5%)	1,277,701 (29.8%)	1,160,459 (27.1%)	624,277 (14.6%)
	1991–94	4,389,754	1,317,031 (30.0%)	1,120,720 (25.5%)	1,326,016 (30.2%)	625,986 (14.3%)
	1996–99	4,585,546	1,364,967 (29.8%)	1,088,509 (23.7%)	1,452,594 (31.7%)	679,477 (14.8%)
	2001–04	4,559,230	1,158,313 (25.4%)	997,804 (21.9%)	1,548,268 (34.0%)	854,845 (18.7%)
1–14 years	1981–84	1,103,124	430,813 (39.1%)	331,439 (30.0%)	159,598 (14.5%)	181,274 (16.4%)
	1986–89	1,017,256	439,992 (43.3%)	279,626 (27.5%)	111,902 (11.0%)	185,737 (18.3%)
	1991–94	1,016,105	424,258 (41.8%)	258,721 (25.5%)	152,577 (15.0%)	180,549 (17.8%)
	1996–99	1,079,176	457,495 (42.4%)	255,283 (23.7%)	192,487 (17.8%)	173,911 (16.1%)
	2001–04	1,050,659	369,190 (35.1%)	240,142 (22.9%)	218,182 (20.8%)	223,145 (21.2%)
15–24 years	1981–84	805,693	162,791 (20.2%)	218,932 (27.2%)	268,315 (33.3%)	155,654 (19.3%)
	1986–89	796,595	164,133 (20.6%)	251,777 (31.6%)	246,234 (30.9%)	134,452 (16.9%)
	1991–94	751,147	192,191 (25.6%)	201,669 (26.8%)	232,586 (31.0%)	124,702 (16.6%)
	1996–99	702,864	189,422 (26.9%)	168,290 (23.9%)	205,365 (29.2%)	139,787 (19.9%)
	2001–04	669,588	171,440 (25.6%)	145,190 (21.7%)	196,525 (29.4%)	156,434 (23.4%)
25–44 years	1981–84	1,211,621	277,999 (22.9%)	347,850 (28.7%)	392,914 (32.4%)	192,860 (15.9%)
	1986–89	1,343,939	328,400 (24.4%)	400,038 (29.8%)	431,085 (32.1%)	184,416 (13.7%)
	1991–94	1,411,612	328,102 (23.2%)	371,168 (26.3%)	515,394 (36.5%)	196,950 (14.0%)
	1996–99	1,462,820	335,492 (22.9%)	363,417 (24.8%)	562,277 (38.4%)	201,634 (13.8%)
	2001–04	1,381,018	262,771 (19.0%)	310,631 (22.5%)	560,054 (40.6%)	247,562 (17.9%)
45–64 years	1981–84	817,195	131,035 (16.0%)	211,231 (25.8%)	329,561 (40.3%)	145,368 (17.8%)
	1986–89	856,436	157,200 (18.4%)	267,380 (31.2%)	328,666 (38.4%)	103,190 (12.0%)
	1991–94	914,188	210,840 (23.1%)	224,040 (24.5%)	373,934 (40.9%)	105,375 (11.5%)
	1996–99	1,023,009	212,596 (20.8%)	234,186 (22.9%)	442,411 (43.2%)	133,816 (13.1%)
	2001–04	1,137,255	207,296 (18.2%)	233,426 (20.5%)	508,713 (44.7%)	187,820 (16.5%)
65–74 years	1981–84	253,666	115,569 (45.6%)	46,886 (18.5%)	48,723 (19.2%)	42,489 (16.8%)
	1986–89	267,856	129,921 (48.5%)	78,881 (29.4%)	42,572 (15.9%)	16,482 (6.2%)
	1991–94	296,701	161,641 (54.5%)	65,123 (21.9%)	51,527 (17.4%)	18,411 (6.2%)
	1996–99	317,678	169,963 (53.5%)	67,333 (21.2%)	50,053 (15.8%)	30,329 (9.5%)
	2001–04	320,710	147,616 (46.0%)	68,415 (21.3%)	64,795 (20.2%)	39,885 (12.4%)
Females						
1–74 years	1981–84	4,229,565	1,304,141 (30.8%)	1,136,105 (26.9%)	1,076,054 (25.4%)	713,265 (16.9%)
	1986–89	4,344,705	1,412,936 (32.5%)	1,262,087 (29.0%)	1,034,625 (23.8%)	635,057 (14.6%)
	1991–94	4,489,748	1,527,201 (34.0%)	1,101,707 (24.5%)	1,223,507 (27.3%)	637,333 (14.2%)
	1996–99	4,726,314	1,570,012 (33.2%)	1,075,623 (22.8%)	1,355,106 (28.7%)	725,573 (15.4%)
	2001–04	4,752,266	1,362,375 (28.7%)	996,972 (21.0%)	1,474,221 (31.0%)	918,698 (19.3%)
1–14 years	1981–84	1,061,307	414,081 (39.0%)	316,190 (29.8%)	155,546 (14.7%)	175,491 (16.5%)
	1986–89	975,839	421,216 (43.2%)	267,171 (27.4%)	108,000 (11.1%)	179,452 (18.4%)
	1991–94	975,916	408,115 (41.8%)	246,760 (25.3%)	146,061 (15.0%)	174,980 (17.9%)
	1996–99	1,025,613	433,321 (42.3%)	242,538 (23.6%)	183,427 (17.9%)	166,326 (16.2%)
	2001–04	999,312	351,046 (35.1%)	226,560 (22.7%)	208,313 (20.8%)	213,394 (21.4%)
15–24 years	1981–84	792,255	187,247 (23.6%)	213,330 (26.9%)	244,181 (30.8%)	147,498 (18.6%)
	1986–89	787,091	185,956 (23.6%)	242,795 (30.8%)	225,892 (28.7%)	132,448 (16.8%)
	1991–94	744,727	210,386 (28.3%)	192,802 (25.9%)	218,277 (29.3%)	123,261 (16.6%)
	1996–99	702,122	207,364 (29.5%)	160,267 (22.8%)	191,552 (27.3%)	142,939 (20.4%)
	2001–04	663,589	185,384 (27.9%)	140,913 (21.2%)	178,300 (26.9%)	158,991 (24.0%)

Age group	Cohort	Total person-years	Low income	Medium income	High income	Missing income
25–44 years	1981–84	1,245,224	357,127 (28.7%)	356,956 (28.7%)	339,937 (27.3%)	191,204 (15.4%)
	1986–89	1,395,303	419,304 (30.1%)	400,540 (28.7%)	371,344 (26.6%)	204,115 (14.6%)
	1991–94	1,501,502	436,754 (29.1%)	373,441 (24.9%)	473,828 (31.6%)	217,480 (14.5%)
	1996–99	1,596,943	463,143 (29.0%)	365,327 (22.9%)	534,756 (33.5%)	233,718 (14.6%)
	2001–04	1,554,474	379,944 (24.4%)	324,561 (20.9%)	552,521 (35.5%)	297,448 (19.1%)
45–64 years	1981–84	824,209	186,739 (22.7%)	195,663 (23.7%)	290,935 (35.3%)	150,871 (18.3%)
	1986–89	858,834	207,368 (24.1%)	261,474 (30.4%)	288,242 (33.6%)	101,749 (11.8%)
	1991–94	923,032	263,563 (28.6%)	217,900 (23.6%)	337,720 (36.6%)	103,849 (11.3%)
	1996–99	1,051,483	265,217 (25.2%)	232,772 (22.1%)	403,791 (38.4%)	149,703 (14.2%)
	2001–04	1,189,132	263,604 (22.2%)	237,858 (20.0%)	482,214 (40.6%)	205,456 (17.3%)
65–74 years	1981–84	306,570	158,947 (51.8%)	53,965 (17.6%)	45,456 (14.8%)	48,201 (15.7%)
	1986–89	327,639	179,092 (54.7%)	90,108 (27.5%)	41,147 (12.6%)	17,293 (5.3%)
	1991–94	344,571	208,383 (60.5%)	70,804 (20.5%)	47,620 (13.8%)	17,764 (5.2%)
	1996–99	350,153	200,967 (57.4%)	74,719 (21.3%)	41,580 (11.9%)	32,887 (9.4%)
	2001–04	345,759	182,397 (52.8%)	67,080 (19.4%)	52,872 (15.3%)	43,409 (12.6%)

Table 5: Deaths (weighted for linkage bias) by income group

Age group	Cohort	Total death	Low income	Medium income	High income	Missing income
Males						
1–74 years	1981–84	23,424	8,703 (37.2%)	5,058 (21.6%)	5,319 (22.7%)	4,344 (18.5%)
	1986–89	22,749	9,204 (40.5%)	6,729 (29.6%)	4,503 (19.8%)	2,316 (10.2%)
	1991–94	21,114	10,188 (48.3%)	4,890 (23.2%)	4,047 (19.2%)	1,986 (9.4%)
	1996–99	20,070	9,192 (45.8%)	4,320 (21.5%)	3,765 (18.8%)	2,793 (13.9%)
	2001–04	18,081	7,524 (41.6%)	3,585 (19.8%)	3,927 (21.7%)	3,045 (16.8%)
1–14 years	1981–84	453	198 (43.7%)	111 (24.5%)	60 (13.2%)	87 (19.2%)
	1986–89	393	192 (48.9%)	93 (23.7%)	30 (7.6%)	81 (20.6%)
	1991–94	312	153 (49.0%)	63 (20.2%)	33 (10.6%)	60 (19.2%)
	1996–99	318	162 (50.9%)	48 (15.1%)	39 (12.3%)	75 (23.6%)
	2001–04	261	87 (33.3%)	57 (21.8%)	45 (17.2%)	69 (26.4%)
15–24 years	1981–84	1,245	234 (18.8%)	342 (27.5%)	384 (30.8%)	285 (22.9%)
	1986–89	1,314	267 (20.3%)	432 (32.9%)	387 (29.5%)	228 (17.4%)
	1991–94	1,155	306 (26.5%)	351 (30.4%)	306 (26.5%)	186 (16.1%)
	1996–99	942	276 (29.3%)	216 (22.9%)	216 (22.9%)	231 (24.5%)
	2001–04	771	228 (29.6%)	174 (22.6%)	177 (23.0%)	192 (24.9%)
25–44 years	1981–84	1,980	579 (29.2%)	573 (28.9%)	528 (26.7%)	306 (15.5%)
	1986–89	2,268	639 (28.2%)	684 (30.2%)	579 (25.5%)	363 (16.0%)
	1991–94	2,364	774 (32.7%)	651 (27.5%)	615 (26.0%)	327 (13.8%)
	1996–99	2,361	747 (31.6%)	558 (23.6%)	663 (28.1%)	390 (16.5%)
	2001–04	1,929	585 (30.3%)	426 (22.1%)	537 (27.8%)	381 (19.8%)
45–64 years	1981–84	9,072	2,157 (23.8%)	2,226 (24.5%)	2,901 (32.0%)	1,785 (19.7%)
	1986–89	8,490	2,340 (27.6%)	2,724 (32.1%)	2,400 (28.3%)	1,026 (12.1%)
	1991–94	7,398	2,799 (37.8%)	1,800 (24.3%)	1,962 (26.5%)	837 (11.3%)
	1996–99	6,999	2,424 (34.6%)	1,608 (23.0%)	1,851 (26.4%)	1,116 (15.9%)
	2001–04	6,846	2,148 (31.4%)	1,368 (20.0%)	2,088 (30.5%)	1,239 (18.1%)

Age group	Cohort	Total death	Low income	Medium income	High income	Missing income
65–74 years	1981–84	10,671	5,541 (51.9%)	1,809 (17.0%)	1,446 (13.6%)	1,881 (17.6%)
	1986–89	10,287	5,763 (56.0%)	2,796 (27.2%)	1,110 (10.8%)	618 (6.0%)
	1991–94	9,891	6,159 (62.3%)	2,025 (20.5%)	1,131 (11.4%)	576 (5.8%)
	1996–99	9,453	5,586 (59.1%)	1,890 (20.0%)	996 (10.5%)	981 (10.4%)
	2001–04	8,280	4,476 (54.1%)	1,557 (18.8%)	1,077 (13.0%)	1,167 (14.1%)
Females						
1–74 years	1981–84	14,154	6,198 (43.8%)	2,763 (19.5%)	2,583 (18.2%)	2,610 (18.4%)
	1986–89	13,857	6,525 (47.1%)	3,846 (27.8%)	2,124 (15.3%)	1,359 (9.8%)
	1991–94	13,032	6,945 (53.3%)	2,715 (20.8%)	2,169 (16.6%)	1,206 (9.3%)
	1996–99	12,651	6,210 (49.1%)	2,610 (20.6%)	2,004 (15.8%)	1,830 (14.5%)
	2001–04	12,054	5,253 (43.6%)	2,169 (18.0%)	2,214 (18.4%)	2,418 (20.1%)
1–14 years	1981–84	303	141 (46.5%)	84 (27.7%)	33 (10.9%)	48 (15.8%)
	1986–89	249	111 (44.6%)	51 (20.5%)	24 (9.6%)	66 (26.5%)
	1991–94	234	105 (44.9%)	45 (19.2%)	24 (10.3%)	63 (26.9%)
	1996–99	222	102 (45.9%)	51 (23.0%)	21 (9.5%)	42 (18.9%)
	2001–04	201	78 (38.8%)	42 (20.9%)	27 (13.4%)	54 (26.9%)
15–24 years	1981–84	438	111 (25.3%)	120 (27.4%)	123 (28.1%)	84 (19.2%)
	1986–89	447	135 (30.2%)	138 (30.9%)	114 (25.5%)	57 (12.8%)
	1991–94	393	129 (32.8%)	96 (24.4%)	93 (23.7%)	78 (19.8%)
	1996–99	378	117 (31.0%)	84 (22.2%)	93 (24.6%)	81 (21.4%)
	2001–04	291	78 (26.8%)	57 (19.6%)	75 (25.8%)	78 (26.8%)
25–44 years	1981–84	1,236	351 (28.4%)	339 (27.4%)	294 (23.8%)	249 (20.1%)
	1986–89	1,230	414 (33.7%)	360 (29.3%)	264 (21.5%)	189 (15.4%)
	1991–94	1,248	444 (35.6%)	288 (23.1%)	303 (24.3%)	213 (17.1%)
	1996–99	1,284	510 (39.7%)	267 (20.8%)	288 (22.4%)	219 (17.1%)
	2001–04	1,236	399 (32.3%)	249 (20.1%)	294 (23.8%)	291 (23.5%)
45–64 years	1981–84	5,217	1,695 (32.5%)	1,185 (22.7%)	1,323 (25.4%)	1,017 (19.5%)
	1986–89	4,992	1,725 (34.6%)	1,572 (31.5%)	1,068 (21.4%)	627 (12.6%)
	1991–94	4,710	2,040 (43.3%)	1,080 (22.9%)	1,062 (22.5%)	528 (11.2%)
	1996–99	4,701	1,791 (38.1%)	1,050 (22.3%)	1,098 (23.4%)	762 (16.2%)
	2001–04	4,812	1,620 (33.7%)	918 (19.1%)	1,236 (25.7%)	1,041 (21.6%)
65–74 years	1981–84	6,960	3,903 (56.1%)	1,035 (14.9%)	810 (11.6%)	1,212 (17.4%)
	1986–89	6,936	4,140 (59.7%)	1,722 (24.8%)	654 (9.4%)	420 (6.1%)
	1991–94	6,447	4,233 (65.7%)	1,209 (18.8%)	684 (10.6%)	327 (5.1%)
	1996–99	6,066	3,690 (60.8%)	1,155 (19.0%)	498 (8.2%)	720 (11.9%)
	2001–04	5,511	3,075 (55.8%)	906 (16.4%)	573 (10.4%)	957 (17.4%)

Causes of death

In addition to all-cause mortality, we also present estimates for avoidable and amenable mortality, and for major condition groups. Avoidable mortality refers to 'untimely unnecessary deaths'; ie, deaths that are both premature (defined here as < 75 years of age) and whose causation is sufficiently understood for the condition to have been prevented (incidence reduction) or treated (case fatality reduction – amenable mortality). ICD codes are assigned based on categorial attribution. The list of codes considered to be avoidable (and amenable) has recently been updated (Tobias and Glover 2006) and is reproduced here (see Table 7) for ease of reference. Note that the same list of avoidable (and amenable) causes has been used throughout the study period, despite improvements in preventive and therapeutic technologies that occurred over the past quarter century. This enables trends to be examined, but represents a limitation that should be kept in mind when interpreting the results.

The major condition groups analysed are summarised below (Table 6). Causes of death were classified to ICD-9 from 1981 to 1999 and to ICD-10 thereafter. However, since only major condition groupings are used, this coding change should have little impact on trend analysis.

Table 6: ICD codes for major condition groups used in this report

Cause of death	ICD-9	ICD-10
Cardiovascular disease	410–414, 393–409, 415–459	I20–I25, I05–I15, I26–I99
IHD	410–414	I20–I25
Stroke	430–438	I60–I69
Diabetes	250	E10–E14
Cancer	140–209	C00–C97
Lung	162	C33–C34
Non-lung		
Colorectal	153–154	C18–C21
Breast	174	C50
Prostate	185	C61
Chronic lung disease	470–478, 490–519	J30–J39, J40–J47, J60–J70, J95–J99
Unintentional injury	800–949	V01–X59
Road traffic crash	810–825	V01–V99
Other	800–809, 826–949	
Suicide	950–959, 980–989	X60–X84

Table 7: Avoidable and amenable causes of death

Condition	ICD-9 codes	ICD-10 codes	Amenable
Tuberculosis	010–018,137	A15–A19, B90	Yes
Selected invasive bacterial infections	034–036, 038, 084, 320, 481–482, 485, 681–682	A38–A41, A46, A48.1, B50–B54, G00, G03, J02.0, J13–15, J18, L03	Yes
HIV/AIDS	042	B20–B24	
Hepatitis	070	B15–B19	
Viral pneumonia and influenza	480, 487	J10, J12, J17.1, J21	
Lip, oral cavity and pharynx cancers	140–149	C00–C14	
Oesophageal cancer	150	C15	
Stomach cancer	151	C16	
Colorectal cancer	153, 154	C18–C21	Yes
Liver cancer	155	C22	
Lung cancer	162	C33–C34	
Melanoma of skin	172	C43	Yes
Non-melanotic skin cancer	173	C44	Yes
Breast cancer	174	C50	Yes, females
Uterine cancer	179, 182	C54–C55	Yes
Cervical cancer	180	C53	Yes
Bladder cancer	188	C67	Yes
Thyroid cancer	193	C73	Yes
Hodgkin's disease	201	C81	Yes
Leukaemia	204–208	C97–C95	Yes, < 45 years
Benign tumours	210–229	D10–D36	Yes
Thyroid disorders	240–246	E00–E07	Yes
Diabetes	250	E10–E14	Yes, 50%*
Alcohol-related disease	291, 303, 305.0, 425.5, 535.3, 571.0–571.3, 760.8	F10, I42.6, K29.2, K70	
Illicit drug-use disorders	292, 304, 305.2–305.9	F11–F16, F18–F19	
Epilepsy	345	G40–G41	Yes
Rheumatic and other valvular heart disease	390–398	O01–I09	Yes
Hypertensive heart disease	402	I11	Yes
Ischaemic heart disease	410–414	I20–I25	Yes, 50%*
Cerebrovascular diseases	430–438	I60–I69	Yes, 50%*
Aortic aneurysm	441	I71	
Nephritis and nephrosis	403, 580–589, 591	I12–I13, N00–N09, N17–N19	Yes
Obstructive uropathy and prostatic hyperplasia	592, 593.7, 594, 598, 599.6, 600	N13, N20–N21, N35, N40, N99.1	Yes
Deep vein thrombosis with pulmonary embolism	415.1, 451.1	I26, I80.2	
Chronic obstructive pulmonary disease	490–492, 496	J40–J44	Yes, ≥ 45 years
Asthma	493	J45–J46	Yes, < 45 years
Peptic ulcer disease	531–534	K25–K28	Yes

Condition	ICD-9 codes	ICD-10 codes	Amenable
Acute abdomen, appendicitis, intestinal obstruction, cholecystitis / lithiasis, pancreatitis, hernia	540–543, 550–553, 574–577	K35–K38, K40–K46, K80–K83, K85–K86, K91.5	Yes
Chronic liver disease	571.4–571.9	K73, K74	
Birth defect	740–759	H31.1, P00, P04, Q00–Q99	Yes
Complications of perinatal period	764–779	P03, P05–P95	Yes
Road traffic injuries, other transport injuries	E810–E819	V01–V04, V06, V09–V80, V87, V89, V99	
Accidental poisonings	E850–E869	X40–X49	
Falls	E880–E886, E888	W00–W19	

* 50% of cases are considered to be amenable.

2.3 Statistical methods

Standardisation

To compare mortality rates between ethnic or income groups, or to examine trends in these rates over time, it is necessary to adjust for age differences between the groups being compared. This was done by direct standardisation, using the WHO world population as the reference. Although the choice of weights (reference population) is arbitrary, the WHO world population provides a convenient standard because it facilitates international comparison, approximates the expected age structure of the global population in 2025, and represents a young population compared to the European/Other population (though not as young as the current Māori, Asian or Pacific populations). Use of the WHO world population thus increases the stability and statistical precision of the estimates for the latter groups, compared to using the total New Zealand population as the standard.

To compare mortality rates across income groups it was necessary to standardise for both age and ethnicity. This is because ethnicity is prior to SEP as a determinant of mortality risk and so confounds the SEP–mortality relationship. Age was standardised as above, while ethnic weights were derived from the 2001 Census population (Table 8). Again, note that the choice of weights is arbitrary.

Table 8: Age and age–ethnicity weights used to standardise mortality rates

Age group	Age weights (WHO standard)	Age–ethnicity weights		
		Māori	Pacific	Non-Māori non-Pacific
0–4*	0.088	0.01241	0.00458	0.07102
5–9	0.087	0.01227	0.00452	0.07021
10-14	0.086	0.01213	0.00447	0.06940
15–19	0.085	0.01199	0.00442	0.06860
20–24	0.082	0.01156	0.00426	0.06617
25–29	0.079	0.01114	0.00411	0.06375
30–34	0.076	0.01072	0.00395	0.06133
35–39	0.072	0.01015	0.00374	0.05810
40–44	0.066	0.00931	0.00343	0.05326
45–49	0.060	0.00846	0.00312	0.04842
50–54	0.054	0.00761	0.00281	0.04358
55–59	0.046	0.00649	0.00239	0.03712
60–64	0.037	0.00522	0.00192	0.02986
65–69	0.030	0.00423	0.00156	0.02421
70–74	0.022	0.00310	0.00114	0.01775
75–79*	0.015	0.00212	0.00078	0.01211
80–84*	0.009	0.00127	0.00047	0.00726
85 +*	0.006	0.00085	0.00031	0.00484
Total	**1.000**	**0.1410**	**0.0520**	**0.8070**
*1–4**	0.0704	0.00993	0.00366	0.05681

Note: The age–ethnicity weights were calculated by multiplying the age-only weights by 0.141, 0.052 and 0.807 for Māori, Pacific and non-Māori non-Pacific, respectively (based on ethnic proportions in the 2001 Census).

* Because the NZCMS cohorts are 'closed' cohort study designs, they are not well suited to analysing infant mortality. Therefore, < 1-year-olds were excluded and a weight for 1–4-year-olds used. Similarly, as all analyses are restricted to <75 year olds, weights for older age groups are not used.

Note that ethnic standardisation excluded adjustment for the varying proportion of Asian people in the population. Such adjustment could not be done because the proportion of Asian New Zealanders was too small in the 1980s for statistical stability.

Measures of association and impact

For ethnic group comparisons, absolute and relative inequalities in mortality (all-cause and by-cause) are presented as SRDs (standardised rate differences) and SRRs (standardised rate ratios) respectively, comparing in each case the ethnic group of interest with the European/Other reference group.

For income group comparisons, SRDs and SRRs were again calculated, comparing in each case the low (bottom tertile) to the high (top tertile) income group. In addition, the slope index of inequality (SII) and relative index of inequality (RII) were also calculated (Blakely, Fawcett et al 2005; Hayes and Berry 2002; Mackenbach and Kunst 1997). The latter analyses used a five-bin (quintiles) rather than the three-bin (tertiles) categorisation of equivalised household income.

The SII and RII are regression-based measures corresponding to the SRD and SRR respectively. They have several advantages over the latter measures, however. The regression-based measures make use of mortality rate estimates for all income bands, rather than just comparing extreme groups (ie, the highest to the lowest income band). More importantly, the regression-based measures incorporate changes in the sizes of the income bands over time by regressing rates on the mid-point of each income's group rank on a scale of zero to one (ie, ridit score).

Because New Zealand's income distribution widened over the 1980s and 1990s (and continues to do so today, albeit more slowly [Ministry of Social Policy 2006]), it is to be expected that income mortality gradients will have increased more when measured using the SII or RII than the SRD or SRR.

Contribution of separate causes of death to all-cause mortality

The inequality burden of different causes of death is best understood on an absolute scale, using the SII (which has the property of additive decomposition). For ethnic inequalities, the SRD was used instead.

In both cases, the percentage contribution of each cause-specific SII or SRD to the all-cause SII or SRD was calculated for each of the five cohorts. The cause-specific SIIs or SRDs were then rescaled so that their sum equalled the all-cause SII or SRD (a very minor rescaling). The contribution of each cause for each cohort, and trends in the contribution of each cause over time, could then be estimated.

Socioeconomic mediation of ethnic inequalities in mortality

Mortality rates for Māori and European/Other ethnic groups cross-classified by income were first compared using a stratified analysis (because of small numbers for the remaining ethnic groups, only Māori and European/Other groups could be included in this analysis.)

Poisson regression models adjusting sequentially for multiple SEP variables were then used to estimate the extent to which ethnic (Māori:European/Other) mortality inequalities were mediated through socioeconomic pathways. The models estimated Māori:European/Other mortality rate ratios adjusting for age and region only, followed by sequential addition of socioeconomic covariates including income, education, housing tenure, labour market position (ie, composite variable of labour force status and occupational class) and small area deprivation. The reduction in the excess rate ratio provides an estimate of the percentage contribution of SEP to the ethnic mortality inequality. More detail on the regression modelling is given in the corresponding results chapter.

Analyses

Primary analyses on unit record NZCMS data (ie, the linked data sets) were conducted in the data laboratory of Statistics New Zealand, and secondary analyses at the University of Otago, Wellington and Ministry of Health. All analyses were conducted in SAS. In addition to 95% confidence intervals, other tests of statistical significance were also conducted. These included tests for linear trends in rates, SRDs, SRRs, SIIs and RIIs. As SRRs and RIIs are ratio measures, we tested for linear trends of the log-transformations of these variables.

All analyses were stratified by sex. In addition to age-standardised results, some results are also presented by age band: 1–14, 15–24, 25–44, 45–64 and 65–74 years using a person-time approach (ie, based on age during follow up and at death). We do not report infant mortality rates because the NZCMS consists of closed cohorts (ie, no newborns enter the study after census night). At the other end of the age spectrum, the first four NZCMS cohorts did not include people aged 75 years and older on census night. Previously people aged 74 on census night were followed up for mortality till age 77; however, in this report we cut off 'cleanly' at the 75th birthday, so the results presented here relate to deaths at ages 1–74 only.

3 Ethnic Inequalities in Mortality

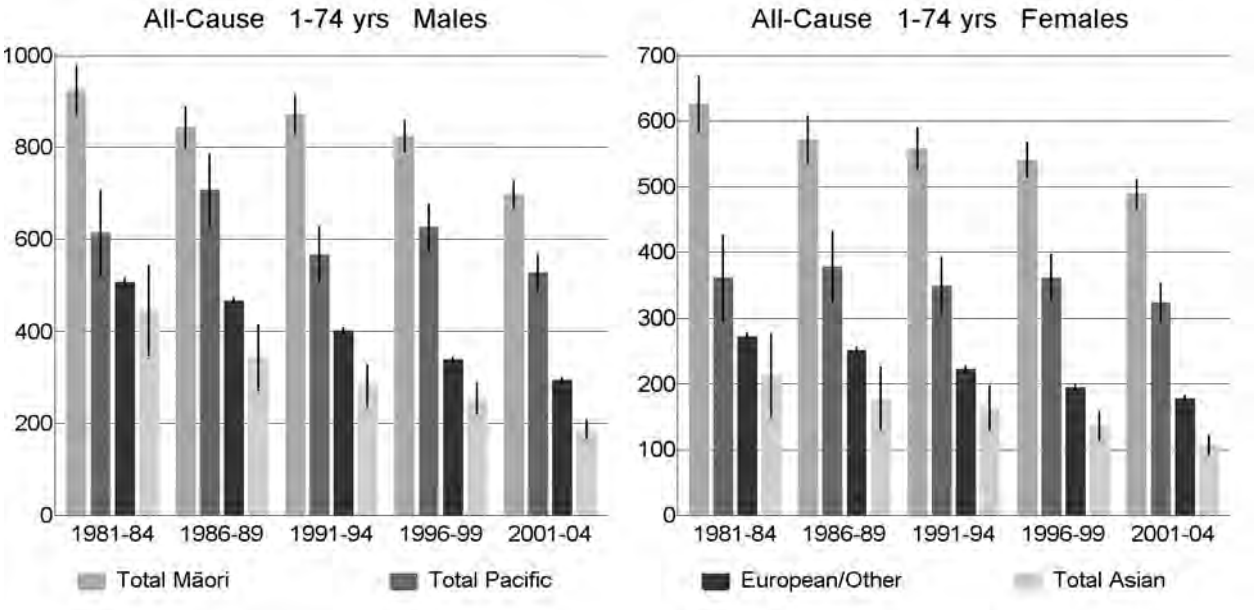
We first present mortality rates and inequality measures (rate differences and rate ratios) for all-cause mortality, followed by avoidable and amenable causes. Specific condition groups are then presented, beginning with cardiovascular causes and the major diseases within this category; ie, ischaemic (coronary) heart disease and stroke. This is followed by cancer, initially categorised into lung and non-lung cancers. Three major non-lung cancers are then examined – colorectal, breast and prostate. The analysis of major chronic diseases is then completed with a section on chronic lung disease. Finally, we turn our attention to injury. Results are presented for all unintentional injury, and then for road traffic crashes as the leading cause of unintentional injury mortality. The analysis is concluded with results for suicide.

Collectively, the specific conditions included account for over 80% of all deaths in the 1–74 years age range for most groups.

3.1 All-cause mortality

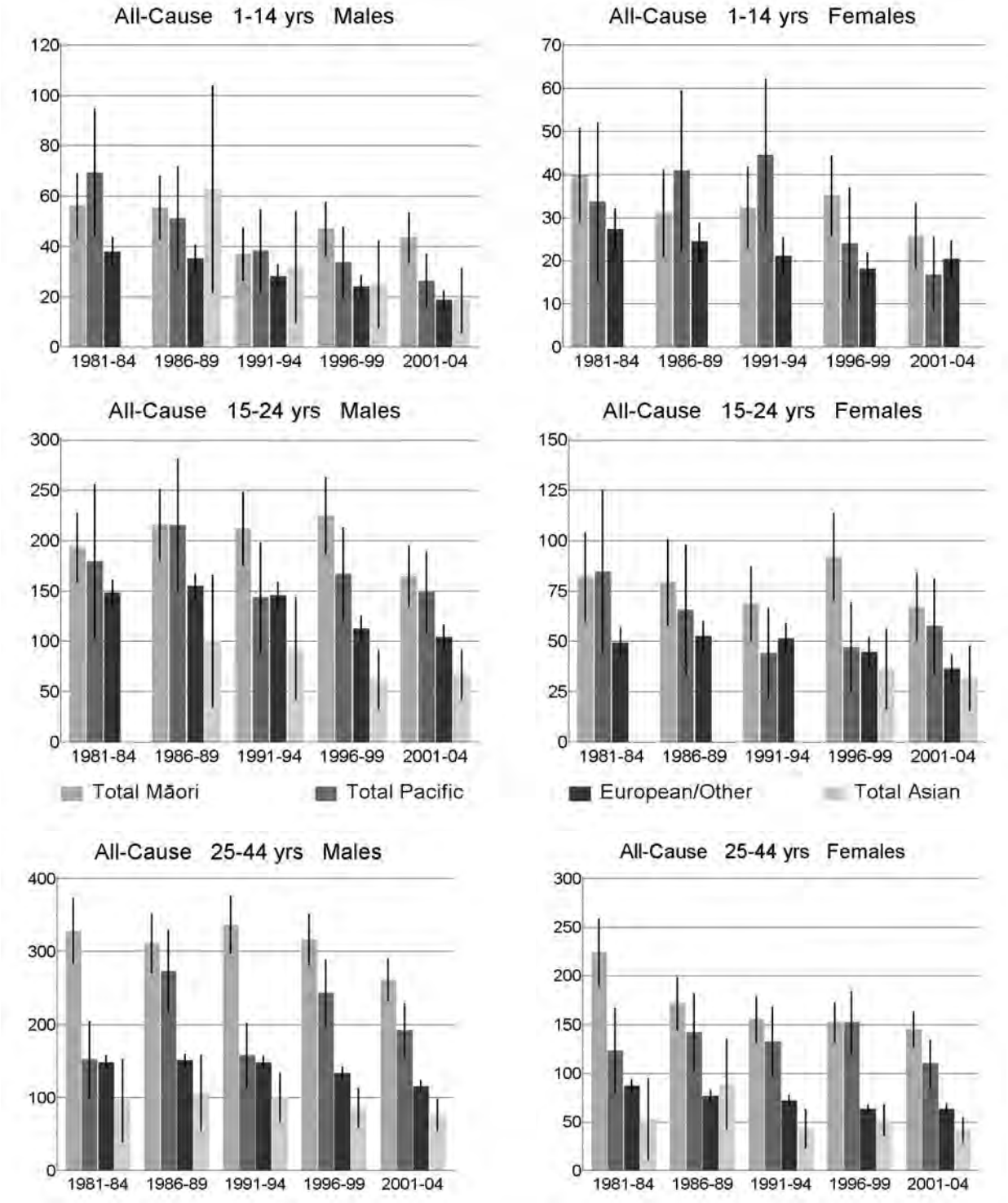
Age-standardised and age-specific all-cause mortality rates by ethnicity and sex are summarised in Figure 1 and Figure 2. Percentage changes in mortality rates from 1981–84 to 2001–04 are shown in Table 9. Rate differences and rate ratios are summarised in Tables 10 and 11 respectively.

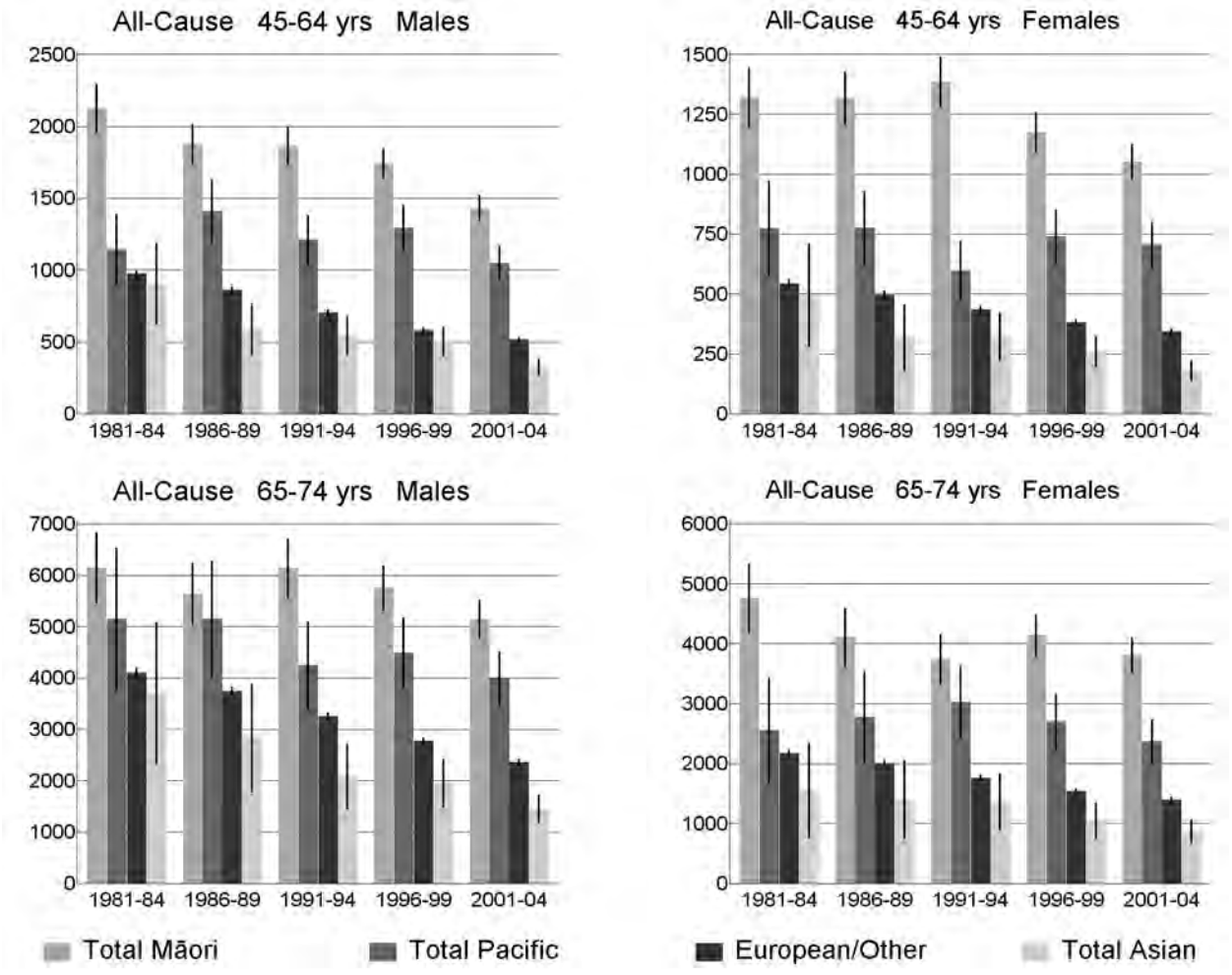
Figure 1: All-cause mortality rates, by ethnicity and sex, age standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S1.

Figure 2: All-cause mortality rates, by ethnicity, sex and age group





Note: Rates and 95% confidence intervals are tabulated in Statistical Annex, Table S1.

Examining age-standardised all-cause mortality within the 1–74 years age range (Figure 1), Māori have the highest rates throughout the observation period, followed in order by Pacific, European/Other and finally Asian ethnic groups. Both of the latter two groups show a steady and regular decline in mortality rates over the observation period (42% and 35% declines from 1981–84 to 2001–04 for European/Other males and females, and 58% and 50% for Asian males and females respectively; see Table 9). The Asian population increased rapidly during this period, largely due to immigration, so the pronounced changes in Asian mortality rates may reflect health selection effects (the so-called 'healthy migrant effect'), at least in part. Pacific peoples show irregular but essentially stable age standardised mortality rates, until a possible decline in the most recent period (ie, mid-1990s onwards), more evident for males. All-cause mortality rates declined notably among Māori from 1981–84 to 1986–89, plateaued for a decade, then fell sharply from 1996–99 to 2001–04 in both sexes, such that by 2001–04 Māori mortality rates were 25% and 22% less than the corresponding rates in 1981–84 for males and females respectively. Of note, Pacific mortality rates – while still intermediate between European/Other and Māori rates – are now closer to the Māori rates.

Table 9: Percentage decreases in mortality rates from 1981–84 to 2001–04, by ethnicity

Sex	Age group	Total Māori	Total Pacific	Total Asian	European/Other
Males	1–74 years	25%	14%	58%	42%
	1–14 years	23%	62%	–	51%
	15–24 years	15%	17%	–	30%
	25–44 years	20%	(25%)*	21%	22%
	45–64 years	33%	8%	64%	47%
	65–74 years	16%	23%	61%	42%
Females	1–74 years	22%	10%	50%	35%
	1–14 years	35%	50%	–	25%
	15–24 years	18%	32%	–	27%
	25–44 years	35%	11%	20%	27%
	45–64 years	20%	9%	64%	37%
	65–74 years	20%	7%	44%	36%

* Increase

Note: there were insufficient numbers of Asian deaths to estimate rates for female children or youth until recent cohorts.

It is interesting to look more closely at the changes in age standardised all-cause mortality rates (1-74 years) for Māori, Pacific and European/Other ethnic groups from 1996–99 to 2001–04 (the actual rates are provided in Table S1 (page 138) of the Statistical Annex). The absolute declines in the Māori mortality rates over this interval were 126 and 52 per 100,000 for males and females, respectively – much greater than the average declines of 34 and 28 per 100,000 in the three earlier inter-period comparisons. Absolute declines in the Pacific mortality rates were 99 and 38 per 100,000, compared to no net change in the 1980s and 1990s (although Pacific rates were more unstable). By contrast, European/Other mortality rate declines from 1996–99 to 2001–04 slowed to 45 and 17 per 100,000 for males and females, respectively – less than the average declines of 56 and 26 per 100,000 in the three earlier inter-period comparisons. That is, compared to trends in the 1980s and early 1990s, the rate of decline in all-cause mortality slowed from 1996–99 to 2001–04 among European/Others, but speeded up among Māori and Pacific ethnic groups. This has profound implications for trends in ethnic *gaps* in mortality, as described below (see page 26).

The ethnic trends in all-cause mortality among adult age groups mirror those described above for all ages combined (1-74 years), especially from middle age (45–64 years) onwards (Figure 2). However, for children and youth (among whom there are relatively few deaths) the pattern is different. Pacific child mortality rates have improved since the early 1980s for males and the early 1990s for females, while Māori children have shown improving rates only more recently. Thus Māori rates remain elevated for both children and youth, while Pacific children (but not youth) now enjoy mortality rates as low as their European/Other counterparts.

Table 10: All-cause mortality SRDs, by ethnicity

Sex	Ethnicity	Cohort	1–74 years	1–14 years	15–24 years	25–44 years	45–64 years	65–74 years
Males	Māori	1981–84	418 (364–472)	18 (4–32)	45 (9–82)	180 (133–226)	1152 (980–1324)	2047 (1353–2741)
		1986–89	378 (331–425)	20 (6–34)	61 (23–99)	160 (118–202)	1014 (874–1154)	1890 (1279–2501)
		1991–94	469 (425–514)	9 (-3–20)	67 (28–105)	188 (148–229)	1159 (1028–1289)	2887 (2299–3476)
		1996–99	485 (449–520)	23 (12–35)	112 (72–153)	183 (146–219)	1160 (1051–1268)	2983 (2544–3422)
		2001–04	403 (373–433)	25 (14–35)	60 (28–93)	146 (115–176)	915 (825–1005)	2787 (2410–3164)
		P (trend)	*0.91*	*0.44*	*0.45*	*0.39*	*0.33*	*0.14*
	Pacific	1981–84	107 (13–201)	31 (6–57)	31 (-47–109)	4 (-48–57)	171 (-74–416)	1048 (-343–2438)
		1986–89	242 (162–322)	16 (-5–37)	61 (-7–128)	122 (64–179)	545 (325–765)	1413 (281–2544)
		1991–94	164 (102–226)	10 (-7–27)	-2 (-58–54)	9 (-35–54)	505 (331–679)	995 (134–1856)
		1996–99	287 (234–339)	10 (-5–25)	54 (6–102)	109 (62–156)	712 (554–870)	1719 (1035–2402)
		2001–04	233 (192–274)	8 (-4–19)	44 (2–87)	77 (39–114)	533 (412–654)	1627 (1092–2162)
		P (trend)	*0.33*	*0.07*	*0.72*	*0.47*	*0.32*	*0.18*
	Asian	1981–84	-61 (-159–38)			-52 (-110–6)	-67 (-351–217)	-397 (-1772–978)
		1986–89	-122 (-195– -49)	28 (-14–69)	-55 (-121–12)	-45 (-98–8)	-272 (-454– -91)	-902 (-1960–157)
		1991–94	-120 (-167– -73)	4 (-19–26)	-53 (-105– -0)	-48 (-83– -13)	-161 (-295– -28)	-1158 (-1797– -518)
		1996–99	-84 (-119– -49)	1 (-17–19)	-51 (-83– -19)	-48 (-77– -19)	-79 (-181–23)	-819 (-1287– -352)
		2001–04	-107 (-128– -85)	-0 (-14–14)	-37 (-65– -10)	-40 (-63– -16)	-188 (-248– -128)	-899 (-1175– -623)
		P (trend)	*0.84*			*0.11*	*0.82*	*0.92*
Females	Māori	1981–84	354 (310–397)	13 (1–25)	33 (9–56)	137 (102–173)	777 (649–904)	2594 (2006–3181)
		1986–89	320 (284–357)	7 (-4–18)	27 (4–50)	95 (67–122)	822 (708–936)	2104 (1621–2586)
		1991–94	336 (303–369)	11 (1–22)	17 (-3–37)	83 (59–107)	951 (846–1056)	1969 (1552–2387)
		1996–99	347 (319–374)	17 (7–27)	47 (24–70)	89 (69–110)	795 (709–880)	2601 (2246–2957)
		2001–04	311 (287–334)	6 (-3–14)	31 (13–49)	82 (63–101)	710 (636–784)	2414 (2112–2716)
		P (trend)	*0.34*	*0.74*	*0.71*	*0.15*	*0.38*	*0.63*
	Pacific	1981–84	88 (22–154)	6 (-13–25)	35 (-6–77)	36 (-8–81)	230 (31–429)	392 (-498–1281)
		1986–89	127 (72–181)	16 (-3–35)	13 (-21–46)	65 (25–106)	279 (125–434)	775 (11–1539)
		1991–94	126 (83–170)	23 (5–41)	-7 (-31–16)	61 (26–96)	164 (42–287)	1262 (654–1870)
		1996–99	167 (130–204)	6 (-7–19)	3 (-21–26)	89 (57–121)	358 (243–472)	1164 (696–1633)
		2001–04	145 (116–175)	-4 (-13–6)	21 (-3–46)	47 (22–72)	363 (267–458)	973 (599–1348)
		P (trend)	*0.17*	*0.21*	*0.95*	*0.91*	*0.20*	*0.45*
	Asian	1981–84	-60 (-124–5)			-34 (-77–9)	-47 (-262–168)	-607 (-1398–185)
		1986–89	-73 (-122– -24)			12 (-35–59)	-177 (-316– -38)	-599 (-1252–53)
		1991–94	-60 (-94– -25)			-29 (-50– -8)	-112 (-214– -10)	-407 (-880–67)
		1996–99	-59 (-81– -36)		-8 (-30–13)	-11 (-29–6)	-120 (-187– -53)	-485 (-789– -180)
		2001–04	-72 (-87– -57)		-5 (-22–13)	-21 (-35– -7)	-162 (-204– -119)	-528 (-729– -328)
		P (trend)	*0.35*			*0.89*	*0.27*	*1.00*

Notes: 95% confidence intervals are given in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

Table 11: All-cause mortality SRRs, by ethnicity

Sex	Ethnicity	Cohort	1–74 years	1–14 years	15–24 years	25–44 years	45–64 years	65–74 years
Males	Māori	1981–84	1.83 (1.72–1.94)	1.48 (1.13–1.95)	1.30 (1.07–1.59)	2.21 (1.90–2.57)	2.18 (2.01–2.37)	1.50 (1.34–1.68)
		1986–89	1.81 (1.71–1.92)	1.57 (1.19–2.06)	1.39 (1.16–1.67)	2.06 (1.78–2.38)	2.18 (2.01–2.35)	1.51 (1.35–1.68)
		1991–94	2.17 (2.06–2.29)	1.31 (0.94–1.83)	1.46 (1.20–1.77)	2.27 (1.98–2.59)	2.64 (2.45–2.85)	1.89 (1.71–2.08)
		1996–99	2.43 (2.32–2.54)	1.97 (1.47–2.63)	2.00 (1.63–2.44)	2.36 (2.08–2.69)	2.99 (2.79–3.20)	2.08 (1.92–2.25)
		2001–04	2.37 (2.26–2.48)	2.32 (1.71–3.16)	1.58 (1.27–1.96)	2.26 (1.98–2.58)	2.77 (2.59–2.97)	2.18 (2.02–2.36)
		P (trend)	*0.03*	*0.09*	*0.19*	*0.30*	*0.07*	*< 0.01*
	Pacific	1981–84	1.21 (1.04–1.41)	1.83 (1.23–2.70)	1.21 (0.78–1.87)	1.03 (0.73–1.45)	1.18 (0.95–1.46)	1.26 (0.96–1.65)
		1986–89	1.52 (1.36–1.70)	1.45 (0.94–2.23)	1.39 (1.01–1.91)	1.80 (1.45–2.24)	1.63 (1.39–1.91)	1.38 (1.11–1.72)
		1991–94	1.41 (1.26–1.57)	1.36 (0.86–2.15)	0.99 (0.67–1.46)	1.06 (0.80–1.41)	1.72 (1.48–1.99)	1.31 (1.07–1.60)
		1996–99	1.84 (1.69–2.01)	1.41 (0.89–2.22)	1.48 (1.10–2.00)	1.81 (1.48–2.22)	2.22 (1.96–2.52)	1.62 (1.39–1.89)
		2001–04	1.79 (1.65–1.94)	1.41 (0.90–2.22)	1.42 (1.06–1.92)	1.66 (1.36–2.04)	2.03 (1.81–2.29)	1.69 (1.48–1.94)
		P (trend)	*0.06*	*0.14*	*0.48*	*0.54*	*0.07*	*0.03*
	Asian	1981–84	0.88 (0.71–1.10)			0.65 (0.36–1.18)	0.93 (0.68–1.27)	0.90 (0.62–1.31)
		1986–89	0.74 (0.60–0.91)	1.78 (0.91–3.48)	0.65 (0.34–1.25)	0.70 (0.43–1.16)	0.68 (0.50–0.93)	0.76 (0.52–1.10)
		1991–94	0.70 (0.59–0.83)	1.13 (0.55–2.31)	0.64 (0.37–1.11)	0.68 (0.48–0.95)	0.77 (0.60–0.99)	0.64 (0.47–0.87)
		1996–99	0.75 (0.66–0.86)	1.04 (0.51–2.14)	0.55 (0.34–0.90)	0.64 (0.46–0.89)	0.86 (0.71–1.06)	0.70 (0.56–0.89)
		2001–04	0.64 (0.57–0.71)	0.99 (0.48–2.06)	0.64 (0.44–0.95)	0.66 (0.49–0.88)	0.64 (0.53–0.76)	0.62 (0.51–0.75)
		P (trend)	*0.08*			*0.48*	*0.32*	*0.06*
Females	Māori	1981–84	2.30 (2.14–2.47)	1.46 (1.06–2.02)	1.66 (1.21–2.26)	2.58 (2.16–3.07)	2.43 (2.19–2.69)	2.20 (1.94–2.49)
		1986–89	2.27 (2.13–2.43)	1.27 (0.88–1.83)	1.51 (1.11–2.05)	2.23 (1.87–2.66)	2.66 (2.42–2.91)	2.05 (1.82–2.31)
		1991–94	2.51 (2.36–2.67)	1.53 (1.07–2.18)	1.33 (0.98–1.82)	2.15 (1.82–2.55)	3.19 (2.94–3.47)	2.12 (1.89–2.37)
		1996–99	2.78 (2.63–2.94)	1.94 (1.38–2.72)	2.06 (1.54–2.76)	2.41 (2.07–2.81)	3.09 (2.85–3.35)	2.69 (2.46–2.95)
		2001–04	2.74 (2.60–2.89)	1.27 (0.89–1.81)	1.85 (1.35–2.54)	2.29 (1.97–2.67)	3.07 (2.84–3.32)	2.73 (2.51–2.97)
		P (trend)	*0.03*	*0.76*	*0.36*	*0.56*	*0.11*	*0.06*
	Pacific	1981–84	1.32 (1.10–1.59)	1.23 (0.70–2.19)	1.71 (1.03–2.83)	1.42 (0.99–2.04)	1.42 (1.10–1.84)	1.18 (0.83–1.67)
		1986–89	1.50 (1.30–1.74)	1.67 (1.03–2.71)	1.25 (0.74–2.09)	1.85 (1.38–2.47)	1.56 (1.28–1.91)	1.39 (1.05–1.83)
		1991–94	1.57 (1.38–1.78)	2.11 (1.35–3.27)	0.86 (0.50–1.46)	1.84 (1.40–2.42)	1.38 (1.12–1.70)	1.72 (1.40–2.10)
		1996–99	1.86 (1.68–2.06)	1.33 (0.75–2.36)	1.06 (0.64–1.75)	2.40 (1.92–3.01)	1.94 (1.66–2.27)	1.76 (1.48–2.10)
		2001–04	1.82 (1.65–2.00)	0.82 (0.47–1.45)	1.58 (1.01–2.49)	1.74 (1.37–2.20)	2.06 (1.79–2.37)	1.70 (1.45–1.99)
		P (trend)	*0.03*	*0.56*	*0.82*	*0.52*	*0.05*	*0.13*
	Asian	1981–84	0.78 (0.58–1.06)			0.61 (0.27–1.35)	0.91 (0.59–1.41)	0.72 (0.43–1.20)
		1986–89	0.71 (0.54–0.93)			1.16 (0.68–1.97)	0.64 (0.42–0.99)	0.70 (0.44–1.11)
		1991–94	0.73 (0.59–0.90)			0.59 (0.37–0.96)	0.74 (0.54–1.02)	0.77 (0.54–1.09)
		1996–99	0.70 (0.59–0.83)		0.81 (0.46–1.45)	0.82 (0.59–1.13)	0.68 (0.53–0.88)	0.68 (0.51–0.91)
		2001–04	0.60 (0.52–0.69)		0.87 (0.51–1.50)	0.67 (0.49–0.91)	0.53 (0.42–0.66)	0.62 (0.49–0.78)
		P (trend)	*0.04*			*0.52*	*0.06*	*0.13*

Notes: 95% confidence intervals are given in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

As a result of these varying trends in mortality rates by ethnic group, gaps between the groups have changed over time. Table 10 shows that *absolute* inequalities (standardised rate differences; SRDs) for Māori compared to European/Other females remained more or less stable over the 1980s and 1990s, then may have narrowed from 1996–99 to 2001–04 (although not statistically significantly, as the confidence intervals for the rate differences in the two latter periods overlap). For Māori compared to European/Other males the rate differences widened up to 1996–99 then may have narrowed from 1996–99 to 2001–04. Gaps for Pacific people compared to European/Others tended to peak in 1996–99 for both sexes, and appear to have fallen from 1996-99 to 2001–04 (albeit not statistically significantly).

By contrast, Table 11 shows that *relative* inequalities (rate ratios) increased significantly for Māori and Pacific peoples compared to European/Others over the observation period as a whole. In 1981–84 Māori had age standardised (1-74 years) mortality rates 1.83 and 2.30 times greater than European/Others for males and females, increasing to 2.37 and 2.74 respectively in 2001–04 (Table 11). For Pacific peoples, the corresponding increases were from 1.21 to 1.79 for males and from 1.32 to 1.82 for females. However, for both Māori and Pacific peoples, the rate ratios appear to have peaked in 1996–99, then reduced slightly in 2001–04 for all four ethnic-by-sex groups. Relative inequalities also widened for Asian people (1–74 years age group) over the study period, but in the opposite direction in that the mortality advantage for Asian people strengthened further (perhaps reflecting a healthy migrant effect).

There is sufficient statistical power to comment only on Māori: European/Other age specific comparisons. Among males, the possible narrowing in absolute inequalities between 1996–99 and 2001–04 (due to a greater rate of mortality decline among Māori than European/Others) was in fact seen only among the 25–44 and 45–64 year age groups, and only in the latter age group was the decline statistically significant. Among 65–74 year-olds absolute inequalities remained more or less stable from 1991–94 to 2001–04, while among 15–24-year-olds these inequalities were particularly high in 1996–99, but with no strong trend otherwise. In parallel with these trends in absolute inequality by age, male SRRs increased across all age groups until 1996–99, then stabilised (or arguably decreased) among 25–44 and 45–64-year-olds from 1996–99 to 2001–04. Among females, however, patterns were similar across all age groups within the 1-74 age range.

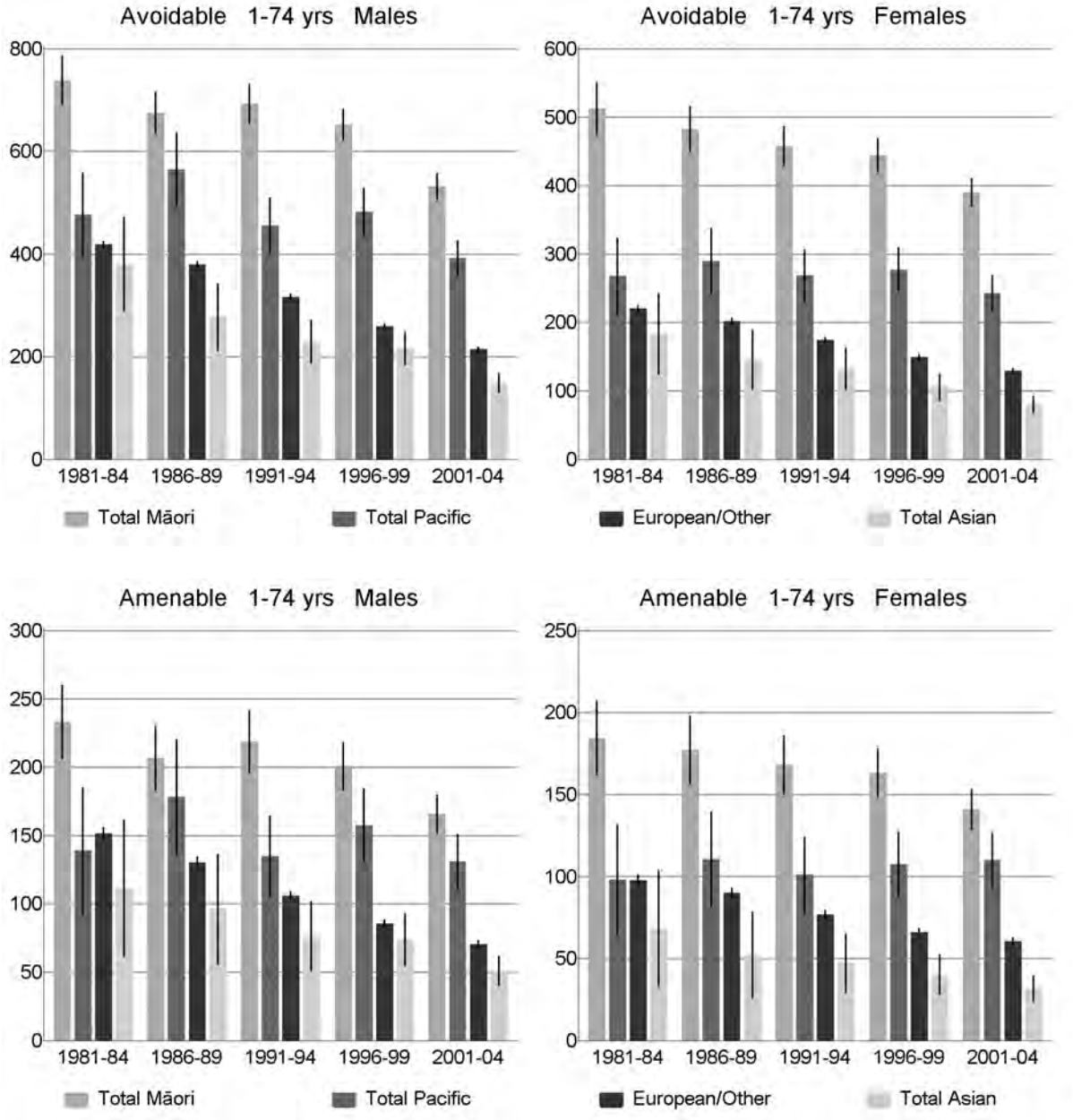
Gender inequalities

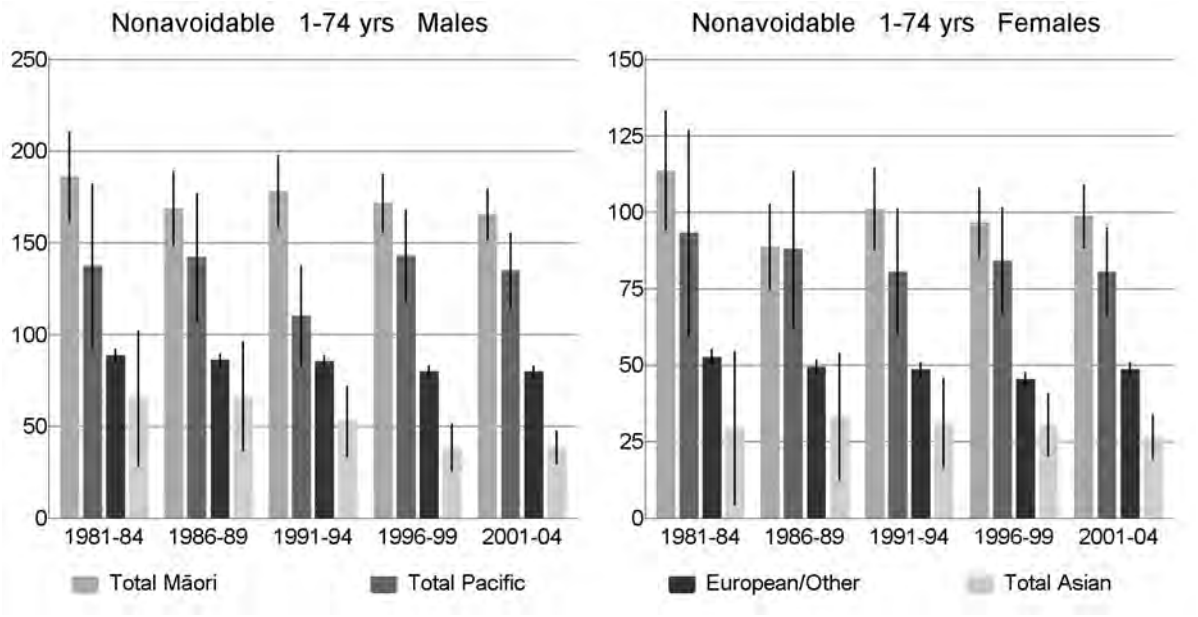
Although this report focuses on ethnic and socioeconomic inequalities, gender inequalities in mortality are also noteworthy. Within all ethnic and income groups, and for all periods and most age groups and conditions included in this report, males have substantially higher mortality rates than their female counterparts. Pooling all age groups (1–74 years) and averaging over the whole observation period, male all-cause mortality rates were about 50%, 70%, 80% and 90% higher than the corresponding female rates for Māori, Pacific, European/Other and Asian ethnic groups respectively. There is some evidence that the gender inequality is narrowing slowly among European/Others (ie, among European/Others, male mortality rates are falling relatively faster than are the corresponding female rates), but there is less evidence of any trend over time for the other ethnic groups. The relatively narrow gender inequality in Māori mortality reflects particularly high mortality rates among Māori females.

3.2 Avoidable and amenable mortality

Age-standardised avoidable, amenable and non-avoidable mortality rates by ethnicity and sex are summarised in Figure 3. Rate differences and rate ratios are summarised in Table 12.

Figure 3: Avoidable, amenable and non-avoidable mortality rates, by ethnicity, sex and age group





Note: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S4.

Table 12: Avoidable, amenable and non-avoidable mortality SRRs and SRDs, by ethnicity

Avoidable mortality		Standardised rate ratios		Standardised rate differences	
Ethnicity	**Cohort**	**Males**	**Females**	**Males**	**Females**
Māori	1981–84	1.77 (1.65–1.89)	2.33 (2.15–2.52)	320 (272–369)	292 (254–331)
	1986–89	1.78 (1.67–1.90)	2.39 (2.22–2.57)	295 (254–337)	281 (247–315)
	1991–94	2.19 (2.06–2.32)	2.63 (2.45–2.81)	376 (337–416)	283 (254–313)
	1996–99	2.52 (2.39–2.65)	2.98 (2.80–3.17)	393 (361–425)	296 (271–320)
	2001–04	2.48 (2.35–2.62)	3.01 (2.84–3.20)	318 (292–344)	261 (240–282)
	P (trend)	*0.02*	*<0.01*	*0.85*	*0.28*
Pacific	1981–84	1.14 (0.96–1.36)	1.22 (0.98–1.50)	58 (-24–141)	47 (-9–104)
	1986–89	1.49 (1.31–1.69)	1.44 (1.21–1.70)	186 (114–258)	88 (40–136)
	1991–94	1.44 (1.27–1.63)	1.54 (1.33–1.78)	139 (84–194)	94 (56–133)
	1996–99	1.86 (1.69–2.05)	1.86 (1.65–2.09)	224 (178–270)	128 (96–161)
	2001–04	1.83 (1.67–2.01)	1.88 (1.68–2.10)	178 (143–213)	114 (88–140)
	P (trend)	*0.04*	*<0.01*	*0.31*	*0.09*
Asian	1981–84	0.91 (0.72–1.16)	0.83 (0.60–1.15)	-37 (-129–54)	-36 (-96–23)
	1986–89	0.73 (0.58–0.93)	0.72 (0.53–0.97)	-102 (-168– -36)	-57 (-101– -13)
	1991–94	0.73 (0.60–0.87)	0.76 (0.60–0.96)	-87 (-130– -44)	-42 (-73– -11)
	1996–99	0.84 (0.72–0.97)	0.71 (0.59–0.86)	-43 (-75– -10)	-44 (-64– -23)
	2001–04	0.70 (0.61–0.79)	0.62 (0.52–0.72)	-65 (-85– -46)	-50 (-63– -36)
	P (trend)	*0.34*	*0.03*	*0.71*	*0.48*

Amenable mortality		Standardised rate ratios		Standardised rate differences	
Ethnicity	**Cohort**	**Males**	**Females**	**Males**	**Females**
Māori	1981–84	1.54 (1.37–1.73)	1.89 (1.66–2.14)	82 (55–109)	87 (64–110)
	1986–89	1.59 (1.41–1.78)	1.97 (1.74–2.22)	77 (53–100)	87 (66–108)
	1991–94	2.07 (1.85–2.31)	2.20 (1.96–2.46)	113 (90–136)	92 (73–110)
	1996–99	2.34 (2.13–2.57)	2.47 (2.23–2.73)	115 (97–133)	97 (82–112)
	2001–04	2.35 (2.14–2.58)	2.33 (2.12–2.57)	95 (81–110)	81 (68–93)
	P (trend)	*0.01*	*0.05*	*0.48*	*0.62*
Pacific	1981–84	0.92 (0.65–1.28)	1.00 (0.71–1.42)	-13 (-60–34)	0 (-34–34)
	1986–89	1.37 (1.08–1.74)	1.23 (0.94–1.60)	48 (5–90)	21 (-9–50)
	1991–94	1.27 (1.02–1.59)	1.32 (1.04–1.67)	29 (-1–59)	25 (1–48)
	1996–99	1.84 (1.54–2.19)	1.63 (1.35–1.97)	72 (45–99)	42 (21–62)
	2001–04	1.86 (1.58–2.18)	1.81 (1.54–2.13)	61 (40–81)	49 (32–67)
	P (trend)	*0.03*	*<0.01*	*0.12*	*< 0.01*
Asian	1981–84	0.73 (0.47–1.15)	0.70 (0.42–1.18)	-40 (-91–10)	-29 (-65–7)
	1986–89	0.74 (0.49–1.12)	0.58 (0.35–0.96)	-34 (-75–7)	-38 (-65– -11)
	1991–94	0.72 (0.52–1.01)	0.62 (0.42–0.91)	-30 (-55– -4)	-29 (-48– -11)
	1996–99	0.86 (0.66–1.12)	0.61 (0.45–0.82)	-12 (-31–7)	-26 (-38– -14)
	2001–04	0.72 (0.58–0.90)	0.52 (0.41–0.68)	-20 (-31– -8)	-29 (-37– -21)
	P (trend)	*0.94*	*0.07*	*0.23*	*0.51*

Non-avoidable mortality		Standardised rate ratios		Standardised rate differences	
Ethnicity	**Cohort**	**Males**	**Females**	**Males**	**Females**
Māori	1981–84	2.10 (1.83–2.42)	2.16 (1.81–2.59)	98 (73–123)	61 (41–81)
	1986–89	1.96 (1.72–2.23)	1.80 (1.52–2.12)	83 (62–104)	39 (25–54)
	1991–94	2.09 (1.86–2.34)	2.08 (1.81–2.40)	93 (73–113)	53 (39–66)
	1996–99	2.14 (1.94–2.37)	2.12 (1.87–2.41)	92 (76–108)	51 (40–63)
	2001–04	2.07 (1.88–2.27)	2.03 (1.81–2.27)	86 (71–100)	50 (39–61)
	P (trend)	*0.63*	*0.86*	*0.52*	*0.97*
Pacific	1981–84	1.55 (1.12–2.16)	1.77 (1.23–2.55)	49 (4–94)	41 (7–75)
	1986–89	1.65 (1.29–2.12)	1.78 (1.33–2.39)	56 (21–91)	39 (13–64)
	1991–94	1.29 (1.00–1.66)	1.66 (1.28–2.15)	25 (-3–53)	32 (11–53)
	1996–99	1.79 (1.49–2.14)	1.85 (1.49–2.29)	63 (38–88)	39 (21–56)
	2001–04	1.69 (1.44–1.98)	1.65 (1.37–1.99)	55 (34–76)	32 (17–46)
	P (trend)	*0.48*	*0.57*	*0.59*	*0.28*
Asian	1981–84	0.74 (0.42–1.30)	0.56 (0.24–1.32)	-23 (-60–14)	-23 (-48–2)
	1986–89	0.77 (0.49–1.21)	0.67 (0.36–1.26)	-20 (-50–10)	-16 (-37–5)
	1991–94	0.62 (0.43–0.89)	0.64 (0.40–1.03)	-33 (-52– -13)	-17 (-32– -3)
	1996–99	0.48 (0.34–0.67)	0.67 (0.48–0.94)	-42 (-55– -28)	-15 (-26– -4)
	2001–04	0.48 (0.38–0.61)	0.55 (0.42–0.72)	-42 (-51– -32)	-22 (-30– -14)
	P (trend)	*0.02*	*0.36*	*0.05*	*0.49*

Notes: 95% confidence intervals are given in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

As for all-cause mortality rates, throughout the observation period Māori experienced the highest rates of avoidable, amenable and non-avoidable mortality, followed in turn by Pacific, European/Other and Asian ethnic groups (pooling ages within the 1–74 years age range). Both Asian and European/Other ethnic groups exhibit steady reductions in avoidable and amenable mortality over the whole period, with little if any change in non-avoidable mortality. Māori and Pacific ethnic groups likewise show little change in non-avoidable mortality rates, but differing patterns with respect to the other cause groups. For avoidable mortality, Māori show a steady decrease over the observation period among females, and a small decrease from 1981–84 to 1986–89 followed by a sharper decrease from 1996–99 to 2001–04 among males. Pacific peoples, by contrast, show an essentially stable rate among females, and an irregular pattern among males, until a significant or near-significant fall in the most recent interval (more evident among males). For amenable mortality, Māori show a slow but steady decline, and then a sharp decline from 1996–99 to 2001–04. Pacific peoples show no suggestion of a trend among females and only a non-significant recent decline among males.

These differential mortality trends have resulted in a widening in relative inequalities (SRRs) over the observation period, comparing Maori or Pacific with European/Other ethnic groups, for both avoidable and amenable but not for non-avoidable causes.

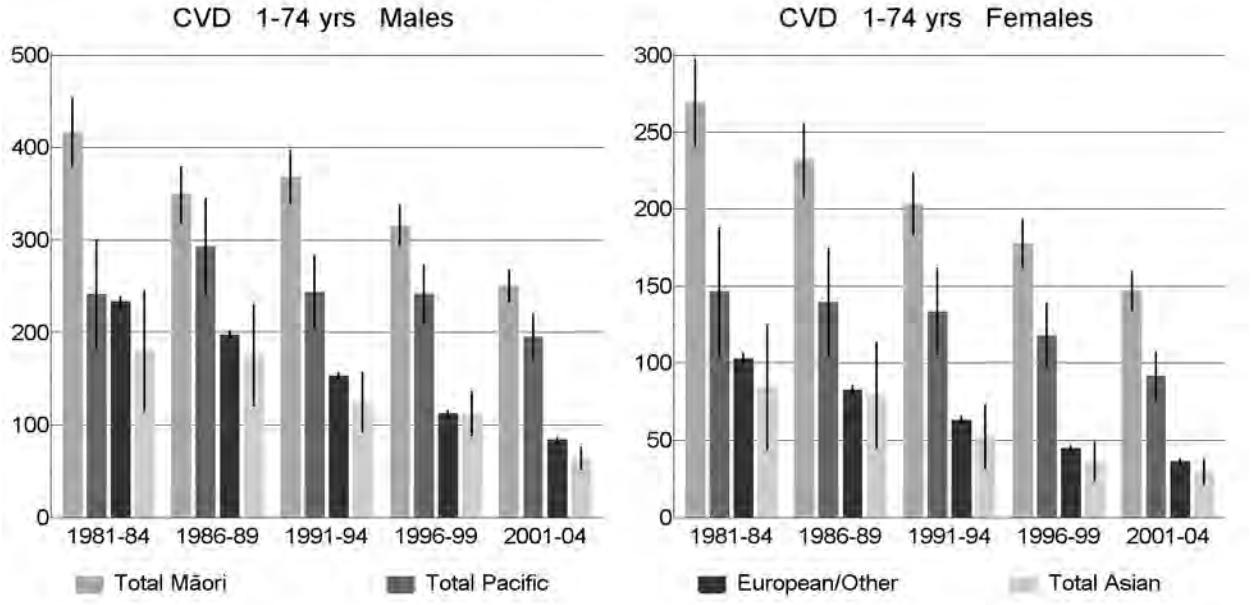
The widening relative inequality in avoidable and amenable mortality actually includes the *emergence* of inequality for Pacific peoples compared to European/Others. Thus in 1981–84, the Pacific SRR for avoidable mortality was 1.1 in males and 1.2 in females (and confidence intervals included 1.0); by 1986–89 significant inequality had emerged with SRRs of 1.5 and 1.4 respectively, and by 2001–04 the SRRs had further increased to 1.8 and 1.9 respectively. Patterns for amenable mortality were almost identical.

Also note that for Māori and Pacific ethnic groups, but not the Asian ethnic group, there is a tendency for inequality to be greater for avoidable and amenable than for unavoidable causes. Thus in 2001–04, for example, female SRRs for avoidable, amenable and non-avoidable mortality were 3.0, 2.3 and 2.0 respectively for Māori; 1.9, 1.8 and 1.6 respectively for Pacific peoples; and 0.6, 0.5 and 0.6 respectively for Asian peoples. This may reflect a contribution from inequalities in access to and quality of health services (including health promotion and disease prevention programmes) to Māori and, to a lesser extent, Pacific mortality disparities.

3.3 Cardiovascular disease

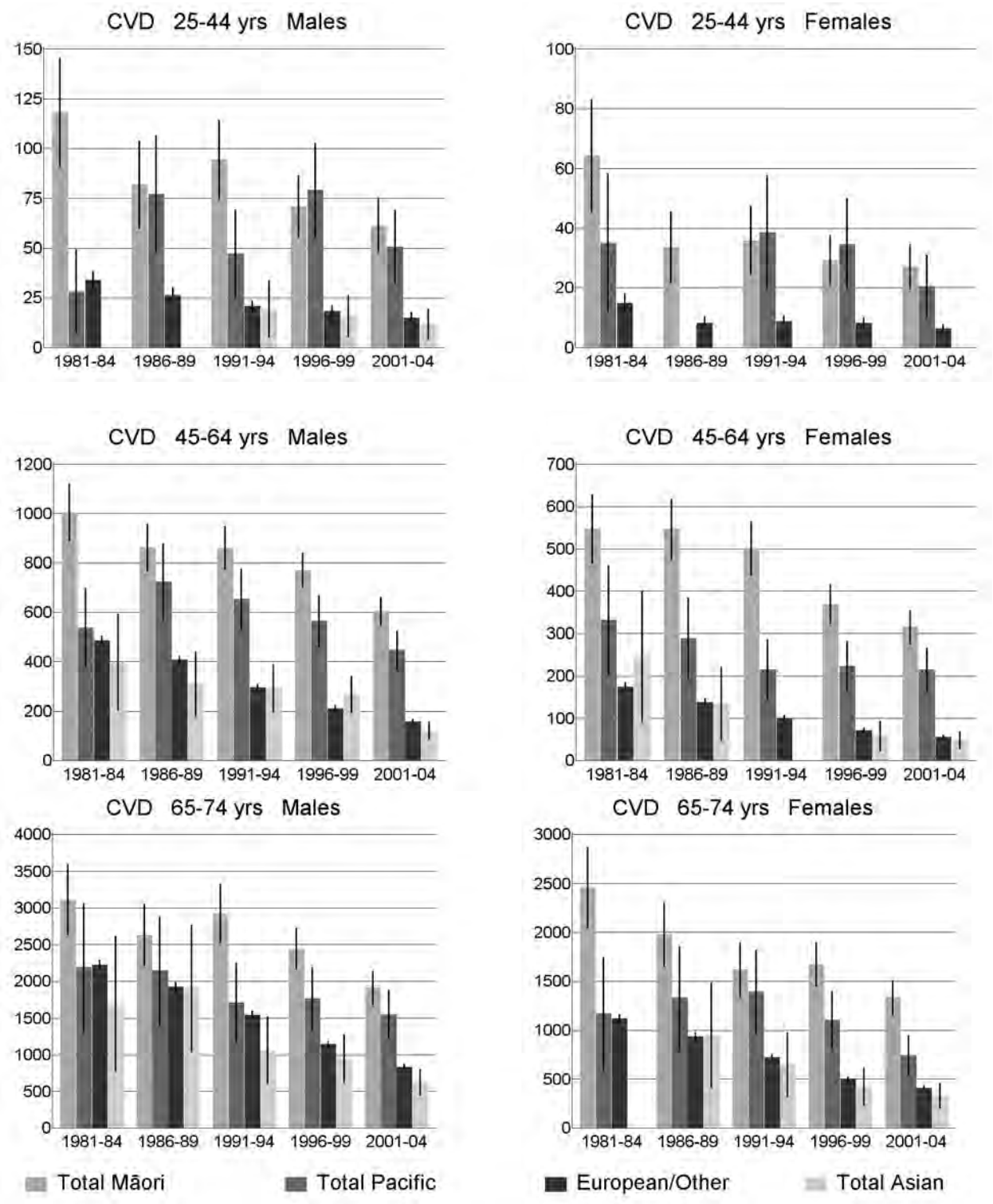
Age-standardised and age-specific cardiovascular disease mortality rates by ethnicity and sex are summarised in Figures 4 and 5. Rate differences and rate ratios are summarised in Tables 13 and 14 respectively. Children and youth are excluded because of the very small number of CVD deaths in these age groups.

Figure 4: Cardiovascular mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S5.

Figure 5: Cardiovascular mortality rates, by ethnicity, age group and sex



Note: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S5.

Table 13: Cardiovascular mortality SRDs by ethnicity

Sex	Ethnicity	Cohort	1–74 years	25–44 years	45–64 years	65–74 years
Males	Māori	1981–84	183 (146–220)	84 (57–112)	517 (400–634)	893 (408–1377)
		1986–89	152 (120–183)	56 (33–78)	457 (361–553)	709 (283–1135)
		1991–94	216 (186–245)	74 (54–94)	566 (478–655)	1379 (973–1786)
		1996–99	203 (181–225)	53 (37–69)	558 (486–630)	1298 (1010–1587)
		2001–04	167 (149–184)	47 (33–60)	446 (389–504)	1077 (848–1306)
		P (trend)	*0.85*	*0.10*	*0.59*	*0.52*
	Pacific	1981–84	8 (-51–68)	-6 (-28–16)	51 (-112–213)	-35 (-917–847)
		1986–89	95 (42–147)	51 (21–80)	317 (161–473)	221 (-520–962)
		1991–94	91 (51–131)	27 (4–49)	358 (234–482)	166 (-372–704)
		1996–99	129 (96–161)	61 (37–85)	353 (250–456)	621 (195–1046)
		2001–04	112 (87–137)	36 (17–54)	289 (211–367)	721 (390–1051)
		P (trend)	*0.15*	*0.25*	*0.43*	*0.02*
	Asian	1981–84	-53 (-118–13)		-87 (-283–109)	-527 (-1451–398)
		1986–89	-22 (-77–33)		-97 (-228–34)	-13 (-877–851)
		1991–94	-28 (-61–4)	-2 (-16–13)	-3 (-100–95)	-483 (-943– -22)
		1996–99	-0 (-24–24)	-2 (-13–9)	56 (-19–131)	-192 (-525–141)
		2001–04	-20 (-33– -7)	-3 (-11–5)	-38 (-75– -1)	-210 (-392– -28)
		P (trend)	*0.65*		*0.97*	*0.37*
Females	Māori	1981–84	166 (138–195)	49 (30–69)	373 (290–455)	1340 (929–1752)
		1986–89	149 (125–173)	25 (13–37)	408 (335–481)	1042 (708–1375)
		1991–94	140 (120–161)	27 (16–39)	401 (337–465)	896 (617–1175)
		1996–99	133 (117–149)	21 (13–30)	300 (252–347)	1174 (949–1400)
		2001–04	111 (98–123)	21 (13–28)	260 (220–300)	925 (747–1103)
		P (trend)	*< 0.01*	*0.13*	*0.05*	*0.37*
	Pacific	1981–84	44 (2–86)	20 (-3–44)	158 (29–287)	52 (-525–628)
		1986–89	57 (22–93)		151 (56–247)	396 (-133–924)
		1991–94	70 (42–99)	30 (11–49)	114 (41–187)	669 (242–1096)
		1996–99	73 (53–94)	27 (11–42)	152 (92–212)	608 (317–899)
		2001–04	56 (40–71)	14 (4–25)	159 (106–211)	337 (134–539)
		P (trend)	*0.97*		*0.52*	*0.99*
	Asian	1981–84	-19 (-59–22)		72 (-83–226)	
		1986–89	-3 (-38–32)		-4 (-92–85)	11 (-526–548)
		1991–94	-11 (-32–10)			-71 (-403–261)
		1996–99	-9 (-22–5)		-12 (-48–23)	-76 (-272–121)
		2001–04	-6 (-15–2)		-7 (-28–14)	-80 (-207–47)
		P (trend)	*0.23*			

Notes 95% confidence intervals are given in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

Table 14: Cardiovascular mortality SRRs, by ethnicity

Sex	Ethnicity	Cohort	1–74 years	25–44 years	45–64 years	65–74 years
Males	Māori	1981–84	1.79 (1.63–1.96)	3.50 (2.68–4.57)	2.06 (1.83–2.33)	1.40 (1.20–1.64)
		1986–89	1.77 (1.61–1.94)	3.11 (2.30–4.20)	2.12 (1.89–2.38)	1.37 (1.16–1.61)
		1991–94	2.41 (2.22–2.62)	4.56 (3.53–5.90)	2.92 (2.61–3.26)	1.89 (1.64–2.18)
		1996–99	2.81 (2.60–3.03)	3.92 (2.97–5.17)	3.63 (3.26–4.03)	2.14 (1.89–2.41)
		2001–04	2.99 (2.76–3.23)	4.13 (3.10–5.51)	3.82 (3.43–4.27)	2.29 (2.02–2.60)
		P (trend)	*<0.01*	*0.33*	*<0.01*	*<0.01*
	Pacific	1981–84	1.04 (0.81–1.32)	0.83 (0.38–1.80)	1.10 (0.82–1.49)	0.98 (0.66–1.47)
		1986–89	1.48 (1.23–1.77)	2.93 (1.95–4.39)	1.78 (1.43–2.21)	1.11 (0.79–1.58)
		1991–94	1.60 (1.35–1.88)	2.28 (1.40–3.71)	2.21 (1.82–2.69)	1.11 (0.81–1.52)
		1996–99	2.15 (1.87–2.46)	4.38 (3.11–6.16)	2.66 (2.21–3.22)	1.54 (1.21–1.97)
		2001–04	2.34 (2.05–2.66)	3.42 (2.28–5.13)	2.83 (2.36–3.39)	1.87 (1.50–2.32)
		P (trend)	*<0.01*	*0.22*	*<0.01*	*0.01*
	Asian	1981–84	0.77 (0.54–1.11)		0.82 (0.50–1.34)	0.76 (0.44–1.32)
		1986–89	0.89 (0.65–1.21)		0.76 (0.50–1.16)	0.99 (0.63–1.56)
		1991–94	0.81 (0.63–1.06)	0.93 (0.43–1.99)	0.99 (0.71–1.38)	0.69 (0.45–1.06)
		1996–99	1.00 (0.81–1.24)	0.87 (0.44–1.73)	1.26 (0.95–1.67)	0.83 (0.59–1.18)
		2001–04	0.76 (0.62–0.93)	0.80 (0.40–1.58)	0.76 (0.56–1.03)	0.75 (0.56–1.00)
		P (trend)	*0.93*		*0.81*	*0.55*
Females	Māori	1981–84	2.62 (2.34–2.93)	4.31 (3.01–6.16)	3.14 (2.67–3.68)	2.20 (1.85–2.61)
		1986–89	2.81 (2.52–3.13)	4.02 (2.62–6.18)	3.97 (3.42–4.61)	2.11 (1.78–2.51)
		1991–94	3.21 (2.88–3.58)	4.07 (2.78–5.97)	5.02 (4.32–5.82)	2.24 (1.88–2.67)
		1996–99	3.98 (3.60–4.40)	3.55 (2.47–5.09)	5.25 (4.50–6.13)	3.36 (2.91–3.88)
		2001–04	4.04 (3.66–4.47)	4.24 (2.90–6.21)	5.71 (4.89–6.67)	3.26 (2.82–3.77)
		P (trend)	*<0.01*	*0.54*	*<0.01*	*0.06*
	Pacific	1981–84	1.42 (1.07–1.90)	2.35 (1.17–4.71)	1.90 (1.29–2.82)	1.05 (0.64–1.71)
		1986–89	1.69 (1.31–2.18)		2.10 (1.50–2.94)	1.42 (0.96–2.12)
		1991–94	2.11 (1.70–2.62)	4.39 (2.56–7.53)	2.14 (1.52–3.03)	1.93 (1.41–2.62)
		1996–99	2.64 (2.20–3.16)	4.20 (2.56–6.90)	3.16 (2.39–4.19)	2.22 (1.70–2.91)
		2001–04	2.53 (2.12–3.02)	3.22 (1.82–5.69)	3.88 (2.99–5.03)	1.82 (1.38–2.40)
		P (trend)	*0.02*		*0.01*	*0.22*
	Asian	1981–84	0.82 (0.51–1.32)		1.41 (0.75–2.65)	
		1986–89	0.96 (0.62–1.49)		0.97 (0.50–1.89)	1.01 (0.57–1.78)
		1991–94	0.83 (0.55–1.23)			0.90 (0.54–1.50)
		1996–99	0.81 (0.57–1.16)		0.83 (0.45–1.51)	0.85 (0.53–1.35)
		2001–04	0.82 (0.62–1.09)		0.87 (0.56–1.35)	0.80 (0.55–1.18)
		P (trend)	*0.42*			

Note: 95% confidence intervals are given in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

Among European/Others aged 1–74 years, cardiovascular mortality rates declined by 65% over the observation period. This decline was similar for both sexes and all ages. Asian peoples show a similar marked decline, but only from 1986–89 onwards. Both Māori males and females showed fairly steady declines of 40% and 45% in cardiovascular mortality from 1981–84 to 2001–04, and Pacific females experienced a decline of 38%. However, Pacific males showed no clear trend, although there is an apparent (non-statistically significant) reduction in 2001–04.

Trends in inequality show similar ethnicity-by-sex interactions. Absolute inequality (SRDs, Table 13) declined significantly over the study period for Māori females compared to European/Others, most notably among the middle aged. By contrast, absolute inequality (rate difference) for Māori males compared to European/Others remained stable up to 1996–99, then appears to decrease. Pacific and Asian peoples tend to show stable absolute inequalities (negative in the case of Asian peoples), except for an increase in rate difference in the 65–74 years age group among Pacific males.

Because of the very pronounced falls in European/Other CVD mortality rates, trends in relative inequalities are quite different from those for absolute inequalities. Significant increases in relative inequalities (SRRs, Table 14) across the study period as a whole are seen for both Māori and Pacific peoples compared to European/Others (both sexes, most notably at middle ages). However, comparing the 1996–99 and 2001–04 cohorts, relative inequalities may have stabilised for both ethnic groups at most adult ages, albeit at a high level. Asian peoples show no significant trends in rate ratios.

In summary, there have been varying trends in CVD mortality rates and inequalities by ethnicity. Over the observation period CVD mortality fell dramatically – by about two-thirds – for European/Others, while lesser, but still considerable, percentage reductions were seen for Māori and Pacific peoples. Relative inequalities for Māori and Pacific compared to European/Other ethnic groups therefore increased over the study period, but trends in absolute inequalities have been more variable.

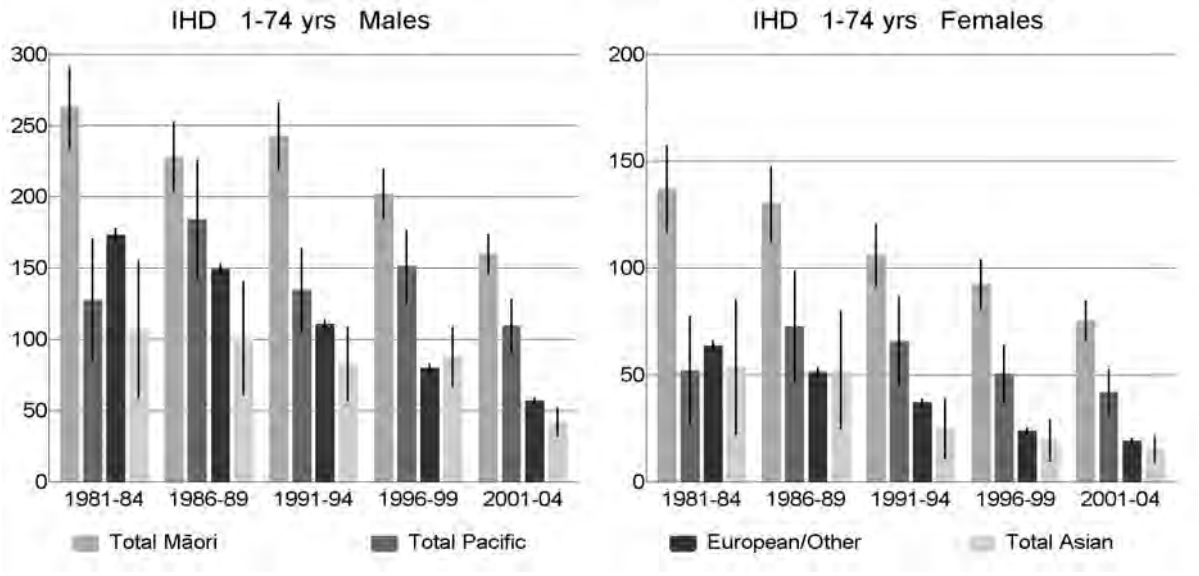
3.4 Ischaemic heart disease

Age-standardised ischaemic heart disease (IHD) mortality rates by ethnicity and sex are summarised in Figure 6. Corresponding rate differences and rate ratios are summarised in Table 15. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/.

The pattern closely resembles that for CVD as a whole. European/ Others show steady declines in IHD mortality across the whole period (67% and 70% from 1981–84 to 2001–04 for males and females, similar across all age groups), as do Asian peoples from the late 1980s. Māori females also show a steady decline of about 45% over the study period, while their male counterparts show stable rates initially, followed by a decline from the early 1990s such that by 2001–04 their IHD mortality rate was 39% less than in 1981–84. Trends are similar but less marked for Pacific peoples (14% and 20% declines from 1981–84 to 2001–04 for males and females respectively).

These differential mortality trends have resulted in a possible (albeit not statistically significant) narrowing in absolute inequality for Māori compared with European/Others from 1996–99 to 2001–04, while absolute inequalities for Pacific peoples have remained essentially stable. By contrast, relative inequalities have increased over time for both Māori and Pacific peoples (p for trend in rate ratios of < 0.01 for Māori males and females and Pacific females).

Figure 6: IHD mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S6.

Table 15: IHD mortality SRRs and SRDs, by ethnicity, 1–74 years

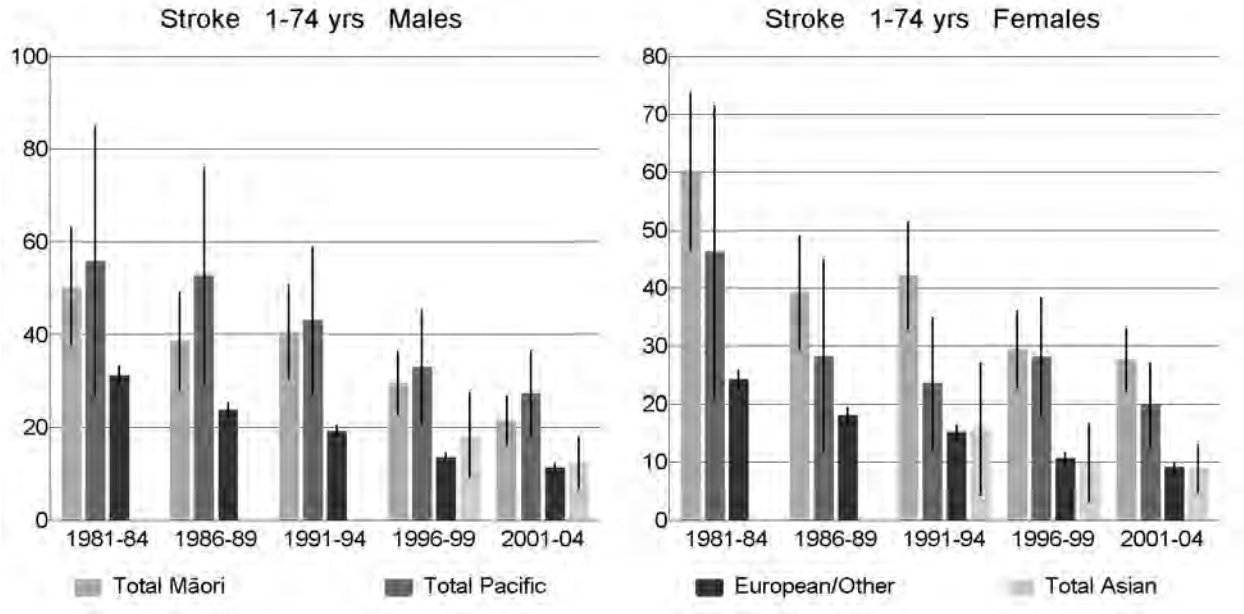
		Standardised rate ratios		Standardised rate differences	
Ethnicity	**Cohort**	**Males**	**Females**	**Males**	**Females**
Māori	1981–84	1.52 (1.35–1.70)	2.15 (1.84–2.52)	89 (60–118)	73 (53–94)
	1986–89	1.53 (1.37–1.71)	2.54 (2.19–2.93)	79 (54–104)	79 (61–97)
	1991–94	2.19 (1.98–2.43)	2.84 (2.45–3.30)	132 (108–156)	69 (54–83)
	1996–99	2.53 (2.30–2.77)	3.87 (3.38–4.44)	122 (104–140)	69 (57–80)
	2001–04	2.80 (2.54–3.09)	3.96 (3.44–4.55)	103 (88–117)	57 (47–66)
	P (trend)	*< 0.01*	*<0.01*	*0.61*	*0.04*
Pacific	1981–84	0.74 (0.53–1.03)	0.82 (0.50–1.34)	-46 (-89– -2)	-11 (-37–14)
	1986–89	1.24 (0.98–1.55)	1.42 (1.00–2.03)	35 (-7–77)	22 (-4–48)
	1991–94	1.21 (0.97–1.51)	1.77 (1.29–2.44)	24 (-6–53)	29 (8–50)
	1996–99	1.89 (1.59–2.25)	2.12 (1.61–2.79)	71 (45–97)	27 (13–40)
	2001–04	1.93 (1.62–2.30)	2.19 (1.67–2.87)	53 (34–72)	23 (12–34)
	P (trend)	*0.02*	*0.01*	*0.12*	*0.28*
Asian	1981–84	0.62 (0.39–0.97)	0.85 (0.47–1.53)	-67 (-115– -18)	-10 (-42–22)
	1986–89	0.68 (0.45–1.00)	1.02 (0.60–1.74)	-48 (-88– -8)	1 (-27–29)
	1991–94	0.75 (0.55–1.03)	0.67 (0.38–1.18)	-28 (-54– -1)	-12 (-27–2)
	1996–99	1.10 (0.86–1.41)	0.81 (0.49–1.35)	8 (-13–30)	-5 (-14–5)
	2001–04	0.74 (0.58–0.94)	0.80 (0.53–1.21)	-15 (-25– -4)	-4 (-10–3)
	P (trend)	*0.57*	*0.49*	*0.29*	*0.36*

Notes: 95% confidence intervals are given in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

3.5 Stroke

Age-standardised stroke mortality rates by ethnicity and sex are summarised in Figure 7. Corresponding rate differences and rate ratios are summarised in Table 16. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/.

Figure 7: Stroke mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group



Notes: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S7. Rates for specific age groups, where calculable, are shown at www.otago.ac.nz/NZCMSWebTable/.

Table 16: Stroke mortality SRDs and SRRs, by ethnicity, 1–74 years

		Standardised rate ratios		Standardised rate differences	
Ethnicity	**Cohort**	**Males**	**Females**	**Males**	**Females**
Māori	1981–84	1.62 (1.24–2.10)	2.49 (1.96–3.16)	19 (6–32)	36 (22–50)
	1986–89	1.62 (1.21–2.16)	2.17 (1.67–2.82)	15 (4–26)	21 (11–31)
	1991–94	2.12 (1.63–2.76)	2.78 (2.19–3.52)	21 (11–32)	27 (18–37)
	1996–99	2.19 (1.71–2.81)	2.80 (2.19–3.58)	16 (9–23)	19 (12–26)
	2001–04	1.92 (1.48–2.49)	3.06 (2.44–3.82)	10 (5–16)	19 (13–24)
	P (trend)	*0.20*	*0.08*	*0.14*	*0.12*
Pacific	1981–84	1.79 (1.06–3.03)	1.91 (1.10–3.31)	25 (-5–54)	22 (-3–47)
	1986–89	2.22 (1.42–3.47)	1.57 (0.86–2.84)	29 (6–52)	10 (-7–27)
	1991–94	2.26 (1.55–3.30)	1.55 (0.95–2.54)	24 (8–40)	8 (-3–20)
	1996–99	2.46 (1.67–3.60)	2.68 (1.84–3.89)	20 (7–32)	18 (7–28)
	2001–04	2.44 (1.71–3.47)	2.20 (1.50–3.22)	16 (7–26)	11 (4–18)
	P (trend)	*0.04*	*0.33*	*0.02*	*0.80*
Asian	1991–94		1.03 (0.50–2.15)		1 (-11–12)
	1996–99	1.36 (0.81–2.27)	0.94 (0.47–1.88)	5 (-5–14)	-1 (-8–6)
	2001–04	1.10 (0.68–1.77)	0.98 (0.60–1.59)	1 (-5–7)	-0 (-5–4)

Notes: 95% confidence intervals are given in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

Within the 1–74 years age range, Europeans show steadily declining stroke mortality (64% for males and 62% for females from 1981–84 to 2001–04), although there was little decline from 1996–99 to 2001–04. Asian stroke mortality rates were similar to those for European/Others, but could be estimated only for recent cohorts because of small numbers in earlier periods. Compared to European/Others, both Māori and Pacific peoples experienced high stroke mortality rates at any one point in time, but also experienced 50% to 60% decreases over the study period. Of note, rates were similar between the sexes, in contrast to most other causes of death included in this report.

Absolute inequalities for Māori and Pacific compared with the European/Other ethnic group tended to decrease over the study period. However, due to the profound decrease in stroke mortality rates for all ethnic groups, relative inequalities tended to increase up to the late 1990s at least.

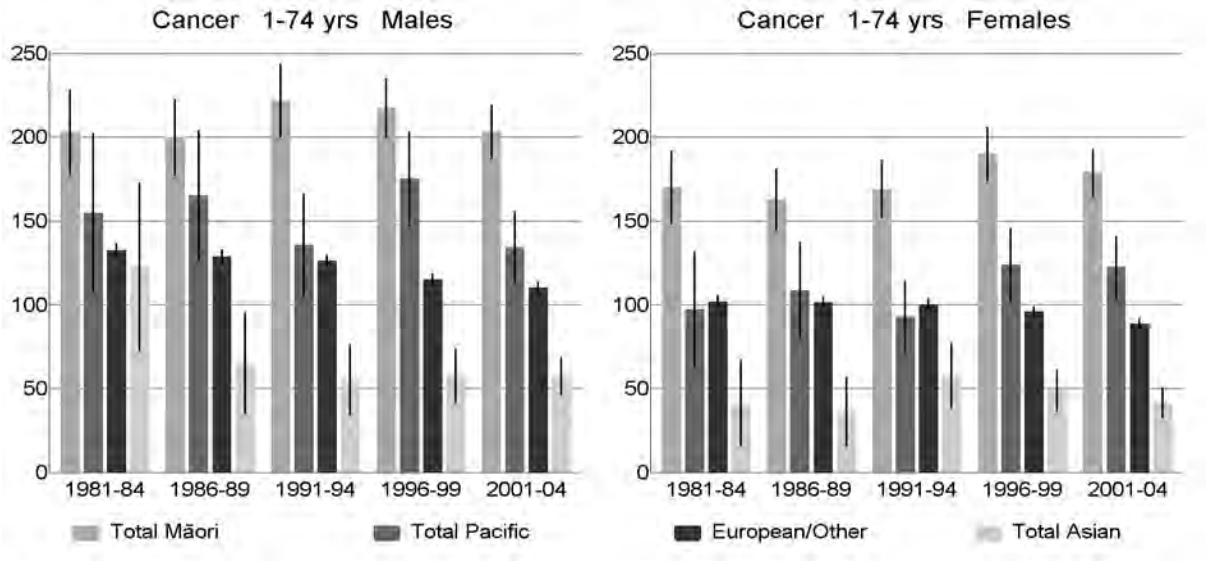
In summary, the key finding was high stroke mortality among Māori and Pacific peoples. Rates are declining among all ethnic groups, such that absolute inequalities tended to decrease while relative inequalities tended to increase (at least until recently).

It should be noted that the declining stroke *mortality* rates for Māori and Pacific peoples shown here are inconsistent with the increasing stroke *incidence* rates demonstrated for these ethnic groups in the Auckland Stroke Studies (ARCOS studies) [Carter et al 2006]. These incidence studies, however, included only the Auckland region, and collected incident cases for one year only (every decade), with resultant wide confidence intervals. Furthermore, while validating near-completeness of capture of stroke cases for all ethnicities combined, the ARCOS studies did not report specifically on completeness of case ascertainment for Māori and Pacific peoples in the 1980s and 1990s. Finally, trends in stroke mortality may differ from those for incidence because of differential trends in case fatality.

3.6 Cancer

Age-standardised all-cancer mortality rates by ethnicity and sex are summarised in Figure 8. Corresponding rate differences and rate ratios are summarised in Table 17. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/.

Figure 8: All-cancer mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S8.

Table 17: All-cancer mortality SRRs and SRDs, by ethnicity, 1–74 years

		Standardised rate ratios		Standardised rate differences	
Ethnicity	**Cohort**	**Males**	**Females**	**Males**	**Females**
Māori	1981–84	1.53 (1.35–1.74)	1.67 (1.46–1.91)	70 (45–96)	68 (46–90)
	1986–89	1.55 (1.38–1.74)	1.61 (1.43–1.81)	71 (48–94)	62 (43–80)
	1991–94	1.76 (1.59–1.95)	1.69 (1.52–1.88)	96 (74–118)	69 (51–87)
	1996–99	1.89 (1.73–2.06)	1.98 (1.81–2.17)	102 (84–121)	94 (78–110)
	2001–04	1.84 (1.69–2.00)	2.02 (1.85–2.20)	93 (76–109)	90 (76–105)
	P (trend)	*0.04*	*0.03*	*0.14*	*0.07*
Pacific	1981–84	1.17 (0.86–1.59)	0.95 (0.67–1.36)	22 (-25–70)	-5 (-39–30)
	1986–89	1.28 (1.01–1.63)	1.07 (0.82–1.40)	36 (-3–76)	7 (-22–36)
	1991–94	1.08 (0.86–1.35)	0.93 (0.73–1.17)	10 (-21–40)	-7 (-29–15)
	1996–99	1.52 (1.29–1.80)	1.29 (1.08–1.55)	60 (32–89)	28 (6–50)
	2001–04	1.22 (1.03–1.43)	1.38 (1.18–1.61)	24 (2–46)	34 (15–52)
	P (trend)	*0.71*	*0.05*	*0.88*	*0.08*
Asian	1981–84	0.92 (0.61–1.40)	0.41 (0.22–0.75)	-10 (-61–41)	-61 (-87– -35)
	1986–89	0.51 (0.32–0.80)	0.36 (0.20–0.64)	-64 (-94– -33)	-65 (-86– -44)
	1991–94	0.44 (0.30–0.64)	0.57 (0.41–0.81)	-71 (-92– -50)	-43 (-63– -23)
	1996–99	0.50 (0.38–0.66)	0.51 (0.39–0.65)	-57 (-73– -41)	-47 (-60– -35)
	2001–04	0.52 (0.43–0.64)	0.47 (0.38–0.59)	-53 (-65– -41)	-47 (-57– -38)
	P (trend)	*0.26*	*0.86*	*0.85*	*0.19*

Notes: 95% confidence intervals are given in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

An important milestone was reached for the European/Other ethnic group in the mid 1990s, when all-cancer mortality began to decline (in both sexes) for the first time. For European/Other males there was a 17% reduction from 1981–84 to 2001–04, and for females a 13% reduction. All-cancer mortality is essentially stable among Māori and Pacific males, although the possibility of a very recent downward trend cannot be excluded, especially for Pacific males. Over the study period as a whole, however, both Māori and Pacific females show a possible upward trend.

Not surprisingly, this is mirrored by increases in absolute inequality between both Māori and Pacific females and the European/Other reference group (p for trend 0.07 and 0.08, respectively). Absolute inequality remains stable for Pacific males and Asian peoples of both sexes (the latter inequality being negative ie, favouring Asian peoples). There was a possible increase in absolute inequalities for Māori males compared to European/Other males, although with no statistically significant trend ($p = 0.14$).

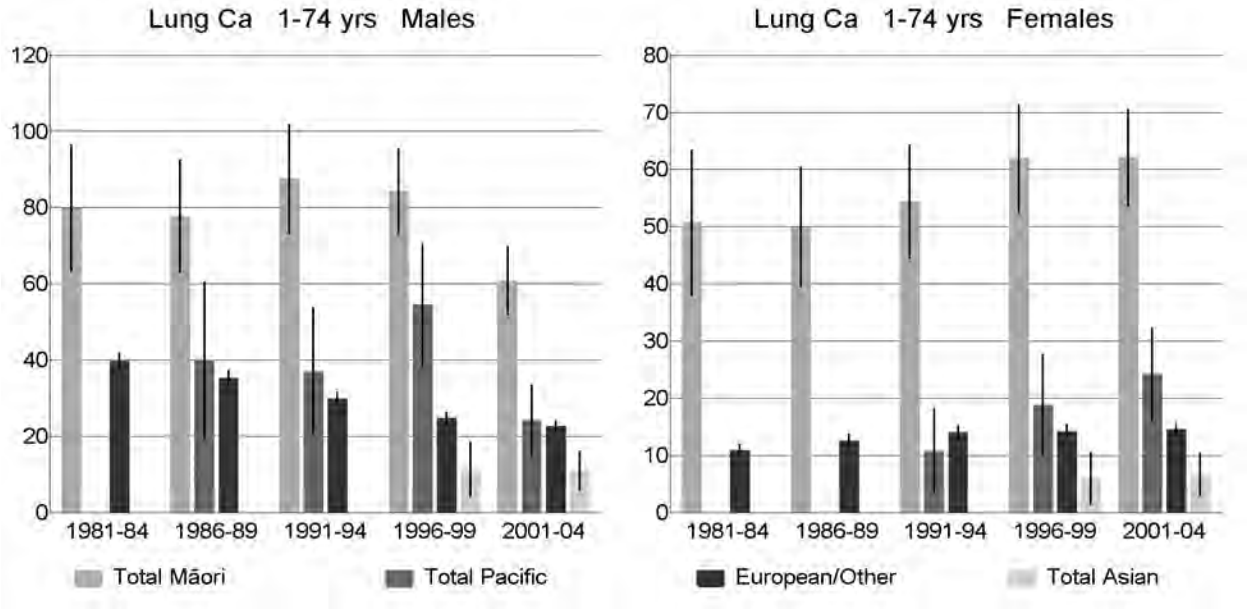
Relative inequality, by contrast, increases by about a third for Māori males and females, with rate ratios increasing from 1.53 to 1.84 (p for trend = 0.04) and 1.67 to 2.02 ($p = 0.03$) respectively. Pacific females initially had similar cancer mortality rates to European/Other females, increasing to a rate ratio of 1.38 by 2001–04 ($p = 0.05$), whereas Pacific males had about 10% to 50% higher cancer mortality than their European/Other counterparts at each point in time with no obvious trend. Relative inequalities were stable for Asian peoples compared to European/Others.

In summary, inequality in all-cancer mortality increased over the study period for Māori and Pacific peoples compared to the European/Other reference group, whether measured on an absolute or relative scale – except for Pacific males, who show no significant trends in inequality. Inequality measures are also stable (and negative) for Asian peoples compared to the European/Other reference group.

3.7 Lung cancer

Age-standardised lung cancer mortality rates by ethnicity and sex are summarised in Figure 9. Corresponding rate differences and rate ratios are summarised in Table 18. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable. Note that as well as being a major cancer in its own right, lung cancer is used in this report as an indicator for all tobacco-attributable cancers.

Figure 9: Lung cancer mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S9. Rates for specific age groups, where calculable, are shown at www.otago.ac.nz/NZCMSWebTable/.

Table 18: Lung cancer mortality SRRs and SRDs, by ethnicity, 1–74 years

		Standardised rate ratios		Standardised rate differences	
Ethnicity	**Cohort**	**Males**	**Females**	**Males**	**Females**
Māori	1981–84	2.00 (1.61–2.49)	4.65 (3.54–6.11)	40 (23–57)	40 (27–53)
	1986–89	2.20 (1.80–2.68)	3.95 (3.13–4.99)	42 (27–57)	37 (27–48)
	1991–94	2.92 (2.46–3.48)	3.89 (3.17–4.76)	58 (43–72)	40 (30–51)
	1996–99	3.41 (2.94–3.95)	4.35 (3.66–5.18)	60 (48–71)	48 (38–57)
	2001–04	2.69 (2.29–3.16)	4.25 (3.63–4.98)	38 (29–47)	48 (39–56)
	P (trend)	*0.24*	*0.96*	*0.87*	*0.05*
Pacific	1986–89	1.13 (0.67–1.89)		5 (-16–25)	
	1991–94	1.24 (0.79–1.95)	0.77 (0.39–1.55)	7 (-10–24)	-3 (-11–4)
	1996–99	2.20 (1.62–2.97)	1.32 (0.82–2.13)	30 (13–46)	5 (-4–14)
	2001–04	1.07 (0.72–1.59)	1.66 (1.17–2.35)	2 (-8–11)	10 (1–18)
Asian	1996–99	0.46 (0.24–0.87)	0.42 (0.19–0.90)	-13 (-21– -6)	-8 (-13– -4)
	2001–04	0.49 (0.30–0.78)	0.45 (0.25–0.81)	-12 (-17– -6)	-8 (-12– -4)

Notes: 95% confidence intervals are given in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

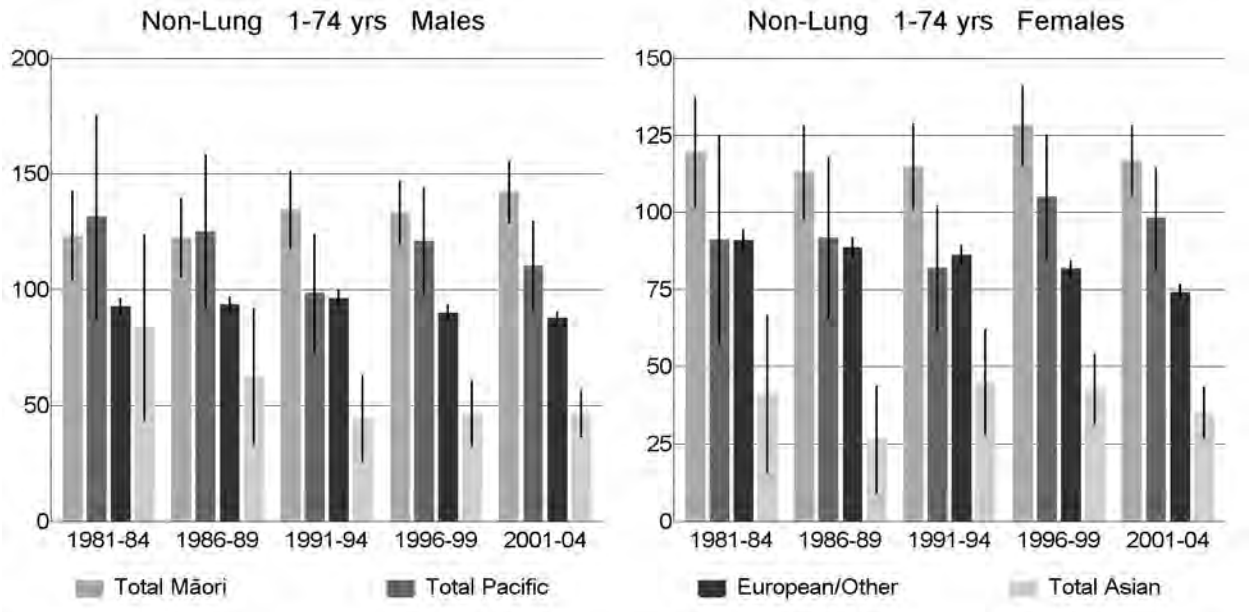
Lung cancer mortality has fallen steadily by 43% across the study period among European/Other males, and since the early 1990s has stabilised (and may soon start declining) among European/Other females. This contrasting pattern reflects the differential timing of the male and female tobacco epidemics, with males having taken up smoking earlier and in greater numbers than females. Rates for Pacific peoples could only be reliably estimated from 1986–89 for males and 1991–94 for females. Pacific female rates increased steadily. Trends in Pacific male lung cancer, however, are more difficult to interpret. One possible interpretation is that the 1996–99 estimate is a statistical outlier, and that there is a decreasing background trend. Most interestingly, Māori males show for the first time a notable (28%) decline in lung cancer mortality from 1996–99 to 2001–04, with 95% confidence intervals non-overlapping (ie, statistically significant). Rates among Māori females may also have peaked (although these rates have not yet begun to decline). Rates for Asian peoples could be estimated only for the two most recent cohorts (both sexes).

Although there were large absolute and relative inequalities between Māori and European/Other ethnic groups, no trend in these inequalities was apparent for females, but among males there were increasing inequalities (both absolute and relative) up to 1996–99, then falling inequalities from 1996–99 to 2001–04. There were no readily apparent trends in the inequalities for Pacific and Asian peoples compared to the European/Other ethnic group.

3.8 Non-lung cancer

Age-standardised non-lung cancer mortality rates by ethnicity and sex are summarised in Figure 10. Corresponding rate differences and rate ratios are summarised in Table 19. Age specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/. Note that while 'non-lung' cancers do include smoking-related cancers other than lung cancer itself, trends in non-lung cancers are both statistically more stable than considering each cancer in turn and may reflect trends in risk factors other than just smoking. Hence, they are used here as a rough proxy indicator for all non-tobacco-attributable cancers.

Figure 10: Non-lung cancer mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S10. Rates for specific age groups, where calculable, are shown at www.otago.ac.nz/NZCMSWebTable/.

Table 19: Non-lung cancer mortality SRDs and SRRs, by ethnicity, 1–74 years

		Standardised rate ratios		Standardised rate differences	
Ethnicity	**Cohort**	**Males**	**Females**	**Males**	**Females**
Māori	1981–84	1.33 (1.13–1.56)	1.31 (1.12–1.53)	31 (11–50)	28 (10–47)
	1986–89	1.31 (1.13–1.51)	1.27 (1.11–1.46)	29 (12–46)	24 (9–40)
	1991–94	1.40 (1.23–1.59)	1.33 (1.17–1.51)	38 (21–55)	29 (14–43)
	1996–99	1.47 (1.32–1.64)	1.57 (1.41–1.74)	43 (29–57)	46 (33–60)
	2001–04	1.62 (1.47–1.79)	1.58 (1.42–1.75)	55 (41–68)	43 (31–54)
	P (trend)	*0.02*	*0.04*	*0.01*	*0.08*
Pacific	1981–84	1.42 (1.01–1.98)	1.00 (0.69–1.45)	39 (-5–83)	0 (-34–34)
	1986–89	1.34 (1.02–1.75)	1.03 (0.78–1.38)	32 (-2–65)	3 (-23–29)
	1991–94	1.02 (0.79–1.33)	0.95 (0.74–1.22)	2 (-24–28)	-4 (-25–16)
	1996–99	1.34 (1.10–1.63)	1.29 (1.06–1.56)	31 (7–54)	23 (3–44)
	2001–04	1.26 (1.05–1.50)	1.32 (1.11–1.57)	23 (3–42)	24 (7–41)
	P (trend)	*0.78*	*0.07*	*0.87*	*0.09*
Asian	1981–84	0.90 (0.56–1.46)	0.45 (0.24–0.84)	-9 (-50–31)	-50 (-76– -24)
	1986–89	0.67 (0.42–1.07)	0.30 (0.15–0.57)	-31 (-61– -2)	-62 (-80– -45)
	1991–94	0.46 (0.30–0.70)	0.52 (0.36–0.77)	-52 (-71– -33)	-41 (-59– -24)
	1996–99	0.52 (0.38–0.70)	0.52 (0.40–0.69)	-44 (-58– -29)	-39 (-51– -27)
	2001–04	0.53 (0.42–0.66)	0.47 (0.37–0.60)	-41 (-52– -31)	-39 (-48– -31)
	P (trend)	*0.15*	*0.69*	*0.57*	*0.13*

Note: 95% confidence intervals are given in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

Non-lung cancer mortality has decreased by 19% among European/Other females from 1981–84 to 2001–04, while remaining stable among males until a possible modest decline recently. By contrast, female rates have remained stable among Māori while male rates have trended upwards. The result has been a near doubling in both absolute and relative inequality in non-lung cancer mortality for Maori compared to European/Other ethnic groups – a finding of great concern (p values all less than 0.1).

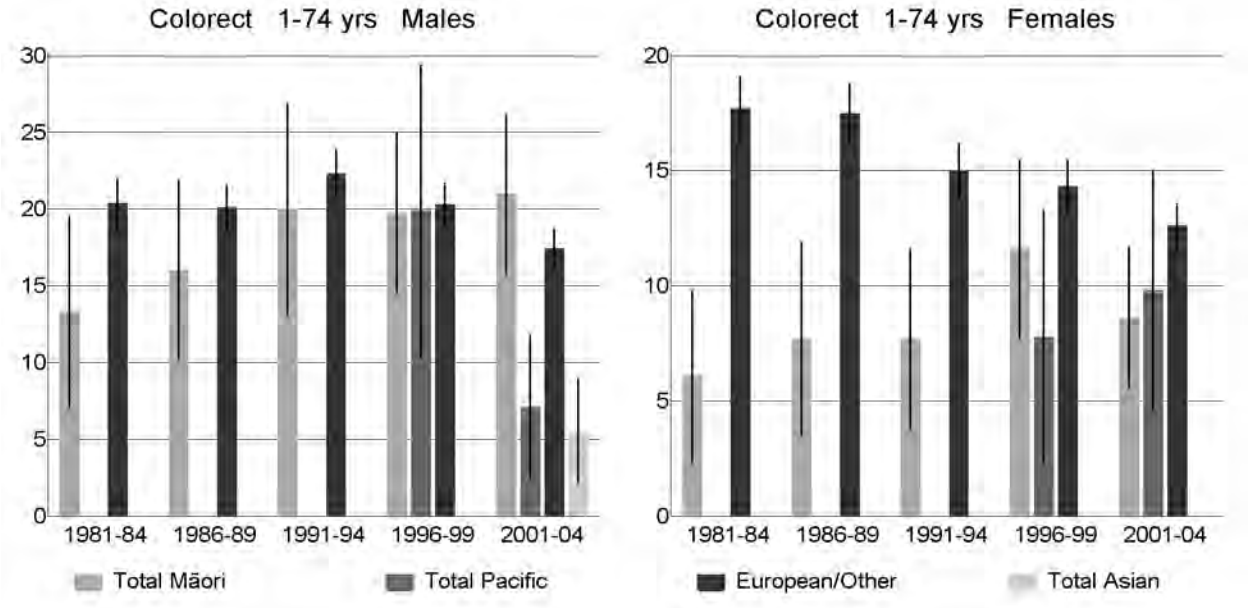
Different trends are seen among Pacific peoples, with male non-lung cancer mortality rates decreasing overall (albeit not smoothly over the study period) while female rates have increased. Thus, the parity in female non-lung cancer mortality rates between Pacific and European/Others in 1981–84 transformed into a statistically significant 32% Pacific excess by 2001–04. Pacific male rates were on average almost a third higher than European/Other rates, but with no apparent trend over time.

Non-lung cancer mortality rates declined dramatically in the 1980s among Asian males but have remained steady since then. Female rates have not shown a regular pattern (perhaps reflecting small numbers) but a possible recent decline is suggested. Measures of inequality compared to European/Others show no significant trends (whether measured on absolute or relative scales).

3.9 Colorectal cancer

Age-standardised colorectal cancer mortality rates by ethnicity and sex are summarised in Figure 11. Corresponding rate differences and rate ratios are summarised in Table 20. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/.

Figure 11: Colorectal cancer mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group



Notes: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S11. Rates for specific age groups, where calculable, are shown at www.otago.ac.nz/NZCMSWebTable/.

Table 20: Colorectal cancer mortality SRRs and SRDs, by ethnicity, 1–74 years

		Standardised rate ratios		Standardised rate differences	
Ethnicity	**Cohort**	**Males**	**Females**	**Males**	**Females**
Māori	1981–84	0.65 (0.41–1.05)	0.34 (0.18–0.64)	-7 (-14– -1)	-12 (-16– -8)
	1986–89	0.80 (0.55–1.16)	0.44 (0.26–0.77)	-4 (-10–2)	-10 (-14– -5)
	1991–94	0.90 (0.63–1.27)	0.51 (0.31–0.85)	-2 (-9–5)	-7 (-11– -3)
	1996–99	0.97 (0.74–1.28)	0.81 (0.58–1.15)	-1 (-6–5)	-3 (-7–1)
	2001–04	1.21 (0.93–1.57)	0.69 (0.48–0.99)	4 (-2–9)	-4 (-7– -1)
	P (trend)	*< 0.01*	*0.09*	*< 0.01*	*0.02*
Pacific	1996–99	0.98 (0.60–1.59)	0.55 (0.27–1.11)	-0 (-10–9)	-7 (-12– -1)
	2001–04	0.41 (0.21–0.80)	0.78 (0.45–1.33)	-10 (-15– -5)	-3 (-8–3)
Asian	2001–04	0.32 (0.17–0.60)		-12 (-16– -8)	

Notes: 95% confidence intervals are given in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

Colorectal cancer mortality has declined steadily among European/Others since the late 1980s for females and since the early 1990s for males. Rates could not be estimated for Pacific peoples until the more recent cohorts, and are imprecise (ie, have wide confidence intervals), so nothing can be said about trends in this ethnic group. The previous *Decade of Disparity I* report suggested markedly increasing colorectal cancer rates for Pacific peoples from 1981–84 to 1996–99. As described under Methods, previous ethnic analyses used unlinked census and mortality data so providing greater statistical power – an arguably more useful analysis when considering individual causes of death in smaller ethnic groups. Thus, the results presented in this report for Pacific colorectal cancer mortality do not overturn our previous findings. Except for males in 2001–04, rates could not be estimated at all for Asian peoples.

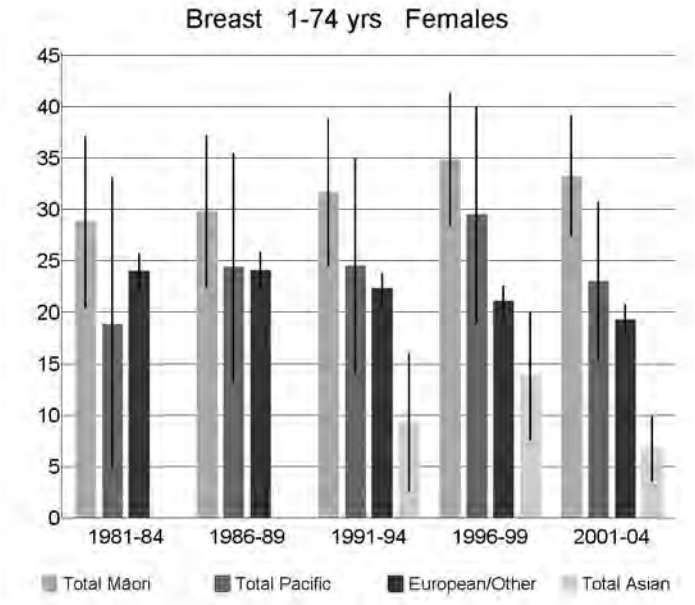
Rates for Māori show a very concerning pattern (and one consistent with that reported in *Decades of Disparity I*). There is a steep, if somewhat irregular, upward trend, such that rates have risen from values well below their European/Other counterparts in the early 1980s to equivalent levels in the 1990s and beyond (especially for males).

This trend is mirrored in the inequality statistics, which show a statistically significant closing of the gap between European/Other and Māori ethnic groups, whether measured on absolute or relative scales. The trend in the SRR for females does not quite reach the conventional level of statistical significance. For males there is a significant reversal, from an SRR of 0.65 at the beginning to an SRR of 1.21 at the end of the study period. Trends in inequality (SRD or SRR) could not be estimated for Pacific or Asian ethnic groups.

3.10 Breast cancer

Age-standardised breast cancer mortality rates by ethnicity are summarised in Figure 12. Corresponding rate differences and rate ratios are summarised in Table 21. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/.

Figure 12: Breast cancer mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group



Notes: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S12. Rates for specific age groups, where calculable, are shown at www.otago.ac.nz/NZCMSWebTable/.

Table 21: Breast cancer mortality SRDs and SRRs, by ethnicity, 1–74 years

Ethnicity	Cohort	Standardised rate ratios	Standardised rate differences
Māori	1981–84	1.20 (0.89–1.62)	5 (-4–13)
	1986–89	1.24 (0.96–1.60)	6 (-2–13)
	1991–94	1.42 (1.12–1.80)	9 (2–17)
	1996–99	1.65 (1.35–2.01)	14 (7–20)
	2001–04	1.72 (1.42–2.08)	14 (8–20)
	P (trend)	*<0.01*	*<0.01*
Pacific	1981–84	0.79 (0.37–1.67)	-5 (-19–9)
	1986–89	1.01 (0.64–1.61)	0 (-11–12)
	1991–94	1.10 (0.71–1.70)	2 (-8–13)
	1996–99	1.40 (0.97–2.01)	8 (-2–19)
	2001–04	1.19 (0.84–1.67)	4 (-4–11)
	P (trend)	*0.20*	*0.17*
Asian	1991–94	0.42 (0.20–0.87)	-13 (-20– -6)
	1996–99	0.66 (0.42–1.03)	-7 (-14– -1)
	2001–04	0.35 (0.22–0.56)	-13 (-16– -9)

Notes: 95% confidence intervals are given in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

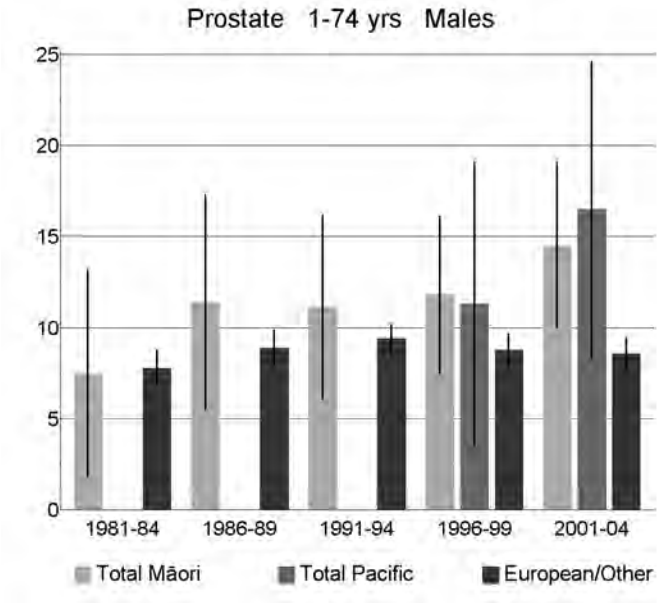
The European/Other age-standardised (1–74 years) breast cancer mortality rate has fallen 20% from 1981–84 to 2001–04, mostly since the late 1980s. By contrast, mortality rose steadily from 1981–84 to1996–99 among both Māori (21% increase) and Pacific (56% increase) women, then decreased to 2001–04. Little can be said about trends for Asian women because rates could not be estimated for the earlier cohorts, but a recent fall or stabilisation is at least suggested.

Inequality has therefore increased markedly over the observation period for Māori compared to European/Other ethnic groups, on both absolute (SRD increasing from 5 to 14 per 100,000) and relative (SRR increasing from 1.20 to 1.72) scales. However, there was no increase in SRD and only a small increase in SRR from 1996–99 to 2001–04, possibly suggesting a peaking in inequalities at least in absolute terms. A similar, but less pronounced, increase in inequality is apparent for Pacific compared to European/Other women from 1981 to 1996–99, with possibly a narrowing again from 1996–99 to 2001–04; whether this represents a true turning point remains to be seen. Trends in SRRs and SRDs could not be estimated for Asian peoples.

3.11 Prostate cancer

Age-standardised prostate cancer mortality rates by ethnicity are summarised in Figure 13. Corresponding rate differences and rate ratios are summarised in Table 22. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/.

Figure 13: Prostate cancer mortality rates by ethnicity and sex, age standardised within the 1–74 year age group



Notes: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S13. Rates for specific age groups, where calculable, are shown at www.otago.ac.nz/NZCMSWebTable/.

Table 22: Prostate cancer mortality SRRs and SRDs, by ethnicity, 1–74 years

Ethnicity	Cohort	Standardised rate ratios	Standardised rate differences
Māori	1981–84	0.96 (0.44–2.08)	-0 (-6–6)
	1986–89	1.28 (0.75–2.17)	3 (-4–9)
	1991–94	1.19 (0.75–1.89)	2 (-3–7)
	1996–99	1.34 (0.92–1.96)	3 (-1–7)
	2001–04	1.69 (1.22–2.35)	6 (1–11)
	P (trend)	*0.04*	*0.03*
Pacific	1996–99	1.27 (0.63–2.57)	2 (-5–10)
	2001–04	1.92 (1.16–3.18)	8 (-0–16)

Notes: 95% confidence intervals are given in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

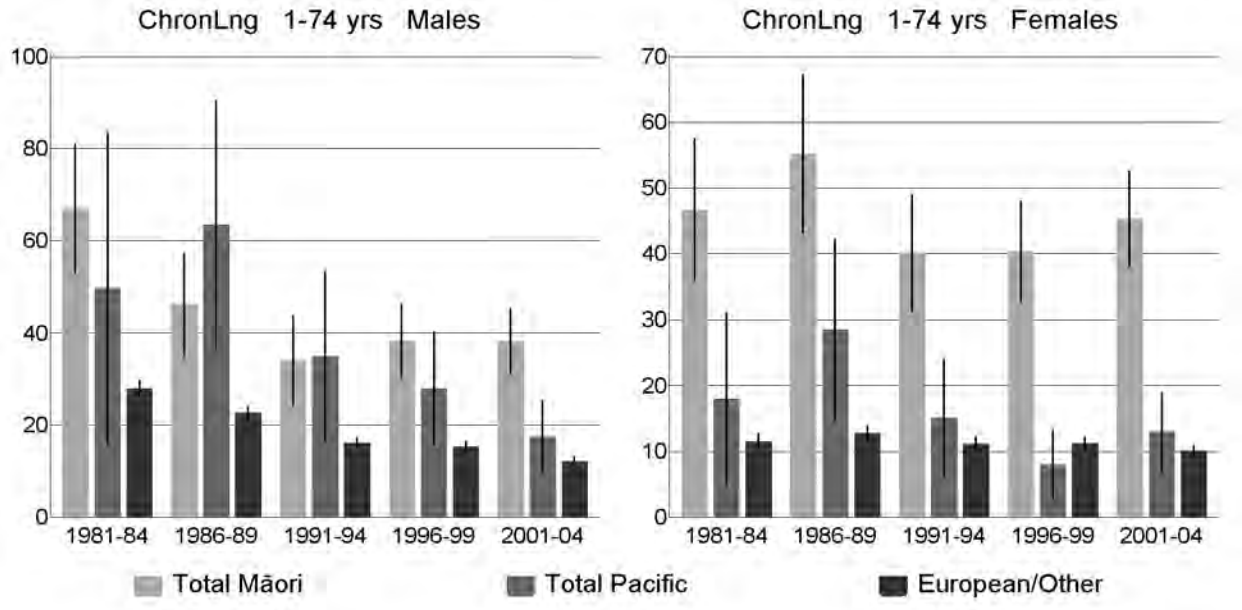
Prostate cancer mortality rates (ages 1–74 years) increased among both European/Other and Māori men through the 1980s and early to mid-1990s. Since then, however, the trajectories have diverged, with rates stabilising among European/Others but increasing steeply among Māori. Thus, from 1981–84 to 2001–04 European/Other rates had only increased by 10% compared to a 93% increase for Māori. Rates could not be estimated for Pacific or Asian peoples, except for the most recent cohorts (Pacific men only).

From a situation of similar rates in the early 1980s, therefore, significant and increasing absolute and relative inequalities have emerged for Māori males when compared to their European/Other counterparts, such that Māori had 1.69 times the European/Other rate by 2001–04. Nothing can be said about trends in inequality for Pacific or Asian peoples.

3.12 Chronic lung disease

Age-standardised chronic lung disease mortality rates by ethnicity and sex are summarised in Figure 14. Corresponding rate differences and rate ratios are summarised in Table 23. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/.

Figure 14: Chronic lung disease mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group



Notes: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S14. Rates for specific age groups, where calculable, are shown at www.otago.ac.nz/NZCMSWebTable/.

Table 23: Chronic lung disease mortality SRDs and SRRs, by ethnicity, 1–74 years

		Standardised rate ratios		Standardised rate differences	
Ethnicity	**Cohort**	**Males**	**Females**	**Males**	**Females**
Māori	1981–84	2.40 (1.92–3.00)	4.05 (3.14–5.23)	39 (25–53)	35 (24–46)
	1986–89	2.05 (1.59–2.64)	4.34 (3.42–5.52)	24 (12–35)	43 (30–55)
	1991–94	2.11 (1.57–2.85)	3.60 (2.83–4.58)	18 (8–28)	29 (20–38)
	1996–99	2.50 (2.00–3.12)	3.61 (2.92–4.46)	23 (15–31)	29 (21–37)
	2001–04	3.15 (2.57–3.88)	4.50 (3.74–5.41)	26 (19–33)	35 (28–43)
	P (trend)	*0.15*	*0.75*	*0.68*	*0.70*
Pacific	1981–84	1.78 (0.90–3.54)	1.56 (0.74–3.26)	22 (-12–56)	6 (-7–20)
	1986–89	2.82 (1.83–4.34)	2.24 (1.37–3.67)	41 (14–68)	16 (2–30)
	1991–94	2.18 (1.28–3.71)	1.36 (0.75–2.46)	19 (0–37)	4 (-5–13)
	1996–99	1.83 (1.17–2.86)	0.72 (0.37–1.40)	13 (0–25)	-3 (-9–2)
	2001–04	1.44 (0.91–2.29)	1.29 (0.80–2.06)	5 (-3–13)	3 (-3–9)
	P (trend)	*0.19*	*0.25*	*0.04*	*0.43*

Notes: 95% confidence intervals are given in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

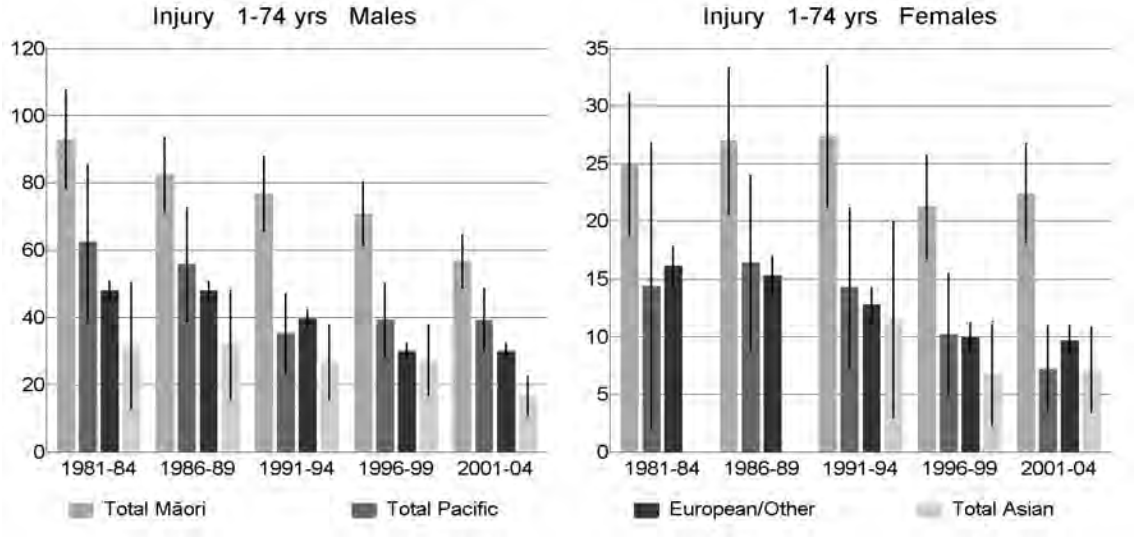
As with other tobacco-dominated diseases, mortality rates for chronic lung disease have fallen steadily over the whole study period among European/Other males (57%) while falling little among females (12%). Interestingly, rates among Pacific males have also fallen steadily from the late 1980s or early 1990s. Pacific females showed declining rates through the 1990s, but most recently their rate appears to have stabilised and may even be increasing once more. Māori females show a similar pattern (albeit at a higher level of mortality), while Māori males show an early decline followed by stable rates since the 1990s. Rates could not be estimated for Asian peoples.

These trends translate into a significant downward trend in absolute inequality for Pacific compared to European/Other males. No clear trends are visible in either SRDs or SRRs for Pacific females. Māori male chronic lung disease mortality rates were roughly two to three times those of European/Other males overall, with possibly widening relative inequalities over time. Māori females had rates about four times higher than European/Other females on average, which – along with lung cancer – is the highest relative disparity in this report.

3.13 Unintentional injury

Age-standardised unintentional injury mortality rates by ethnicity and sex are summarised in Figure 15. Corresponding rate differences and rate ratios are summarised in Table 24. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/.

Figure 15: Unintentional injury mortality rates by ethnicity and sex, age standardised within the 1–74 year age group



Note: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S15. Rates for specific age groups, where calculable, are shown at www.otago.ac.nz/NZCMSWebTable/.

Table 24: Unintentional injury mortality SRDs and SRRs, by ethnicity, 1–74 years

		Standardised rate ratios		Standardised rate differences	
Ethnicity	**Cohort**	**Males**	**Females**	**Males**	**Females**
Māori	1981–84	1.93 (1.63–2.29)	1.54 (1.17–2.02)	45 (30–60)	9 (2–15)
	1986–89	1.72 (1.48–2.00)	1.76 (1.36–2.28)	35 (23–46)	12 (5–18)
	1991–94	1.93 (1.64–2.27)	2.14 (1.66–2.76)	37 (25–49)	15 (8–21)
	1996–99	2.36 (2.01–2.76)	2.14 (1.66–2.75)	41 (31–51)	11 (7–16)
	2001–04	1.88 (1.60–2.22)	2.30 (1.82–2.91)	27 (18–35)	13 (8–17)
	P (trend)	*0.52*	*0.01*	*0.20*	*0.34*
Pacific	1981–84	1.30 (0.89–1.89)	0.90 (0.37–2.14)	14 (-9–38)	-2 (-14–11)
	1986–89	1.16 (0.85–1.58)	1.07 (0.67–1.72)	8 (-10–25)	1 (-7–9)
	1991–94	0.89 (0.63–1.26)	1.12 (0.68–1.84)	-5 (-17–8)	2 (-6–9)
	1996–99	1.31 (0.98–1.76)	1.02 (0.60–1.75)	9 (-2–21)	0 (-5–6)
	2001–04	1.30 (1.01–1.69)	0.74 (0.43–1.27)	9 (-1–19)	-3 (-7–1)
	P (trend)	*0.64*	*0.29*	*0.72*	*0.18*
Asian	1981–84	0.66 (0.36–1.20)		-17 (-36–3)	
	1986–89	0.66 (0.40–1.11)		-16 (-33–1)	
	1991–94	0.67 (0.44–1.04)	0.90 (0.43–1.90)	-13 (-25– -1)	-1 (-10–7)
	1996–99	0.91 (0.61–1.36)	0.68 (0.34–1.36)	-3 (-14–8)	-3 (-8–2)
	2001–04	0.55 (0.37–0.81)	0.73 (0.43–1.26)	-14 (-20– -7)	-3 (-7–1)
	P (trend)	*0.91*		*0.81*	

Notes: 95% confidence intervals are given in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

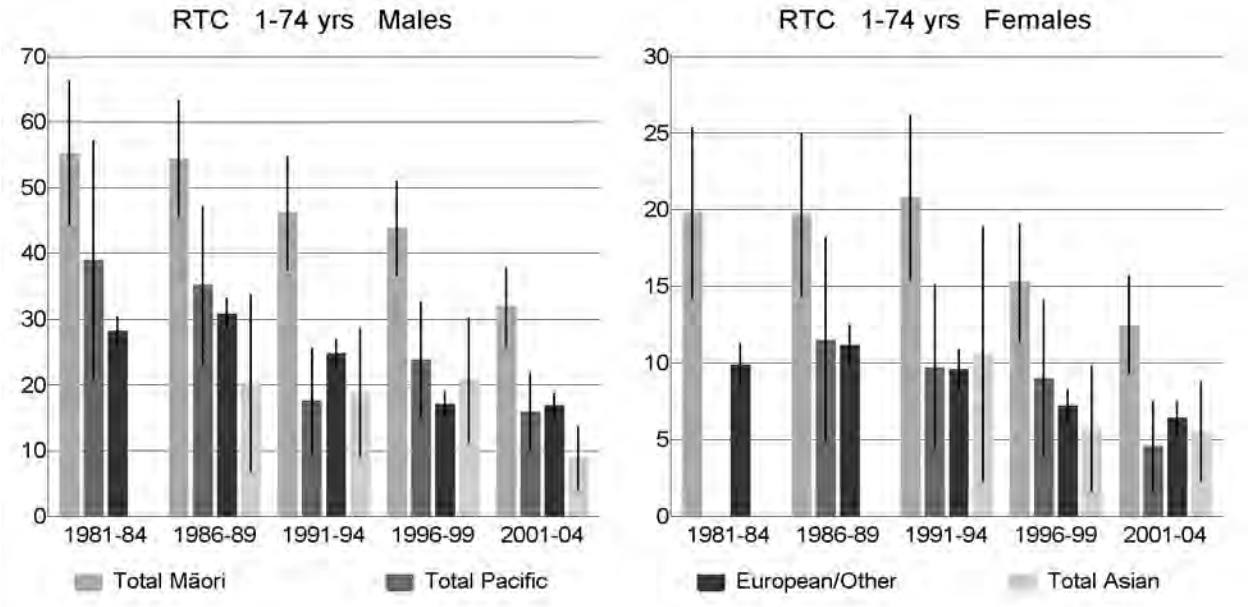
Total unintentional injury mortality rates have declined by a third to a half over the study period for all ethnicity-by-sex groups, except among Māori females, where rates only declined by 10% (mostly in the 1990s). However, Māori (both sexes) continue to experience rates that are approximately double those of European/Others, whereas rates for Pacific peoples have been similar to (or for males, slightly higher than) their European/Other counterparts. Rates for Asian peoples, where calculable, are lower than those of the European/ Other ethnic group.

The similar proportional declines in injury mortality rates across all ethnic by sex groups resulted in essentially stable SRDs and a suggestion of increasing SRRs, at least until recently. However, only for Māori compared to European/Other females is the (linear) increase in SRR statistically significant: from 1.54 in 1981–84 to 2.30 in 2001–04 (p for trend 0.01).

3.14 Road traffic injury

Age-standardised road traffic mortality rates by ethnicity and sex are summarised in Figure 16. Corresponding rate differences and rate ratios are summarised in Table 25. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/.

Figure 16: Road traffic injury mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group



Notes: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S16. Rates for specific age groups, where calculable, are shown at www.otago.ac.nz/NZCMSWebTable/.

Table 25: Road traffic injury mortality SRDs and SRRs, by ethnicity, 1–74 years

		Standardised rate ratios		Standardised rate differences	
Ethnicity	**Cohort**	**Males**	**Females**	**Males**	**Females**
Māori	1981–84	1.96 (1.58–2.44)	1.99 (1.46–2.73)	27 (16–38)	10 (4–16)
	1986–89	1.77 (1.47–2.12)	1.75 (1.30–2.36)	24 (14–33)	8 (3–14)
	1991–94	1.86 (1.51–2.30)	2.17 (1.62–2.91)	21 (12–30)	11 (6–17)
	1996–99	2.56 (2.10–3.13)	2.12 (1.57–2.86)	27 (19–34)	8 (4–12)
	2001–04	1.89 (1.52–2.35)	1.95 (1.44–2.65)	15 (9–21)	6 (3–10)
	P (trend)	*0.53*	*0.64*	*0.20*	*0.14*
Pacific	1981–84	1.38 (0.86–2.22)		11 (-8–29)	
	1986–89	1.14 (0.80–1.62)	1.03 (0.57–1.86)	4 (-8–17)	0 (-7–7)
	1991–94	0.71 (0.44–1.14)	1.02 (0.58–1.79)	-7 (-16–1)	0 (-5–6)
	1996–99	1.40 (0.96–2.04)	1.25 (0.69–2.26)	7 (-2–16)	2 (-4–7)
	2001–04	0.94 (0.64–1.39)	0.72 (0.38–1.38)	-1 (-7–5)	-2 (-5–1)
	P (trend)	*0.64*		*0.78*	
Asian	1986–89	0.66 (0.34–1.28)		-11 (-24–3)	
	1991–94	0.76 (0.44–1.29)	1.11 (0.50–2.45)	-6 (-16–4)	1 (-7–9)
	1996–99	1.22 (0.76–1.95)	0.79 (0.38–1.64)	4 (-6–13)	-2 (-6–3)
	2001–04	0.53 (0.30–0.91)	0.86 (0.46–1.59)	-8 (-13– -3)	-1 (-4–3)

Notes: 95% confidence intervals are given in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

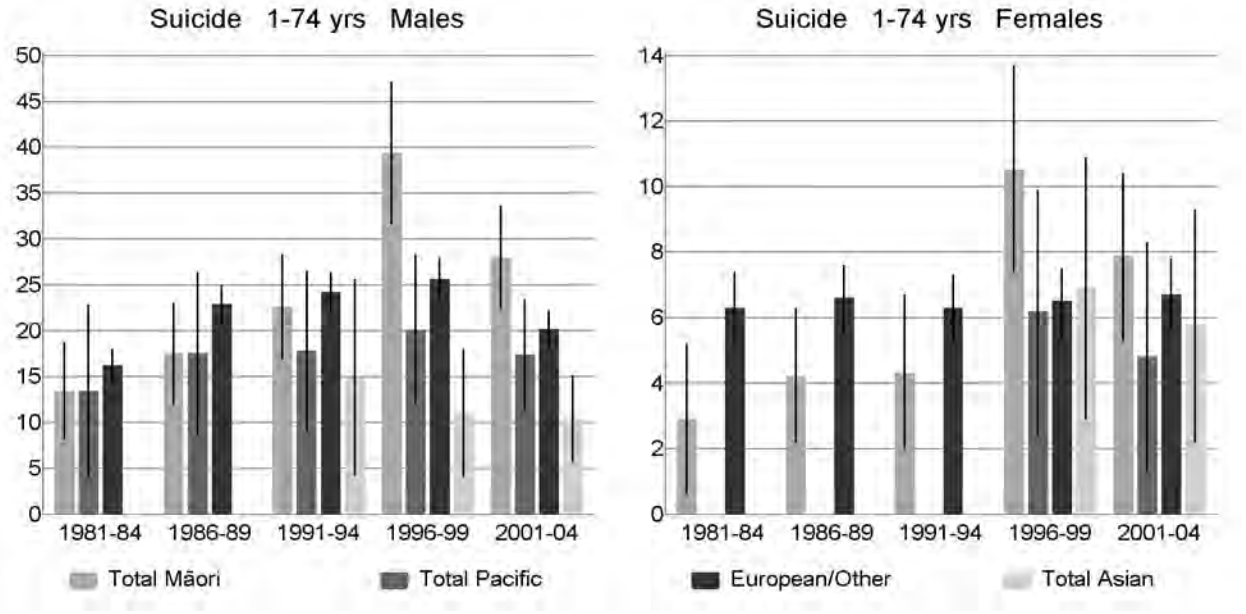
Road traffic injury accounts for the majority of unintentional injury deaths, so the ethnicity-by-sex patterns seen above are also reflected in the road traffic statistics. Particularly notable are the steep declines in Māori mortality since the late 1980s for males and the early 1990s for females, although 2001-04 rates remain nearly two-fold higher for Maori compared to European/Others. Pacific, Asian (females only) and European/Other ethnic groups all show similar levels of mortality, and similar trends in mortality, with (irregular) declines mainly in more recent cohorts. Asian male mortality is now significantly lower than that of the European/Other reference group.

No notable or statistically significant linear trends were found in SRDs or SRRs for any ethnic group (where these could be estimated).

3.15 Suicide

Age-standardised suicide rates by ethnicity and sex are summarised in Figure 17. Corresponding rate differences and rate ratios are summarised in Table 26. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/.

Figure 17: Suicide rates, by ethnicity and sex, age standardised within the 1–74 year age group



Notes: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S17. Rates for specific age groups, where calculable, are shown at www.otago.ac.nz/NZCMSWebTable/.

Table 26: Suicide SRDs and SRRs, by ethnicity, 1–74 years

		Standardised rate ratios		Standardised rate differences	
Ethnicity	**Cohort**	**Males**	**Females**	**Males**	**Females**
Māori	1981–84	0.83 (0.55–1.25)	0.46 (0.20–1.03)	-3 (-8–3)	-3 (-6– -1)
	1986–89	0.76 (0.55–1.06)	0.64 (0.39–1.07)	-5 (-11–1)	-2 (-5–0)
	1991–94	0.93 (0.71–1.22)	0.69 (0.39–1.22)	-2 (-8–5)	-2 (-5–1)
	1996–99	1.54 (1.24–1.90)	1.63 (1.16–2.29)	14 (6–22)	4 (1–7)
	2001–04	1.39 (1.11–1.73)	1.17 (0.81–1.68)	8 (2–14)	1 (-2–4)
	P (trend)	*0.09*	*0.21*	*0.10*	*0.09*
Pacific	1981–84	0.83 (0.41–1.68)		-3 (-12–7)	
	1986–89	0.76 (0.46–1.28)		-5 (-15–4)	
	1991–94	0.73 (0.44–1.21)		-7 (-16–3)	
	1996–99	0.79 (0.52–1.19)	0.96 (0.51–1.79)	-6 (-14–3)	-0 (-4–4)
	2001–04	0.86 (0.60–1.24)	0.71 (0.34–1.49)	-3 (-9–4)	-2 (-6–2)
	P (trend)	*0.31*		*0.71*	
Asian	1991–94	0.62 (0.30–1.27)		-9 (-20–2)	
	1996–99	0.43 (0.23–0.81)	1.07 (0.59–1.96)	-15 (-22– -7)	1 (-4–5)
	2001–04	0.52 (0.33–0.82)	0.86 (0.45–1.61)	-10 (-15– -5)	-1 (-5–3)

Notes: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

Suicides comprise the vast majority of intentional injury deaths, with rates much higher among males than females. Rates have remained stable over the observation period among European/Other females, but increased steadily until 1996–99 among their male counterparts, only to decrease once again thereafter. Māori males experienced increasing rates of suicide from 1981–84 (when they were similar to those of the European/Other ethnic group) to peak in 1996–99 (at a significantly higher level than that of European/Other males). Māori females, unlike their European/Other counterparts, also experienced increasing rates – at least until recently. Rate estimates for Pacific and Asian ethnic groups are too unstable (because of small numbers of deaths) for reliable estimations of trends. Nevertheless, it is interesting to note that suicide rates declined from 1996–99 to 2001–04 for all sex-by-ethnicity groupings except European/Other females.

Māori suicide rates exceeded European/Other rates by 1996–99 for both males and females, with both SRDs and SRRs peaking in 1996–99 then falling in 2001–04. For example, the SRR for Māori males increased from 0.83 in 1981–84 to 1.54 in 1996–99, then fell to 1.39 in 2001–04. No clear trend in inequality measures was apparent for Pacific males, and trends could not be estimated for the other ethnicity-by-sex groups.

4 Socioeconomic Inequalities in Mortality

Sociological theories of social stratification have focused predominantly on the concept of social class. In practice, however, education and income have often been used instead of occupation to assign socioeconomic position (SEP). In this chapter, we use equivalised household income as our preferred measure of SEP, for reasons already cited (see page 2 in the Introduction and 11 in Methods).

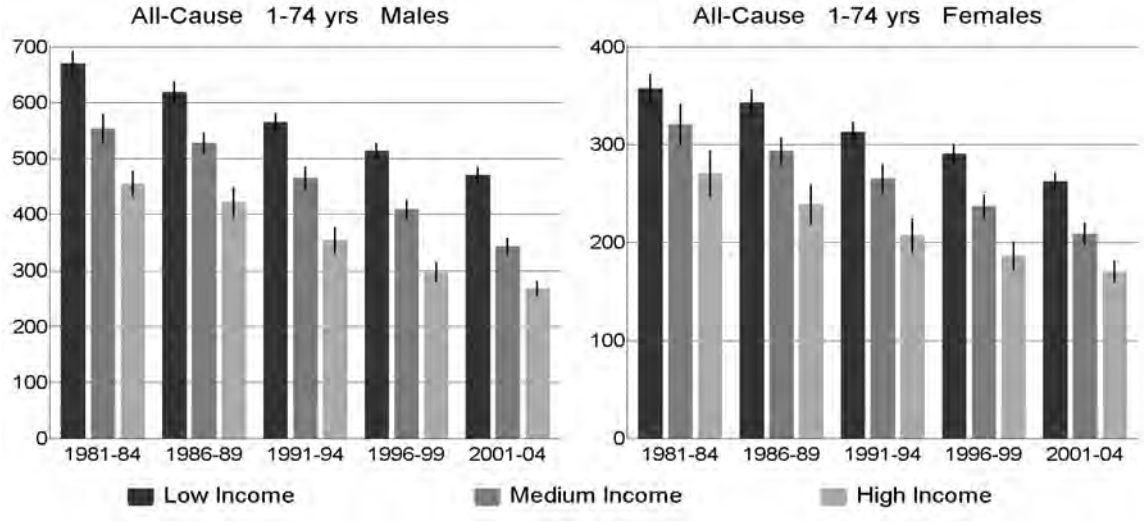
The chapter is structured similarly to the previous chapter on ethnic inequalities in mortality. That is, we begin with an examination of all-cause mortality, followed by avoidable and amenable causes and then major chronic diseases, followed by injuries. In each case, age-standardised and (sometimes) age-specific mortality rates by income group (and sex) are presented first, followed by measures of inequality. Note that all rates have been standardised to the ethnic composition of the 2001 Census, so that income groups can be compared at any one point in time free of confounding by differences in their ethnic mix, and trends in mortality by income groups can be compared over time free of confounding by changing ethnic mix over time.

Unlike the ethnic analysis, the income analysis includes the slope index of inequality (SII) and relative index of inequality (RII) as measures of inequality, in addition to the more familiar SRD and SRR. The former, regression-based, measures allow us to utilise information from the whole income distribution (not just to compare low- with high-income groups), and are sensitive to changes in the sizes of the groups over time, (see page 18 in Methods for more detail on these measures).

4.1 All-cause mortality

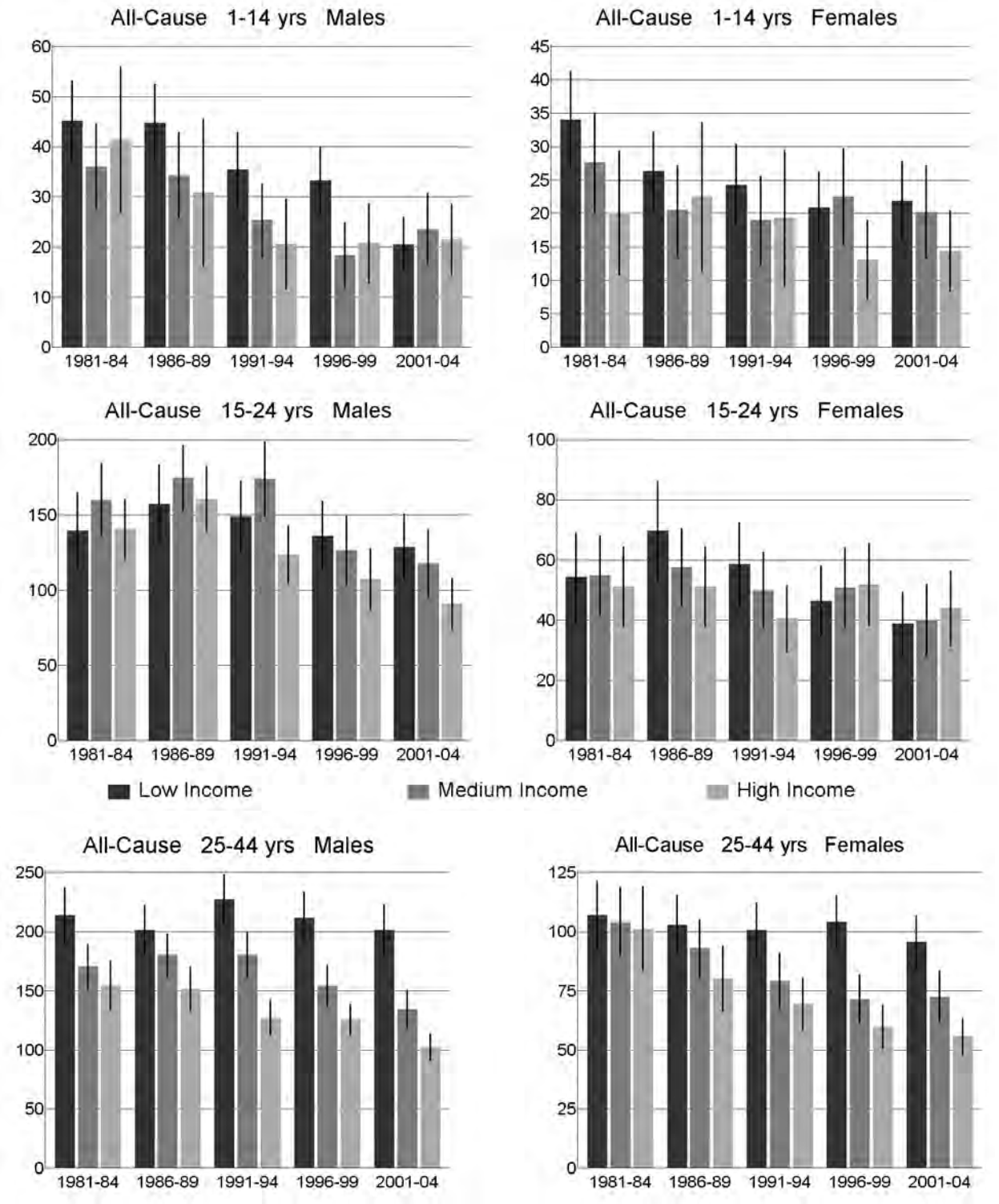
Age-standardised and age-specific all-cause mortality rates by income group and sex are summarised in Figures 18 and 19. Measures of inequality (SRD, SII, SRR, RII) are summarised in Table 27.

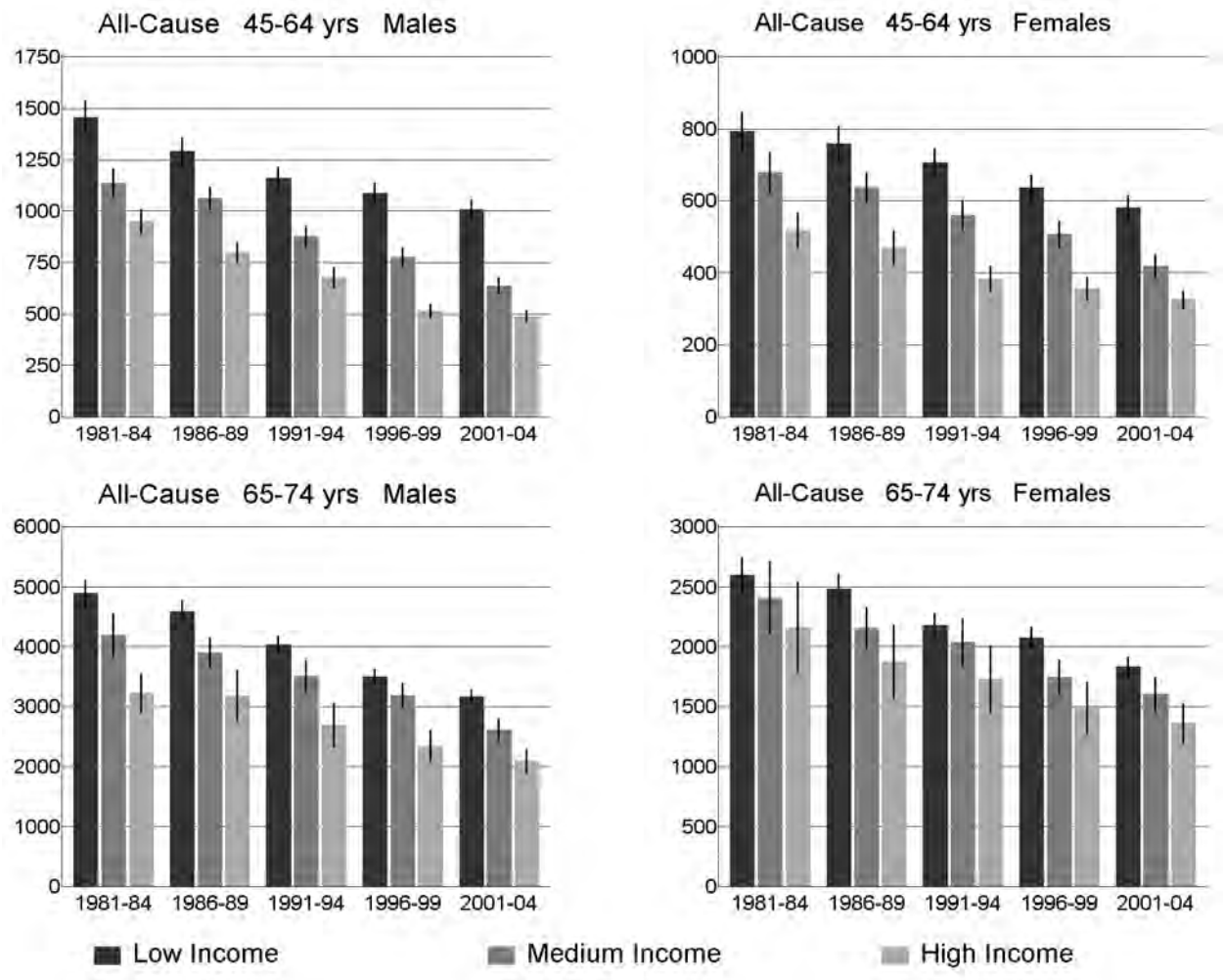
Figure 18: All-cause mortality rates, by income group and sex, age-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S18.

Figure 19: All-cause mortality rates, by income group, sex and age group





Note: Rates and 95% confidence intervals are tabulated in the Statistical Annex, Table S18.

Table 27: All-cause mortality SRDs, SIIs, SRRs and RIIs, by income group

			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Males	1–74 years	1981–84	1.47	1.9 (1.7–2.0)	215	331 (244–418)
		1986–89	1.47	1.8 (1.6–2.0)	197	299 (225–373)
		1991–94	1.60	2.2 (2.0–2.5)	212	345 (301–389)
		1996–99	1.73	2.5 (2.3–2.8)	216	351 (308–394)
		2001–04	1.75	2.6 (2.3–2.9)	202	313 (243–382)
		P (trend)	*< 0.01*	*0.02*	*0.68*	*0.75*
	1–14 years	1981–84	1.09	1.5 (0.9–2.5)	4	16 (0–31)
		1986–89	1.45	2.2 (1.2–3.8)	14	29 (2–56)
		1991–94	1.72	2.1 (1.1–4.0)	15	21 (11–31)
		1996–99	1.60	3.5 (1.6–7.8)	13	29 (17–42)
		2001–04	0.96	1.0 (0.6–1.9)	-1	0 (-9–10)
		P (trend)	*1.00*	*0.81*	*0.40*	*0.35*
	15–24 years	1981–84	0.99	1.0 (0.7–1.4)	-1	0 (-70–69)
		1986–89	0.98	1.0 (0.7–1.3)	-4	-6 (-65–54)
		1991–94	1.20	1.4 (1.0–1.9)	25	49 (-29–128)
		1996–99	1.27	1.4 (1.0–2.1)	29	41 (-1–82)
		2001–04	1.41	1.7 (1.1–2.5)	38	55 (15–96)
		P (trend)	*< 0.01*	*0.03*	*0.02*	*0.03*
	25–44 years	1981–84	1.38	1.6 (1.2–2.0)	59	76 (5–148)
		1986–89	1.33	1.5 (1.1–1.8)	50	64 (43–84)
		1991–94	1.79	2.7 (2.0–3.5)	100	153 (106–200)
		1996–99	1.69	2.4 (1.8–3.2)	86	128 (64–192)
		2001–04	1.97	2.9 (2.1–4.1)	99	132 (82–182)
		P (trend)	*0.05*	*0.06*	*0.12*	*0.13*
	45–64 years	1981–84	1.54	2.0 (1.8–2.3)	508	742 (394–1089)
		1986–89	1.61	2.3 (2.0–2.7)	491	777 (558–995)
		1991–94	1.71	2.6 (2.2–3.1)	482	763 (618–908)
		1996–99	2.12	3.7 (3.1–4.5)	572	827 (601–1052)
		2001–04	2.06	3.6 (3.0–4.3)	518	717 (378–1056)
		P (trend)	*0.02*	*< 0.01*	*0.48*	*0.80*
	65–74 years	1981–84	1.52	1.8 (1.5–2.1)	1666	2481 (1668–3294)
		1986–89	1.45	1.6 (1.4–1.9)	1418	1942 (1664–2220)
		1991–94	1.50	1.8 (1.6–2.1)	1347	2048 (1356–2742)
		1996–99	1.49	1.8 (1.6–2.0)	1154	1835 (1375–2296)
		2001–04	1.51	1.8 (1.6–2.1)	1061	1593 (1263–1923)
		P (trend)	*0.95*	*0.47*	*< 0.01*	*0.05*

			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Females	1–74 years	1981–84	1.32	1.5 (1.4–1.8)	87	135 (99–172)
		1986–89	1.44	1.6 (1.4–1.8)	104	141 (118–164)
		1991–94	1.51	1.9 (1.6–2.1)	106	161 (154–169)
		1996–99	1.56	2.1 (1.9–2.4)	105	172 (151–194)
		2001–04	1.54	2.2 (1.9–2.5)	92	157 (143–171)
		P (trend)	*0.04*	*< 0.01*	*0.75*	*0.51*
	1–14 years	1981–84	1.69	1.5 (0.8–2.8)	14	12 (-1–25)
		1986–89	1.17	1.6 (0.8–3.2)	4	11 (-13–35)
		1991–94	1.26	2.0 (1.0–4.3)	5	15 (6–24)
		1996–99	1.61	1.5 (0.8–3.0)	8	8 (-3–19)
		2001–04	1.52	1.7 (0.8–3.5)	8	10 (-3–23)
		P (trend)	*0.94*	*0.67*	*0.59*	*0.47*
	15–24 years	1981–84	1.06	0.9 (0.5–1.6)	3	-5 (-52–42)
		1986–89	1.36	1.4 (0.9–2.4)	18	20 (1–39)
		1991–94	1.45	1.5 (0.9–2.6)	18	20 (1–40)
		1996–99	0.90	0.9 (0.5–1.6)	-5	-5 (-39–29)
		2001–04	0.88	0.9 (0.5–1.7)	-5	-4 (-37–29)
		P (trend)	*0.41*	*0.67*	*0.32*	*0.35*
	25–44 years	1981–84	1.06	1.1 (0.8–1.5)	6	9 (-17–35)
		1986–89	1.28	1.4 (1.1–1.9)	23	32 (23–42)
		1991–94	1.45	2.1 (1.5–2.9)	31	59 (37–81)
		1996–99	1.74	2.5 (1.8–3.6)	44	68 (46–89)
		2001–04	1.72	2.9 (2.0–4.3)	40	70 (58–83)
		P (trend)	*< 0.01*	*< 0.01*	*0.04*	*< 0.01*
	45–64 years	1981–84	1.54	2.1 (1.7–2.5)	277	444 (324–564)
		1986–89	1.61	2.1 (1.8–2.5)	288	434 (343–525)
		1991–94	1.85	2.9 (2.4–3.5)	324	513 (471–555)
		1996–99	1.78	2.8 (2.3–3.4)	280	446 (369–524)
		2001–04	1.78	3.1 (2.5–3.8)	255	418 (352–484)
		P (trend)	*0.13*	*0.03*	*0.35*	*0.50*
	65–74 years	1981–84	1.20	1.3 (1.1–1.6)	436	660 (154–1167)
		1986–89	1.33	1.3 (1.1–1.6)	611	632 (303–961)
		1991–94	1.26	1.3 (1.1–1.5)	454	512 (324–699)
		1996–99	1.40	1.5 (1.3–1.8)	588	821 (342–1300)
		2001–04	1.34	1.6 (1.3–1.8)	470	748 (469–1026)
		P (trend)	*0.20*	*0.07*	*0.81*	*0.38*

Notes: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

Considering first age and ethnicity standardised all-cause mortality rates within the 1–74 years age range (Figure 18), the expected socioeconomic gradient in mortality is clearly evident. That is, at all times and for both sexes, the high-income group enjoys the lowest mortality risk, followed in turn by the medium-income group and finally the low-income group. Importantly, all income groups have shown a steady downward trend in all-cause mortality from 1981–84 to 2001–04: 30% and 41% decreases for low- and high-income males, and 27% and 37% for low- and high-income females, respectively. That is, in percentage terms the mortality rate reductions have been greater in the high-income groups, but in absolute terms the rate reductions have been similar across income groups, resulting in the visual impression in Figure 18 of 'parallel tracking'. This general impression is important – it explains why, for many age groups and causes of death, relative inequalities by income have tended to increase but absolute inequalities have tended to remain more or less stable.

More specifically, this close to parallel downward tracking of rates across all three income groups means that absolute inequality as measured by the SRD has remained essentially stable (both sexes) (Table 27). Despite changing proportions in the three income groups over time, the trend in the SII is likewise not statistically significant. We therefore conclude that, for both males and females over the past quarter of a century, absolute inequality between socioeconomic groups in health (mortality) has remained stable. Note, however, that there is a suggestion (not statistically significant) that absolute inequality may recently have begun to decline (both sexes), as can be seen by comparing the SRD or SII in 1996–99 with the corresponding estimate in 2001–04.

By contrast, relative inequality has increased (this is inevitable if mortality has declined at the same pace in all income groups – the only way a relative increase in inequality could be avoided in a context of declining overall mortality would be for mortality to decline *faster* in absolute terms (or by the same amount in percentage terms) in the low-income group compared to the high-income groups).

Among males, the SRR comparing the low- to the high- income group increased from 1.47 in 1981–84 to 1.75 in 2001–04, a 60% increase in the excess relative risk. At the same time, the RII increased from 1.9 to 2.6 respectively, a 78% increase. Among females a similar pattern is seen, with the SRR increasing from 1.32 to 1.54 (69% increase) while the RII increases from 1.5 to 2.2 (140% increase). The greater increase in the RII than the SRR partly reflects the widening income distribution in New Zealand over the study period.

Interestingly, there is little further increase in SRR or RII from 1996–99 to 2001–04 for either sex – suggesting that relative inequality in mortality between income groups may now be stabilising in parallel with a possible decrease in absolute inequalities. However, it is too early to tell if a real and sustained change in trend direction is occurring.

Turning now to a consideration of specific age groups (Figure 19 and Table 27), some differences from the overall (age standardised) pattern can be seen. For 1–14-year-olds, all income groups show similar if irregular declines in mortality over the study period, by approximately half among males and by approximately a third among females. Rates were higher among the low-income group at all points in time for females. For males, the expected income mortality gradient was seen from 1986–89 to 1996–99 but had disappeared completely by 2001-04. No statistically significant linear trends are evident for either sex in either absolute or relative inequalities; it remains to be seen whether the recent trend for males represents a real turning point and can be sustained.

Among youth (15–24 years), mortality rates tended to fall in all income groups by up to a third, albeit irregularly. There was no consistent income mortality gradient among females. But male youth do show the emergence of a statistically significant difference in mortality between low- and high-income groups in 2001–04, the result of a more rapid decline in mortality among the latter group since the early 1990s. Thus female youth show no trend in absolute or relative measures of inequality, while male youth show significant trends in all measures of inequality. For example, the SRR for male youth increases from 0.99 (ie, no disparity) to 1.41 over the observation period, while the RII increases even more, from 1.0 to 1.7.

Young adults (25–44 years) show concerning trends. Among males, there was no noticeable decrease in mortality in the low-income group over the whole of the observation period, a decline in mortality in the medium-income group by about a quarter (occurring post 1991–94), and an irregular decline in the high-income group by about a third (occurring post 1986–89). The pattern differs slightly for females, among whom the high-income group shows a greater and more regular reduction of 45% in all-cause mortality while the medium-income group shows a fall of 30% (occurring only in earlier periods). Mortality in the low-income group is again almost stable (showing only an 11% decline over the whole observation period). These patterns are reflected in steep increases in both absolute and relative inequalities in mortality by income among young adults of both sexes. Among males the SRR increases from 1.38 to 1.97 and the RII from 1.6 to 2.9 (p for trend 0.06), and among females the corresponding trends are from 1.06 to 1.72 and from 1.1 to 2.9 ($p < 0.01$) respectively. This emergence (females) or worsening (males) of inequality in all-cause mortality by SEP among young adults is one of the most concerning findings of this report.

The pattern in middle-aged adults mirrors the overall (age-standardised) pattern; that is, a steady and parallel decline in all-cause mortality risks is seen for all income groups (about a 30% decline in the low-income group (both sexes) and a 37% (females) or 48% (males) decline in the high-income group). So absolute inequalities are stable (both SRD and SII), while relative inequalities increase significantly over the study period. For males, the SRR increases from 1.54 to 2.06 while the RII increases from 2.0 to 3.6; corresponding changes for females are 1.54 to 1.78 and 2.1 to 3.1 respectively. Again, the increase in RII is proportionately greater than the increase in SRR, reflecting the widening of the income distribution that occurred over the observation period.

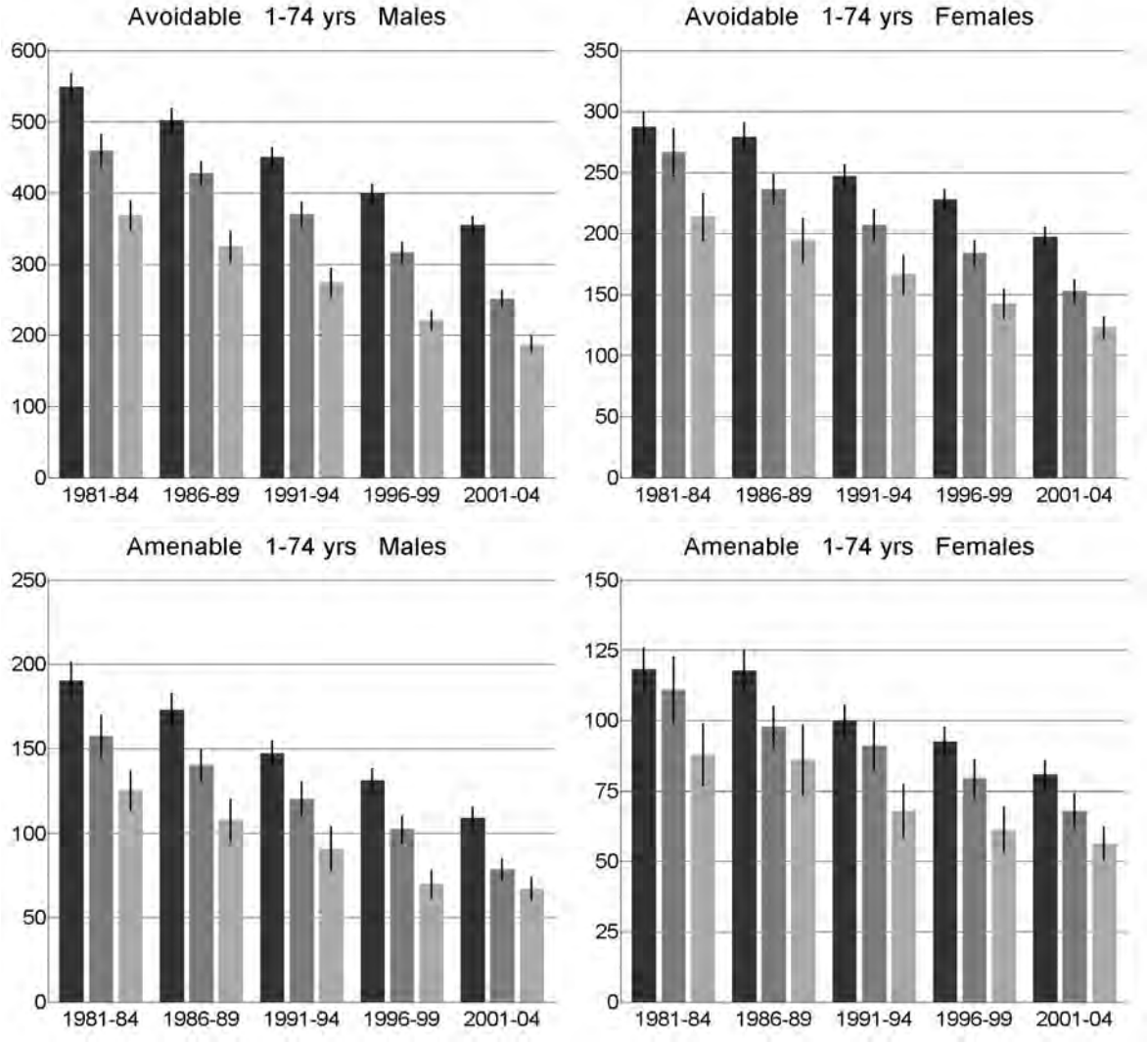
Differences at any one point in time between all-cause mortality rates are less marked among older people (especially among females), perhaps reflecting the lower sensitivity of equivalised household income as a marker of SEP in this age group. Nevertheless, older females show a pattern similar to middle-aged adults, with parallel falls in mortality over the study period for all income groups. This results in stable absolute and increasing relative inequality; in particular, the RII increases from 1.3 to 1.6 over the observation period ($p = 0.07$), while the SRR shows a suggestive increase from 1.20 to 1.34 ($p = 0.20$). Older males, however, show a steeper fall in mortality among low-income (and to a lesser extent medium-income) than among high-income groups; that is, the trend lines are not parallel. Uniquely in this group, therefore, we see the combination of stable relative inequalities (SRR about 1.5 and RII 1.8 at both the beginning and the end of the observation period), with over a one-third reduction in absolute inequalities (SRD falls by approximately 600 per 100,000 while SII falls by approximately 900 per 100,000).

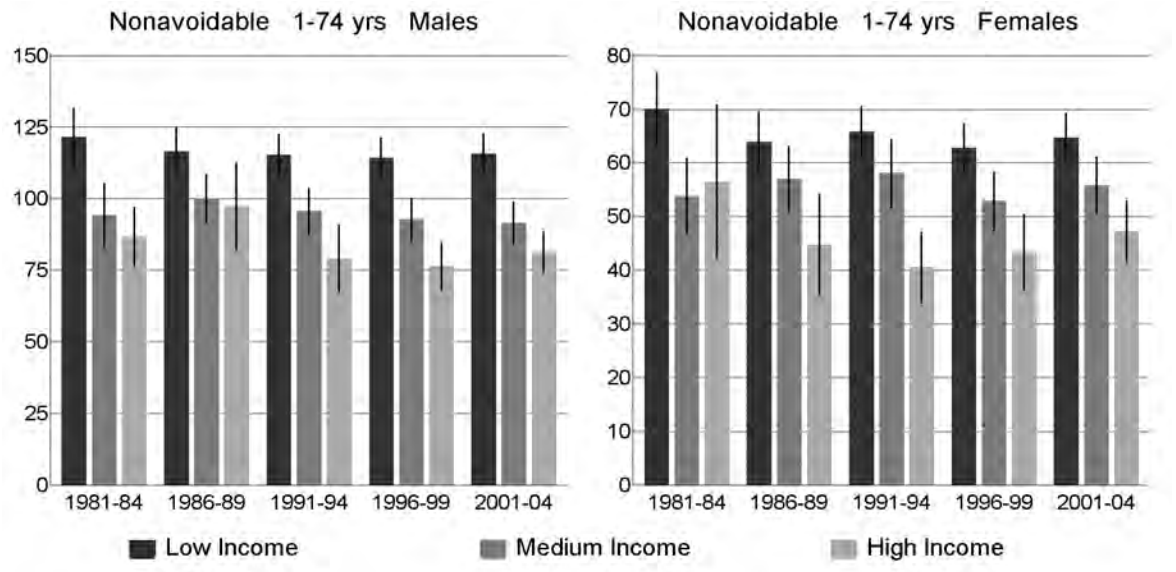
In summary, while there are some differences between age–sex groups, the overall finding is one of stable absolute inequalities and increasing relative inequalities in all-cause mortality between income groups over the study period. The increase in relative inequality is greater when measured by the RII than by the SRR, indicating that the widening of New Zealand's income distribution over the past quarter century has further widened relative inequality in mortality by SEP. However, it is worth noting that little further increase in SRR or RII occurred from 1996–99 to 2001–04, while the SRD and SII may have actually begun to decrease (although this change is not statistically significant).

4.2 Avoidable and amenable mortality

Age- (and ethnic-) standardised avoidable, amenable and non-avoidable mortality rates by income group and sex are summarised in Figure 20, and corresponding measures of inequality are summarised in Table 28. Avoidable mortality relates to deaths in the < 75 years age group from causes that can potentially be prevented (incidence reduction) or treated (case fatality reduction). Amenable mortality refers to the latter subset of treatable causes (ie, conditions amenable to health care) and so constitutes a summary indicator of health system performance (ie, access to and quality of health care).

Figure 20: Avoidable, amenable and non-avoidable mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group





Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Table S19.

Table 28: Avoidable, amenable and non-avoidable mortality SRDs, SIIs, SRRs and RIIs, by income group

Avoidable mortality			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Males	1–74 years	1981–84	1.49	1.9 (1.7–2.1)	180	271 (203–339)
		1986–89	1.55	2.0 (1.8–2.2)	178	273 (203–343)
		1991–94	1.64	2.3 (2.1–2.6)	176	286 (235–337)
		1996–99	1.81	2.7 (2.4–3.1)	178	287 (261–314)
		2001–04	1.90	3.1 (2.7–3.5)	168	260 (211–310)
		P (trend)	*< 0.01*	*< 0.01*	*0.12*	*0.94*
Females	1–74 years	1981–84	1.34	1.6 (1.4–1.8)	74	113 (53–174)
		1986–89	1.44	1.6 (1.4–1.9)	85	113 (95–132)
		1991–94	1.48	1.8 (1.6–2.1)	81	125 (117–132)
		1996–99	1.60	2.2 (1.9–2.5)	85	141 (122–160)
		2001–04	1.60	2.4 (2.1–2.8)	74	129 (115–144)
		P (trend)	*< 0.01*	*< 0.01*	*0.70*	*0.19*

Amenable mortality			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Males	1–74 years	1981–84	1.52	1.9 (1.6–2.2)	65	94 (62–126)
		1986–89	1.60	2.2 (1.8–2.6)	65	103 (78–127)
		1991–94	1.62	2.3 (1.9–2.9)	56	94 (73–115)
		1996–99	1.88	2.9 (2.3–3.6)	61	97 (84–111)
		2001–04	1.63	2.3 (1.9–2.8)	42	65 (44–86)
		P (trend)	*0.29*	*0.18*	*0.09*	*0.26*
Females	1–74 years	1981–84	1.35	1.5 (1.2–1.9)	30	44 (36–52)
		1986–89	1.37	1.5 (1.2–1.8)	32	40 (24–56)
		1991–94	1.47	1.7 (1.4–2.1)	32	46 (36–57)
		1996–99	1.50	2.0 (1.6–2.4)	31	51 (38–64)
		2001–04	1.43	1.9 (1.6–2.4)	25	43 (35–51)
		P (trend)	*0.21*	*0.03*	*0.16*	*0.83*

Non-avoidable mortality			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Males	1–74 years	1981–84	1.40	1.8 (1.4–2.4)	35	60 (27–92)
		1986–89	1.20	1.3 (1.0–1.6)	19	26 (0–51)
		1991–94	1.46	1.9 (1.5–2.3)	36	59 (35–83)
		1996–99	1.50	2.0 (1.7–2.5)	38	63 (46–81)
		2001–04	1.42	1.8 (1.5–2.1)	34	53 (31–75)
		P (trend)	*0.47*	*0.57*	*0.60*	*0.53*
Females	1–74 years	1981–84	1.24	1.4 (1.0–2.0)	14	22 (-11–54)
		1986–89	1.43	1.7 (1.3–2.2)	19	28 (17–39)
		1991–94	1.62	2.0 (1.5–2.6)	25	37 (27–46)
		1996–99	1.45	1.8 (1.4–2.4)	20	31 (28–35)
		2001–04	1.37	1.7 (1.3–2.1)	18	28 (19–36)
		P (trend)	*0.95*	*0.61*	*0.81*	*0.81*

Notes: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

Rates of avoidable and amenable mortality have declined steadily over the observation period in all income groups. While the trajectories appear parallel for avoidable mortality, there is some convergence for amenable mortality (ie, the rates of decline appear greater for low- and – especially – middle-income groups than for the high-income group). By contrast, there has been little reduction in non-avoidable mortality in any income group.

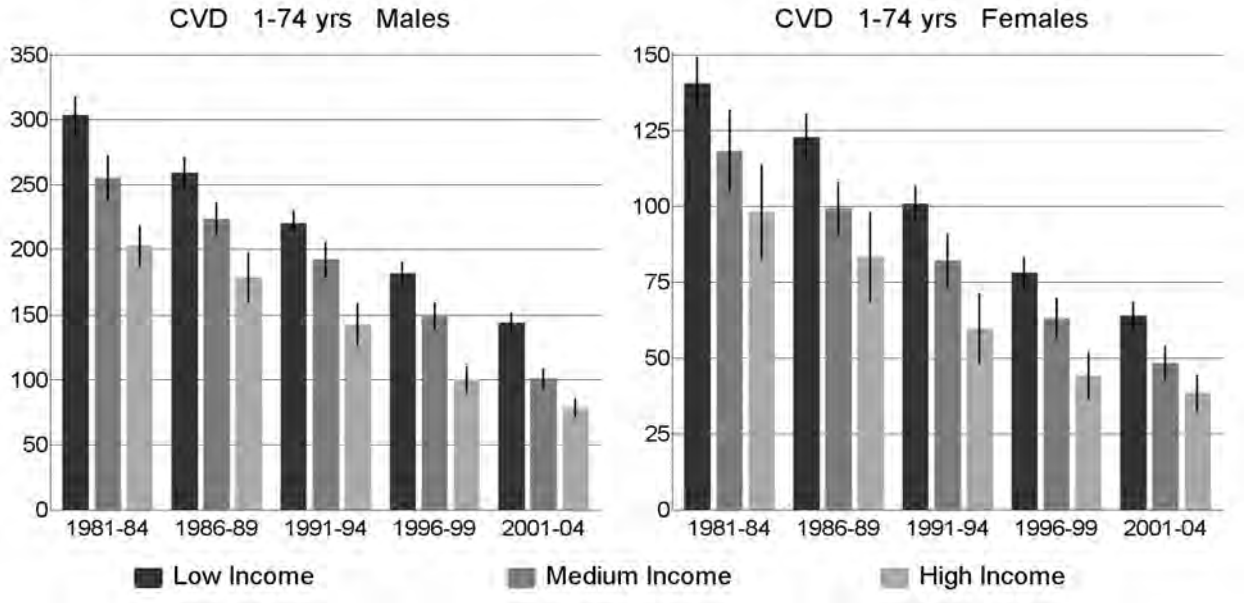
As a result, absolute inequality in avoidable mortality has remained stable overall (both sexes) while relative inequality has increased significantly. Amenable mortality inequality shows a similar pattern, although the increasing trend in relative inequality is not statistically significant. For both mortality categories, there is a suggestion of stabilising relative and narrowing absolute inequality (more clearly seen for amenable than avoidable mortality) from 1996-99 to 2001-04. However, confidence intervals for all measures of inequality in 1996–99 and 2001–04 do overlap.

There is no suggestion of any trend in non-avoidable mortality inequality.

4.3 Cardiovascular disease

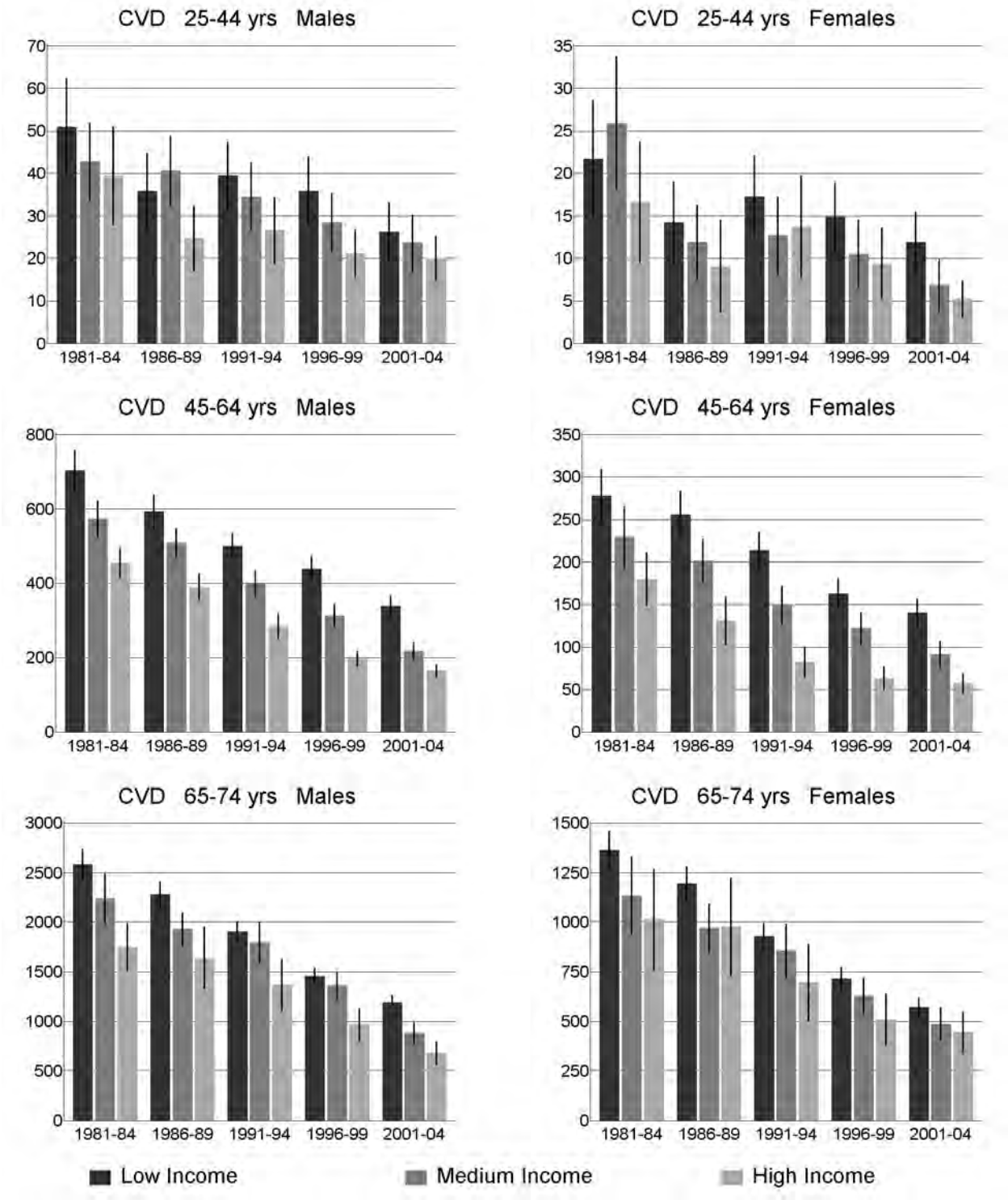
Age- (and ethnic-) standardised and age-specific cardiovascular disease (CVD) mortality rates by income group and sex are summarised in Figures 21 and 22, and corresponding measures of inequality are summarised in Table 29. Children and youth are excluded because of the very small number of CVD deaths in these age groups.

Figure 21: Cardiovascular mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Table S20.

Figure 22: Cardiovascular mortality rates, by income group, age and sex, standardised for ethnicity



Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Table S20.

Table 29: Cardiovascular mortality SRDs, SIIs, SRRs and RIIs, by income group

			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Males	1–74 years	1981–84	1.50	1.9 (1.6–2.1)	101	150 (118–182)
		1986–89	1.45	1.8 (1.5–2.1)	81	125 (76–174)
		1991–94	1.54	2.1 (1.8–2.5)	78	129 (99–159)
		1996–99	1.81	2.8 (2.3–3.4)	82	134 (114–154)
		2001–04	1.84	2.9 (2.4–3.5)	66	103 (80–126)
		P (trend)	*0.04*	*0.03*	*0.04*	*0.11*
	25–44 years	1981–84	1.29	1.5 (0.9–2.6)	11	17 (-5–39)
		1986–89	1.45	1.9 (1.1–3.3)	11	20 (-6–46)
		1991–94	1.48	2.6 (1.4–4.9)	13	28 (17–40)
		1996–99	1.71	2.5 (1.3–4.9)	15	23 (15–31)
		2001–04	1.31	1.6 (0.9–2.8)	6	10 (-10–30)
		P (trend)	*0.62*	*0.67*	*0.44*	*0.71*
	45–64 years	1981–84	1.54	1.8 (1.5–2.1)	247	299 (108–490)
		1986–89	1.52	2.0 (1.7–2.5)	203	321 (178–464)
		1991–94	1.75	2.7 (2.1–3.5)	215	339 (266–413)
		1996–99	2.23	4.2 (3.0–5.9)	242	348 (237–459)
		2001–04	2.06	3.4 (2.5–4.7)	174	238 (111–365)
		P (trend)	*0.05*	*0.02*	*0.30*	*0.47*
	65–74 years	1981–84	1.48	1.8 (1.5–2.1)	835	1265 (848–1682)
		1986–89	1.39	1.6 (1.3–1.9)	645	926 (507–1345)
		1991–94	1.39	1.6 (1.3–2.0)	539	811 (362–1260)
		1996–99	1.51	1.9 (1.5–2.3)	491	814 (536–1092)
		2001–04	1.75	2.2 (1.7–2.7)	510	730 (490–970)
		P (trend)	*0.21*	*0.22*	*0.06*	*0.03*
Females	1–74 years	1981–84	1.43	1.8 (1.4–2.3)	42	68 (53–83)
		1986–89	1.48	1.7 (1.3–2.1)	40	53 (51–54)
		1991–94	1.69	2.3 (1.7–3.0)	41	65 (51–79)
		1996–99	1.76	2.6 (2.0–3.5)	34	56 (43–69)
		2001–04	1.66	2.8 (2.1–3.7)	26	46 (44–49)
		P (trend)	*0.08*	*0.03*	*0.02*	*0.07*
	25–44 years	1981–84	1.30	1.2 (0.6–2.4)	5	4 (-8–15)
		1986–89	1.56	1.8 (0.7–4.4)	5	7 (-3–16)
		1991–94	1.26	1.9 (0.8–4.5)	4	9 (5–13)
		1996–99	1.58	1.8 (0.8–4.0)	6	7 (1–12)
		2001–04	2.26	4.9 (1.1–22.1)	7	10 (5–16)
		P (trend)	*0.12*	*0.10*	*0.17*	*0.27*
	45–64 years	1981–84	1.54	2.1 (1.5–3.0)	98	155 (124–186)
		1986–89	1.95	3.0 (2.0–4.5)	125	191 (129–253)
		1991–94	2.59	8.5 (3.6–20.0)	131	220 (205–235)
		1996–99	2.59	6.2 (3.0–12.7)	100	154 (129–180)
		2001–04	2.46	10.4 (3.3–33.2)	83	140 (121–159)
		P (trend)	*0.06*	*0.02*	*0.21*	*0.41*
	65–74 years	1981–84	1.35	1.7 (1.3–2.2)	350	618 (418–817)
		1986–89	1.22	1.2 (0.9–1.6)	217	237 (53–422)
		1991–94	1.33	1.3 (1.0–1.7)	230	215 (-25–454)
		1996–99	1.40	1.5 (1.1–1.9)	206	261 (-12–534)
		2001–04	1.28	1.7 (1.2–2.2)	123	262 (147–377)
		P (trend)	*0.94*	*0.77*	*0.02*	*0.27*

Notes: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

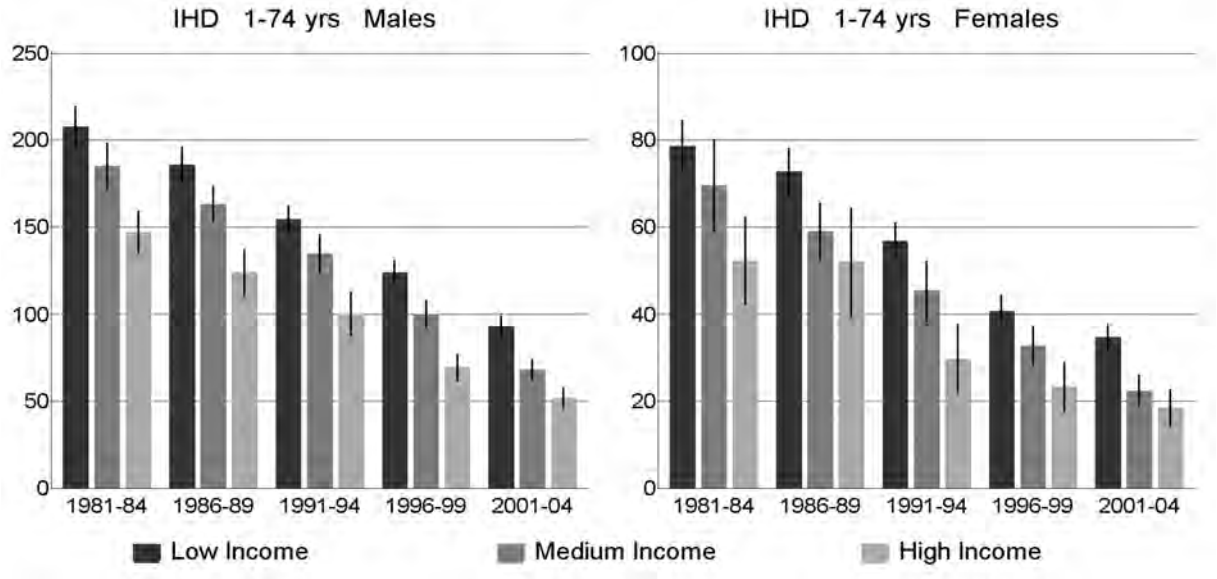
All income groups show a steep and reasonably regular decline in age- and ethnicity-standardised rates of CVD mortality over the study period (52% and 54% for males and females in the low-income group, and 61% for both sexes in the high-income group). Across the whole 1–74 years age range, both sexes show a pattern of narrowing absolute inequality accompanied by widening relative inequality. However, it is worth noting that from 1996–99 onwards among males, and from 1991–94 onwards among females, little if any further increase in relative inequality occurred.

The pattern varies across age-by-sex groups. In young adults, CVD mortality fell by between 45% to 70% across income groups, but inequalities remained stable, except for a possible increase in relative inequality for females. In middle-aged adults (45–64 years), CVD mortality fell from 1981–84 to 2001–04 by about a half among the low-income group and by about two-thirds among the high income group, resulting in stable absolute inequalities but increasing relative inequalities. However, closer inspection shows a more nuanced and statistically significant pattern for females of both increasing relative and absolute inequalities up to 1991–94, followed by falling absolute and stable relative inequalities thereafter. Although not statistically significant, there is a suggestion of falling absolute inequalities (and stable relative inequalities) for 45–64-year-old males from 1996–99 to 2001–04. CVD rates for older people decreased by over half for all income groups, with falling absolute inequality but stable (females) or possibly slightly increasing (males) relative inequality.

4.4 Ischaemic heart disease

Age- and ethnic-standardised IHD mortality rates by income group and sex are summarised in Figure 23, and corresponding measures of inequality are summarised in Table 30. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/.

Figure 23: IHD mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Table S21.

Table 30: IHD mortality SRDs, SIIs, SRRs and RIIs, by income group

			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Males	1–74 years	1981–84	1.41	1.6 (1.4–1.9)	61	82 (71–93)
		1986–89	1.50	1.8 (1.6–2.2)	62	93 (63–124)
		1991–94	1.54	2.0 (1.7–2.4)	54	86 (60–113)
		1996–99	1.79	2.6 (2.1–3.2)	55	85 (66–104)
		2001–04	1.80	2.9 (2.3–3.7)	42	67 (55–79)
		P (trend)	*< 0.01*	*< 0.01*	*0.04*	*0.19*
Females	1–74 years	1981–84	1.51	1.9 (1.4–2.5)	27	40 (26–54)
		1986–89	1.40	1.5 (1.0–2.1)	21	24 (10–38)
		1991–94	1.91	3.2 (2.1–4.7)	27	46 (32–61)
		1996–99	1.75	2.6 (1.8–3.7)	17	29 (17–41)
		2001–04	1.88	4.0 (2.4–6.6)	16	30 (23–37)
		P (trend)	*0.11*	*0.11*	*0.08*	*0.52*

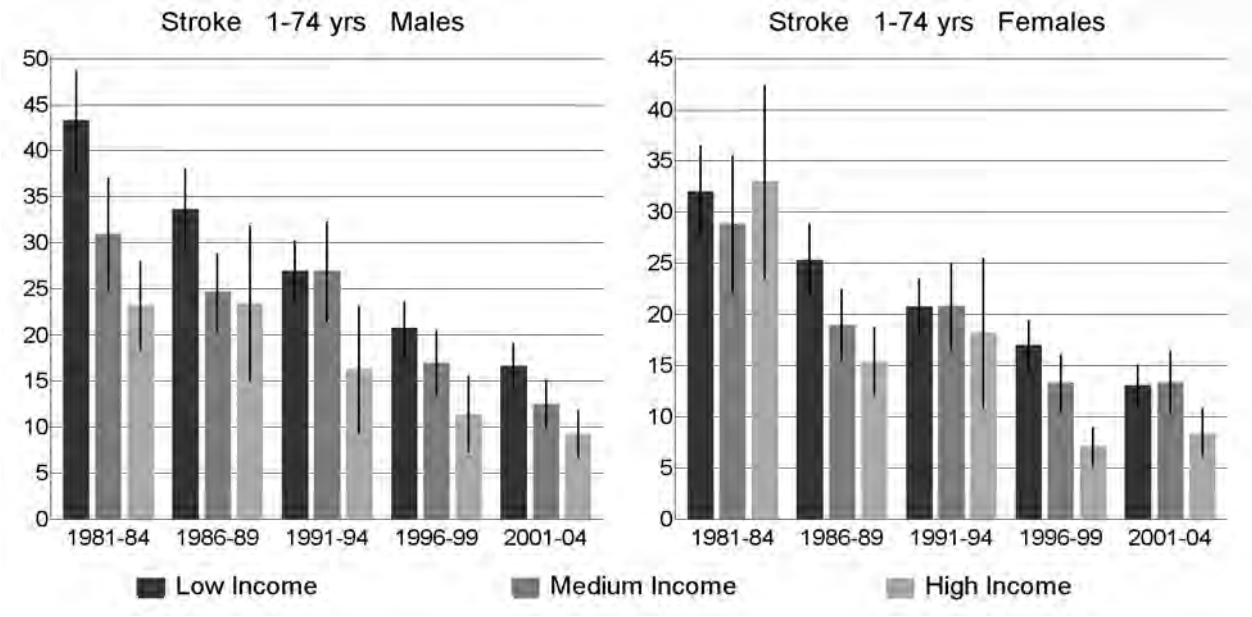
Note: 95% confidence intervals are in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

IHD mortality rates have fallen by about 60% in all income groups over the observation period (slightly more for high-income groups, and slightly less for low-income groups), similar to CVD mortality as a whole. For both sexes (adjusting for age and ethnicity) there has been a small but statistically significant fall in SRD (although the reduction in SII is not statistically significant). This narrowing in absolute inequality has, however, been accompanied by a statistically significant widening in relative inequality in males, and a near-significant widening in females. Both sexes show much greater increases in the RII than in the SRR, again reflecting the impact of widening income inequality over the study period.

4.5 Stroke

Age- and ethnic-standardised stroke mortality rates by income group and sex are summarised in Figure 24, and corresponding measures of inequality are summarised in Table 31. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/.

Figure 24: Stroke mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Table S22.

Table 31: Stroke mortality SRDs, SIIs, SRRs and RIIs, by income group

			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Males	1–74 years	1981–84	1.86	3.1 (1.9–5.0)	20	33 (19–46)
		1986–89	1.44	2.3 (1.5–3.5)	10	20 (7–34)
		1991–94	1.65	2.0 (1.1–3.6)	11	15 (4–26)
		1996–99	1.81	4.0 (2.0–7.9)	9	19 (13–25)
		2001–04	1.80	2.5 (1.5–4.3)	7	11 (9–13)
		P (trend)	*0.97*	*0.98*	*0.03*	*0.03*
Females	1–74 years	1981–84	0.97	1.0 (0.7–1.6)	-1	1 (-16–19)
		1986–89	1.64	2.0 (1.3–3.0)	10	14 (8–19)
		1991–94	1.14	1.0 (0.6–1.9)	3	1 (-5–7)
		1996–99	2.40	4.4 (2.3–8.7)	10	16 (11–21)
		2001–04	1.55	1.9 (1.1–3.2)	5	7 (1–13)
		P (trend)	*0.34*	*0.37*	*0.77*	*0.97*

Note: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

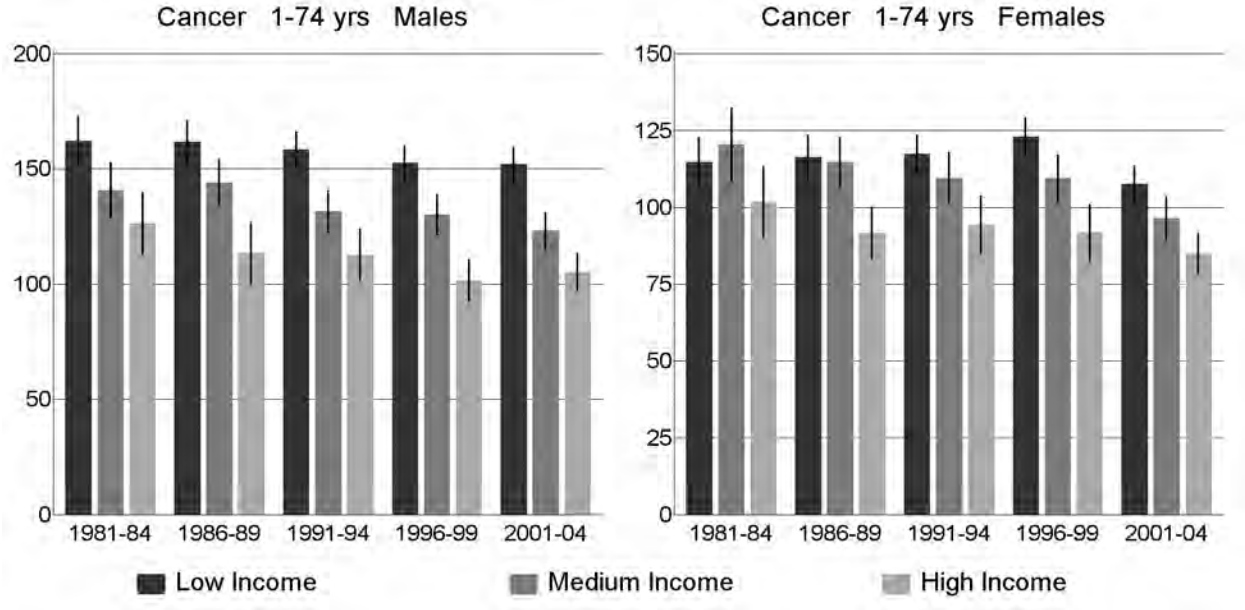
All income groups show a decline in stroke mortality over the observation period of between half to three-quarters, although the trajectories are not as smooth as those for IHD. In particular, no socioeconomic gradient is seen among females at the beginning of the study period, although such a gradient is well established by the end. Males show a clear gradient throughout.

Absolute inequality between income groups declines significantly among males, but there is no clear trend for females. Relative inequality is stable among males but shows an increasing (albeit non-statistically significant) trend among females until 1996–99 (for example, the SRR among females increases from 0.97 (ie, no disparity) in 1981–84 to 2.40 in 1996–99, then decreases to 1.55 in 2001–04, adjusting for age within the 1-74 year age range and ethnic composition).

4.6 Cancer

Age- and ethnic-standardised all-cancer mortality rates by income group and sex are summarised in Figure 25, and corresponding measures of inequality are summarised in Table 32. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/.

Figure 25: All-cancer mortality rates by income group and sex, age- and ethnic-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Table S23.

Table 32: All-cancer mortality SRDs, SIIs, SRRs and RIIs by income group

			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Males	1–74 years	1981–84	1.28	1.5 (1.2–1.8)	36	53 (34–73)
		1986–89	1.43	1.6 (1.3–2.0)	48	66 (54–78)
		1991–94	1.40	1.8 (1.5–2.1)	46	76 (68–84)
		1996–99	1.50	2.0 (1.7–2.3)	51	82 (73–91)
		2001–04	1.44	1.8 (1.5–2.1)	47	70 (50–89)
		P (trend)	*0.15*	*0.12*	*0.28*	*0.13*
Females	1–74 years	1981–84	1.13	1.2 (0.9–1.4)	13	16 (-1–33)
		1986–89	1.27	1.3 (1.1–1.5)	25	29 (6–51)
		1991–94	1.25	1.3 (1.1–1.6)	23	30 (22–39)
		1996–99	1.34	1.7 (1.4–1.9)	31	53 (44–63)
		2001–04	1.27	1.5 (1.3–1.8)	23	40 (29–50)
		P (trend)	*0.23*	*0.06*	*0.43*	*0.16*

Note: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

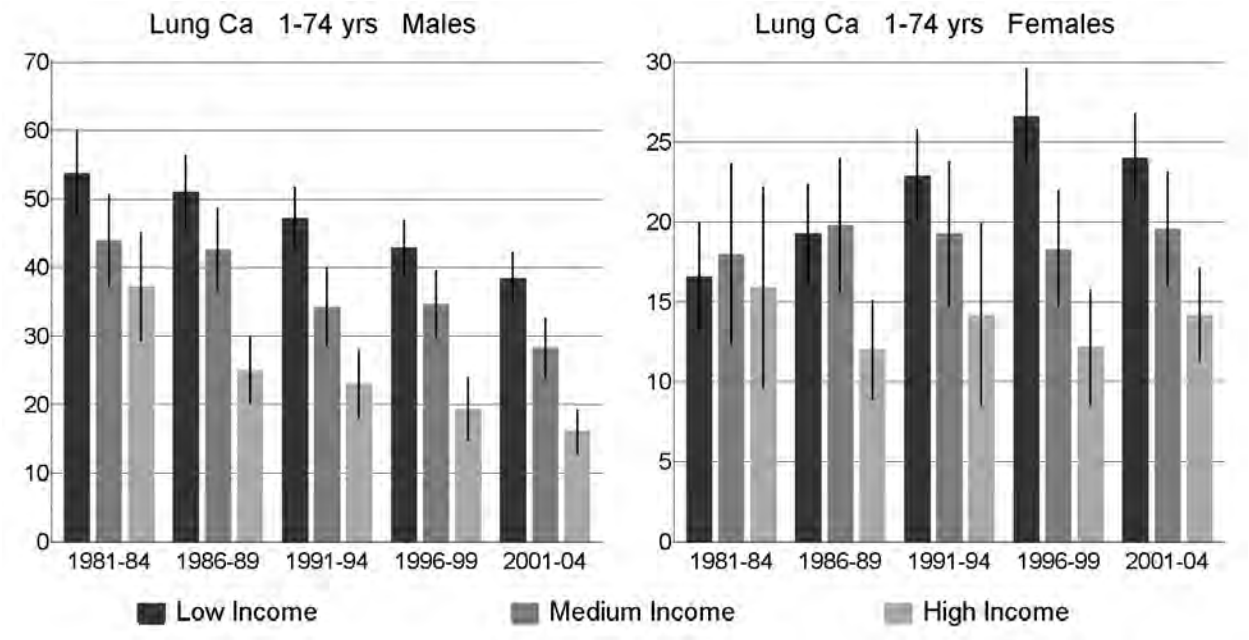
All-cancer mortality rates (ages 1–74, adjusting for age and ethnic composition) declined in the high-income group by 17% from 1981–84 to 2001–04 (both sexes), with much of this fall occurring from 1981–84 to 1986–89. There has also been an overall decline in the middle-income group, although this is smaller in magnitude and less regular in trajectory than that seen in the high-income group. Rates have only fallen by about 7% in the low-income group (both sexes), and among females this has only occurred recently.

At most points in time, there is a monotonic socioeconomic gradient in all-cancer mortality. Both absolute and relative inequalities increased from 1981–84 to 1996–99, but then stabilised or fell slightly from 1996–99 to 2001–04. Thus, p-values for the (linear) trend statistic are not necessarily valid.

4.7 Lung cancer

Age- and ethnic-standardised lung cancer mortality rates by income group and sex are summarised in Figure 26, and corresponding measures of inequality are summarised in Table 33. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/. Lung cancer is an indicator of tobacco-attributable cancers more generally.

Figure 26: Lung cancer mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Table S24.

Table 33: Lung cancer mortality SRDs, SIIs, SRRs and RIIs by income group

			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Males	1–74 years	1981–84	1.44	1.8 (1.3–2.5)	17	25 (13–37)
		1986–89	2.04	2.8 (1.9–4.1)	26	38 (24–52)
		1991–94	2.06	3.5 (2.2–5.4)	24	38 (31–45)
		1996–99	2.22	3.5 (2.2–5.5)	24	35 (24–46)
		2001–04	2.40	7.0 (3.5–14.0)	23	39 (32–45)
		P (trend)	*0.03*	*0.02*	*0.89*	*0.18*
Females	1–74 years	1981–84	1.05	1.2 (0.7–2.3)	1	3 (-13–19)
		1986–89	1.61	1.7 (1.0–2.6)	7	9 (0–17)
		1991–94	1.61	1.9 (1.0–3.4)	9	12 (5–18)
		1996–99	2.19	4.4 (2.4–8.0)	15	24 (18–31)
		2001–04	1.69	2.8 (1.8–4.3)	10	18 (11–25)
		P (trend)	*0.33*	*0.08*	*0.19*	*0.12*

Notes: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

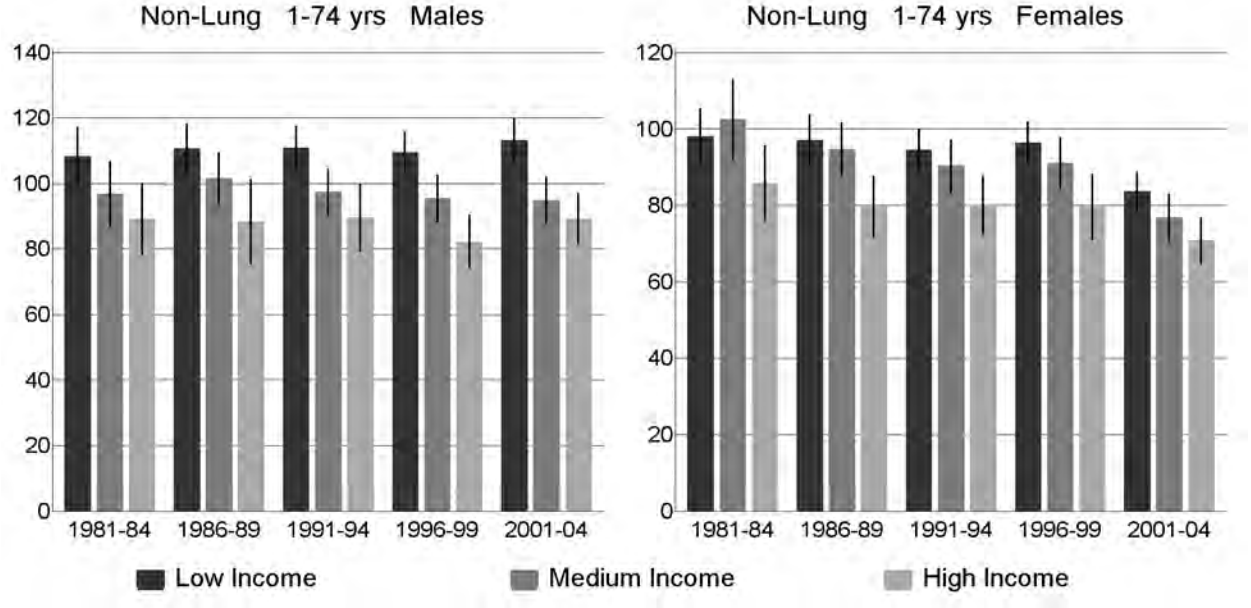
Lung cancer mortality rates declined markedly among males of all income groups over the whole observation period (28% and 57% declines in low- and high-income groups, respectively). Among females, however, rates increased by 60% in the low-income group from 1981–84 to 1996–99 while decreasing by 23% in the high-income group. From 1996–99 to 2001–04 there was a convergence of rates among females, with rates declining in all income groups.

As a result, absolute inequality remains stable among males while relative inequalities increase over the observation period. Among females, both absolute and relative inequalities increase up to 1996–99, then decrease. Assuming a 20-year lag in exposure to tobacco use by socioeconomic position, a recent peaking followed by falling in lung cancer mortality rates in low-income females is plausible (smoking rates among low-income females fell in the 1980s [Hill et al 2005]).

4.8 Non-lung cancer

Age- and ethnic-standardised non-lung cancer mortality rates by income group and sex are summarised in Figure 27, and corresponding measures of inequality are summarised in Table 34. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/. Non-lung cancer is an indicator of non-tobacco-attributable cancers more generally.

Figure 27: Non-lung cancer mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Table S25.

Table 34: Non-lung cancer mortality SRDs, SIIs, SRRs and RIIs by income group

			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Males	1–74 years	1981–84	1.21	1.3 (1.1–1.7)	19	28 (19–38)
		1986–89	1.25	1.3 (1.1–1.7)	22	28 (18–38)
		1991–94	1.24	1.5 (1.2–1.8)	21	38 (35–40)
		1996–99	1.33	1.7 (1.4–2.0)	27	47 (43–50)
		2001–04	1.27	1.4 (1.2–1.6)	24	31 (14–47)
		P (trend)	*0.25*	*0.59*	*0.17*	*0.07*
Females	1–74 years	1981–84	1.14	1.1 (0.9–1.4)	12	12 (8–16)
		1986–89	1.22	1.2 (1.1–1.5)	17	20 (-0–40)
		1991–94	1.18	1.2 (1.1–1.5)	14	19 (9–28)
		1996–99	1.21	1.4 (1.2–1.6)	17	29 (14–44)
		2001–04	1.18	1.3 (1.1–1.6)	13	22 (16–28)
		P (trend)	*0.69*	*0.07*	*0.79*	*0.03*

Notes: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

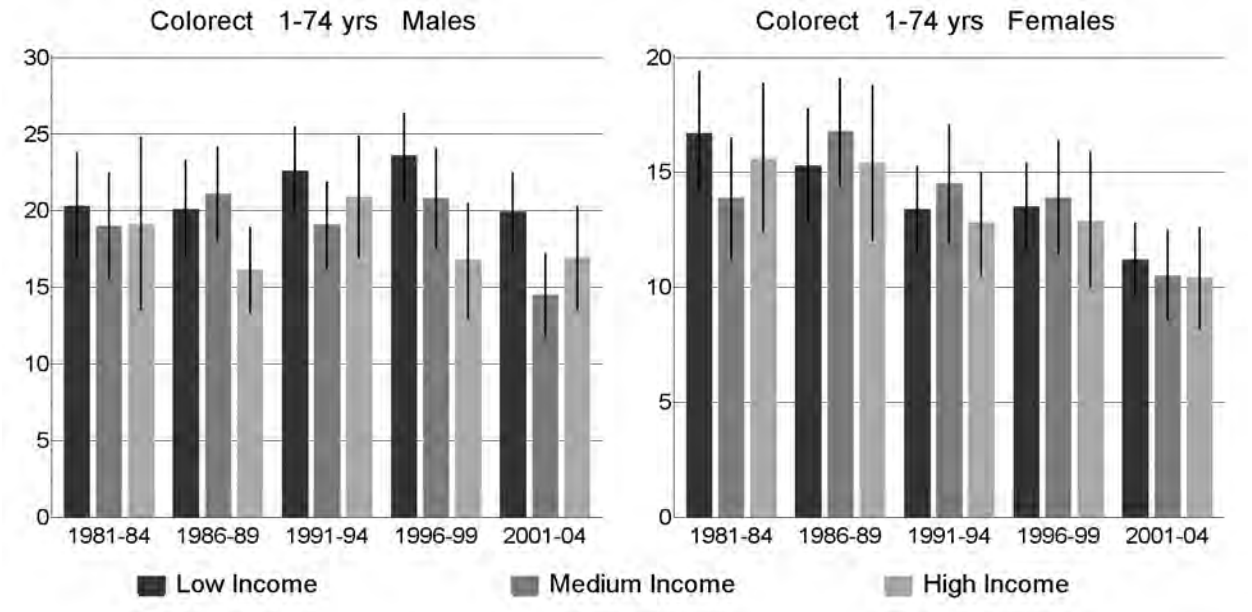
Among males, mortality rates are stable over the observation period for the high- and middle-income groups, while increasing slightly for the low-income group. Among females, rates decrease slightly in all income groups until 1996–99, and then decline more markedly from 1996–99 to 2001–04 (adjusted for age and ethnicity).

Thus for males a near-significant increase in absolute inequality is seen over the observation period, while relative inequality remains stable. For females, statistically significant or near-significant increasing trends are seen for both the SII and the RII, while the SRDs and SRRs remain stable. However, the socioeconomic gradients in non-lung cancer mortality are shallow and trends over time are small; for example, the (statistically significant) increases in SII and RII over the study period among females involve only a change from 12 to 22 per 100,000 and 1.1 to 1.3 respectively. This contrasts with the situation shown above for lung cancer.

4.9 Colorectal cancer

Age- and ethnic-standardised colorectal cancer mortality rates by income group and sex are summarised in Figure 28, and corresponding measures of inequality are summarised in Table 35. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/. Colorectal cancer is a major cancer type and the leading cause of non-tobacco-attributable cancer mortality across sexes.

Figure 28: Colorectal cancer mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Table S26.

Table 35: Colorectal cancer mortality SRDs, SIIs, SRRs and RIIs, by income group

			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Males	1–74 years	1981–84	1.06	1.1 (0.7–1.7)	1	2 (-4–7)
		1986–89	1.25	1.4 (1.0–2.0)	4	7 (-3–16)
		1991–94	1.08	1.3 (1.0–1.8)	2	6 (-5–17)
		1996–99	1.41	1.7 (1.2–2.5)	7	10 (5–16)
		2001–04	1.18	1.3 (0.9–1.8)	3	4 (-3–10)
		P (trend)	*0.60*	*0.58*	*0.62*	*0.38*
Females	1–74 years	1981–84	1.07	1.0 (0.7–1.4)	1	-1 (-10–8)
		1986–89	1.00	0.9 (0.6–1.3)	-0	-1 (-6–4)
		1991–94	1.05	1.0 (0.7–1.4)	1	0 (-4–3)
		1996–99	1.05	1.1 (0.8–1.7)	1	2 (-2–6)
		2001–04	1.08	1.1 (0.8–1.7)	1	1 (-3–6)
		P (trend)	*0.56*	*0.05**	*0.84*	*0.10*

Notes: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

* This statistically significant trend in RII results from regular (but very small) stepwise increases in the RII across time and is probably of little if any public health significance.

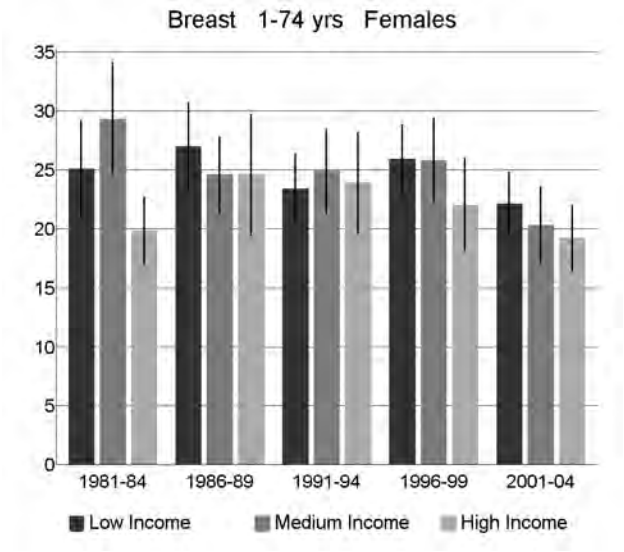
Rates have declined reasonably smoothly and by up to 24% to 33% among females of all three income groups since 1986–89. Among males, however, rates have declined only since 1991–94 among the high-income group and since 1996–99 among the middle- and low-income groups.

There is little evidence of a socioeconomic gradient in colorectal cancer mortality at any time for either sex (except for males in 1996–99). Given this very weak association between income and colorectal cancer mortality, little can be said about trends in inequality.

4.10 Breast cancer

Age- and ethnic-standardised breast cancer mortality rates by income group are summarised in Figure 29 and corresponding measures of inequality are summarised in Table 36. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/. Breast cancer is a major cancer type and the leading cause of non-tobacco-attributable cancer mortality among females.

Figure 29: Breast cancer mortality rates, by income group, age- and ethnic-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Table S27.

Table 36: Breast cancer mortality SRDs, SIIs, SRRs and RIIs, by income group

			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Females	1–74 years	1981–84	1.27	1.3 (1.0–1.9)	5	7 (-1–16)
		1986–89	1.10	1.2 (0.9–1.7)	2	5 (3–6)
		1991–94	0.98	0.9 (0.7–1.3)	-1	-2 (-10–6)
		1996–99	1.17	1.3 (1.0–1.7)	4	6 (-2–14)
		2001–04	1.15	1.3 (0.9–1.7)	3	5 (2–8)
		P (trend)	*0.71*	*0.98*	*0.70*	*0.93*

Notes: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

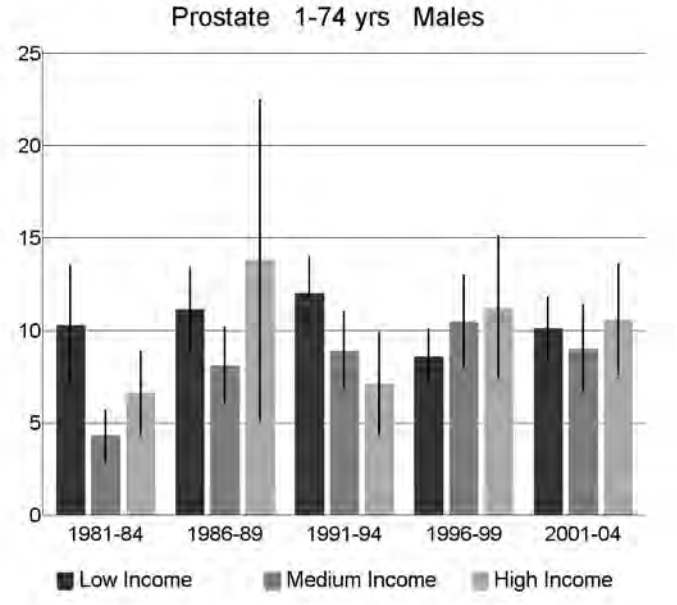
Only a shallow and somewhat irregular socioeconomic gradient is seen in breast cancer mortality, adjusting for age (within the 1-74 year age range) and ethnicity. Mortality rates were stable or increasing across all income groups until the late 1990s, whereafter rates appear to have fallen by 10% to 20% in all three income groups.

Both absolute and relative inequalities in breast cancer mortality have therefore been small or non-existent, and stable over time. For example, even in 2001–04 the point estimates for the SRR and RII were only 1.15 and 1.3 respectively.

4.11 Prostate cancer

Age- and ethnic-standardised prostate cancer mortality rates by income group are summarised in Figure 30, and corresponding measures of inequality are summarised in Table 37. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/. Prostate cancer is a major cancer type and a leading cause of non-tobacco-attributable cancer mortality among males (after colorectal cancer). Note that the NZCMS is not the ideal study to examine trends in prostate cancer, because only census respondents up to the age of 74 are linked to mortality data for the first four cohorts.

Figure 30: Prostate cancer mortality rates, by income group, age- and ethnic-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Table S28.

Table 37: Prostate cancer mortality SRDs, SIIs, SRRs and RIIs, by income group

			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Males	1–74 years	1981–84	1.56	1.8 (0.8–4.0)	4	4 (-5–13)
		1986–89	0.81	0.4 (0.1–2.1)	-3	-10 (-30–10)
		1991–94	1.69	2.4 (1.3–4.3)	5	8 (4–11)
		1996–99	0.77	0.8 (0.5–1.5)	-3	-2 (-5–1)
		2001–04	0.95	0.9 (0.5–1.5)	-1	-1 (-7–4)
		P (trend)	*0.29*	*0.34*	*0.29*	*0.28*

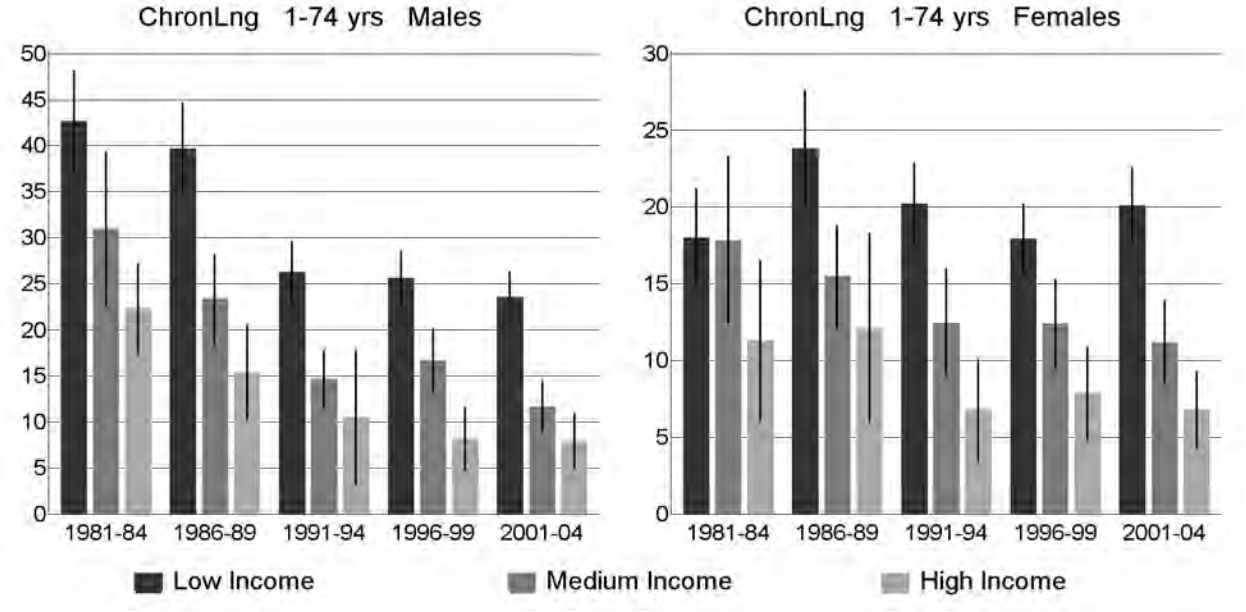
Notes: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

Overall, there is no evidence for a socioeconomic gradient in prostate cancer mortality. Statistical measures of inequality confirm the absence of significant disparity, except for the estimates of 1.69 and 2.4 for the SRR and RII in 1991–94 respectively. These estimates are inconsistent with those of the preceding and following cohorts and may represent an artefact or chance finding.

4.12 Chronic lung disease

Age- and ethnic-standardised chronic lung disease (CLD) mortality rates by income group and sex are summarised in Figure 31, and corresponding measures of inequality are summarised in Table 38. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/.

Figure 31: Chronic lung disease mortality rates, by income group, age- and ethnic-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Table S29.

Table 38: Chronic lung disease mortality SRDs, SIIs, SRRs and RIIs, by income group

			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Males	1–74 years	1981–84	1.92	3.0 (1.7–5.2)	20	31 (7–55)
		1986–89	2.57	6.6 (2.5–17.8)	24	38 (28–49)
		1991–94	2.49	9.7 (1.5–63.5)	16	27 (21–34)
		1996–99	3.10	9.7 (2.5–37.3)	17	28 (16–39)
		2001–04	2.97	11.9 (2.3–60.3)	16	24 (12–35)
		P (trend)	*0.02*	*0.02*	*0.11*	*0.15*
Females	1–74 years	1981–84	1.60	2.8 (1.3–5.8)	7	14 (1–28)
		1986–89	1.96	2.2 (1.1–4.5)	12	14 (2–26)
		1991–94	2.99	6.6 (2.0–22.4)	14	20 (10–30)
		1996–99	2.28	5.2 (2.2–12.2)	10	18 (13–23)
		2001–04	2.95	12.5 (2.4–66.1)	13	21 (14–29)
		P (trend)	*0.11*	*0.09*	*0.29*	*0.10*

Notes: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

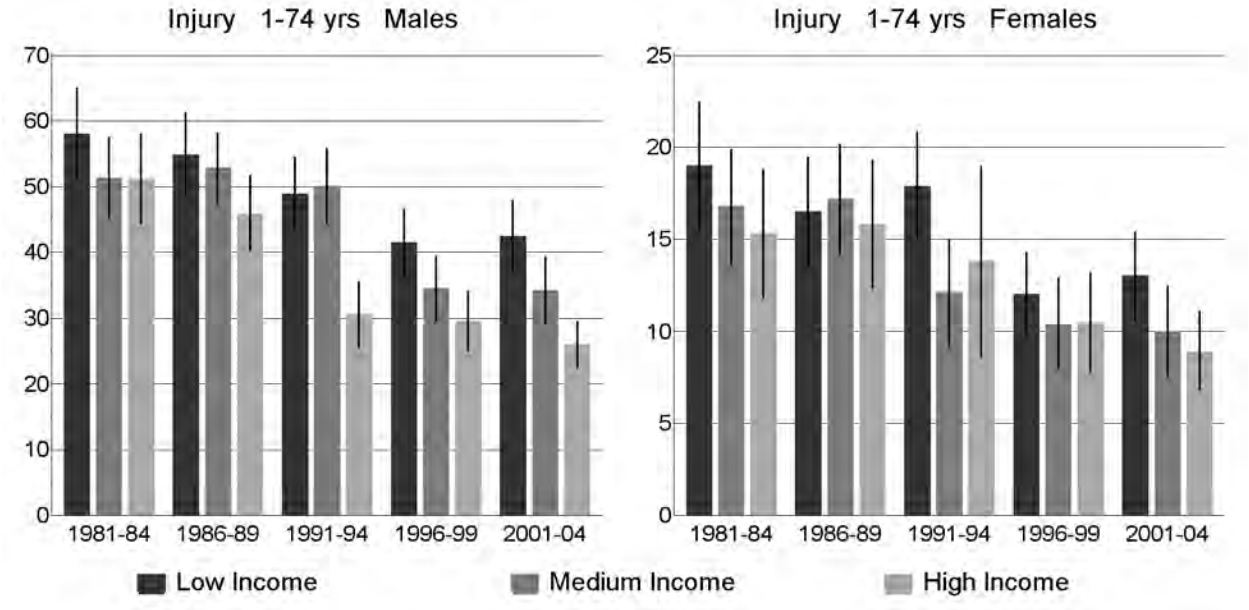
Chronic lung disease mortality rates have declined over time for males in all income groups (45% and 65% for low- and high-income groups, respectively). However, among females these rates have declined by about 40% in the high- and middle-income groups while remaining essentially stable in the low-income group. Thus relative inequality has increased for both sexes (although the trend does not quite reach statistical significance for females) while there is a (non-significant) suggestion of increasing absolute inequality for females (stable for males).

For both sexes, the RII trend greatly exceeds the corresponding SRR trend. For example, among males the SRR and RII increase from 1.9 and 3.0 in 1981–84 to 3.0 and 11.9 in 2001–04 respectively. Again, this reflects (at least in part) the contribution of widening of the population income distribution (ie increasing social inequality) to the socioeconomic mortality gradient.

4.13 Unintentional injury

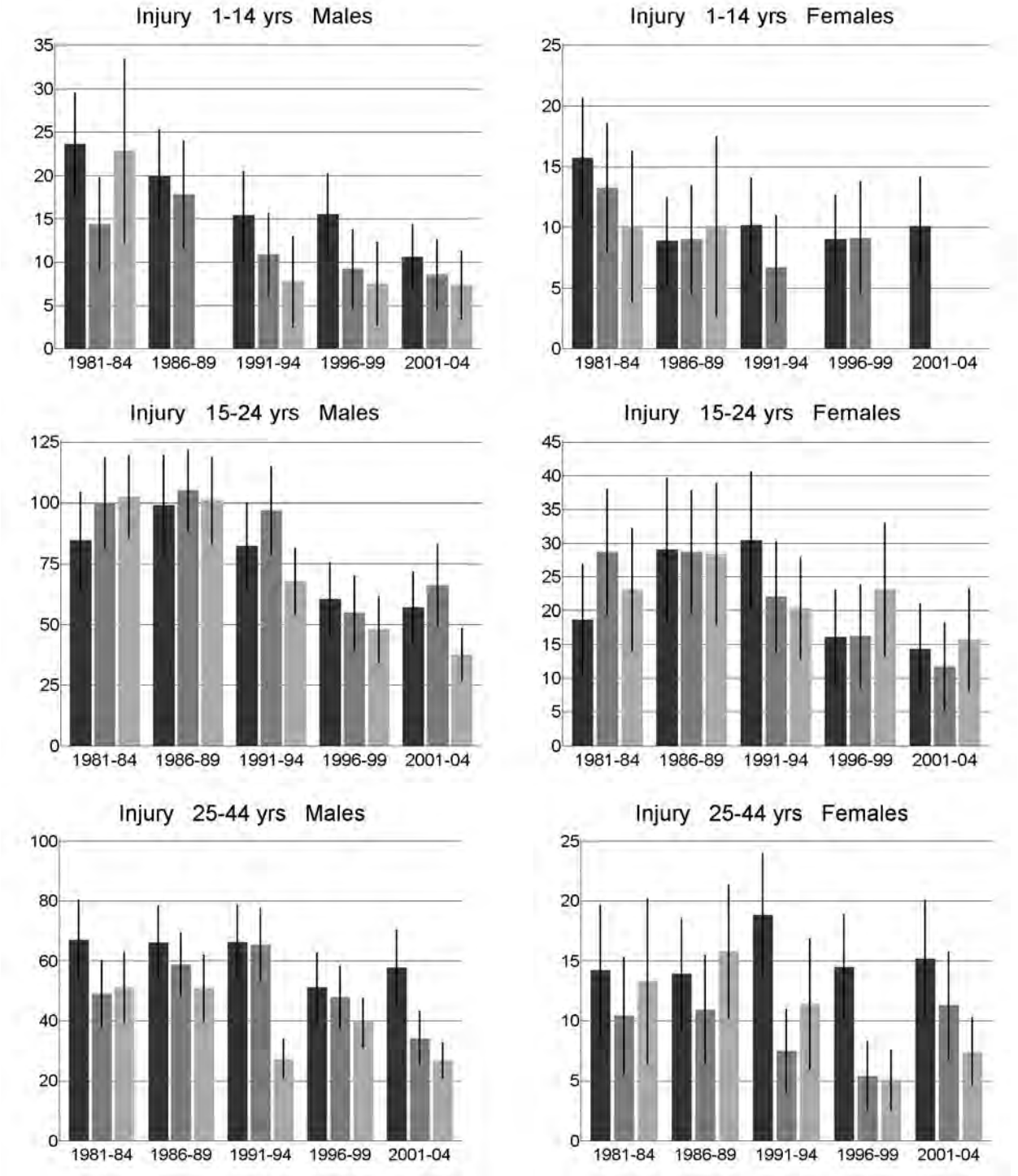
Age- and ethnic-standardised unintentional injury mortality rates by income group for the 1–74 years age range and age groups within this range are summarised in Figures 32 and 33. Corresponding measures of inequality are summarised in Table 39. We present estimates by age, despite sometimes limited statistical power, because the types and circumstances of injury vary widely by age – as do the corresponding patterns of inequality.

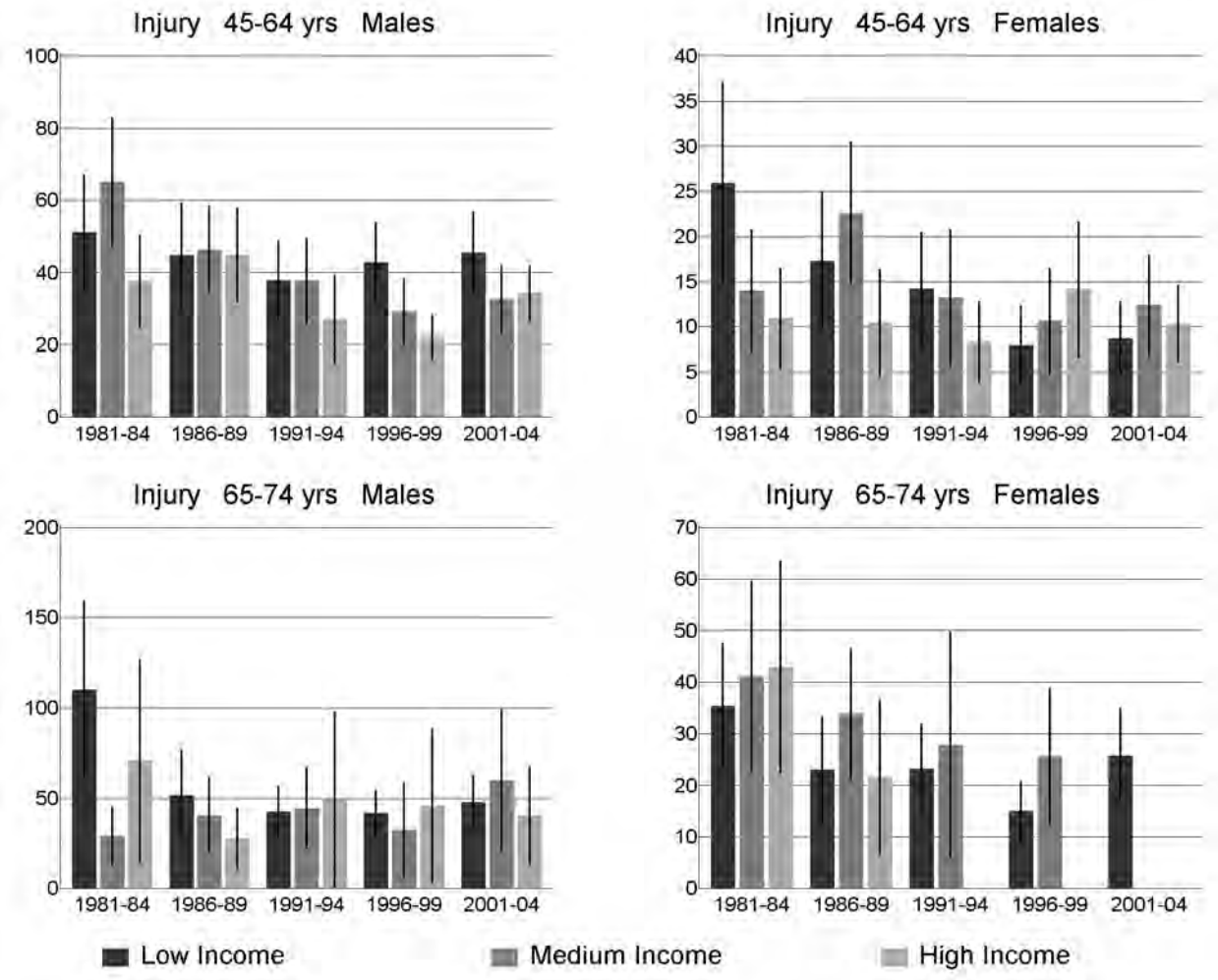
Figure 32: Unintentional injury mortality rates, by income group, age- and ethnic-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Table S30.

Figure 33: Unintentional injury mortality rates, by income group and age group, age- and ethnic-standardised within the specified age group





Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Table S30.

Table 39: Unintentional injury mortality SRDs, SIIs, SRRs and RIIs, by income group

			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Males	1–74 years	1981–84	1.13	1.3 (1.0–1.7)	7	13 (-4–31)
		1986–89	1.20	1.3 (1.0–1.6)	9	12 (2–21)
		1991–94	1.60	1.9 (1.4–2.5)	18	26 (4–48)
		1996–99	1.40	1.8 (1.3–2.5)	12	20 (13–27)
		2001–04	1.63	2.4 (1.7–3.3)	17	27 (12–41)
		P (trend)	*0.06*	*0.03*	*0.22*	*0.06*
	1–14 years	1981–84	1.03	1.9 (0.9–4.4)	1	13 (-8–34)
		1986–89	2.83	1.9 (0.9–4.2)	13	11 (-5–28)
		1991–94	1.98	2.1 (0.8–5.3)	8	8 (2–15)
		1996–99	2.07	6.7 (1.0–44.2)	8	18 (9–27)
		2001–04	1.44	2.7 (0.9–8.2)	3	8 (2–14)
		P (trend)	*0.62*	*0.29*	*0.44*	*0.82*
	15–24 years	1981–84	0.82	0.7 (0.5–1.1)	-18	-30 (-92–32)
		1986–89	0.98	1.1 (0.7–1.5)	-2	5 (-53–64)
		1991–94	1.22	1.4 (0.9–2.2)	15	28 (-37–93)
		1996–99	1.26	1.4 (0.8–2.6)	12	19 (-11–49)
		2001–04	1.52	1.9 (1.0–3.7)	20	33 (-25–91)
		P (trend)	*< 0.01*	*< 0.01*	*0.03*	*0.05*
	25–44 years	1981–84	1.31	1.5 (0.9–2.5)	16	23 (-5–51)
		1986–89	1.30	1.2 (0.8–1.9)	15	13 (2–23)
		1991–94	2.42	3.6 (1.9–6.9)	39	56 (33–80)
		1996–99	1.29	1.5 (0.9–2.4)	12	17 (3–31)
		2001–04	2.15	3.1 (1.5–6.4)	31	37 (14–61)
		P (trend)	*0.41*	*0.42*	*0.64*	*0.56*
	45–64 years	1981–84	1.36	2.5 (1.1–5.7)	14	42 (23–60)
		1986–89	1.00	1.2 (0.7–2.1)	-0	7 (-15–30)
		1991–94	1.39	1.3 (0.6–3.0)	11	9 (-16–34)
		1996–99	1.93	3.3 (1.4–8.2)	21	31 (17–45)
		2001–04	1.32	1.7 (0.9–2.9)	11	18 (-10–45)
		P (trend)	*0.58*	*0.86*	*0.56*	*0.73*
	65–74 years	1981–84	1.55	2.5 (0.5–12.6)	39	73 (-44–189)
		1986–89	1.89	2.8 (0.7–10.5)	24	41 (20–62)
		1991–94	0.86	0.7 (0.2–2.4)	-7	-15 (-67–37)
		1996–99	0.92	1.2 (0.3–4.5)	-4	8 (-40–56)
		2001–04	1.18	1.6 (0.5–4.5)	7	21 (-24–66)
		P (trend)	*0.25*	*0.54*	*0.21*	*0.27*
Females	1–74 years	1981–84	1.24	1.4 (0.9–2.2)	4	6 (-3–15)
		1986–89	1.05	1.0 (0.7–1.6)	1	1 (-5–6)
		1991–94	1.30	1.7 (1.0–3.1)	4	8 (-2–19)
		1996–99	1.15	1.4 (0.9–2.3)	2	4 (-2–10)
		2001–04	1.46	2.1 (1.3–3.7)	4	8 (6–9)
		P (trend)	*0.32*	*0.26*	*0.59*	*0.09*
	1–14 years	1981–84	1.55	1.5 (0.6–3.6)	6	6 (-4–15)
		1986–89	0.88	1.4 (0.4–4.3)	-1	3 (-14–20)
		1991–94	1.81	6.6 (0.6–78.0)	5	12 (3–22)
		1996–99	2.96	3.4 (0.8–15.2)	6	9 (-1–18)
		2001–04	4.37	15.7 (0.1–4619)	8	12 (7–18)
		P (trend)	*0.07*	*0.12*	*0.22*	*0.10*

			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
	15–24 years	1981–84	0.81	0.6 (0.3–1.5)	-4	-11 (-39–17)
		1986–89	1.02	1.0 (0.5–2.0)	1	-1 (-14–11)
		1991–94	1.50	1.6 (0.7–3.4)	10	11 (-3–25)
		1996–99	0.69	0.7 (0.3–1.9)	-7	-6 (-21–10)
		2001–04	0.91	1.1 (0.4–3.2)	-1	2 (-14–17)
		P (trend)	*0.97*	*0.53*	*0.94*	*0.83*
	25–44 years	1981–84	1.07	1.6 (0.6–4.2)	1	5 (-6–17)
		1986–89	0.88	1.1 (0.5–2.2)	-2	1 (-6–7)
		1991–94	1.65	3.1 (1.1–8.9)	7	13 (-1–27)
		1996–99	2.86	10.9 (0.5–227.9)	9	14 (6–22)
		2001–04	2.05	4.8 (1.2–20.1)	8	14 (12–16)
		P (trend)	*0.12*	*0.13*	*0.11*	*0.03*
	45–64 years	1981–84	2.38	5.5 (0.7–43.3)	15	22 (2–43)
		1986–89	1.66	2.4 (0.8–6.8)	7	13 (-5–31)
		1991–94	1.70	3.4 (0.7–17.7)	6	12 (-3–28)
		1996–99	0.56	0.6 (0.2–2.0)	-6	-5 (-18–7)
		2001–04	0.84	1.2 (0.5–3.1)	-2	2 (-4–8)
		P (trend)	*0.03*	*0.16*	*0.07*	*0.12*
	65–74 years	1981–84	0.82	0.6 (0.2–1.7)	-8	-18 (-39–2)
		1986–89	1.06	0.5 (0.2–1.7)	1	-16 (-36–5)
		1991–94	0.35	0.1 (0.0–111.4)	-43	-48 (-129–32)
		1996–99	0.73	0.7 (0.2–2.1)	-6	-6 (-36–24)
		2001–04	1.21	1.1 (0.3–3.9)	4	2 (-8–12)
		P (trend)	*0.72*	*0.18*	*0.70*	*0.03*

Notes: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

Examining first the age standardised mortality rates (ie, 1–74-year-olds combined), unintentional injury mortality has declined in the high-income group by 49% for males and 42% for females over the observation period. More specifically, injury mortality has been declining since 1981–84 among males, with a particularly sharp fall from 1986–89 to 1991–94; among females, the decline began later and has been smoother. The middle-income group shows a steep fall from 1991–94 to 1996–99 among males, with no further decline thereafter; among females, a steep fall is seen slightly earlier (1986–89 to 1991–94), again with little if any decline thereafter. For the low-income group, mortality declined by about 27% for males and 32% for females over the observation period as a whole; however, most of this decline occurred in the 1980s and early '90s, with no further reduction from the mid-1990s onwards (a pattern reasonably similar to the middle-income group).

For 1–74-year-olds combined, a socioeconomic gradient exists in unintentional injury mortality for both sexes, and this gradient has become steeper since the early 1990s. Both absolute and relative inequality increased among males, although the trend in SRD does not quite reach statistical significance (probably due to the non-linear trajectory). For example, the SRR and RII among males increased from 1.13 and 1.3 in 1981–84 to 1.63 and 2.4 respectively in 2001–04. Among females, however, absolute inequalities remained stable (and low), while the increasing trend in relative inequalities was suggestive but failed to reach conventional levels of statistical significance.

The patterns differ by age group. Across income groups, rates fell the most in percentage terms for children and youth. Among children, injury mortality was about double in the low- compared to the high-income group at each point in time (both sexes). Girls appeared to have increasing relative inequalities, but there was no discernible trend for boys. The opposite pattern was seen among youth, with female youth showing no evidence of changing inequalities over time while male youth showed steady and significant increases in inequality measured on both scales (eg, the SRR (RII) steadily increasing from 0.82 (0.7) in 1981–84 to 1.52 (1.9) in 2001–04). Among young adults (25–44 years), inequalities were greater from 1991–94 onwards than in the 1980s (both sexes). However, statistical tests of a linear trend over time in these inequalities approached significance only for females.

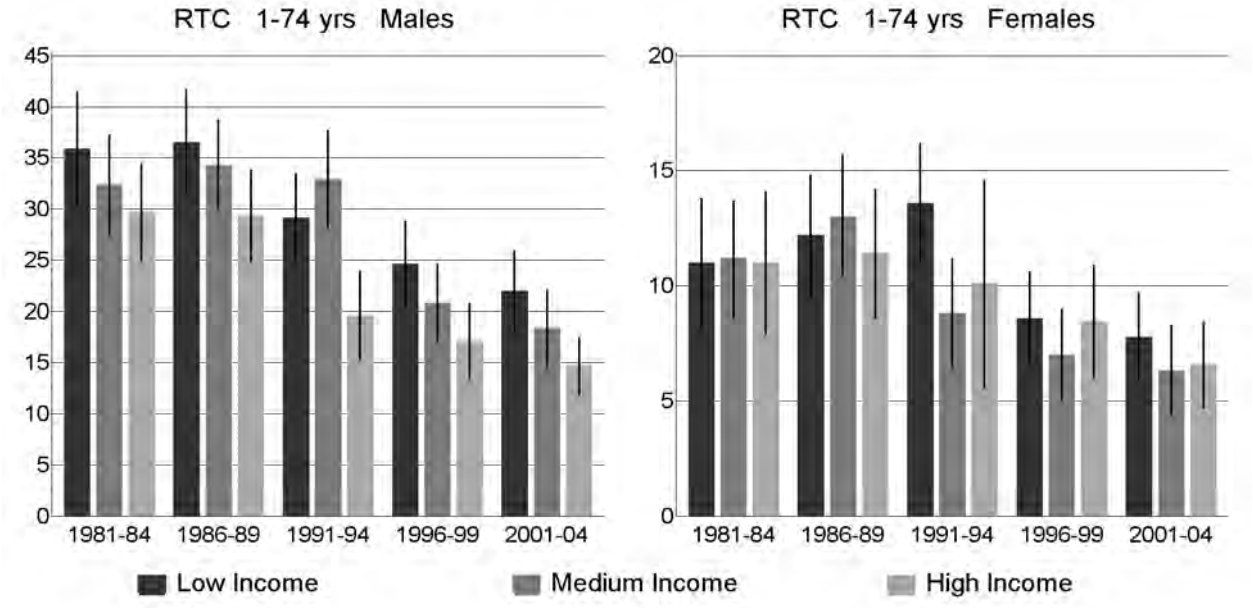
An interesting pattern is seen among middle-aged females, who show significant or near-significant *decreases* in both absolute and relative measures of inequality over time: the SRR (RII) declines from 2.38 (5.5) in 1981–84 to 0.84 (1.2) in 2001–04, while the SRD (SII) declines from 15 (22) per 100,000 to –2 (2) per 100,000. This is one of the few instances of the disappearance of a socioeconomic mortality gradient seen over the observation period across all population groups and conditions. Males show no discernible trends in any measure of inequality. Among older adults each of the point estimates of rates by income are imprecise. There are once again no clearly discernible or statistically significant trends.

In summary, the overall pattern is one of increasing absolute and relative inequalities in unintentional injury mortality for males, driven largely by youth – older males had stable inequalities over time. Among females, the overall pattern is one of stable absolute and relative inequalities, except for middle-aged females, among whom both absolute and relative inequalities decreased.

4.14 Road traffic injury

Age- and ethnic-standardised road traffic injury mortality rates by income group and sex for the 1–74 years age range are summarised in Figure 34. Corresponding measures of inequality are summarised in Table 40. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/.

Figure 34: Road traffic injury mortality rates, by income group, age- and ethnic-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Table S31.

Table 40: Road traffic injury mortality SRDs, SIIs, SRRs and RIIs, by income group

			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Males	1–74 years	1981–84	1.21	1.4 (1.0–1.9)	6	10 (4–16)
		1986–89	1.25	1.4 (1.0–1.9)	7	11 (2–19)
		1991–94	1.48	1.8 (1.3–2.7)	10	16 (-1–33)
		1996–99	1.44	1.9 (1.2–2.9)	8	13 (8–18)
		2001–04	1.50	2.3 (1.4–3.8)	7	14 (2–26)
		P (trend)	*0.03*	*0.01*	*0.78*	*0.04*
Females	1–74 years	1981–84	1.00	1.0 (0.6–1.6)	0	0 (-8–7)
		1986–89	1.07	1.1 (0.7–1.7)	1	1 (-3–5)
		1991–94	1.35	2.0 (1.1–3.8)	4	7 (1–14)
		1996–99	1.01	1.2 (0.7–2.1)	0	2 (-2–5)
		2001–04	1.18	1.5 (0.8–2.8)	1	3 (1–5)
		P (trend)	*0.53*	*0.27*	*0.73*	*0.43*

Notes: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

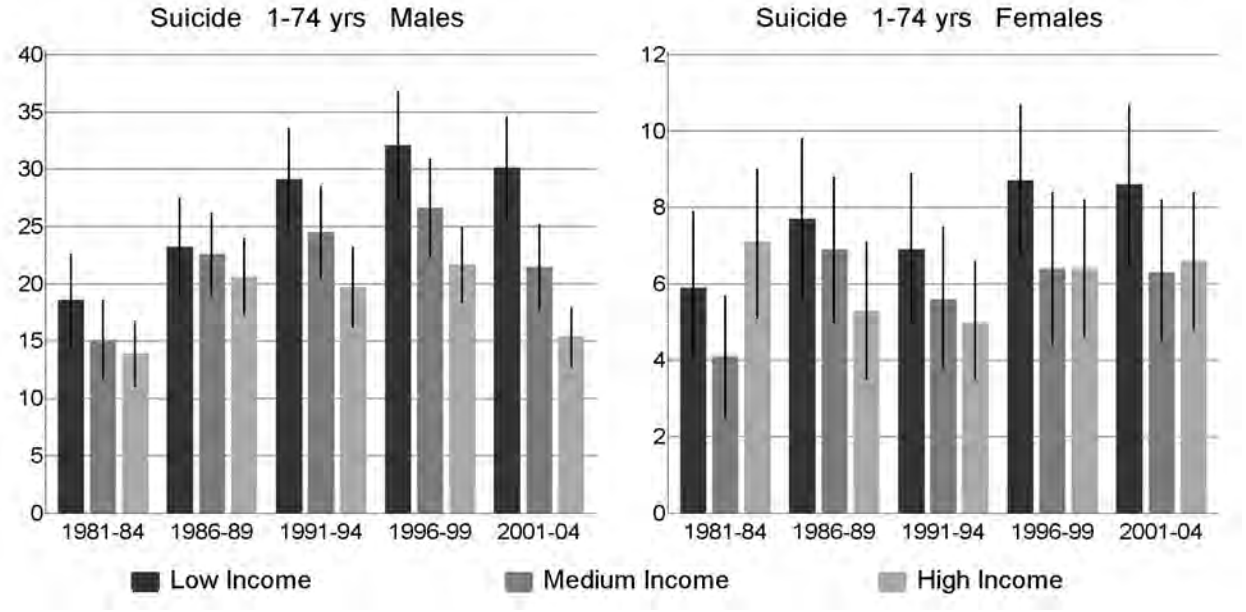
Road traffic injury mortality has declined in all income groups over the observation period (by up to half in males and a third or more in females), with the declines occurring since 1986–89 for males and 1991–94 for females. Among males, a reasonably strong socioeconomic gradient in road traffic injury mortality has existed since the beginning of the observation period and indeed has steepened over time. However, among females there is no clear gradient, although there is some suggestion that one may now be emerging.

Thus significant increases have occurred in both absolute and relative indicators of inequality among males, although the trend is more convincing on the latter scale: the SRR and RII increased from 1.21 and 1.4 in 1981–84 to 1.50 and 2.3 respectively in 2001–04, a trend that is highly statistically significant. There are no apparent trends in inequality among females.

4.15 Suicide

Age- and ethnic-standardised suicide rates by income group for the 1–74 years age range are summarised in Figure 35. Corresponding measures of inequality are summarised in Table 41. Age-specific rates and inequality measures, where calculable, are available at www.otago.ac.nz/NZCMSWebTable/. Suicide accounts for the vast majority of intentional injury deaths.

Figure 35: Suicide rates, by income group, age- and ethnic-standardised within the 1–74 years age group



Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Table S34.

Suicide rates increased for all income groups among males until 1996–99 (more so for low-income males), and have since fallen (less for low-income males). Rates among females have varied irregularly, but have tended to trend upwards for all income groups.

Table 41: Suicide SRDs, SIIs, SRRs and RIIs by income group and age group

			Relative inequalities		Absolute inequalities	
Sex	**Age group**	**Cohort**	**SRR**	**RII**	**SRD**	**SII**
Males	1–74 years	1981–84	1.34	1.5 (0.9–2.5)	5	7 (1–12)
		1986–89	1.12	1.1 (0.8–1.6)	3	3 (-8–13)
		1991–94	1.48	2.0 (1.3–2.9)	9	16 (6–26)
		1996–99	1.48	2.1 (1.4–3.0)	10	19 (8–29)
		2001–04	1.95	2.9 (1.8–4.7)	15	21 (13–30)
		P (trend)	*0.07*	*0.07*	*0.03*	*0.03*
Females	1–74 years	1981–84	0.84	0.7 (0.3–1.4)	-1	-2 (-6–1)
		1986–89	1.46	1.7 (0.9–3.2)	2	3 (0–7)
		1991–94	1.38	1.5 (0.8–2.9)	2	3 (-2–7)
		1996–99	1.36	1.8 (1.0–3.2)	2	4 (-3–11)
		2001–04	1.32	1.5 (0.9–2.7)	2	3 (-1–7)
		P (trend)	*0.34*	*0.23*	*0.21*	*0.18*

Notes: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

A socioeconomic gradient has existed in male suicide since the beginning of the study period, and has clearly steepened over time. Among females, a gradient first emerged in 1986–89, but has not steepened since then. For males a significant or near-significant increase has occurred in both absolute and relative suicide inequality over the observation period.

5 Contribution of Specific Conditions to Inequalities in Mortality

Absolute measures of inequality possess the property of additive decomposition and so can be readily decomposed into the 'shares' contributed by different causes of death. These shares can then be expressed as percentages of the total, and so the contribution of each specific condition to the ethnic disparity or socioeconomic gradient in mortality can be estimated.

For ethnic disparities, the standardised rate difference (SRD) is the appropriate inequality metric, while for income the slope index of inequality (SII) is superior because it compares mortality rate differences from the highest to the lowest ranked (by income) individuals and everyone in between, rather than simply differencing the average mortality rates of the low and high-income groups. Note that the ethnic share analysis is adjusted for age only, while the income share analysis is adjusted for both age and ethnicity. For more details on the SRD and SII, see Methods page 18.

Cause contributions to ethnic SRDs are presented first, with the European/Other group serving as the reference category. This is followed by an examination of the contribution of specific conditions to income group SIIs. In both cases, estimated contributions by cause to the total mortality inequality are first presented for all ages pooled (within the 1-74 year age range), followed by estimates for each age group separately.

5.1 Ethnic disparities in mortality

Māori compared to European/Other ethnic groups

The contribution of specific conditions to the absolute gap in mortality rates between Māori and European/Other ethnic groups (ie, the Māori–European SRD) is summarised in Figure 36 and Table 42. Note that the width of the total bar in Figure 36 is that given for the SRDs for all-cause mortality earlier in this report (Table 10, page 25). Further, the width of each cause-specific component is equivalent to the SRDs shown in Tables 13 to 26 of the report.

Figure 36: Contribution of specific conditions to the Māori:European/Other absolute gap in mortality rates (SRD), for ages 1–74 years and disaggregated age groups

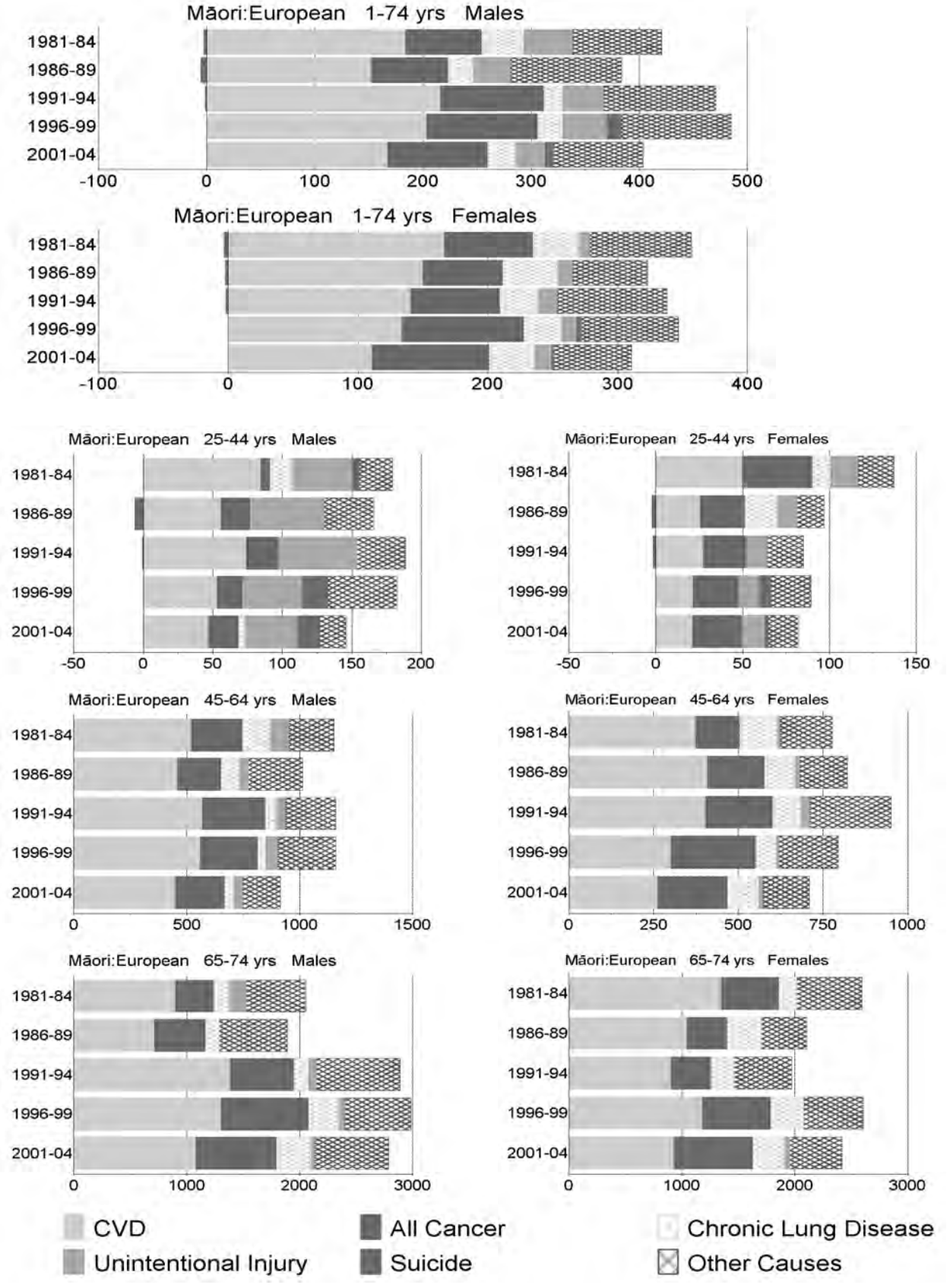


Table 42: Percentage contribution of each condition to the Māori: European/Other absolute gap in mortality rates (SRD)

Age group	Cause of death	Males					Females				
		1981–84	1986–89	1991–94	1996–99	2001–04	1981–84	1986–89	1991–94	1996–99	2001–04
1–74 years	CVD	44	40	46	42	41	47	47	42	38	36
	• IHD	21	21	28	25	25	21	25	20	20	18
	• Stroke	5	4	5	3	3	10	7	8	5	6
	• Other CVD	18	15	13	13	13	16	15	13	13	11
	All cancer	17	19	20	21	23	19	19	21	27	29
	• Lung cancer	10	11	12	12	9	11	12	12	14	15
	• Non-lung cancer	7	8	8	9	14	8	8	8	13	14
	Chronic lung disease	9	6	4	5	6	10	13	9	8	11
	Unintentional injury	11	9	8	8	7	2	4	4	3	4
	Suicide	-1	-1	-0	3	2	-1	-1	-1	1	0
	Other causes	20	27	22	21	21	22	18	25	22	20
1–14 years	Unintentional injury	49	78	68	69	36	25	106	57	60	140
	Other causes	51	22	32	31	64	75	-6	43	40	-40
15–24 years	Unintentional injury	49	60	48	45	26	47	54	50	38	25
	Suicide	-20	14	26	38	41	.	25	19	28	39
	Other causes	71	26	26	17	33	53	21	31	34	35
25–44 years	CVD	47	35	39	29	32	36	27	32	23	25
	All cancer	4	13	12	10	15	30	27	30	30	35
	Chronic lung disease	9				3	7	20			
	Unintentional injury	24	34	30	24	26	12	12	15	13	16
	Suicide	3	-4	-0	10	12	.	-2	-2	8	3
	Other causes	14	22	19	27	13	15	16	25	26	21
45–64 years	CVD	45	45	49	48	49	48	50	42	38	37
	All cancer	20	19	24	22	24	17	20	21	32	29
	Chronic lung disease	11	8	4	3	4	14	11	9	7	13
	Unintentional injury	7	4	3	5	4	1	2	3	1	2
	Other causes	18	24	19	22	19	20	17	25	22	20
65–74 years	CVD	44	38	48	44	39	52	50	45	45	38
	All cancer	17	24	20	26	26	20	17	18	23	29
	Chronic lung disease	7	7	4	9	11	6	15	11	11	12
	Unintentional injury	7		3	2	1					2
	Other causes	25	32	26	20	24	22	19	26	20	19

Pooling all ages (1–74 years), the leading cause of (absolute) mortality disparity between Maori and European/Other ethnic groups has at all times been CVD. The contribution of this cause group has remained stable over the whole observation period at about 40% for males while decreasing from 47% in 1981-84 to 36% in 2001-04 for females.

The disparity proportion attributable to cancer (all types combined) has increased moderately for males (from 17% to 23%) but more substantially for females (from 19% to 29%) over the observation period. This increase is fully accounted for by non-lung cancer among males while among females both lung and non-lung cancers have contributed about equally. Chronic lung disease (CLD) accounts for a stable 10% of the total mortality disparity among females, but its share has fallen over the observation period (from 9% to 6%) among males. The differences in lung cancer and CLD contributions by sex most probably reflect differences in tobacco epidemic dynamics.

Unintentional injury makes a small but not insignificant contribution to overall mortality disparity among males (although its contribution has fallen over the study period from 11% to 7%), but less so among females. Suicide makes little contribution in percentage terms to the total disparity for either sex when pooled across all ages, although there is a suggestion that its contribution may be increasing, at least among males. 'Other causes', a category that includes diabetes, contribute a stable 20% to the all-cause mortality disparity over the observation period (both sexes).

The pattern of cause contributions differs markedly by age group. Estimates are unstable for children because of small numbers of deaths (especially among Māori), yet it can be seen (Table 42) that unintentional injury is the major contributor throughout the observation period. Among youth, unintentional injury is again important, but suicide also makes a substantial – and increasing – contribution. Among adults the pattern of cause contributions resembles the overall pattern, with chronic diseases – in particular CVD and cancer – contributing the major share.

Pacific peoples compared to European/Other ethnic groups

The contribution of specific conditions to the SRD between Pacific and European/Other ethnic groups is summarised in Figure 37 and Table 38.

Figure 37: Contribution of specific conditions to the Pacific:European/Other absolute gap in mortality rates (SRD)

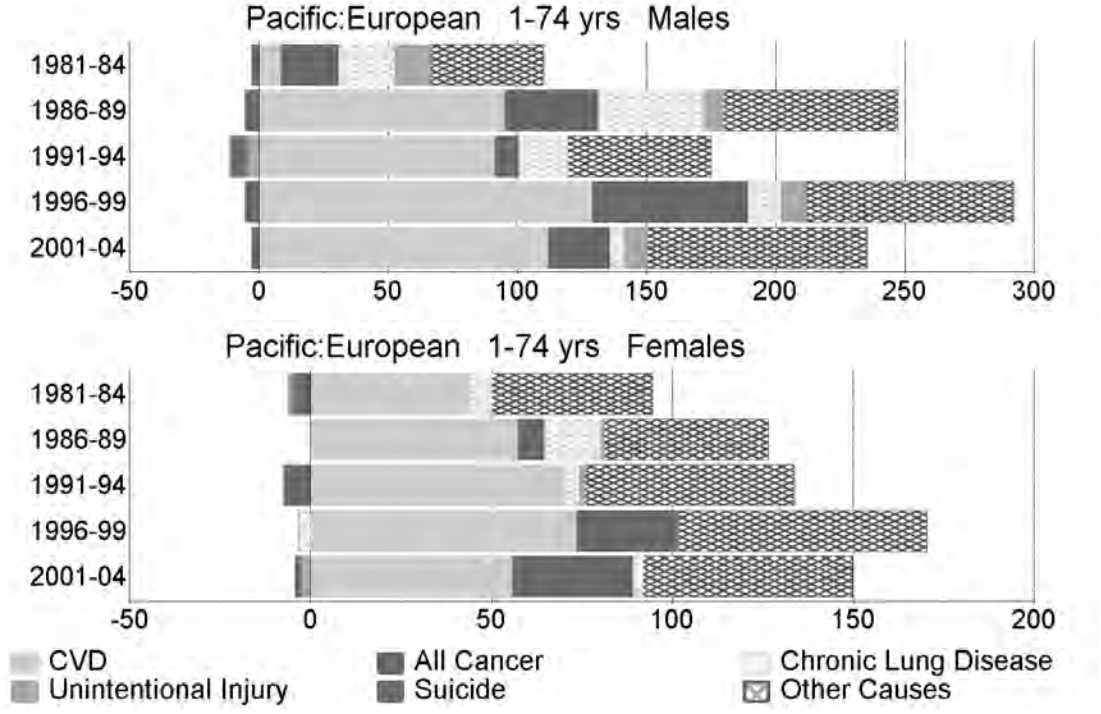


Table 43: Percentage contribution of each condition to the Pacific:European/Other absolute gap in mortality rates (SRD)

Age group	Cause of death	Males					Females				
		1981–84	1986–89	1991–94	1996–99	2001–04	1981–84	1986–89	1991–94	1996–99	2001–04
1–74 years	CVD	8	39	56	45	48	50	45	56	44	38
	• IHD	-42	15	15	25	23	-13	17	23	16	16
	• Stroke	23	12	15	7	7	25	8	7	11	7
	• Other CVD	27	13	26	13	18	37	20	26	17	15
	All cancer	21	15	6	21	10	-5	6	-6	17	23
	• Lung cancer		2	4	10	1			-3	3	7
	• Non-lung cancer	36	13	1	11	10	0	2	-3	14	16
	Chronic lung disease	20	17	12	4	2	7	12	3	-2	2
	Unintentional injury	13	3	-3	3	4	-2	1	1	0	-2
	Suicide	-3	-2	-4	-2	-1				-0	-1
	Other causes	40	28	34	28	37	50	36	46	41	40

The estimates for the contributions of specific causes to the Pacific:European/Other all-cause mortality disparity are unreliable because of small numbers of Pacific deaths once disaggregated by cause. However, some usable information may still be extracted from Table 43. It is clear that CVD is the major contributor to inequality and probably has been so throughout the study period. There is also a suggestion that the percentage contribution of CVD to the total mortality disparity may be declining among females but not males. Cancer makes a smaller contribution (both sexes), largely accounted for by non-lung cancer; trends in the contribution of cancer to the total disparity are unclear for males, but there is a suggestion of a (recently) increasing contribution for females. Injury (irrespective of intent) makes little contribution when distributed across all age groups (but is more important among younger age groups – data not shown). 'Other causes' – which include diabetes – make a more substantial contribution (around 40% for both sexes) to the Pacific than to the Māori all-cause mortality disparity compared with the European/Other ethnic group; this contribution has remained essentially stable over time.

Asian peoples compared to European/Other ethnic groups

The contribution of specific conditions to the absolute gap in mortality between Asian and European/Other ethnic groups is summarised in Figure 38 and Table 44.

Figure 38: Contribution of specific conditions to the Asian:European/Other absolute gap in mortality rates (SRD)

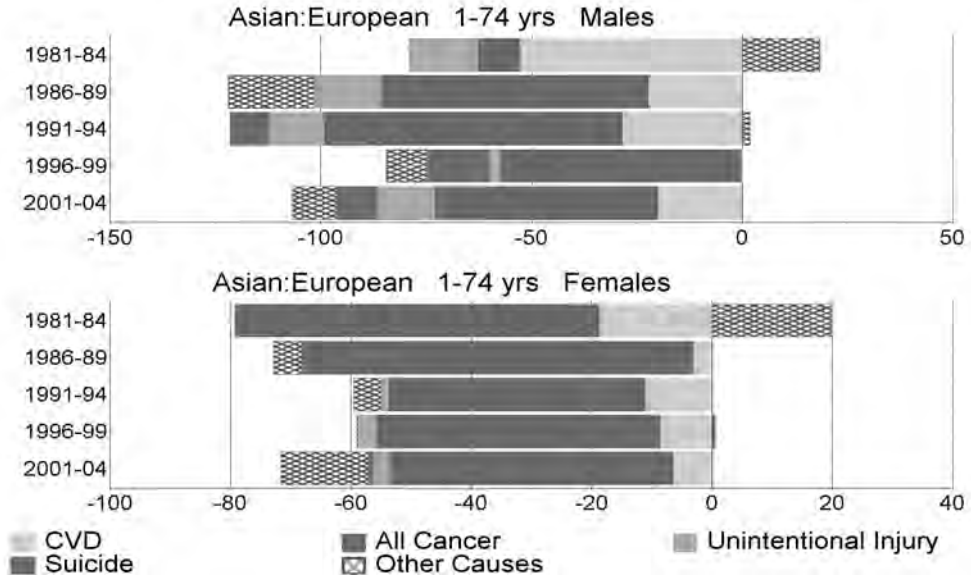


Table 44: Percentage contribution of each condition to the Asian:European/Other absolute gap in mortality rates (SRD)

Age group	Cause of death	Males					Females				
		1981–84	1986–89	1991–94	1996–99	2001–04	1981–84	1986–89	1991–94	1996–99	2001–04
1–74 years	CVD	87	18	24	0	19	31	4	18	15	9
	• IHD	110	40	23	-10	14	16	-2	21	8	5
	• Stroke				-6	-1			-1	1	0
	• Other CVD	-23	-21	1	16	6	15	6	-1	6	3
	All cancer	17	52	59	68	50	102	89	72	81	66
	• Lung cancer				16	11				14	11
	• Non-lung cancer	15	25	43	52	39	84	85	69	67	55
	Unintentional injury	27	13	11	3	13			2	5	4
	Suicide			8	17	9				-1	1
	Other causes	-31	17	-2	12	10	-33	6	8	0	20

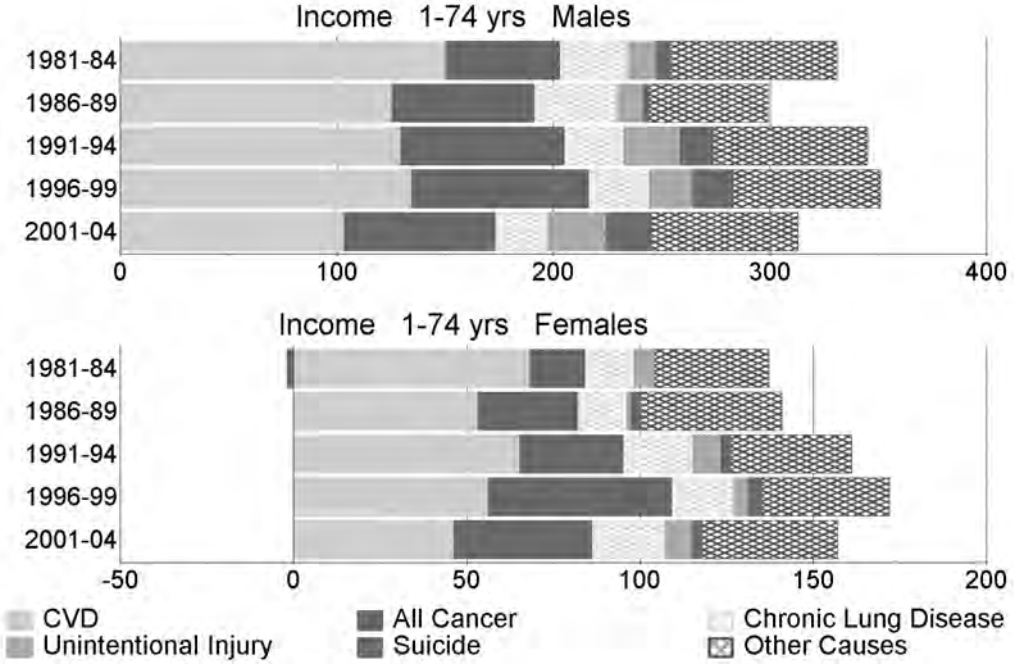
As for Pacific peoples, small numbers largely prevent conclusions being drawn as to the relative contributions of specific conditions to the all-cause mortality disparity between Asian and European/Other ethnic groups. Note that the disparity in this case is in the opposite direction; ie, Asian New Zealanders have lower all-cause mortality rates than European/Other New Zealanders.

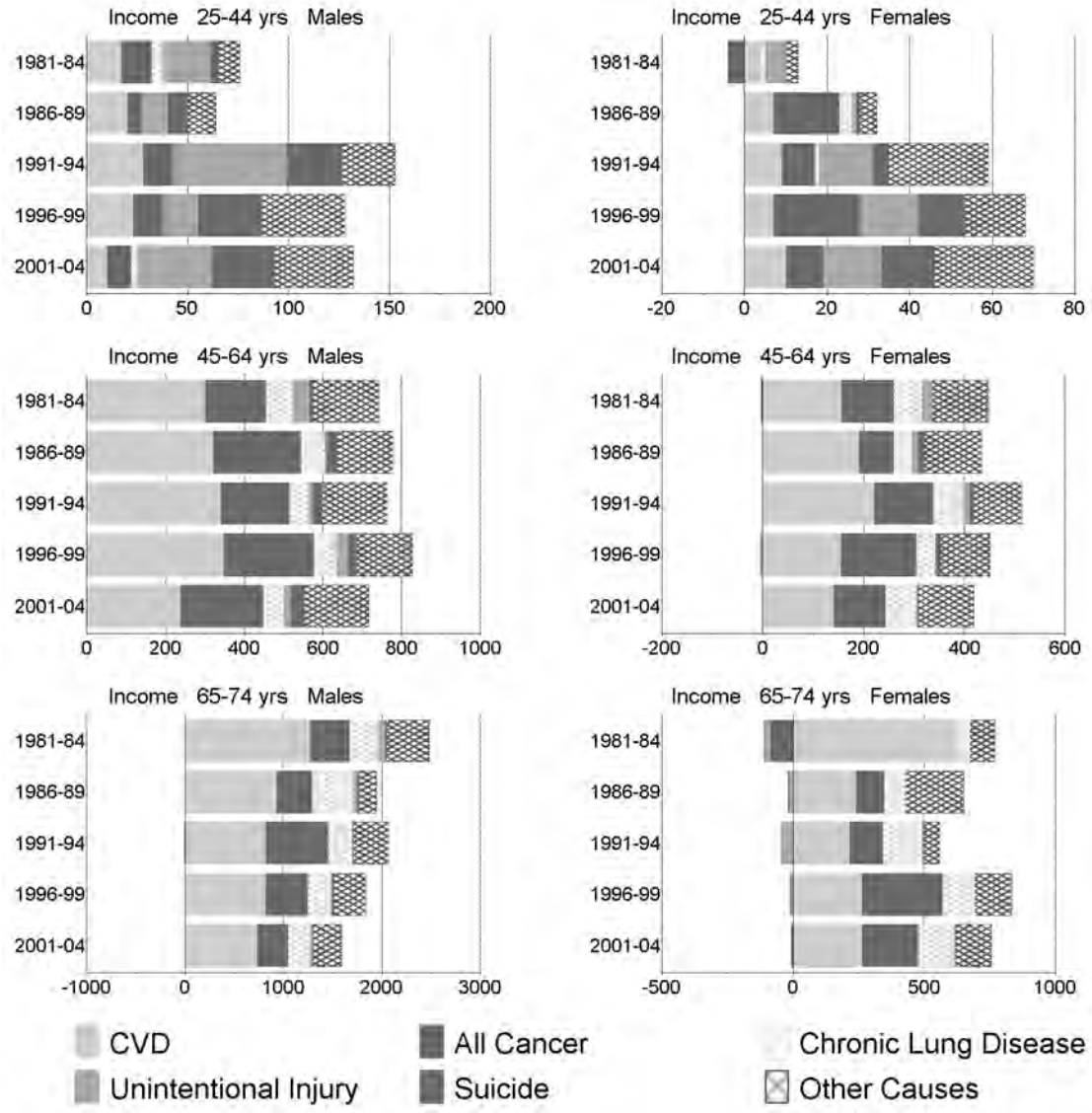
However, pooling across ages and focusing just on 2001–04, it can be seen that the major cause of lower Asian mortality is lower non-lung cancer mortality, which alone accounts for approximately half of the total difference. Lower lung cancer mortality explains an additional (approximately) 10%. CVD accounts for 'only' about 20% of the disparity among males and an even smaller proportion (10%) among females. Injury (irrespective of intent) makes an important contribution (over 20%) to the male but not to the female disparity. 'Other causes' account for 10% of the male and 20% of the female disparity in 2001–04.

5.2 Income disparities in mortality

The contribution of specific conditions to the absolute gap in mortality across income groups (ie, contribution to the SII) is summarised in Figure 39 and Table 45. Note that the width of the total bar in Figure 39 is that given for the SIIs for all-cause mortality earlier in this report (Table 27, page 61). Further, the width of each cause-specific component is equivalent to the SIIs shown in Tables 29 to 41 of this report.

Figure 39: Contribution of specific conditions to the income absolute gap in mortality rates (SII), for ages 1–74 years and disaggregated age groups





Note: The charts for children and youth could not be shown because of insufficient numbers of deaths in the high-income groups.

Table 45: Percentage contribution of each condition to the income absolute gap in mortality rates (SII)

Age group	Cause of death	Males					Females				
		1981–84	1986–89	1991–94	1996–99	2001–04	1981–84	1986–89	1991–94	1996–99	2001–04
1–74 years	CVD	45	42	37	38	33	50	38	40	33	29
	• IHD	25	31	25	24	21	30	17	29	17	19
	• Stroke	10	7	4	5	4	1	10	1	9	4
	• Other CVD	11	4	8	9	8	20	11	11	6	6
	All cancer	16	22	22	23	22	12	21	19	31	25
	• Lung cancer	8	13	11	10	12	2	6	7	14	11
	• Non-lung cancer	8	9	11	13	10	9	14	12	17	14
	Chronic lung disease	9	13	8	8	8	10	10	12	10	13
	Unintentional injury	4	4	8	6	9	4	1	5	2	5
	Suicide	2	1	5	5	7	-1	2	2	2	2
	Other causes	23	18	21	19	22	24	29	22	22	25
25–44 years	CVD	22	31	18	18	8	44	22	15	10	14
	All cancer	20	11	10	12	9	0	50	14	31	13
	Chronic lung disease	8	.	.	.	2	11	9	2	.	.
	Unintentional injury	30	20	37	13	28	56	3	22	21	20
	Suicide	5	16	18	25	23	-44	3	7	16	19
	Other causes	14	22	18	32	30	33	13	41	22	34
45–64 years	CVD	40	41	44	42	33	35	44	43	35	33
	All cancer	21	29	23	28	29	23	16	23	34	25
	Chronic lung disease	9	8	6	7	7	13	8	12	9	15
	Unintentional injury	6	1	1	4	3	5	3	2	-1	0
	Suicide	1	3	3	3	5	-1	3	2	2	1
	Other causes	23	18	22	17	23	25	26	18	22	26
65–74 years	CVD	51	48	40	44	46	94	38	42	32	35
	All cancer	16	19	31	24	20	-13	17	25	38	29
	Chronic lung disease	11	21	12	13	14	8	13	29	15	18
	Unintentional injury	3	2	-1	0	1	-3	-3	-9	-1	0
	Suicide	1	1	0	1	1	-1	-0	1	-1	-1
	Other causes	18	9	17	18	18	14	35	12	17	18

Note: Very few deaths among high-income children and youth render the SIIs by cause of death unstable, and hence the contributors to all-cause mortality gaps. Accordingly, we do not show results for 1–14 and 15–24-year-olds.

Pooling all age groups within the 1–74 years age range, CVD has declined over the observation period as a contributor to absolute inequality in all-cause mortality between income groups. Among males, CVD's share has dropped from 45% at the start to 33% at the end of the observation period; among females, the corresponding decline has been from 50% to 29%. Thus cardiovascular causes now account for about one-third of the income disparity in mortality (both sexes).

By contrast, the proportionate contribution of cancer (all types combined) has increased over time from 16% to 22% among males and from 12% to 25% among females. Cancer now accounts for about one-quarter of the mortality disparity between income groups – still less than CVD but approaching it in importance, especially among females. For both sexes, about two-thirds of the increase in the contribution of cancer has come from lung cancer (ie, tobacco-associated cancers), although in absolute terms the lung cancer share has increased 'only' 50% among males (from 8% to 12%) but 450% among females (from 2% to 11%). This difference reflects the differential timing by sex of the tobacco epidemic. The contribution of chronic lung disease is substantial in both sexes, but has remained stable at around 9% among males while increasing from 10% to 13% among females – again probably reflecting differential dynamics of the tobacco epidemics between the genders.

Unintentional injury accounts for a small share of total mortality inequality in both sexes at the start of the study period (about 4%). This contribution remains stable among females but increases to around 9% among males by the end of the observation period. The contribution of suicide increases over this time period for both sexes, but more substantially (from 2% to 7%) among males. 'Other causes' (which include diabetes) account for about 25% of the total mortality disparity in both sexes throughout.

Turning to separate age groups, too few deaths occurred among children and youth in the high-income category to permit a cause contribution analysis for these age groups. Among adult age groups the patterns largely reflect the overall findings detailed above, with some exceptions. In particular, injury (suicide and unintentional) makes little contribution to mortality disparity among older or middle-aged adults but is prominent for young adults: suicide alone now accounts for almost one-quarter of the total income mortality disparity among young adults.

6 Socioeconomic Mediation of Ethnic Inequalities in Mortality

To what extent are ethnic inequalities in mortality mediated by socioeconomic position? And has this varied over time, as social inequality has itself increased? These critical questions are examined in two ways. First, a stratified analysis is presented of mortality rates, cross-classifying ethnic and income groups. Then regression modelling is used to explore the contributions of socioeconomic factors (including position in the labour market [PLM]) to ethnic mortality inequalities. Unfortunately, despite the large size of the NZCMS linked data sets, statistical power considerations restrict the ethnic component of the analysis to a comparison of Māori with European/Other (ie, non-Māori non-Pacific non-Asian) ethnic groups.

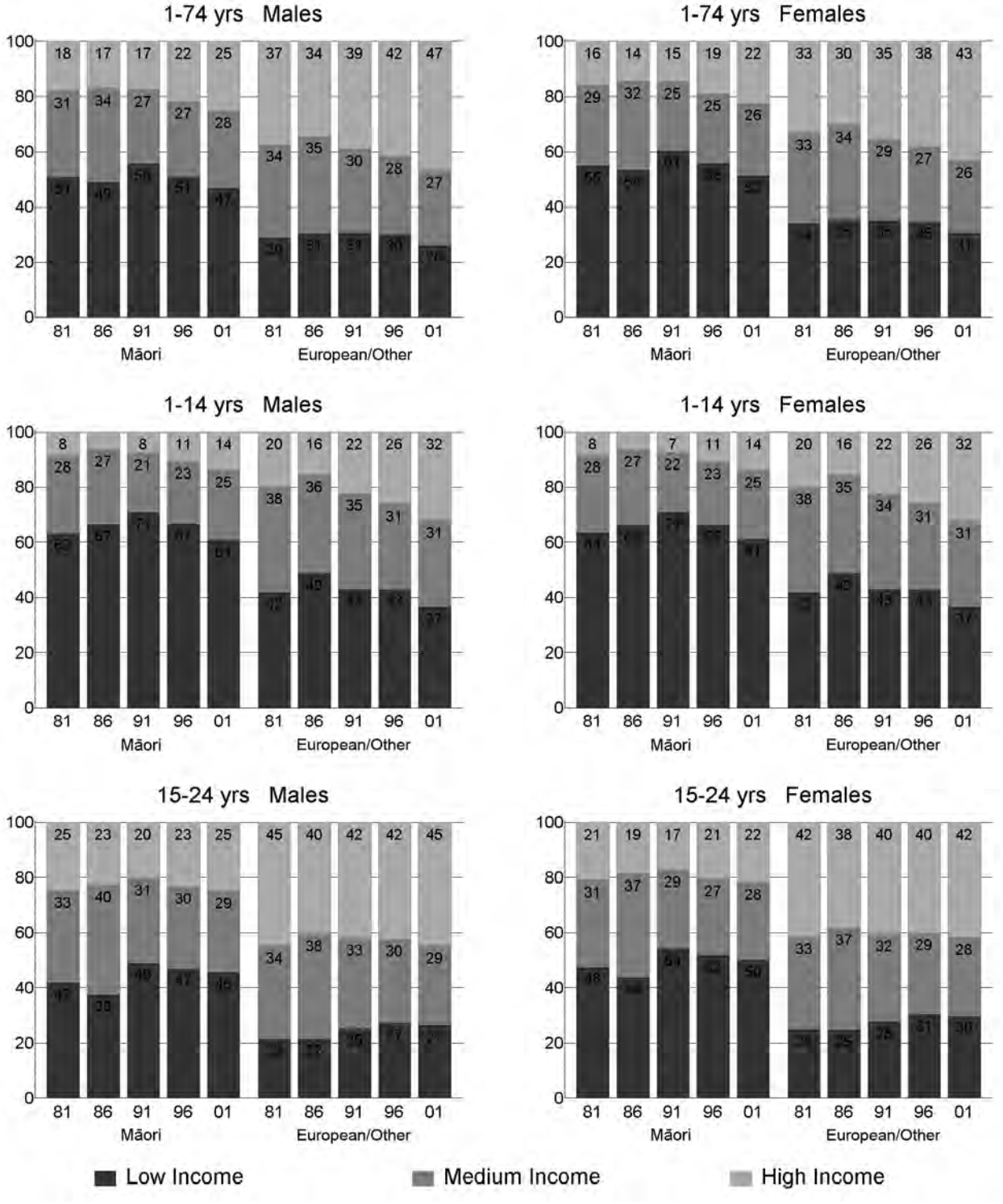
6.1 Stratified analysis

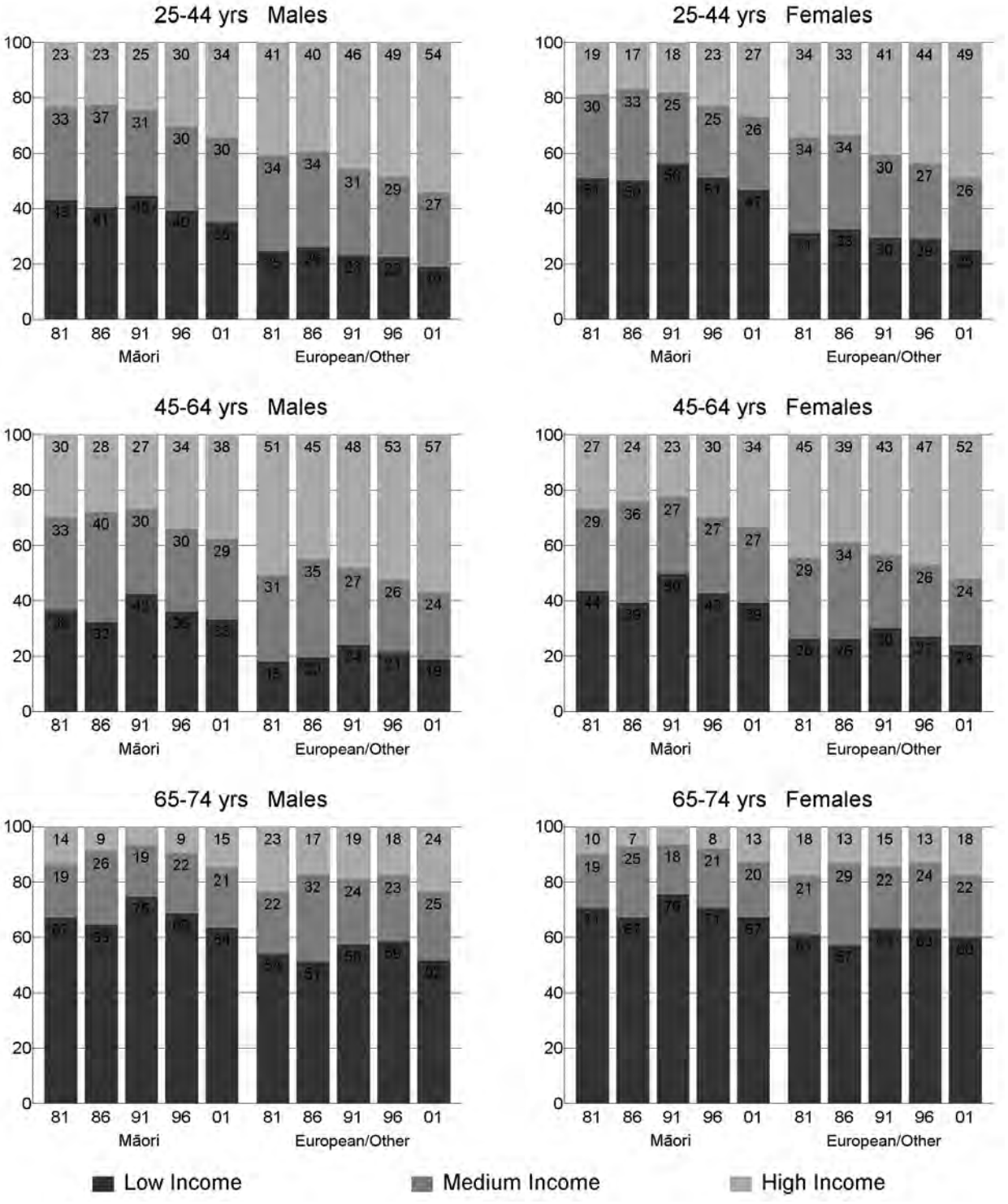
Income distribution

Figure 40 shows the income distribution of, and inequalities in the income distribution between, Māori and European/Other ethnic groups in each period, overall and by age group. Throughout the study period, in all age-by-sex strata, Māori were more likely than European/Others to be in the lower income group, and less likely to be in the higher income group. The ethnic differences in income distribution were – and are – greater for younger than older age groups.

In the working-age group, in particular, the disparity between the Māori and European/Other income distributions widened until the mid-1990s, then narrowed again. For example, in the 25–44 year age group, the proportion of Māori in the low-income group increased to 45% and 56% in 1991 (males and females respectively), then fell. By contrast, the proportion of European/Others in the low-income group was static, or even fell slightly, up to 1991.

Figure 40: Distribution of the New Zealand population, by income level, ethnicity, period, sex and age group



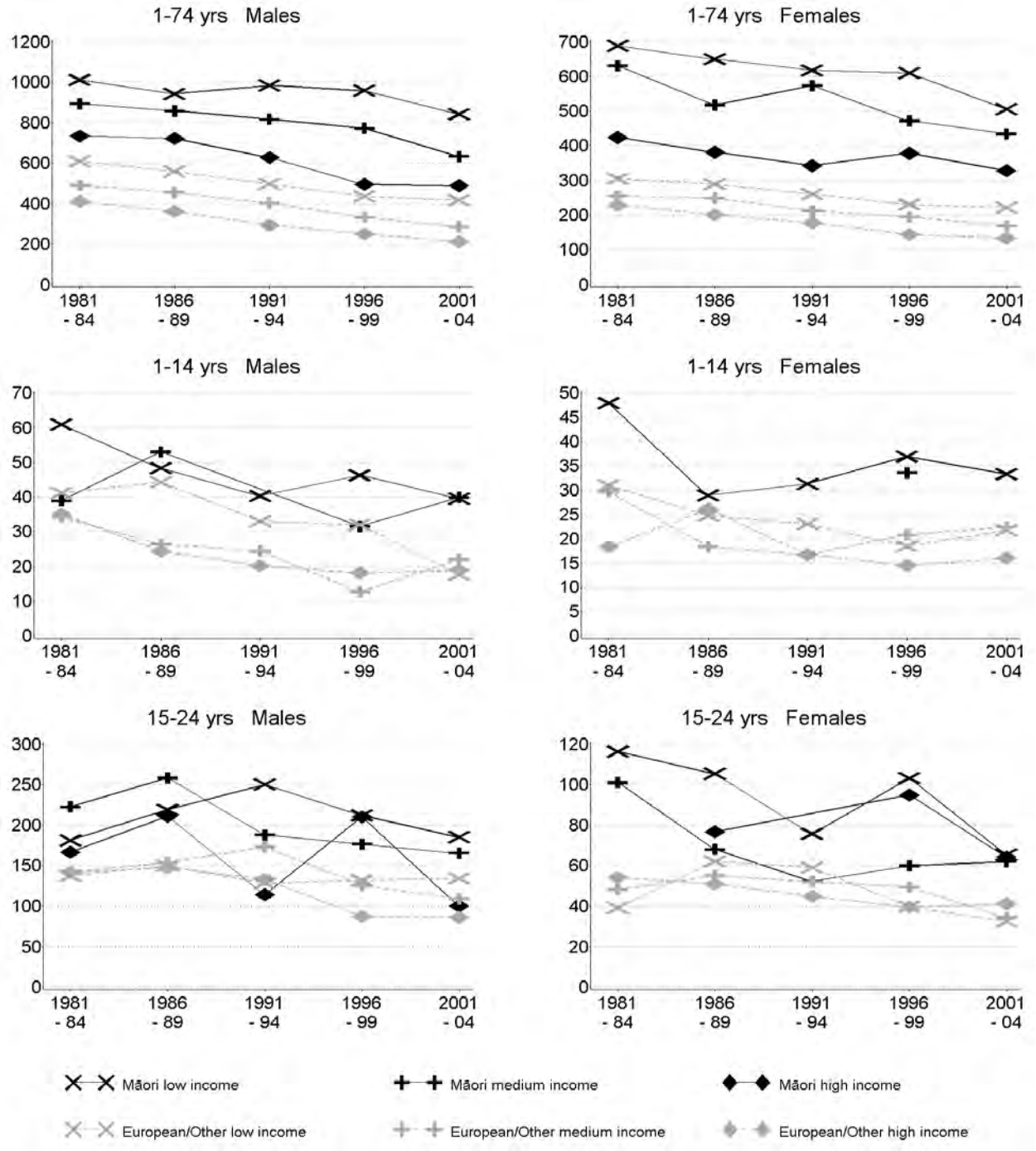


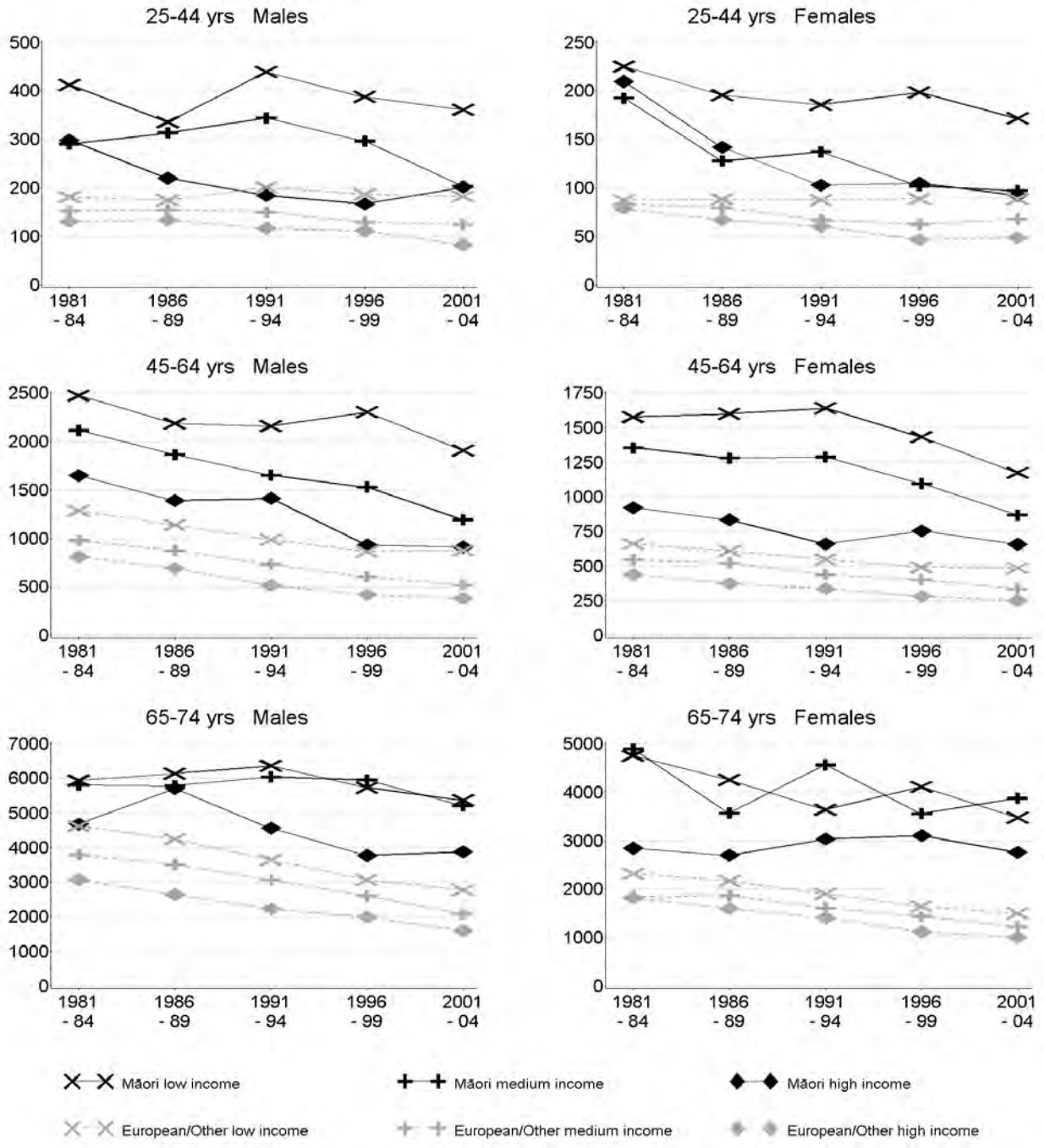
Note: Y axis and values shown in bars are percentages.

Mortality rates by income and ethnicity

Figure 41 shows all-cause mortality rates by age group and sex for each cohort, cross-classified by income group (high, medium, low) and ethnicity (Māori, European/Other).

Figure 41: All-cause mortality rates cross-classified by ethnicity and income

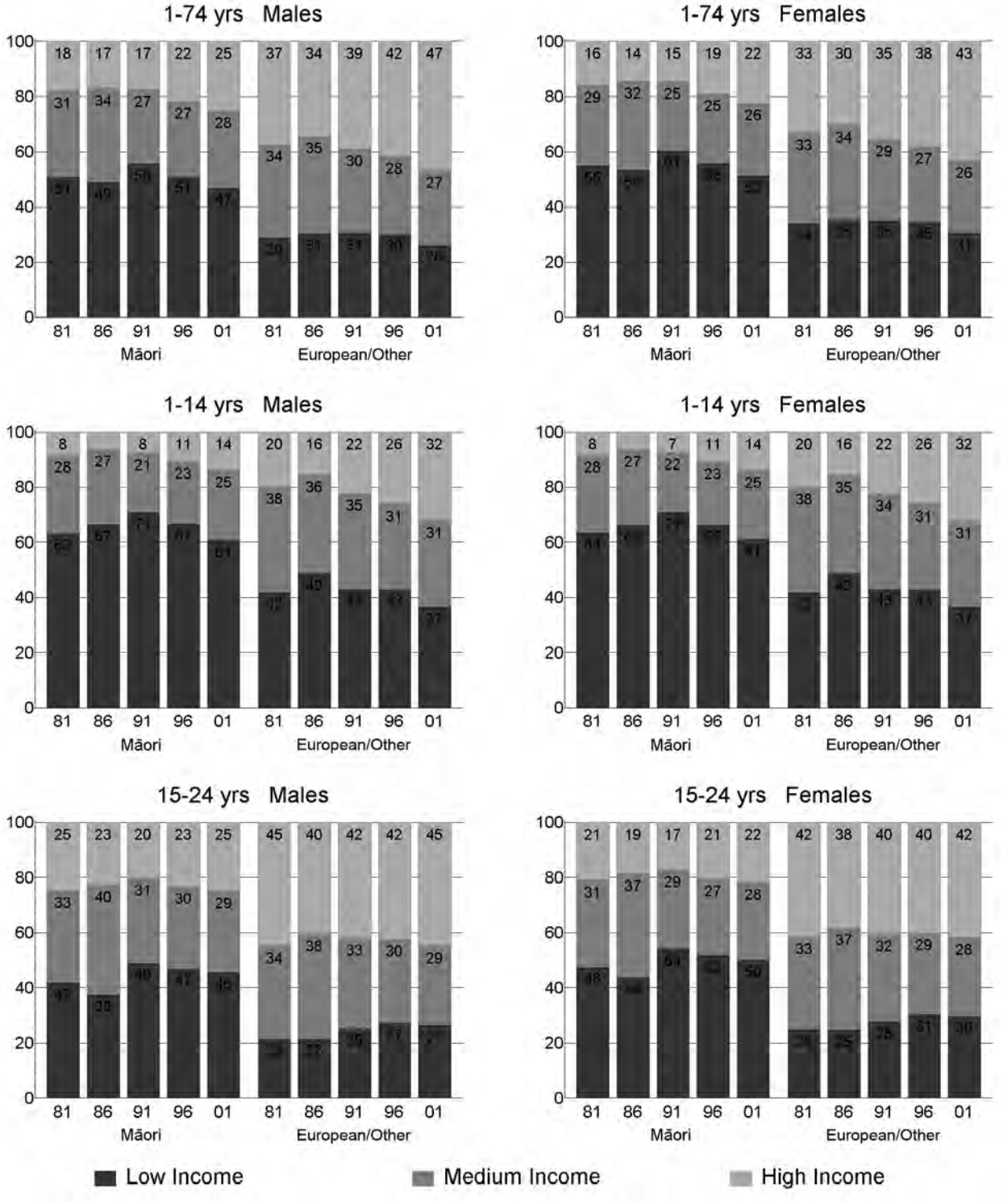




Note: Rates and 95% confidence intervals are provided in the Statistical Annex, Tables S33 and S34. Rates are not always presented for medium- and high-income groups among Māori children and youth due to small numbers.

Throughout the observation period, within each income group, Māori experienced higher all-cause mortality rates than their European/Other counterparts. That is, disparities in mortality between Māori and European/Other ethnic groups persist within income groups. For males and females aged 25–74 years, the mortality rates for Māori in the *high*- income group were similar to, or greater than, the mortality rates for European/Others in the *low*- income group in each period.

Figure 40: Distribution of the New Zealand population, by income level, ethnicity, period, sex and age group



Among European/Others, mortality declined from 1981–84 to 2001–04 within all income groups (overall and among middle-aged and older adults in particular). However, among Māori, declines in mortality rates in the 1980s and 1990s tended to be more evident among the high- (and medium-) income groups, but not the low-income group (see Figure 41 above, and Tables S33 and S34 in the Statistical Annex).

The absolute differences (SRDs) between Māori and European/Other mortality rates were, in general, smaller in the high- than in the medium- or low-income groups (see Table 46). However, note that if these inequalities were measured on a relative scale (ie as SRRs), they would be similar across all three income groups.

Although trends were difficult to discern because of wide confidence intervals, the difference between Māori and European/Other mortality rates declined significantly or near-significantly over the observation period for middle-income females aged 25–44 and 45–64 years, middle-income males aged 45–64 and 65–74 years, and low-income males aged 65–74 years. SRD trends in other age and income groups were not statistically significant.

Table 46: Māori SRDs by income group and cohort, by age group and sex

			Standardised rate differences (Māori:European) by income group		
Sex	**Age group**	**Cohort**	**Low income**	**Medium income**	**High income**
Males	1–74 years	1981–84	401 (306–497)	403 (273–534)	323 (194–453)
		1986–89	383 (300–467)	403 (309–497)	360 (207–514)
		1991–94	487 (418–556)	414 (313–515)	334 (200–468)
		1996–99	523 (460–585)	439 (361–517)	245 (159–330)
		2001–04	425 (367–483)	349 (280–417)	277 (206–348)
		P (trend)	*0.68*	*0.40*	*0.21*
	25–44 years	1981–84	231 (138–324)	138 (53–223)	168 (59–276)
		1986–89	161 (81–241)	159 (84–234)	86 (2–171)
		1991–94	238 (159–317)	194 (113–275)	68 (2–133)
		1996–99	201 (127–275)	167 (95–239)	55 (4–106)
		2001–04	179 (107–251)	79 (22–135)	119 (68–171)
		P (trend)	*0.60*	*0.29*	*0.93*
	45–64 years	1981–84	1188 (836–1540)	1137 (767–1508)	837 (518–1157)
		1986–89	1048 (749–1347)	989 (735–1244)	697 (428–967)
		1991–94	1173 (942–1403)	919 (665–1173)	896 (613–1179)
		1996–99	1438 (1210–1666)	926 (713–1139)	514 (349–678)
		2001–04	1033 (827–1238)	673 (495–851)	528 (389–666)
		P (trend)	*0.89*	*0.03*	*0.12*
	65–74 years	1981–84	1312 (336–2287)	2019 (172–3865)	1603 (-309–3515)
		1986–89	1896 (1013–2779)	2277 (937–3618)	3062 (527–5596)
		1991–94	2713 (1961–3465)	2975 (1481–4469)	2332 (182–4483)
		1996–99	2662 (2069–3254)	3342 (2264–4420)	1772 (396–3147)
		2001–04	2593 (2042–3145)	3127 (2149–4105)	2278 (1145–3410)
		P (trend)	*0.07*	*0.06*	*0.76*

			Standardised rate differences (Māori:European) by income group		
Sex	**Age group**	**Cohort**	**Low income**	**Medium income**	**High income**
Females	1–74 years	1981–84	383 (313–452)	375 (260–490)	195 (85–306)
		1986–89	361 (300–422)	268 (197–340)	180 (76–284)
		1991–94	357 (309–404)	361 (279–442)	165 (63–266)
		1996–99	379 (334–424)	277 (215–338)	234 (153–315)
		2001–04	284 (245–324)	265 (208–322)	195 (137–252)
		P (trend)	*0.14*	*0.25*	*0.66*
	25–44 years	1981–84	138 (76–199)	109 (43–174)	131 (39–223)
		1986–89	107 (57–157)	48 (2–94)	75 (9–140)
		1991–94	99 (57–140)	70 (20–120)	43 (-3–89)
		1996–99	110 (71–149)	40 (2–77)	58 (19–98)
		2001–04	83 (46–120)	30 (-6–66)	44 (10–77)
		P (trend)	*0.11*	*0.08*	*0.18*
	45–64 years	1981–84	916 (674–1159)	809 (504–1114)	482 (223–741)
		1986–89	991 (769–1213)	758 (539–977)	460 (222–697)
		1991–94	1093 (918–1269)	850 (629–1070)	324 (139–510)
		1996–99	939 (778–1100)	693 (510–877)	473 (306–640)
		2001–04	688 (547–829)	533 (382–684)	407 (278–536)
		P (trend)	*0.19*	*0.07*	*0.76*
	65–74 years	1981–84	2430 (1632–3227)	3051 (1343–4758)	1026 (-655–2707)
		1986–89	2083 (1427–2738)	1703 (742–2664)	1097 (-512–2705)
		1991–94	1737 (1229–2245)	2954 (1755–4154)	1621 (-63–3304)
		1996–99	2469 (1996–2943)	2118 (1286–2951)	1985 (677–3292)
		2001–04	1972 (1556–2388)	2651 (1820–3482)	1752 (862–2643)
		P (trend)	*0.61*	*0.85*	*0.07*

Notes: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously. Results are not shown for 1–14-year-olds and 15–24-year-olds because of instability of these rates among Māori due to small numbers of deaths.

Is the income–mortality association similar for Māori and European/Others?

Table 47 shows SRRs for low- compared with high-income groups, by ethnicity and cohort. That is, we are comparing income–mortality associations across ethnic groups, on a relative scale.

Table 47: SRR for low- to high-income groups, by ethnicity, cohort, age group and sex

		Standardised rate ratios			
Age group	**Cohort**	**Males**		**Females**	
		Māori	**European/Other**	**Māori**	**European/Other**
1–74 years	1981–84	1.38 (1.13–1.68)	1.49 (1.42–1.56)	1.62 (1.23–2.14)	1.34 (1.25–1.42)
	1986–89	1.31 (1.04–1.64)	1.55 (1.47–1.63)	1.70 (1.28–2.27)	1.44 (1.34–1.54)
	1991–94	1.57 (1.25–1.96)	1.69 (1.61–1.78)	1.80 (1.33–2.44)	1.47 (1.38–1.56)
	1996–99	1.94 (1.61–2.33)	1.74 (1.65–1.84)	1.61 (1.29–2.02)	1.60 (1.49–1.71)
	2001–04	1.72 (1.47–2.02)	1.97 (1.86–2.08)	1.54 (1.28–1.86)	1.66 (1.55–1.78)
	P (trend)	*0.11*	*< 0.01*	*0.32*	*< 0.01*
25–44 years	1981–84	1.38 (0.91–2.11)	1.39 (1.16–1.66)	1.07 (0.65–1.79)	1.11 (0.89–1.39)
	1986–89	1.53 (0.98–2.38)	1.31 (1.11–1.54)	1.38 (0.82–2.31)	1.32 (1.05–1.64)
	1991–94	2.39 (1.62–3.52)	1.73 (1.47–2.03)	1.81 (1.11–2.95)	1.45 (1.18–1.78)
	1996–99	2.33 (1.64–3.30)	1.67 (1.41–1.99)	1.89 (1.25–2.87)	1.91 (1.55–2.35)
	2001–04	1.79 (1.31–2.45)	2.21 (1.83–2.67)	1.86 (1.24–2.79)	1.83 (1.47–2.27)
	P (trend)	*0.46*	*0.05*	*0.04*	*0.02*
45–64 years	1981–84	1.50 (1.18–1.90)	1.59 (1.47–1.71)	1.71 (1.25–2.35)	1.50 (1.37–1.66)
	1986–89	1.57 (1.24–1.99)	1.64 (1.52–1.77)	1.92 (1.40–2.63)	1.63 (1.47–1.80)
	1991–94	1.53 (1.22–1.91)	1.91 (1.77–2.06)	2.48 (1.84–3.34)	1.63 (1.48–1.79)
	1996–99	2.47 (2.02–3.02)	2.07 (1.91–2.24)	1.90 (1.49–2.43)	1.75 (1.59–1.94)
	2001–04	2.09 (1.74–2.51)	2.28 (2.11–2.47)	1.78 (1.42–2.24)	1.94 (1.76–2.14)
	P (trend)	*0.15*	*< 0.01*	*0.89*	*0.01*
65–74 years	1981–84	1.27 (0.82–1.97)	1.50 (1.40–1.61)	1.67 (0.91–3.08)	1.28 (1.16–1.40)
	1986–89	1.08 (0.68–1.71)	1.61 (1.49–1.73)	1.58 (0.85–2.91)	1.35 (1.23–1.49)
	1991–94	1.39 (0.86–2.26)	1.64 (1.52–1.76)	1.20 (0.68–2.12)	1.35 (1.23–1.48)
	1996–99	1.52 (1.04–2.22)	1.54 (1.42–1.66)	1.32 (0.86–2.04)	1.46 (1.31–1.64)
	2001–04	1.39 (1.02–1.88)	1.74 (1.60–1.88)	1.26 (0.89–1.77)	1.49 (1.34–1.66)
	P (trend)	*0.25*	*0.18*	*0.08*	*< 0.01*

Notes: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously. Results not shown among 1–14-year-olds and 15–24-year-olds because of instability of these rates among Māori due to small numbers of deaths.

Within the same cohort, Māori and European/Other income SRRs are generally similar and seldom if ever statistically significantly different: in almost all age and sex strata, the confidence intervals of the ethnic-specific SRR estimates overlap. Furthermore, the income SRRs tend to increase over time (at least until recently) for both ethnic groups.

We conclude that income mortality gradients are similar for Māori and non-Māori when measured on a *relative* scale. However, it should be noted that the *absolute* differences in mortality rates between low- and high-income groups will be larger for Māori than for European/Others, as suggested in Figure 41 (this is mathematically required given higher background mortality rates for Māori than European/ Others).

6.2 Regression modelling –to what extent are ethnic disparities in mortality attributable to socioeconomic position?

Poisson regression models were constructed for each cohort to estimate all-cause mortality rate ratios for Māori compared to European/Others, separately for males and females aged 25–59 years ('working-age' adults) and 60–74 years ('older' adults). These age groups were used to enable position in the labour market (PLM, a composite variable of occupational class for those employed [classes 1–3 and 4–6], unemployed, and non-active in the labour force) to be examined as a covariate for younger adults only. Only all-cause mortality was examined due to statistical power limitations when specific causes of death were modelled separately.

The models were initially adjusted only for age and region (model A, Table 48). For all cohorts and age-by-sex strata, Māori mortality is typically two to three times that of European/Others (with the exception of 60–74-year-old males in the 1980s), with some suggestion that the disparity widened over time until 1996–99 and has since narrowed slightly.

Addition of socioeconomic variables (model B; household equivalised income, educational qualifications, car access [a measure of asset wealth] and housing tenure [another measure of wealth]) reduces the excess rate ratio (ie, RR – 1). From Table 43, it can be seen that the percentage reduction in the excess rate ratio from model A to B is between 25% to 36% for 25–59-year-olds (both males and females), and there is a tendency for this percentage to *increase* over time. That is, socioeconomic factors (as measured) appear to explain on average about a third of Māori:European/Other disparities in mortality for 25–59-year-olds, and over time the contribution of socioeconomic factors to the ethnic disparity in all-cause mortality appears to increase.

In the 60–74 year age group, about a third of the male and about a quarter of the female disparities in mortality between Maori and European/Other ethnic groups were explained by socioeconomic factors, but there was no obvious tendency for this contribution to increase over time.

Next, we added PLM to the regression analyses for the 'working age group' (25–59-years) (model C). The reduction in the excess mortality rate ratio (model A to model C) averaged 32% for females and 41% for males, with a suggestion that this proportion may have increased over time. The marginal contribution of PLM (represented by the '% point change B to C' row in Table 48) was greater for males, and maximal in the 1990s – a finding consistent with divergent trends between Māori and European/Other males in their participation in employment during this period.

For recent cohorts, a measure of neighbourhood deprivation (ie, NZDep) could also be included in the models. This had a further independent effect, as can be seen by comparing models C and D. For example, among working age females in 1996–99, inclusion of NZDep reduced the excess rate ratio from 2.23 (model C) to 2.03 (model D), a further reduction of approximately 10%.

With all variables included in the models (where possible, ie working-age adults from 1991–94 onwards), the total reduction in the excess mortality rate ratio averages 45% for females and 53% for males. For older adults (for whom position in the labour market cannot be measured), an average of 35% for females and 42% for males of the ethnic mortality disparity could be explained.

Table 48: All-cause mortality rate ratios for Māori compared to European/Others, by cohort, age group and sex, adjusting for socioeconomic factors, position in the labour market, and small area deprivation (Poisson regression)

Age group	Sex	Model	1981–84	1986–89	1991–94	1996–99	2001–04
25–59 years	Males	A: Adjusted for age and region	2.42	2.21	2.60	2.65	2.57
		B: Model A plus socioeconomic factors*	2.04	1.89	2.03	2.09	2.00
		C: Model B plus position in labour market	1.97	1.79	1.81	1.91	1.88
		D: Model C plus NZDep			1.67	1.78	1.81
		% reduction excess rate ratio A to B	27%	26%	36%	34%	36%
		% reduction excess rate ratio A to C	31%	35%	49%	45%	44%
		(% point change B to C)	(4%)	(8%)	(13%)	(11%)	(8%)
		% reduction excess rate ratio A to D			58%	53%	48%
	Females	A: Adjusted for age and region	2.41	2.38	2.82	2.80	2.59
		B: Model A plus socioeconomic factors*	2.06	1.98	2.26	2.28	2.02
		C: Model B plus position in labour market	2.04	1.98	2.19	2.23	2.00
		D: Model C plus NZDep			2.01	2.03	1.83
		% reduction excess rate ratio A to B	25%	29%	31%	29%	36%
		% reduction excess rate ratio A to C	26%	29%	35%	32%	37%
		(% point change B to C)	(1%)	(0%)	(4%)	(3%)	(1%)
		% reduction excess rate ratio A to D			44%	43%	48%
60–74 years	Males	A: Adjusted for age and region	1.61	1.61	2.05	2.11	2.14
		B: Model A plus socioeconomic factors*	1.43	1.36	1.69	1.79	1.73
		D: Model B plus NZDep			1.59	1.68	1.63
		% reduction excess rate ratio A to B	29%	41%	34%	28%	36%
		% reduction excess rate ratio A to D			44%	39%	44%
	Females	A: Adjusted for age and region	2.15	2.24	2.37	2.55	2.54
		B: Model A plus socioeconomic factors*	1.92	1.94	2.02	2.21	2.11
		D: Model B plus NZDep			1.88	2.06	1.97
		% reduction excess rate ratio A to B	21%	24%	26%	22%	28%
		% reduction excess rate ratio A to D			36%	32%	37%

* Equivalised household income, education, car access and housing tenure.

Note: Only those respondents with complete data on all variables listed above could be included in the analyses:

- 63%, 72%, 78%, 75% and 64% of 25–59-year-old male Māori
- 62%, 70%, 77%, 74% and 64% of 25–59-year-old female Māori
- 76%, 84%, 86%, 86% and 79% of 25–59-year-old male European/Others
- 75%, 83%, 86%, 86% and 79% of 25–59-year-old female European/Others
- 58%, 67%, 77%, 72% and 52% of 60–74-year-old male Māori
- 58%, 66%, 77%, 70% and 50% of 60–74-year-old female Māori
- 72%, 84%, 90%, 87% and 74% of 60–74-year-old male European/Others
- 71%, 81%, 90%, 88% and 72% of 60–74-year-old female European/Others,

were included for each cohort in chronological order from 1981-84 to 2001-04.

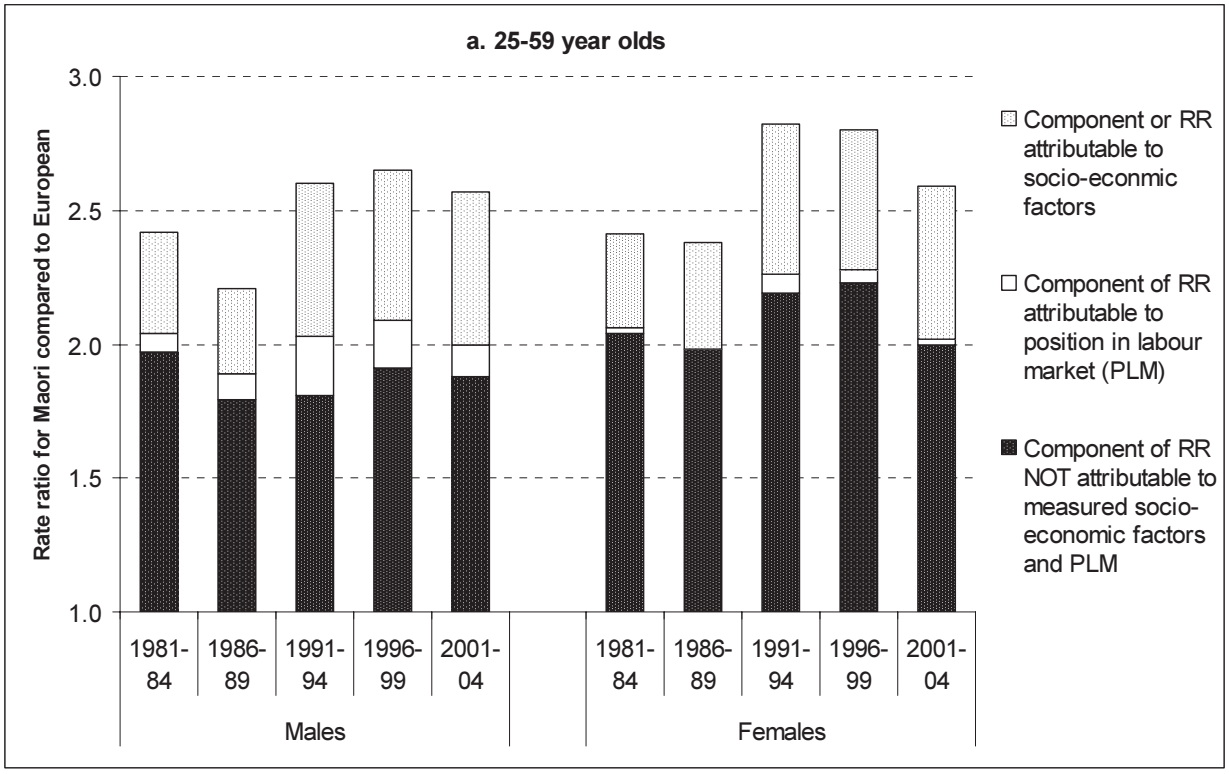
What is the contribution of *trends* in social inequality to *trends* in ethnic mortality inequality?

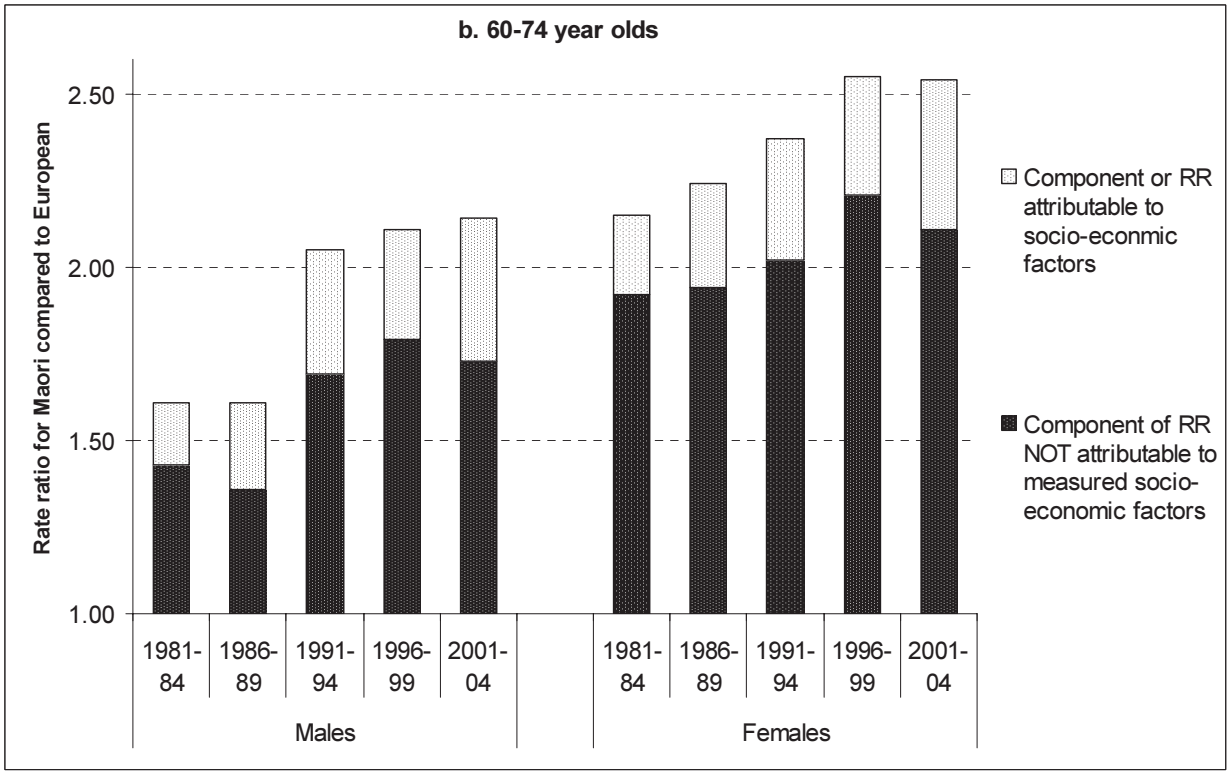
In our previous *Decades of Disparity III* report (Fawcett et al 2006), we pooled the first four cohorts and used interaction terms of time and ethnicity to answer this question. In this report, we conduct analyses separately on each cohort (Figure 42), rather than pooling all five cohorts, for the following reasons.

- The 2001–04 results (not previously available) strongly suggest that it would be false to assume linear trends in inequalities over time.
- Analysing each cohort separately allows the association of socioeconomic factors with mortality to vary over time (as they do), whereas with a pooled analysis this would require a complex specification of interaction terms.
- We are not solely reliant on interpreting a multiplicative interaction term; rather we can 'see' the various ratio ratios over time and consider the absolute changes in the excess rate ratios.
- The presentation (Figure 42), being visual, is more easily understood by a wider audience.

Figure 42 shows the Māori:European/Other rate ratios from the Poisson regression models. The total height of each bar represents the age- and region-adjusted rate ratio (ie, model A in Table 48 above). The shading shows the portion 'explained away' by adjusting for socioeconomic factors (ie, model B) and the further portion explained away by PLM for the working age group (ie, model C). It must be noted that the interpretation of this figure is indicative – we have not been able to fully incorporate statistical imprecision in our analyses.

Figure 42: All-cause mortality rate ratios for Māori compared to European/Others, and components due to socioeconomic factors and position in the labour market (PLM) (Poisson regression)





Because of the non-linearity in the inequality trends, we cannot summarise the contribution of the *trends in social inequality* to the *trends in ethnic mortality inequality* in a single number. However, inspection of Figure 42 strongly suggests that much (probably well over half) of the increase in ethnic mortality inequality from 1981–84 to 2001–04 among working-age adults has resulted from the widening in socioeconomic inequalities that occurred over (much of) this period. For older adults, the contribution of trends in socioeconomic factors to the trend in mortality rate ratios appears to be less, but this may reflect limitations in the ability of the census variables to fully capture socioeconomic inequality for this age group.

Why are socioeconomic factors (including PLM) making an increasing contribution over time to ethnic inequalities in mortality? There are two reasons. First, unequal distribution of socioeconomic resources and employment between Māori and European/Others widened over the observation period – most notably in the late 1980s and 1990s (Figure 40, page 105). Second, the strength of the association between socioeconomic factors and mortality (steepness of the income-mortality gradient) has increased over the 1980s and 1990s, as evidenced by the majority of income-mortality rate ratios reported earlier in this report.

In summary, it appears that:

- When a full range of socioeconomic factors, including PLM and neighbourhood deprivation, are included in the analysis (which is possible only for restricted ages and cohorts), about 50% of the disparity in all-cause mortality between Maori and European/Other ethnic groups is explained for working-age adults and about 40% for older adults.
- PLM made a notable contribution to this disparity for working-age males, peaking in the 1990s.
- The contribution of *trends* in socioeconomic inequality to *trends* in ethnic mortality inequality over the observation period cannot be precisely quantified (because of non-linearity and instability). Nevertheless, it appears that the increase over time in socioeconomic inequality explains much of the corresponding increase in mortality inequality between Maori and European/Other ethnic groups for working-age adults, and somewhat less (perhaps a quarter to a half) for older adults.

7 Discussion

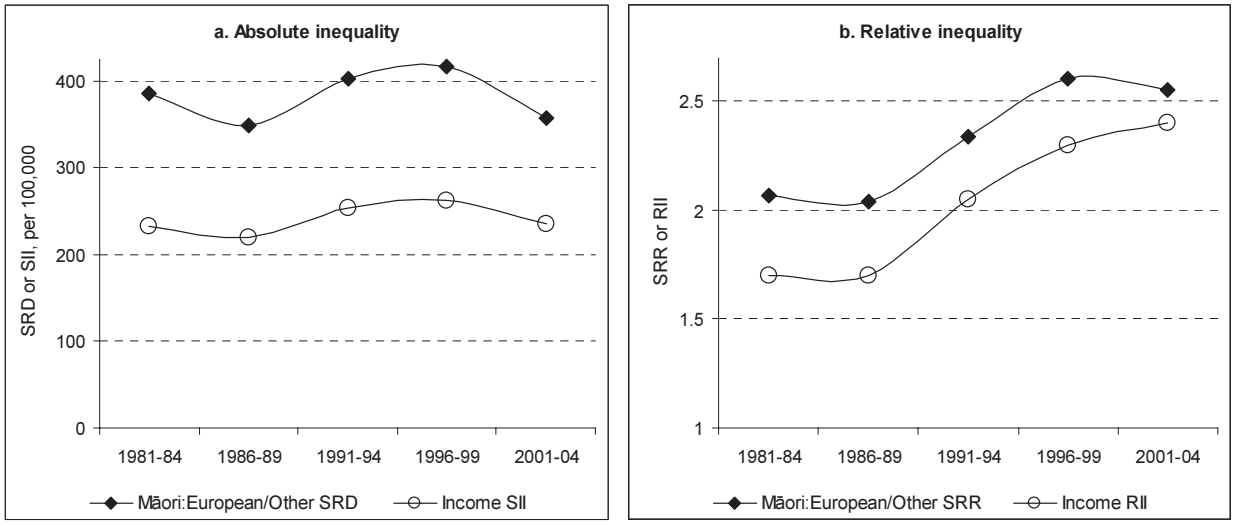
7.1 Summary of key findings – inequalities in mortality persist but may have begun to narrow

Before reviewing the findings detailed in this report separately by ethnicity and socioeconomic position, the key finding should be emphasised: after increasing steadily from the mid-1980s, inequalities in all-cause mortality by both ethnicity and income appear to have stabilised, or may have even declined, from 1996–99 to 2001–04 (depending on the inequality, population group and scale of measurement).

This possible turning point in inequalities for both income and ethnic groups (Māori compared to European:Other) is summarised below (Figure 43). This figure shows the sex-averaged SRDs and SIIs (Figure A) and the sex-averaged SRRs and RIIs (Figure B) for ages 1–74 years pooled. All measures of inequality show a pattern of peaking in 1996–99, then falling in 2001–04 (except the income RII, which continued to increase to 2001–04, but more slowly than before).

While it will be important to confirm that these trends are sustained in the next cohort (2006–09) and beyond, these findings raise the hope that the phase of increasing health inequality in New Zealand that characterised the 1980s and 1990s – the 'decades of increasing disparity' – may be drawing to a close.

Figure 43: Summarised presentation of estimated trends in absolute and relative inequality in all-cause mortality, 1981–2004, all ages and both sexes combined



7.2 Ethnic inequalities in mortality

Throughout the period from 1981 to 2004, Māori experienced the highest mortality rates (pooling causes of death) at all ages within the 1–74 years range, followed in turn by the Pacific, European/Other and Asian ethnic groups.

From the 1980s to the mid 1990s, mortality disparities between the Māori and Pacific ethnic groups and the majority European/Other population increased steeply. Yet from the late 1990s to the early 2000s, relative inequalities (mortality rate ratios) between Māori or Pacific ethnic groups and the European/Other ethnic group stabilised, and absolute inequalities (mortality rate differences) may have begun to decline – a turnaround of major importance if it can be sustained. Among adults, this turnaround has been steeper for Māori than for Pacific peoples: while still intermediate, Pacific adult mortality is now closer to that of Māori than to that of the European/Other ethnic group, especially for males.

The widening inequality between European/Other and Asian peoples (favouring the latter group) may reflect the rapid increase in the proportion of the Asian population comprising recent migrants since the early 1990s. Migrants typically have much lower mortality than the host population because of health selection (Ministry of Health 2006); ie, healthier people are more likely to move to a new country. If this explanation is correct, this inequality may also begin to narrow in future as health selection effects begin to wear off. There is also the possibility that, with acculturation, Asian New Zealanders may increasingly adopt the lifestyle of other New Zealanders, so contributing to health convergence. Finally, it should be noted that results are presented in this report for all Asian peoples combined (for reasons of statistical power), yet the Asian population is extremely heterogeneous. For example, Chinese have lower mortality rates than Indian people – especially for heart disease and diabetes (Ministry of Health 2006). Better understanding of the health profile of Asian New Zealanders, past and future, requires more research.

The decline in mortality for all ethnic groups over the observation period has resulted mainly from progressive reduction in the incidence and case fatality of cardiovascular disease (CVD), ischaemic heart disease and stroke in particular. Consequently, the contribution of CVD to the total mortality inequality between the ethnic groups has fallen and has been replaced by an increasing contribution from cancer (both tobacco-related and non-tobacco-related). Among Māori male youth, suicide has emerged as a major contributor to ethnic mortality inequalities.

There is enough statistical power to gain a more nuanced understanding of trends in disparities between Māori and European/Other ethnic groups, across age groups and causes of death.

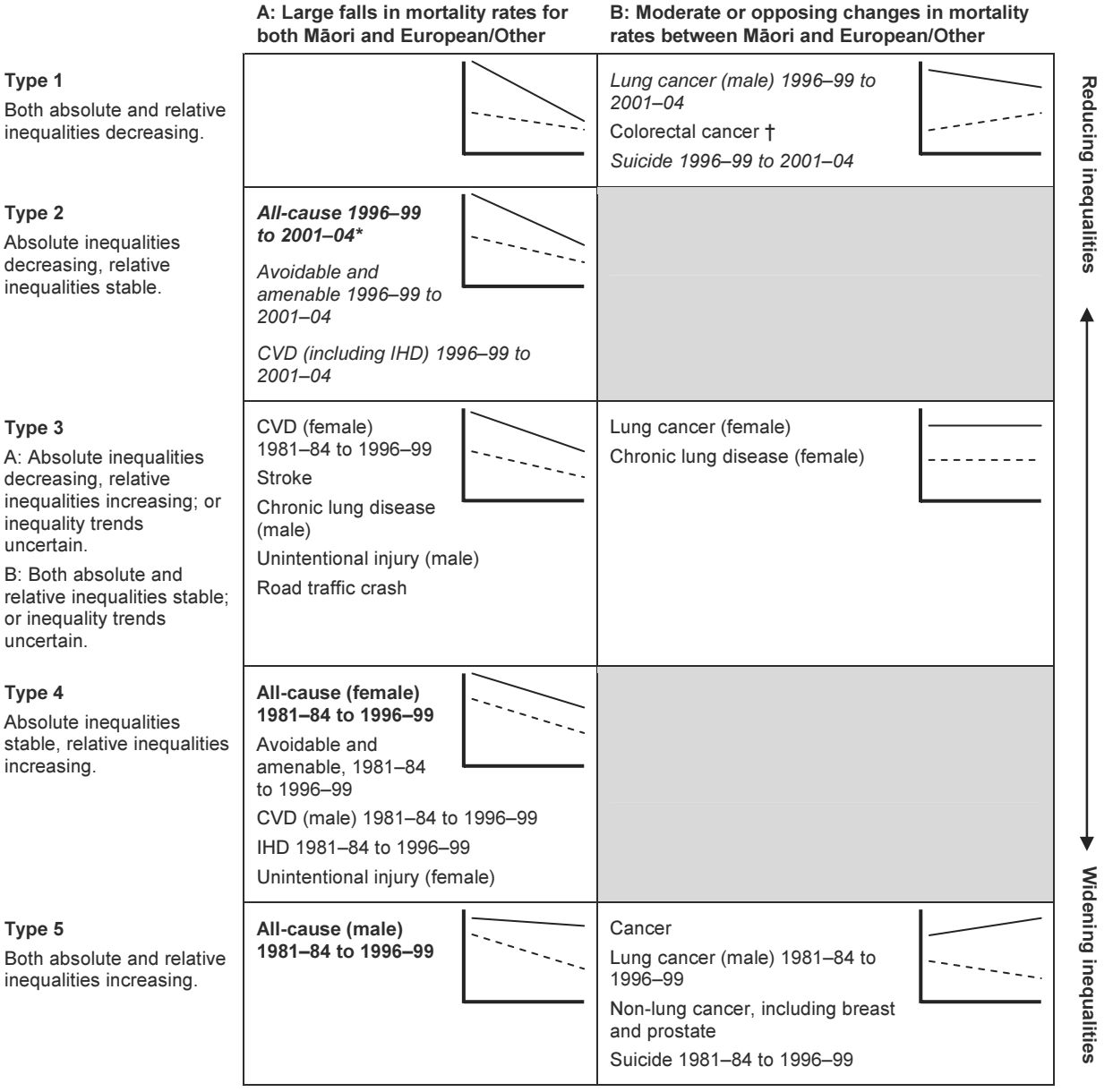
Figure 44 below attempts to visually provide such an understanding. Broadly speaking, we can think of causes of death or age groups where there are either large falls in mortality rates for both Māori and European/Other, or moderate or opposing changes in mortality rates. This is represented by the two columns in Figure 44. (Hypothetically, we can also think of causes of death or age groups with large increases in both ethnic groups, but with the possible exception of youth suicide, this has not occurred. Hence we simplify the figure to two columns.)

We can then also think about trends in the mortality gaps themselves. At one end of the spectrum, gaps between Māori and European/Other could be closing in both absolute and relative terms (Type 1 in Figure 44), and at the other end of the spectrum they could be widening in both absolute and relative terms (Type 5 in Figure 44). This spectrum of trends in inequality is shown down the left-hand side of Figure 44. Ideally, we want to observe large falls in mortality rates in both ethnic groups *and* closing of the gaps in both absolute and relative terms – the top left cell of the figure (unfortunately no causes of death or age groups fall in this cell).

Interpreting Figure 44, for all-cause mortality pooled across all ages, we see that during the 1980s and 1990s trends in inequalities were unfavourable – particularly for males. However, and as already noted above, from 1996–99 to 2001–04 it appears that absolute inequalities may have narrowed (while relative inequalities have remained stable). Likewise, trends in inequalities in amenable and avoidable mortality and in CVD mortality from 1996–99 to 2001–04, appear to have shifted to a more favourable Type 2 pattern.

Of note are the trends in cancer mortality inequalities. For all cancers combined, both absolute and relative inequalities have increased throughout the observation period (Type 5 in Figure 44). However, it appears that from 1996–99 to 2001–04, lung cancer inequalities for males may have narrowed. Colorectal cancer is the only example of inequalities reducing throughout the study period, but this has occurred because Māori colorectal cancer mortality rates are increasing while European/Other rates are stable or decreasing. Assuming that these trends continue, it seems probable that in the next five to ten years this inequality will widen as rates for Maori overtake those for European/Others – a very concerning possibility.

Figure 44: Summary diagram of trends in ethnic inequalities in mortality (bold = all-cause mortality; italics = possible trends 2001–04) (solid line = Maori, broken line = European/Other)



* A fall in absolute inequalities from 1996–99 to 2001–04 for males is driven by 25- to 64-year-olds.

† Colorectal cancer is the only example in this report of clearly reducing inequalities between Māori and European/Others, but in such a way that rates for European/Others are falling while those for Māori are increasing, erasing any previous mortality advantage Māori had. It is plausible that in the next decade(s) Māori rates will increase above European/Other rates.

7.3 Socioeconomic inequalities in mortality

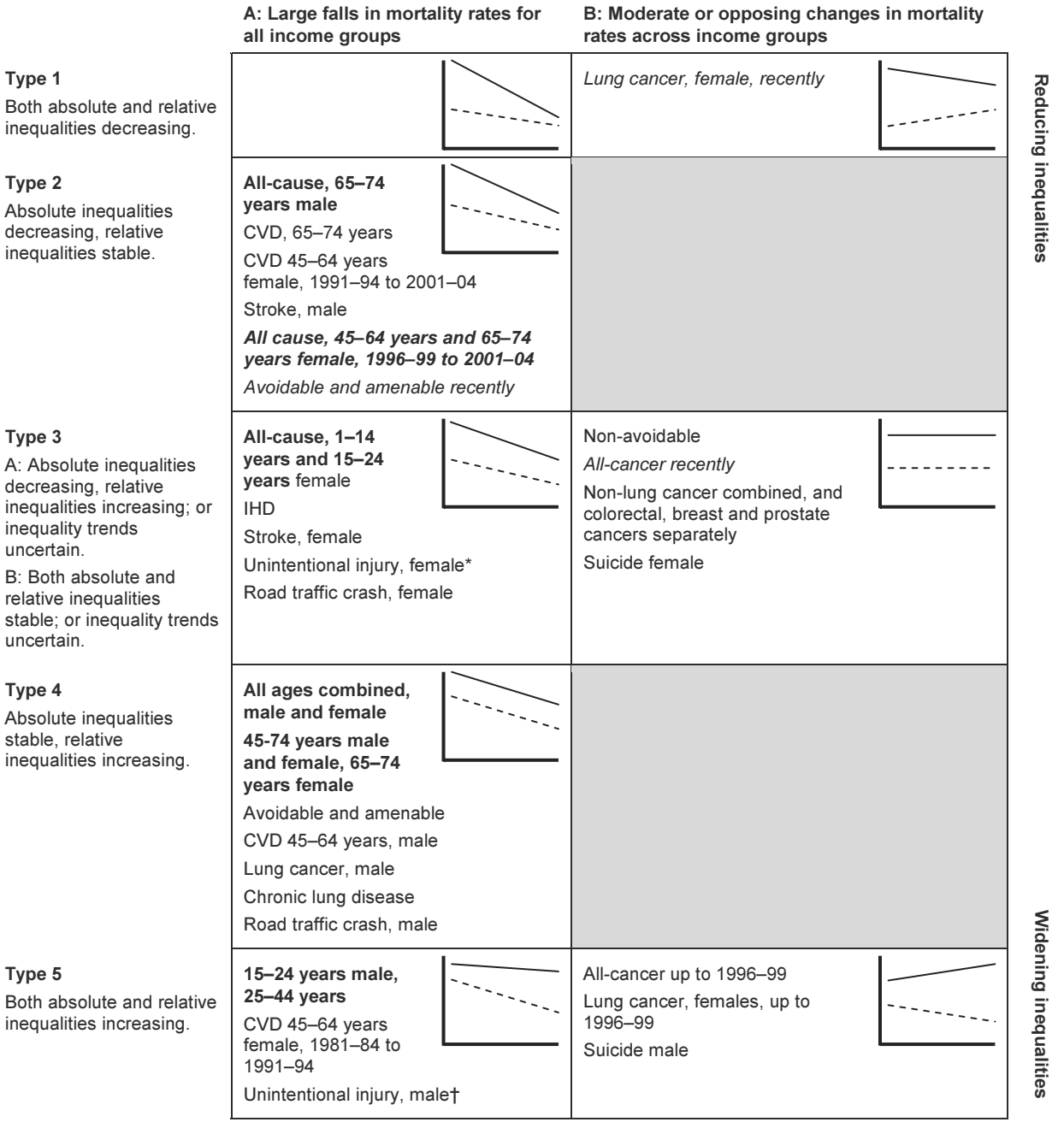
Like all other societies, New Zealand exhibits a socioeconomic gradient in mortality, with low-income groups experiencing higher risks of dying at every age than their more privileged counterparts. Mortality fell for all income groups from 1981 to 2004, and to a similar proportionate extent, with the result that absolute inequality remained stable while relative inequality increased.

The increase in relative inequality was greater when measured using a regression-based measure of impact, the relative index of inequality, than when measured using the rate ratio of the low- to the high-income group. This indicates that the widening of New Zealand's income distribution that occurred over the 1980s and 1990s (Förster and d'Ercole 2005; Ministry of Social Policy 2006; Mowbray 2001; Statistics New Zealand 1999) contributed to the increase in mortality inequality.

Although too early to draw firm conclusions, it is worth noting that little further increase in relative inequality between income groups – and a possible decrease in absolute inequality – occurred from the mid-1990s to the early 2000s. This mirrors findings noted above with respect to the ethnic groups, at least comparing Māori and to a lesser extent Pacific to European/Other ethnic groups. While less clear cut, this pattern of slowing – or even turning – in inequality trends is important. It is mathematically and biologically impossible for mortality rates to relentlessly decline at the same absolute rate into the future (mortality rates cannot be less than zero). At some stage, absolute reductions in mortality rates must slow down or even come to an end. Correspondingly, absolute inequalities by income must also reduce, *unless* relative inequalities become very high. Of note, males aged 65–74 years experienced narrowing absolute inequalities in mortality by income accompanied by stable relative inequalities throughout the observation period – but no other sex-by-age group exhibited such trends in all-cause mortality throughout the period.

Figure 45 summarises trends in income disparities in mortality in the same way as Figure 44 does for ethnic disparities. Among 45–64-year-olds (both sexes) and 65–74-year-old females, absolute inequalities in all-cause mortality declined from 1996–99 to 2001–04, in contrast to the stable absolute (and increasing relative) inequalities seen in these age groups prior to 1996-99. Of particular concern are trends in inequalities for 25–44-year-old males and females (and to a lesser extent 15- to 24-year-old males). Static mortality rates among the low-income group at these ages, but falling rates for their high-income counterparts, have resulted in a profound widening of gaps in mortality throughout the study period. Divergent trends by income in suicide rates are a partial – but far from full – explanation for this persisting widening in all-cause mortality inequalities among young adults, a finding of great concern.

Figure 45: Summary diagram of trends in income inequalities in mortality (bold = all-cause mortality; italics = possible trends 2001–04) (solid line = low income group, broken line = high income group)



* There was substantial variation by age in inequality trends for female unintentional injury (page 85)

† This overall pattern of increasing unintentional injury inequalities for males was largely due to 15–24-year-olds. Other age groups tended to have stable inequalities over time (ie, Type 3).

CVD is a major driver of declining all-cause mortality rates in all income groups, reflecting falling incidence and improving survival for ischaemic heart disease and stroke in particular. For 65–74-year-olds, absolute inequalities in CVD mortality have narrowed throughout the observation period (while relative inequalities have remained stable). However, CVD mortality inequalities among 45–64-year-olds increased in relative terms (only) for males, and peaked for females in 1991–94. The profound drops in CVD mortality rates across all income groups, associated with narrowing in absolute gaps, mean that the contribution of CVD to the total income disparity in mortality has diminished from about half to a third or less (Table 45, page 102). Assuming that CVD mortality rates continue to fall in all income groups, and the absolute gap in CVD mortality between income groups also continues to fall, it seems probable that the contribution of CVD to the total income disparity in mortality will continue to decline. However, the obesity epidemic, if disproportionately concentrated in the low-income group, could potentially reverse this trend.

As the percentage contribution from CVD to the total income gap in mortality falls, so too must the percentage contribution of other causes of death rise. Thus, the contribution of cancer to total mortality inequalities has increased to about a quarter – although its contribution does not appear to have increased from 1996–99 to 2001–04 as much as might have been expected. To maintain, and indeed accelerate, the recent trend towards reducing inequality, resources and effort will need to be devoted to reducing cancer incidence and improving access to and quality of cancer treatment for the low-income group in particular. It will also be necessary to ensure that the reduction in CVD mortality (especially in low-income populations) is sustained, despite the burgeoning obesity and type 2 diabetes epidemics.

7.4 Socioeconomic mediation of ethnic inequality

Regression modelling indicates that, on average over the observation period, *measured* socioeconomic position (SEP) mediated approximately one-third (older adults) to one-half (working-age adults) of the disparity in mortality between Maori and European/Other ethnic groups. It is rare for a study of ethnic or racial inequalities in mortality to be able to adjust for as many socioeconomic factors as we were able to – indeed, we know of no other study of similar size internationally. Nevertheless, we have still probably underestimated the total contribution of socioeconomic factors to ethnic inequalities in mortality because:

- not all possible dimensions of SEP have been captured (eg, we had no direct measure of asset wealth)
- SEP was measured at one point in time only, rather than longitudinally or over the life course
- there will be inevitable measurement error in those socioeconomic and labour market variables that we could model.

On the other hand, it seems most unlikely that unmeasured components of SEP could account for all of the remaining ethnic mortality disparity – there is simply too much of the gap left. Other factors, operating (at least in part) independently of SEP – such as interpersonal racism, residential ethnic segregation, disparities in access to and quality of health care, and differences in risk factors such as smoking – may explain much of the residual ethnic inequality in mortality (Blakely et al 2006; Blakely, Tobias, et al 2005; Harris et al 2006).

How much of the *widening* in the disparity in all-cause mortality between Maori and European/Other ethnic groups (when measured on a relative scale) over the observation period (at least until the late 1990s) was explained by *widening* socio-economic disparities between these ethnic groups over the same period? This question proved more difficult to answer, but our best estimate is over half for working-age adults and approximately a quarter to a half for older adults.

This empirical finding is consistent with recent history. The structural and economic reforms of the 1980s and 1990s weighed particularly heavily on Māori (and Pacific peoples), with inequalities between Māori and non-Māori widening in labour market outcomes, educational attainment, income and housing (Howden-Chapman and Tobias 2000; Mowbray 2001; Statistics New Zealand 1999; Te Puni Kōkiri 2000). Of particular note, Māori unemployment rates rose from 10.7% in 1986 to a peak of 25.4% in 1992, remained above 15% for the rest of the 1990s, and fell back to 10.2% by 2003 (Ministry of Social Policy 2004). By contrast, European/Other unemployment rates rose from 3.2% in 1986 to a peak of 7.9% in 1992 and declined to 3.5% by 2003. These observations, together with the well-established fact that these socioeconomic factors influence health, make it highly probable that at least some of the widening gap in health status between Māori and European/Others during the 1980s and 1990s was due to the differential short-term impacts of the structural and economic reforms.

7.5 Strengths and limitations of the analysis

The study covers the whole New Zealand population 1–74 years of age, maximising statistical power and ensuring generalisability of the results. Record linkage of census and mortality data overcomes numerator–denominator bias that has plagued previous attempts to describe ethnic trends in mortality rates (Ajwani et al 2004; Blakely, Tobias, et al 2005). Using linked census–mortality data allows full use to be made of the rich ethnic and socioeconomic data captured in the census. Although each cohort can be followed up for only a relatively short time (three years), the study design is similar for all five cohorts. Thus, comparisons over longer periods of time are likely to be valid because the same study design was used in each instance.

At the same time, our study – like any study – is not without its limitations. Reliance had to be placed on mortality (all-cause and by-cause) as the sole health outcome that could be investigated. Ethnic and socioeconomic disparities may show different patterns with respect to morbidity and disability than mortality outcomes. Furthermore, death is a relatively uncommon outcome, especially at younger ages, so some subgroup analyses were limited by insufficient statistical power.

Not all eligible mortality records were linked to a census record, reflecting the high residential mobility of the New Zealand population. We overcome this incomplete linkage by 'weighting up' the linked deaths to be representative of all eligible deaths – an approach that we have found to be reliable in the past (Fawcett et al 2002). Nevertheless, it must be pointed out that linkage rates were as low as 50% for youth (15–24-year-olds), meaning that we must be cautious when interpreting results for this age group.

The measurement of SEP remains challenging, even with linkage to the census. Between 16% and 20% of cohort members had to be excluded because of missing income data, thereby introducing the potential for bias in estimates of income disparities in mortality. More seriously, income alone is unable to capture the full extent of socioeconomic impacts on health. This was illustrated in the regression modelling of the socioeconomic mediation of ethnic mortality inequalities, in which each socioeconomic indicator (income, education, measures of asset wealth [car access and housing tenure], labour market position and neighbourhood deprivation) was shown to exert an additional independent effect. Thus, the trends in mortality, and trends in inequalities in mortality, by income may not fully reflect trends by education, occupational class or asset wealth (although we did find in *Decades of Disparity II* that trends in mortality by education were broadly similar [Blakely, Fawcett, et al 2005].) Furthermore, our study design captures the socioeconomic 'exposure' at one point in time only in the three years preceding death, rather than dynamically over each individual's life-course.

Finally, our study design excluded infants and older people (> 75 years), despite the fact that ethnic and socioeconomic inequalities in mortality are likely to exist at these ages as well. While the former age group is unsuited to the NZCMS design, the 2001–04 cohort did link data for people > 75 years of age on census night. These data were not analysed here because corresponding data are not available for the earlier cohorts; however, the 2001–04 results for the 75+ age group will be presented elsewhere and future cohorts will include all ages.

7.6 Explanations for the observed mortality inequalities

There are many frameworks for explaining health inequalities. They usually include levels of explanation from structural/macroeconomic, to behavioural and psychosocial, health services, and various pathophysiological pathways (Turrell et al 1999). Explanations for ethnic inequalities in health also invoke racial discrimination (institutional, interpersonal and internalised) (Jones 2000; Krieger 2000), which both influences the distribution of SEP by ethnicity and acts independently of SEP through other pathways such as direct trauma, psychosocial stress and access to and quality of health care. The contribution of each explanation will vary between ethnic and socioeconomic inequalities in health, as well as between time periods, places and population groups.

A full canvassing of all these possible explanations is beyond the scope of this monitoring report. However, there are several discrete questions that may be addressed here.

- Were the structural reforms of the 1980s and 1990s responsible for widening mortality inequalities?
- Is a structural explanation compatible with the trends seen by age group and cause of death? And is a structural explanation compatible with the time lags (or lack of them) apparent in the results in this report?
- How important is tobacco as an explanation?
- Do the results in this report tell us much about the possible contribution of health services?
- Do the results in this report tell us much about the possible contribution of racism to ethnic inequalities in health?
- Are genetics a likely explanation for ethnic inequalities in health?
- What could explain the possible recent reduction in mortality inequalities, ie from 1996–99 to 2001–04?

Were the structural reforms responsible for widening mortality inequalities?

With respect to ethnic inequalities in mortality, the answer appears to be possibly yes – at least in part. This report adds direct empirical evidence of the role that socioeconomic factors (including labour market dynamics) made to widening ethnic inequalities in mortality, a 'final step' in a long chain of documentation and analysis by ourselves and others.

With respect to socioeconomic inequalities in mortality, again the answer appears to be possibly yes – in part at least. We demonstrate in this report (and the previous *Decades of Disparity II* report) that the mortality gradient is steeper when measured using the SII and RII than when measured using the SRD and SRR – suggesting that widening income inequality over time has contributed to the mortality inequality between income groups. However, it must also be noted that (relative) inequalities in mortality increased in most of the economically developed countries over the last few decades (Mackenbach et al 2003), and inequalities in New Zealand increased no faster than did those in similar countries that did not undergo structural and economic reform, at least to the same extent as New Zealand (Fawcett et al 2005). Thus the structural and economic reforms are unlikely to have been the full explanation for the rising socio-economic and ethnic inequalities in health observed in New Zealand over the 1980s and '90s, although they may have contributed to these trends.

Is a structural explanation compatible with the trends seen by age group and cause of death?

While it seems probable that the structural reforms had some measurable impact on health inequalities (especially ethnic inequalities), the varying trends by sex, age group and cause of death point to other influences as well.

The dramatic falls in CVD mortality from 1981–84 to 2001–04 (65% for European/Others and a lesser but still impressive 40% to 45% for Māori) reflect both falls in incidence due to primary prevention (eg, smoking cessation, lower saturated fat intake, lower salt intake, higher fruit and vegetable intake) and improved medical treatments (Capewell et al 2000). The relatively smaller decline in CVD mortality among Maori may, in part, reflect underlying structural factors.

First, changes in CVD mortality have been shown to occur quite quickly – within two years – after structural and economic reform in other countries (Notzon et al 1998). Second, it is not implausible that trends in risk factors may diverge between ethnic and socioeconomic groups during times of structural reform – people of lower socioeconomic position may be less likely to quit smoking due to stress, and food insecurity may lead to a higher risk of nutrition-related diseases in these groups. Third, access to health services may also diverge during periods of structural adjustment, especially if there are financial barriers to treatment.

Likewise, divergent trends in suicide and unintentional injury – especially among youth and young adults – are other pathways through which structural and economic processes could affect mortality inequalities (although empirical evidence in support of such mechanisms is scant).

However, there are also interesting trends in cancer in this report that cannot be explained (possibly not even partially) by structural factors. Most notably, the marked increase in colorectal cancer among Māori and Pacific peoples (Shaw et al 2006) probably reflects risk factor profiles experienced 20 years or more before cancer incidence. Likewise, Māori:European/Other inequalities in mortality among 60–74-year-olds increased relentlessly throughout the observation period, even after adjusting for socioeconomic factors, pointing to likely cohort effects or diseases with longer time lags.

Accordingly, it seems that there are trends in mortality by age and cause of death that may be independent of structural or macroeconomic explanations.

How important is tobacco as an explanation?

Tobacco smoking, just as with other risk factors such as high saturated fat consumption and physical inactivity, does not occur outside of a social context. Rather, such risk behaviours are shaped by the social conditions in which one lives. Hence, behavioural risk factors are – at least in part – likely to be on the causal chain leading from ethnicity and socioeconomic position to elevated mortality risk. Tobacco smoking is undoubtedly an important mediator of health inequalities. Using NZCMS data, we have previously shown that tobacco contributes to about 10-20% of ethnic inequalities in mortality and 20-30% of socioeconomic inequalities in mortality (Blakely et al 2006; Blakely and Wilson 2005; Wilson et al 2006a, 2006b). For both ethnic and socioeconomic disparities in mortality, smoking made an increasing contribution from 1981–84 to 1996–99; ie, smoking contributed to widening mortality disparities. Whether this trend continues will depend on recent and future relative rates of decline in smoking prevalence by ethnicity and SEP.

It is also noteworthy that the Māori:European/Other differences in lung cancer mortality shown in this report are larger than can be explained by differences in smoking prevalence alone. The very high lung cancer rates among Māori may reflect incremental contributions from exposure to passive smoking, occupational exposures, other risk factors, and interactions between them.

Do the results in this report tell us much about the possible contribution of health services?

Not directly. However, the results for amenable mortality point to the importance of health services. There is also much external evidence that health services matter, from theoretical perspectives on inverse access by social position to new technologies (Victora et al 2000), to specific New Zealand evidence on unequal access to health services by ethnicity (Jeffreys, Stevanovic et al 2005; Robson et al 2006; Tukuitonga and Bindman 2002) and possibly socioeconomic position (Jeffreys, Sarfati et al 2005). However, there is no reliable evidence on *trends* in access to, and through, health services by ethnicity or socioeconomic position, so we cannot determine whether the trends in mortality observed in this report might be due (in part at least) to differential trends in access to or quality of health services (eg, whether recent developments in primary health care, such as 'by Māori for Māori' services, may have contributed to the possible turning point in inequality trends between 1996–99 and 2001–04).

Do the results in this report tell us much about the possible contribution of racial discrimination?

Not directly. However, there is other accumulating evidence in New Zealand that points to the possible role of racism on health inequalities, be it via interpersonal or institutional discrimination. Regarding interpersonal discrimination, recent analyses of the New Zealand Health Survey (Harris et al 2006) suggest that exposure to discrimination makes an independent contribution (from SEP) to self-reported health status. Regarding institutional racism, the unequal distribution of socioeconomic resources between ethnic groups that contributes to much of the ethnic disparities demonstrated in this report is in itself evidence of this. The possible contribution of health services mentioned above could be considered to be another manifestation of institutional racism.

Are genetics a likely explanation for ethnic inequalities?

Our genetic inheritance has a profound influence on our own personal chances of experiencing a given disease. However, the genetic variation between ethnic groups (eg, Māori and European/Other) is much less than the variation between individuals within an ethnic group, meaning that genetics cannot be an important explanation for social group differences in health (other than for a few specific diseases with a very strong genetic component). Further, the dynamic nature of inequalities demonstrated in this report (eg, substantial changes in ethnic inequalities for specific diseases in less than 25 years) argues strongly against genetic explanations for *trends* in inequalities.

What could explain the apparent reduction in mortality inequalities from 1996–99 to 2001–04?

The introduction since 1999 of pro-equity social policies (including active labour market policies, housing policies and social assistance policies) may have contributed to the apparent turning point in mortality inequalities seen from 1996–99 to 2001–04 (especially on an absolute scale). Likewise, reductions in financial and other barriers to primary health care, the increasing provision of culturally safe health care (such as 'by Maori for Maori' services), and slowing in the growth of single-parent versus partnered families – a reflection of changing family values as well as social circumstances – may have made a modest contribution.

New Zealand's good macroeconomic performance over the past decade, with very low unemployment rates and substantial real increases in income for working families, must also be considered a likely explanation for the apparent narrowing of mortality disparities from 1996–99 to 2001–04. However, this report is unable to firmly draw such causal conclusions, nor to separate macroeconomic performance from welfare policies (such as housing policy and social assistance policy) and labour market performance.

Furthermore, it is important to reiterate that the apparent stabilisation or slowing in the growth of health inequalities between 1996–99 and 2001–04 is based on comparison of two time points only. Ongoing monitoring is required before we can be certain that this represents a true turning point.

7.7 Policy and monitoring implications

The declining trend in Māori (and to a lesser extent Pacific) mortality described in this report largely reflects falling cardiovascular mortality, as does that for the low income group. However, there is a limit to how low CVD rates can go (Tobias et al 2006). It seems likely that more advantaged groups are rapidly approaching this limit, so their less advantaged counterparts are now beginning to catch up. This is consistent with the so-called 'inverse equity law' (Victora et al 2000), whereby advantaged groups initially have falling mortality rates, followed later by disadvantaged groups. Our study shows that CVD already accounts for a smaller share of the total ethnic mortality disparity than it did formerly, with its place being taken by cancer (both tobacco-associated and non-tobacco-associated). If health disparities are to continue to narrow – and indeed, if this emerging trend is to further accelerate – a new focus on improving access to and quality of cancer prevention and treatment services for disadvantaged and marginalised groups will be necessary. At the same time, recent improvements in cardiovascular health of disadvantaged groups need to be sustained and further strengthened – particularly in the face of a growing obesity and type 2 diabetes epidemic that affects these groups more severely than their more advantaged counterparts.

The possible recent narrowing in ethnic mortality inequalities probably reflects the corresponding recent narrowing in socioeconomic inequalities in mortality also demonstrated in our study (when measured on an absolute scale). Yet trends in ethnic inequalities in mortality are not fully explained by socioeconomic mediation. While policies aiming to reduce social inequalities between ethnic groups are necessary, our results indicate that such policies acting alone are unlikely to be sufficient. Rather, policies aimed at reducing non-socioeconomically mediated ethnic inequalities in health are also important sites for policy attention. These include policies relating to (non-financial) access to and the quality and cultural safety of health care, special measures to combat racial discrimination, and culturally appropriate health promotion programmes.

Understanding the contributions of specific social and economic policies and other determinants of the welfare mix to the recent possible trend reversal in health inequality is an important topic for research – albeit a challenging one. Such analysis is beyond the scope of this monitoring report. Whatever the explanations may turn out to be, it will be important to continue the NZCMS monitoring programme in order to see whether this apparent emerging trend can be sustained and indeed accelerated in future years. The outcome of the 2006–09 record linkage is therefore awaited with interest.

It will also be important to ensure that the 2006–09 and further cohorts include the older age group, and to analyse the data in future by all major ethnic groups, differentiating where relevant and possible between New Zealand-born and migrant subgroups. Monitoring of regional variation in (trends in) socioeconomic mortality gradients and ethnic mortality disparities is also of policy interest, albeit technically challenging; statistical techniques for such monitoring are currently under development. Given these enhancements, the NZCMS should continue to provide New Zealand with a high-quality and cost-effective information system with which to monitor inequalities in health outcomes between groups stratified by ethnic, socioeconomic, geographic, migration, gender, age, and other social axes.

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Appendix: Māori:non-Māori Analysis

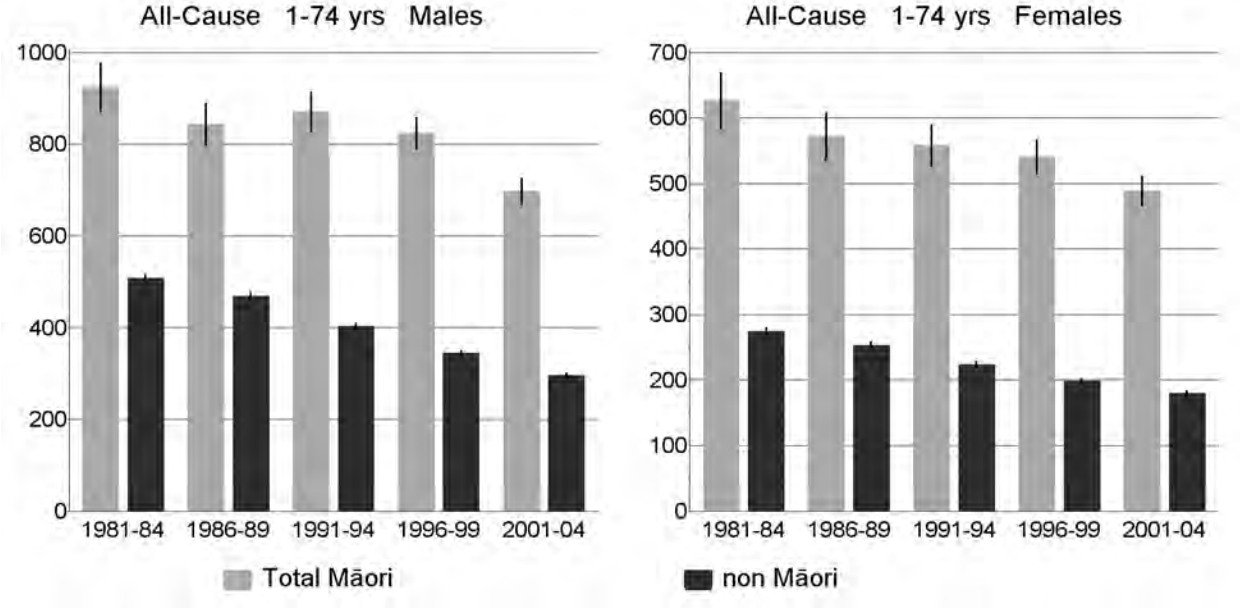
In addition to the ethnic analysis presented earlier in this report, we present here a comparison of mortality rate trends among Māori and non-Māori. This analysis has been done for all-cause mortality only. Age-standardised and age-specific mortality rates are presented first (Figures A1 and A2) followed by the corresponding rate differences and rate ratios (Tables A1 and A2).

Looking first at the summary age-standardised mortality rates, the different trajectories of Māori and non-Māori over the study period are immediately evident. While all-cause mortality declined steadily and substantively among non-Māori (both sexes), no such pattern is seen among Māori. For both sexes, there is some suggestion of a decline in mortality from 1981–84 to 1986–89 followed by a prolonged plateau until 1996–99 – the period of major economic restructuring in New Zealand. Most recently, a statistically significant fall in Māori mortality is seen from 1996–99 to 2001–04.

This pattern is mirrored in the inequality statistics. Thus for both sexes, absolute inequality (ie, the SRD) fell from 1981–84 to 1986–89 only to increase progressively thereafter until 1996–99. Then from the late 1990s to the early 2000s a statistically significant reduction in the SRD is seen for males and a near-significant reduction is seen for females.

This recent narrowing of the mortality gap on an absolute scale has been accompanied by a stabilisation in inequality when measured on a relative scale. That is, the SRR increased progressively from approximately 1.8 for males or 2.3 for females in 1981–84 to 2.4 and 2.7 respectively in 1996–99, then remained stable at the latter levels in 2001–04.

Figure A1: All-cause mortality rates, by Māori and non-Māori ethnicity and sex, age-standardised within the 1–74 years age group



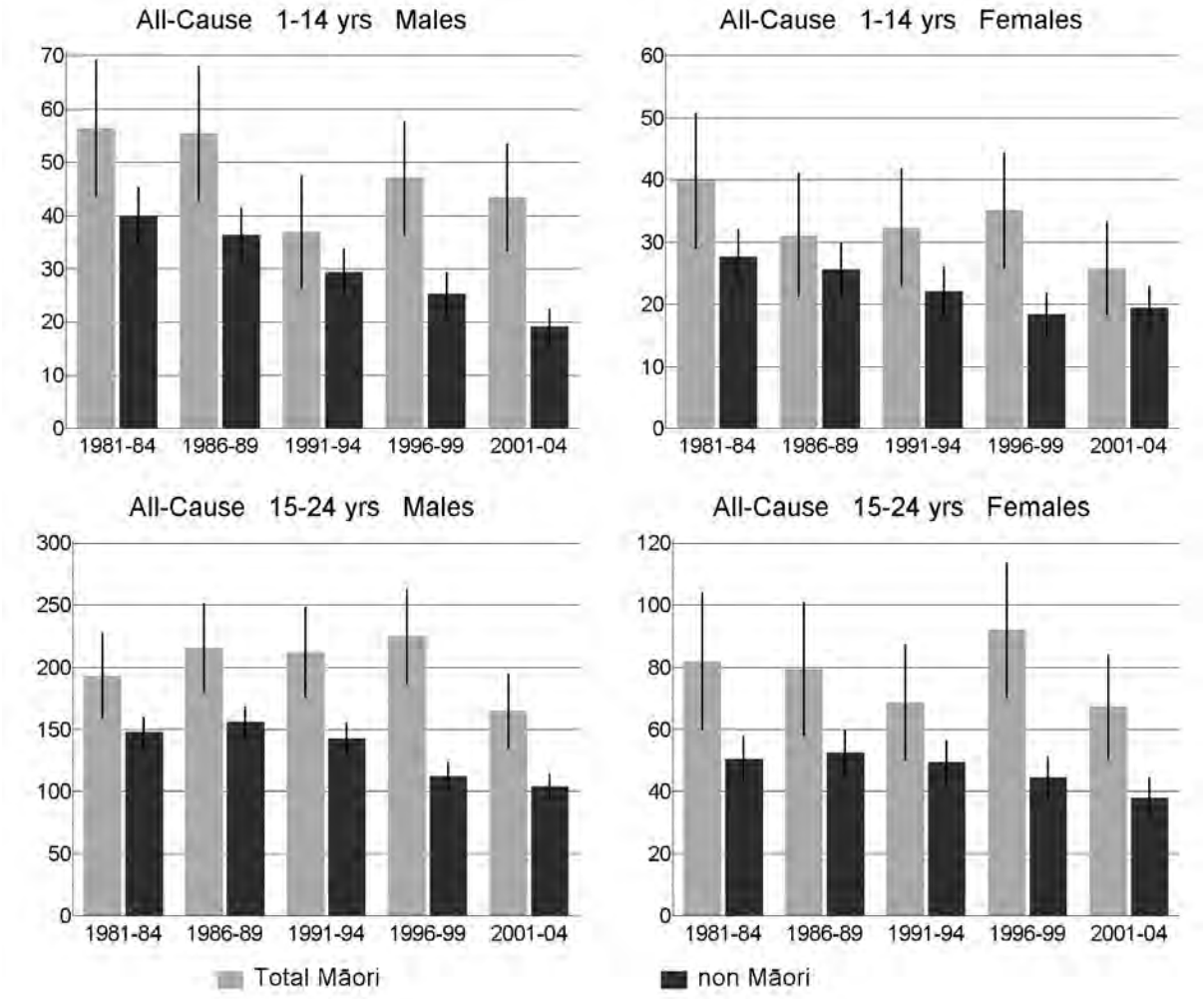
Much the same pattern is seen in all age groups. In children (1–14 years) the reduction in all-cause mortality among non-Māori is greater for boys than for girls, whereas this is not the case among Māori. So some reduction in both absolute and relative inequality is seen in the most recent cohort for girls but not for boys, among whom stable absolute and increasing relative inequality is evident.

Among non-Māori youth (15–24 years) relatively little mortality reduction is seen since the mid-1990s in both sexes, whereas Māori youth show a rapid recent decline. The result has been a significant reduction in absolute and relative inequality since 1996, following 20 years of increasing relative and stable or increasing absolute inequality.

All-cause mortality inequalities in adulthood (25-74 years) show a similar pattern, with stable absolute inequalities to 1996–99 followed by a decline (not quite statistically significant in young adult females) and increasing relative inequalities followed by stabilisation.

In summary, the key finding is one of recent improvement in Māori mortality rates at most if not all ages for both sexes, leading to stabilisation of relative, and possible narrowing of absolute, inequalities in all-cause mortality.

Figure A2: All-cause mortality rates, by Māori and non-Māori ethnicity, age group and sex



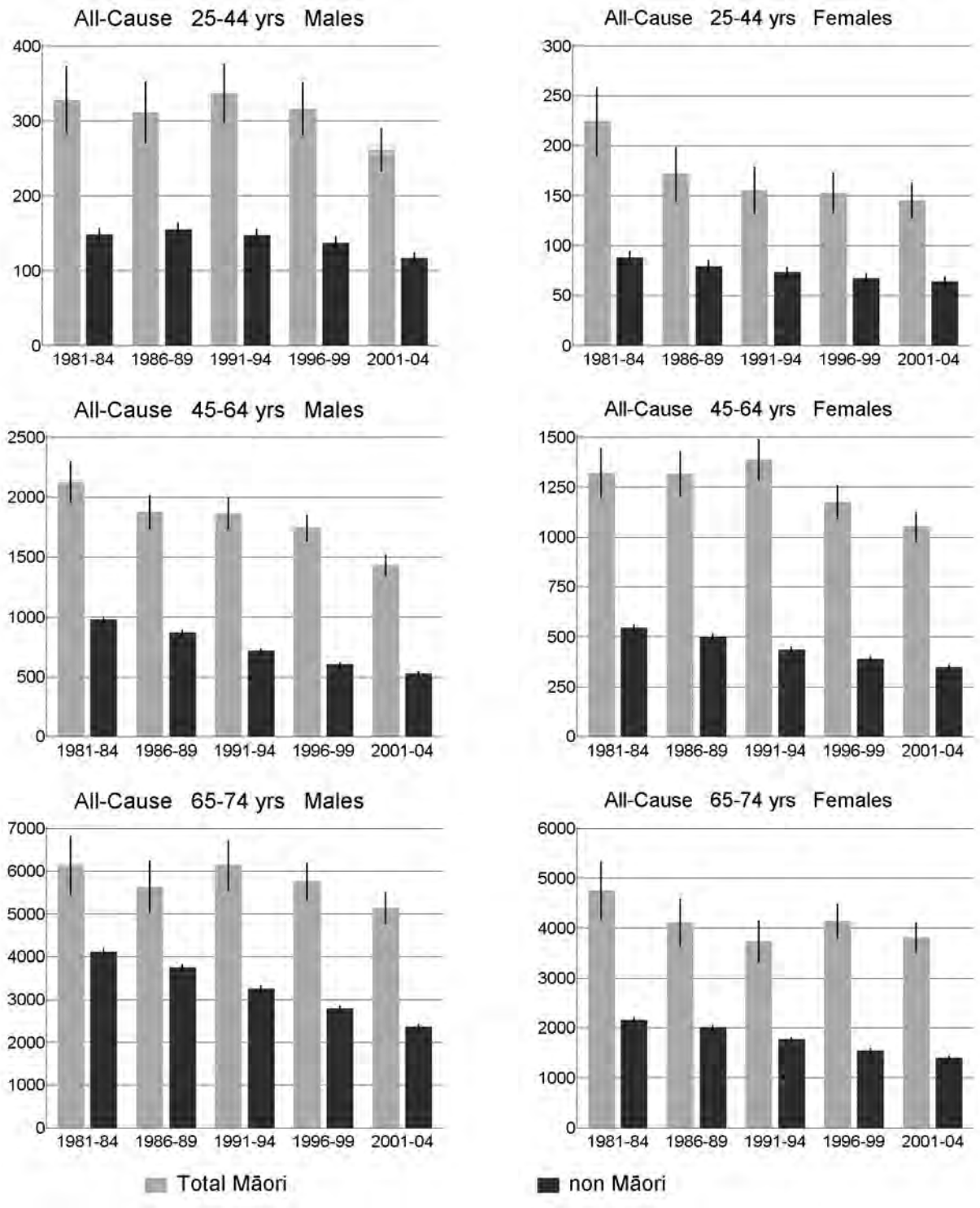

All-Cause 25-44 yrs Males
All-Cause 25-44 yrs Females
All-Cause 45-64 yrs Males
All-Cause 45-64 yrs Females
All-Cause 65-74 yrs Males
All-Cause 65-74 yrs Females
1981-84
1986-89
1991-94
1996-99
2001-04
Total Māori
non Māori

Table A1: All-cause mortality SRDs for Māori compared to non-Māori, 1–74 years and by age group

		Standardised rate differences					
Sex	**Cohort**	**1–74 years**	**1–14 years**	**15–24 years**	**25–44 years**	**45–64 years**	**65–74 years**
Males	1981–84	417 (362–471)	17 (3–30)	45 (9–82)	180 (134–227)	1147 (976–1319)	2041 (1347–2735)
	1986–89	374 (328–421)	19 (6–33)	60 (22–97)	156 (115–198)	1005 (865–1145)	1882 (1271–2493)
	1991–94	468 (423–512)	8 (-4–19)	69 (31–108)	190 (149–230)	1148 (1017–1278)	2885 (2296–3473)
	1996–99	479 (444–515)	22 (11–33)	113 (73–153)	180 (144–216)	1141 (1033–1249)	2969 (2530–3408)
	2001–04	401 (371–431)	24 (14–35)	61 (29–93)	145 (114–175)	906 (816–995)	2783 (2407–3160)
	P (trend)	*0.92*	*0.38*	*0.45*	*0.38*	*0.30*	*0.14*
Females	1981–84	352 (309–396)	12 (1–24)	31 (8–55)	136 (101–172)	773 (645–901)	2594 (2007–3182)
	1986–89	319 (282–355)	6 (-5–16)	27 (4–50)	92 (64–120)	819 (705–933)	2101 (1618–2583)
	1991–94	335 (302–367)	10 (0–21)	19 (-1–39)	82 (58–106)	949 (844–1054)	1957 (1540–2375)
	1996–99	343 (316–370)	17 (7–27)	48 (25–70)	86 (65–106)	787 (702–873)	2583 (2228–2939)
	2001–04	309 (286–333)	7 (-2–15)	29 (11–47)	81 (63–100)	705 (631–779)	2404 (2103–2706)
	P (trend)	*0.31*	*0.89*	*0.74*	*0.16*	*0.38*	*0.65*

Table A2: All-cause mortality SRRs for Māori compared to non-Māori, 1–74 years and by age group

		Standardised rate ratios					
Sex	**Cohort**	**1–74 years**	**1–14 years**	**15–24 years**	**25–44 years**	**45–64 years**	**65–74 years**
Males	1981–84	1.82 (1.71–1.93)	1.41 (1.08–1.84)	1.31 (1.08–1.59)	2.22 (1.91–2.59)	2.17 (2.00–2.36)	1.50 (1.34–1.68)
	1986–89	1.80 (1.70–1.90)	1.53 (1.17–1.99)	1.38 (1.15–1.66)	2.01 (1.74–2.32)	2.15 (1.99–2.33)	1.50 (1.35–1.68)
	1991–94	2.16 (2.05–2.28)	1.26 (0.91–1.74)	1.49 (1.22–1.80)	2.29 (2.01–2.61)	2.60 (2.42–2.81)	1.89 (1.71–2.08)
	1996–99	2.39 (2.28–2.50)	1.87 (1.41–2.47)	2.01 (1.65–2.45)	2.31 (2.04–2.62)	2.90 (2.71–3.10)	2.07 (1.91–2.23)
	2001–04	2.35 (2.24–2.46)	2.27 (1.70–3.05)	1.58 (1.28–1.95)	2.24 (1.96–2.55)	2.72 (2.54–2.92)	2.18 (2.02–2.35)
	P (trend)	*0.03*	*0.08*	*0.20*	*0.43*	*0.06*	*< 0.01*
Females	1981–84	2.28 (2.13–2.45)	1.45 (1.05–1.99)	1.62 (1.19–2.20)	2.54 (2.14–3.03)	2.42 (2.18–2.67)	2.20 (1.94–2.50)
	1986–89	2.26 (2.11–2.42)	1.22 (0.85–1.74)	1.51 (1.11–2.05)	2.16 (1.81–2.57)	2.64 (2.41–2.90)	2.05 (1.81–2.31)
	1991–94	2.49 (2.34–2.65)	1.46 (1.04–2.07)	1.39 (1.02–1.89)	2.11 (1.78–2.50)	3.18 (2.92–3.45)	2.10 (1.87–2.36)
	1996–99	2.73 (2.58–2.88)	1.91 (1.38–2.66)	2.07 (1.56–2.74)	2.27 (1.96–2.64)	3.03 (2.79–3.28)	2.66 (2.43–2.92)
	2001–04	2.72 (2.58–2.87)	1.33 (0.94–1.89)	1.77 (1.31–2.39)	2.27 (1.96–2.63)	3.03 (2.81–3.28)	2.71 (2.49–2.95)
	P (trend)	*0.02*	*0.65*	*0.36*	*0.53*	*0.14*	*0.07*

Notes: 95% confidence intervals are given in brackets. The underlying non-linear trend means the p for trend value must be treated cautiously.

Statistical Annex

Table S1: All-cause mortality rates, by ethnicity, sex, and age group

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Males					
1–74 years	1981–84	925 (871–978)	614 (520–708)	446 (348–544)	507 (498–515)
	1986–89	843 (798–889)	707 (628–787)	344 (271–416)	466 (458–473)
	1991–94	871 (827–915)	566 (505–627)	282 (236–329)	402 (395–409)
	1996–99	824 (789–859)	626 (574–678)	255 (220–289)	339 (333–346)
	2001–04	698 (668–727)	527 (486–567)	188 (167–208)	294 (288–300)
	% change	*-25%*	*-14%*	*-58%*	*-42%*
	P (trend)	*0.04*	*0.19*	*< 0.01*	*< 0.01*
1–14 years	1981–84	56.4 (43.5–69.2)	69.4 (44.1–94.7)		38.0 (32.4–43.6)
	1986–89	55.4 (42.8–68.0)	51.2 (30.6–71.8)	62.9 (21.8–104.0)	35.3 (30.0–40.6)
	1991–94	36.9 (26.3–47.5)	38.3 (21.9–54.6)	31.9 (9.8–54.1)	28.2 (23.5–32.9)
	1996–99	47.1 (36.4–57.7)	33.7 (19.5–47.8)	25.0 (7.6–42.4)	24.0 (19.6–28.3)
	2001–04	43.4 (33.3–53.5)	26.4 (15.8–37.0)	18.6 (5.5–31.6)	18.7 (14.9–22.5)
	% change	*-23%*	*-62%*		*-51%*
	P (trend)	*0.29*	*< 0.01*		*< 0.01*
15–24 years	1981–84	193 (159–228)	179 (103–256)		148 (136–161)
	1986–89	216 (181–251)	216 (149–282)	100 (35–166)	155 (142–168)
	1991–94	212 (176–249)	144 (89–198)	93.1 (42.5–143.8)	146 (132–159)
	1996–99	225 (187–263)	167 (120–213)	62.0 (32.5–91.4)	113 (100–125)
	2001–04	165 (135–195)	149 (108–189)	67.1 (42.2–92.0)	104 (92–117)
	% change	*-15%*	*-17%*		*-30%*
	P (trend)	*0.46*	*0.25*		*0.04*
25–44 years	1981–84	328 (283–373)	153 (101–204)	96.2 (39.2–153.2)	148 (139–158)
	1986–89	311 (271–352)	273 (216–330)	107 (54–159)	152 (142–161)
	1991–94	337 (297–376)	158 (115–201)	101 (67–135)	149 (139–158)
	1996–99	317 (282–352)	243 (197–289)	86.2 (58.8–113.6)	134 (125–143)
	2001–04	261 (232–291)	192 (156–229)	76.0 (54.2–97.8)	116 (107–124)
	% change	*-20%*	*26%*	*-21%*	*-22%*
	P (trend)	*0.14*	*0.80*	*0.04*	*0.05*
45–64 years	1981–84	2125 (1956–2295)	1144 (901–1388)	907 (624–1189)	974 (948–999)
	1986–89	1875 (1737–2013)	1407 (1188–1625)	589 (409–769)	862 (838–885)
	1991–94	1863 (1735–1992)	1210 (1037–1382)	544 (411–676)	705 (684–725)
	1996–99	1742 (1635–1849)	1294 (1137–1451)	504 (404–604)	583 (565–601)
	2001–04	1432 (1343–1520)	1050 (930–1169)	329 (271–386)	517 (500–533)
	% change	*-33%*	*-8%*	*-64%*	*-47%*
	P (trend)	*0.01*	*0.30*	*0.01*	*< 0.01*
65–74 years	1981–84	6144 (5457–6832)	5145 (3758–6533)	3701 (2329–5072)	4097 (4004–4191)
	1986–89	5631 (5026–6235)	5153 (4025–6281)	2839 (1784–3894)	3741 (3656–3826)
	1991–94	6138 (5554–6722)	4245 (3388–5103)	2093 (1457–2728)	3250 (3176–3324)
	1996–99	5757 (5323–6191)	4492 (3812–5173)	1954 (1492–2417)	2774 (2708–2839)
	2001–04	5143 (4771–5515)	3983 (3451–4514)	1457 (1188–1726)	2356 (2295–2418)
	% change	*-16%*	*-23%*	*-61%*	*-42%*
	P (trend)	*0.12*	*0.05*	*< 0.01*	*< 0.01*

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Females					
1–74 years	1981–84	626 (584–669)	361 (296–426)	213 (150–277)	273 (267–279)
	1986–89	572 (536–608)	378 (324–432)	179 (130–227)	251 (246–257)
	1991–94	559 (526–591)	349 (306–393)	163 (129–198)	223 (218–228)
	1996–99	541 (514–568)	362 (325–398)	136 (114–158)	195 (190–199)
	2001–04	489 (466–512)	324 (294–353)	106 (92–121)	178 (174–183)
	% change	*-22%*	*-10%*	*-50%*	*-35%*
	P (trend)	*< 0.01*	*0.12*	*< 0.01*	*< 0.01*
1–14 years	1981–84	39.9 (29.0–50.8)	33.7 (15.3–52.1)		27.3 (22.5–32.1)
	1986–89	31.1 (21.2–41.1)	40.9 (22.4–59.4)		24.5 (20.1–28.9)
	1991–94	32.3 (22.9–41.8)	44.6 (27.0–62.1)		21.2 (16.9–25.4)
	1996–99	35.1 (25.8–44.4)	24.1 (11.3–36.9)		18.1 (14.2–22.0)
	2001–04	25.8 (18.2–33.4)	16.8 (8.0–25.6)		20.4 (16.2–24.6)
	% change	*-35%*	*-50%*		*-25%*
	P (trend)	*0.14*	*0.08*		*0.06*
15–24 years	1981–84	81.9 (59.8–104.1)	84.6 (44.0–125.2)		49.4 (41.8–57.0)
	1986–89	79.3 (57.8–100.9)	65.5 (33.0–98.0)		52.6 (44.9–60.3)
	1991–94	68.7 (50.0–87.3)	44.1 (21.6–66.6)		51.5 (43.8–59.2)
	1996–99	91.9 (70.2–113.6)	47.1 (24.7–69.4)	36.2 (16.2–56.1)	44.6 (36.9–52.2)
	2001–04	67.3 (50.3–84.2)	57.5 (33.9–81.1)	31.8 (15.7–47.9)	36.3 (29.4–43.2)
	% change	*-18%*	*-32%*		*-27%*
	P (trend)	*0.56*	*0.41*		*0.08*
25–44 years	1981–84	224 (189–259)	123 (80–167)	52.7 (10.5–94.9)	87.0 (79.9–94.1)
	1986–89	172 (145–198)	142 (102–182)	89.1 (42.3–135.9)	77.0 (70.8–83.3)
	1991–94	155 (132–179)	133 (98–168)	42.7 (22.5–63.0)	72.2 (66.5–77.9)
	1996–99	153 (133–173)	152 (120–184)	52.0 (35.7–68.2)	63.4 (58.1–68.6)
	2001–04	145 (127–164)	110 (86–135)	42.3 (29.5–55.2)	63.4 (58.0–68.8)
	% change	*-35%*	*-11%*	*-20%*	*-27%*
	P (trend)	*0.06*	*0.51*	*0.38*	*0.01*
45–64 years	1981–84	1319 (1193–1446)	773 (575–971)	496 (282–710)	543 (524–562)
	1986–89	1318 (1205–1431)	775 (622–929)	319 (181–457)	496 (478–514)
	1991–94	1385 (1282–1489)	598 (477–720)	322 (222–423)	434 (418–450)
	1996–99	1176 (1091–1260)	739 (625–852)	261 (195–327)	381 (367–395)
	2001–04	1052 (979–1125)	705 (611–800)	181 (140–222)	343 (330–355)
	% change	*-20%*	*-9%*	*-63%*	*-37%*
	P (trend)	*0.06*	*0.80*	*< 0.01*	*< 0.01*
65–74 years	1981–84	4757 (4173–5341)	2555 (1668–3442)	1557 (768–2346)	2164 (2101–2226)
	1986–89	4110 (3630–4589)	2781 (2019–3543)	1407 (756–2057)	2006 (1949–2063)
	1991–94	3733 (3319–4147)	3026 (2419–3632)	1357 (886–1828)	1764 (1713–1814)
	1996–99	4136 (3784–4489)	2699 (2233–3165)	1051 (750–1352)	1535 (1489–1582)
	2001–04	3809 (3510–4108)	2368 (1996–2740)	867 (672–1062)	1395 (1349–1440)
	% change	*-20%*	*-7%*	*-44%*	*-36%*
	P (trend)	*0.22*	*0.26*	*< 0.01*	*< 0.01*

Table S2: All-cause mortality rates, by sole ethnicity and total New Zealand population, sex, and age group

Age group	Cohort	Sole Māori	Sole Pacific	Sole Asian	European/Other	Total New Zealand population*
Males						
1–74 years	1981–84	927 (873–980)	616 (522–711)	455 (355–555)	507 (498–515)	535 (527–543)
	1986–89	845 (799–891)	710 (629–791)	343 (269–418)	466 (458–473)	495 (487–502)
	1991–94	875 (831–920)	572 (510–634)	285 (238–333)	402 (395–409)	435 (428–442)
	1996–99	824 (789–859)	617 (563–671)	238 (204–272)	339 (333–346)	386 (380–393)
	2001–04	700 (671–730)	526 (485–568)	178 (157–198)	294 (288–300)	330 (325–336)
	% change	*-24%*	*-15%*	*-61%*	*-42%*	*-38%*
	P (trend)	*0.04*	*0.15*	*< 0.01*	*< 0.01*	*< 0.01*
1–14 years	1981–84	54.9 (42.0–67.8)	64.4 (39.1–89.8)		38.0 (32.4–43.6)	43.3 (38.3–48.4)
	1986–89	53.7 (40.9–66.5)	40.7 (20.6–60.8)		35.3 (30.0–40.6)	40.2 (35.4–45.0)
	1991–94	36.8 (25.9–47.7)	38.2 (20.8–55.6)	35.6 (10.8–60.3)	28.2 (23.5–32.9)	30.8 (26.7–35.0)
	1996–99	49.2 (37.6–60.8)	34.1 (17.0–51.2)	26.2 (6.5–45.8)	24.0 (19.6–28.3)	30.4 (26.4–34.5)
	2001–04	43.7 (33.1–54.4)	24.2 (13.0–35.4)		18.7 (14.9–22.5)	25.0 (21.4–28.5)
	% change	*-20%*	*-62%*		*-51%*	*-42%*
	P (trend)	*0.38*	*0.02*		*< 0.01*	*< 0.01*
15–24 years	1981–84	193 (158–227)	175 (97–254)		148 (136–161)	155 (143–167)
	1986–89	215 (179–251)	198 (131–265)	87.1 (22.3–151.8)	155 (142–168)	165 (154–177)
	1991–94	211 (173–248)	135 (79–192)	91.7 (39.8–143.6)	146 (132–159)	154 (142–166)
	1996–99	227 (187–267)	170 (118–222)	52.4 (25.2–79.6)	113 (100–125)	134 (122–145)
	2001–04	170 (139–202)	151 (107–195)	63.8 (39.2–88.3)	104 (92–117)	115 (105–126)
	% change	*-12%*	*-14%*		*-30%*	*-26%*
	P (trend)	*0.56*	*0.41*		*0.04*	*0.04*
25–44 years	1981–84	331 (285–377)	151 (99–203)	90.4 (34.2–146.5)	148 (139–158)	165 (156–175)
	1986–89	312 (271–353)	275 (217–334)	95.6 (43.3–147.9)	152 (142–161)	170 (161–179)
	1991–94	343 (303–383)	165 (119–210)	104 (69–139)	149 (139–158)	167 (158–176)
	1996–99	321 (285–357)	254 (204–304)	73.5 (48.0–98.9)	134 (125–143)	161 (152–170)
	2001–04	262 (232–291)	192 (153–230)	71.5 (50.0–92.9)	116 (107–124)	136 (128–144)
	% change	*-21%*	*27%*	*-21%*	*-22%*	*-18%*
	P (trend)	*0.17*	*0.79*	*0.13*	*0.05*	*0.10*
45–64 years	1981–84	2130 (1960–2300)	1159 (911–1407)	937 (646–1229)	974 (948–999)	1051 (1025–1076)
	1986–89	1883 (1744–2022)	1422 (1200–1645)	620 (431–808)	862 (838–885)	940 (916–964)
	1991–94	1871 (1742–2001)	1229 (1053–1404)	551 (416–686)	705 (684–725)	798 (777–819)
	1996–99	1745 (1636–1853)	1256 (1096–1417)	485 (384–586)	583 (565–601)	700 (681–719)
	2001–04	1433 (1344–1522)	1044 (922–1165)	311 (254–368)	517 (500–533)	601 (584–617)
	% change	*-33%*	*-10%*	*-67%*	*-47%*	*-43%*
	P (trend)	*0.01*	*0.22*	*< 0.01*	*< 0.01*	*< 0.01*
65–74 years	1981–84	6153 (5465–6842)	5175 (3781–6569)	3754 (2362–5145)	4097 (4004–4191)	4179 (4086–4272)
	1986–89	5644 (5036–6251)	5235 (4081–6389)	2932 (1842–4021)	3741 (3656–3826)	3814 (3730–3898)
	1991–94	6157 (5572–6743)	4274 (3406–5142)	2087 (1445–2728)	3250 (3176–3324)	3359 (3285–3432)
	1996–99	5710 (5273–6146)	4397 (3697–5098)	1820 (1365–2275)	2774 (2708–2839)	2941 (2875–3006)
	2001–04	5170 (4795–5545)	4007 (3466–4548)	1390 (1125–1654)	2356 (2295–2418)	2521 (2461–2581)
	% change	*-16%*	*-23%*	*-63%*	*-42%*	*-40%*
	P (trend)	*0.11*	*0.03*	*< 0.01*	*< 0.01*	*< 0.01*

Age group	Cohort	Sole Māori	Sole Pacific	Sole Asian	European/Other	Total New Zealand population*
Females						
1–74 years	1981–84	628 (585–671)	363 (297–428)	206 (143–270)	273 (267–279)	295 (289–301)
	1986–89	572 (535–608)	375 (320–430)	164 (116–212)	251 (246–257)	273 (267–278)
	1991–94	555 (523–587)	343 (299–386)	150 (117–183)	223 (218–228)	247 (242–252)
	1996–99	547 (519–574)	366 (328–404)	136 (113–158)	195 (190–199)	227 (222–231)
	2001–04	494 (471–518)	329 (298–359)	105 (90–120)	178 (174–183)	205 (201–209)
	% change	*-21%*	*-9%*	*-49%*	*-35%*	*-30%*
	P (trend)	*0.01*	*0.21*	*< 0.01*	*< 0.01*	*< 0.01*
1–14 years	1981–84	39.0 (28.0–49.9)	34.6 (14.9–54.2)		27.3 (22.5–32.1)	30.1 (25.8–34.4)
	1986–89	31.0 (20.7–41.2)	42.4 (21.4–63.4)		24.5 (20.1–28.9)	26.7 (22.8–30.7)
	1991–94	28.3 (19.2–37.4)	33.3 (16.9–49.7)		21.2 (16.9–25.4)	24.2 (20.5–28.0)
	1996–99	37.3 (27.1–47.4)	26.4 (10.6–42.2)		18.1 (14.2–22.0)	22.5 (19.0–26.0)
	2001–04	27.2 (18.9–35.5)	17.4 (7.1–27.7)		20.4 (16.2–24.6)	20.8 (17.5–24.1)
	% change	*-30%*	*-50%*		*-25%*	*-31%*
	P (trend)	*0.35*	*0.03*		*0.06*	*< 0.01*
15–24 years	1981–84	83.0 (60.6–105.5)	89.4 (46.5–132.2)		49.4 (41.8–57.0)	55.5 (48.4–62.6)
	1986–89	78.1 (56.4–99.7)	66.6 (32.5–100.6)		52.6 (44.9–60.3)	56.9 (49.8–64.0)
	1991–94	67.6 (48.7–86.5)	37.9 (16.3–59.5)		51.5 (43.8–59.2)	52.8 (46.1–59.5)
	1996–99	96.6 (73.5–119.7)	50.1 (24.8–75.4)	39.6 (17.8–61.4)	44.6 (36.9–52.2)	54.1 (47.1–61.1)
	2001–04	68.5 (50.6–86.3)	61.4 (34.5–88.4)	31.1 (14.8–47.4)	36.3 (29.4–43.2)	43.8 (37.8–49.9)
	% change	*-17%*	*-31%*		*-27%*	*-21%*
	P (trend)	*0.69*	*0.62*		*0.08*	*0.08*
25–44 years	1981–84	225 (190–260)	127 (82–171)		87.0 (79.9–94.1)	102 (95–109)
	1986–89	172 (145–199)	138 (98–178)	75.5 (30.6–120.3)	77.0 (70.8–83.3)	89.3 (83.1–95.5)
	1991–94	153 (130–177)	131 (96–167)	38.0 (19.0–57.0)	72.2 (66.5–77.9)	82.7 (77.2–88.3)
	1996–99	150 (130–170)	152 (118–185)	46.2 (30.5–62.0)	63.4 (58.1–68.6)	79.3 (74.2–84.5)
	2001–04	146 (127–164)	108 (82–133)	40.2 (27.4–53.0)	63.4 (58.0–68.8)	75.4 (70.5–80.4)
	% change	*-35%*	*-15%*		*-27%*	*-26%*
	P (trend)	*0.08*	*0.45*		*0.01*	*0.01*
45–64 years	1981–84	1323 (1196–1450)	786 (585–988)	513 (291–734)	543 (524–562)	595 (575–614)
	1986–89	1316 (1203–1429)	772 (616–927)	286 (153–420)	496 (478–514)	555 (537–573)
	1991–94	1386 (1282–1490)	600 (477–723)	304 (205–402)	434 (418–450)	508 (491–524)
	1996–99	1181 (1095–1267)	726 (610–843)	252 (186–317)	381 (367–395)	458 (443–473)
	2001–04	1066 (993–1140)	717 (620–814)	176 (135–217)	343 (330–355)	407 (394–419)
	% change	*-19%*	*-9%*	*-66%*	*-37%*	*-32%*
	P (trend)	*0.07*	*0.84*	*0.02*	*< 0.01*	*< 0.01*
65–74 years	1981–84	4762 (4177–5347)	2497 (1616–3377)	1458 (693–2223)	2164 (2101–2226)	2247 (2184–2310)
	1986–89	4112 (3632–4593)	2747 (1980–3514)	1373 (720–2027)	2006 (1949–2063)	2080 (2023–2137)
	1991–94	3701 (3287–4114)	2983 (2376–3590)	1241 (789–1694)	1764 (1713–1814)	1847 (1797–1898)
	1996–99	4203 (3844–4562)	2816 (2324–3307)	1089 (777–1401)	1535 (1489–1582)	1691 (1644–1739)
	2001–04	3838 (3537–4140)	2417 (2036–2798)	871 (673–1068)	1395 (1349–1440)	1550 (1504–1595)
	% change	*-19%*	*-3%*	*-40%*	*-36%*	*-31%*
	P (trend)	*0.30*	*0.42*	*< 0.01*	*< 0.01*	*< 0.01*

* ie, all New Zealanders, regardless of ethnicity.

Table S3: All-cause mortality rates, by prioritised ethnicity, sex, and age group

Age group	Cohort	Prioritised Māori	Prioritised Pacific	Prioritised Asian	European/Other
Males					
1–74 years	1981–84	925 (871–978)	613 (519–707)	455 (355–555)	507 (498–515)
	1986–89	843 (798–889)	704 (624–785)	343 (269–418)	466 (458–473)
	1991–94	871 (827–915)	568 (506–630)	285 (238–333)	402 (395–409)
	1996–99	824 (789–859)	613 (560–666)	238 (204–272)	339 (333–346)
	2001–04	698 (668–727)	528 (487–569)	178 (157–198)	294 (288–300)
	% change	*-25%*	*-14%*	*-61%*	*-42%*
	P (trend)	*0.04*	*0.16*	*< 0.01*	*< 0.01*
1–14 years	1981–84	56.4 (43.5–69.2)	64.1 (38.9–89.3)		38.0 (32.4–43.6)
	1986–89	55.4 (42.8–68.0)	45.5 (24.3–66.7)		35.3 (30.0–40.6)
	1991–94	36.9 (26.3–47.5)	37.6 (20.5–54.6)	35.6 (10.8–60.3)	28.2 (23.5–32.9)
	1996–99	47.1 (36.4–57.7)	34.2 (17.6–50.9)	26.2 (6.5–45.8)	24.0 (19.6–28.3)
	2001–04	43.4 (33.3–53.5)	23.7 (12.7–34.6)		18.7 (14.9–22.5)
	% change	*-23%*	*-63%*		*-51%*
	P (trend)	*0.29*	*< 0.01*		*< 0.01*
15–24 years	1981–84	193 (159–228)	174 (96–253)		148 (136–161)
	1986–89	216 (181–251)	205 (137–272)	87.1 (22.3–151.8)	155 (142–168)
	1991–94	212 (176–249)	133 (78–189)	91.7 (39.8–143.6)	146 (132–159)
	1996–99	225 (187–263)	165 (115–215)	52.4 (25.2–79.6)	113 (100–125)
	2001–04	165 (135–195)	155 (110–199)	63.8 (39.2–88.3)	104 (92–117)
	% change	*-15%*	*-11%*		*-30%*
	P (trend)	*0.46*	*0.48*		*0.04*
25–44 years	1981–84	328 (283–373)	154 (102–206)	90.4 (34.2–146.5)	148 (139–158)
	1986–89	311 (271–352)	273 (216–331)	95.6 (43.3–147.9)	152 (142–161)
	1991–94	337 (297–376)	163 (118–208)	104 (69–139)	149 (139–158)
	1996–99	317 (282–352)	252 (203–301)	73.5 (48.0–98.9)	134 (125–143)
	2001–04	261 (232–291)	191 (153–228)	71.5 (50.0–92.9)	116 (107–124)
	% change	*-20%*	*24%*	*-21%*	*-22%*
	P (trend)	*0.14*	*0.83*	*0.13*	*0.05*
45–64 years	1981–84	2125 (1956–2295)	1144 (899–1389)	937 (646–1229)	974 (948–999)
	1986–89	1875 (1737–2013)	1403 (1183–1622)	620 (431–808)	862 (838–885)
	1991–94	1863 (1735–1992)	1216 (1042–1391)	551 (416–686)	705 (684–725)
	1996–99	1742 (1635–1849)	1253 (1095–1411)	485 (384–586)	583 (565–601)
	2001–04	1432 (1343–1520)	1040 (920–1161)	311 (254–368)	517 (500–533)
	% change	*-33%*	*-9%*	*-67%*	*-47%*
	P (trend)	*0.01*	*0.24*	*< 0.01*	*< 0.01*
65–74 years	1981–84	6144 (5457–6832)	5160 (3769–6551)	3754 (2362–5145)	4097 (4004–4191)
	1986–89	5631 (5026–6235)	5173 (4033–6314)	2932 (1842–4021)	3741 (3656–3826)
	1991–94	6138 (5554–6722)	4267 (3405–5129)	2087 (1445–2728)	3250 (3176–3324)
	1996–99	5757 (5323–6191)	4366 (3675–5057)	1820 (1365–2275)	2774 (2708–2839)
	2001–04	5143 (4771–5515)	4041 (3501–4582)	1390 (1125–1654)	2356 (2295–2418)
	% change	*-16%*	*-22%*	*-63%*	*-42%*
	P (trend)	*0.12*	*0.04*	*< 0.01*	*< 0.01*

Age group	Cohort	Prioritised Māori	Prioritised Pacific	Prioritised Asian	European/Other
Females					
1–74 years	1981–84	626 (584–669)	364 (298–430)	206 (143–270)	273 (267–279)
	1986–89	572 (536–608)	375 (321–430)	164 (116–212)	251 (246–257)
	1991–94	559 (526–591)	342 (298–385)	150 (117–183)	223 (218–228)
	1996–99	541 (514–568)	360 (323–397)	136 (113–158)	195 (190–199)
	2001–04	489 (466–512)	327 (297–357)	105 (90–120)	178 (174–183)
	% change	*-22%*	*-10%*	*-49%*	*-35%*
	P (trend)	*< 0.01*	*0.14*	*< 0.01*	*< 0.01*
1–14 years	1981–84	39.9 (29.0–50.8)	34.4 (14.8–53.9)		27.3 (22.5–32.1)
	1986–89	31.1 (21.2–41.1)	41.4 (20.9–61.9)		24.5 (20.1–28.9)
	1991–94	32.3 (22.9–41.8)	35.0 (18.3–51.7)		21.2 (16.9–25.4)
	1996–99	35.1 (25.8–44.4)	25.5 (10.2–40.7)		18.1 (14.2–22.0)
	2001–04	25.8 (18.2–33.4)	17.0 (6.9–27.0)		20.4 (16.2–24.6)
	% change	*-35%*	*-51%*		*-25%*
	P (trend)	*0.14*	*0.03*		*0.06*
15–24 years	1981–84	81.9 (59.8–104.1)	88.9 (46.3–131.5)		49.4 (41.8–57.0)
	1986–89	79.3 (57.8–100.9)	64.9 (31.7–98.0)		52.6 (44.9–60.3)
	1991–94	68.7 (50.0–87.3)	37.1 (16.0–58.3)		51.5 (43.8–59.2)
	1996–99	91.9 (70.2–113.6)	47.7 (23.6–71.9)	39.6 (17.8–61.4)	44.6 (36.9–52.2)
	2001–04	67.3 (50.3–84.2)	59.9 (33.6–86.2)	31.1 (14.8–47.4)	36.3 (29.4–43.2)
	% change	*-18%*	*-33%*		*-27%*
	P (trend)	*0.56*	*0.61*		*0.08*
25–44 years	1981–84	224 (189–259)	125 (81–169)	49.0 (5.9–92.0)	87.0 (79.9–94.1)
	1986–89	172 (145–198)	142 (102–183)	75.5 (30.6–120.3)	77.0 (70.8–83.3)
	1991–94	155 (132–179)	130 (95–165)	38.0 (19.0–57.0)	72.2 (66.5–77.9)
	1996–99	153 (133–173)	149 (116–181)	46.2 (30.5–62.0)	63.4 (58.1–68.6)
	2001–04	145 (127–164)	109 (83–134)	40.2 (27.4–53.0)	63.4 (58.0–68.8)
	% change	*-35%*	*-13%*	*-18%*	*-27%*
	P (trend)	*0.06*	*0.43*	*0.47*	*0.01*
45–64 years	1981–84	1319 (1193–1446)	778 (579–977)	513 (291–734)	543 (524–562)
	1986–89	1318 (1205–1431)	767 (614–921)	286 (153–420)	496 (478–514)
	1991–94	1385 (1282–1489)	595 (473–717)	304 (205–402)	434 (418–450)
	1996–99	1176 (1091–1260)	718 (604–832)	252 (186–317)	381 (367–395)
	2001–04	1052 (979–1125)	717 (620–813)	176 (135–217)	343 (330–355)
	% change	*-20%*	*-8%*	*-66%*	*-37%*
	P (trend)	*0.06*	*0.88*	*0.02*	*< 0.01*
65–74 years	1981–84	4757 (4173–5341)	2566 (1674–3457)	1458 (693–2223)	2164 (2101–2226)
	1986–89	4110 (3630–4589)	2760 (1997–3524)	1373 (720–2027)	2006 (1949–2063)
	1991–94	3733 (3319–4147)	2984 (2380–3588)	1241 (789–1694)	1764 (1713–1814)
	1996–99	4136 (3784–4489)	2760 (2278–3242)	1089 (777–1401)	1535 (1489–1582)
	2001–04	3809 (3510–4108)	2388 (2011–2764)	871 (673–1068)	1395 (1349–1440)
	% change	*-20%*	*-7%*	*-40%*	*-36%*
	P (trend)	*0.22*	*0.29*	*< 0.01*	*< 0.01*

Table S4: Avoidable, amenable and non-avoidable mortality rates. by ethnicity, sex and age group

Avoidable mortality

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Males					
1–74 years	1981–84	739 (691–786)	477 (395–559)	381 (290–472)	418 (411–426)
	1986–89	675 (634–716)	565 (494–637)	277 (211–343)	379 (372–386)
	1991–94	693 (654–732)	456 (401–510)	230 (187–272)	317 (310–323)
	1996–99	652 (621–683)	483 (437–529)	217 (185–248)	259 (254–265)
	2001–04	532 (506–558)	392 (357–427)	149 (130–168)	214 (209–219)
	% change	*-28%*	*-18%*	*-61%*	*-49%*
	P (trend)	*0.04*	*0.12*	*< 0.01*	*< 0.01*
Females					
1–74 years	1981–84	513 (474–551)	268 (212–324)	184 (125–243)	220 (215–226)
	1986–89	483 (450–517)	290 (242–338)	145 (101–189)	202 (197–207)
	1991–94	458 (428–487)	269 (230–307)	132 (101–163)	174 (170–179)
	1996–99	445 (420–469)	277 (246–309)	106 (86–125)	149 (145–153)
	2001–04	390 (369–411)	243 (217–269)	79.7 (67.0–92.5)	129 (126–133)
	% change	*-24%*	*-9%*	*-57%*	*-41%*
	P (trend)	*< 0.01*	*0.18*	*< 0.01*	*< 0.01*

Amenable mortality

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Males					
1–74 years	1981–84	233 (207–260)	139 (92–186)	111 (61–161)	152 (147–156)
	1986–89	207 (183–230)	178 (136–220)	96.4 (56.0–136.7)	130 (127–134)
	1991–94	219 (196–242)	135 (105–165)	76.3 (50.9–101.7)	106 (103–109)
	1996–99	201 (183–218)	158 (131–185)	73.8 (54.7–92.9)	85.7 (82.7–88.6)
	2001–04	166 (151–180)	131 (111–151)	50.9 (39.9–61.9)	70.6 (67.9–73.3)
	% change	*-29%*	*-6%*	*-54%*	*-53%*
	P (trend)	*0.04*	*0.44*	*< 0.01*	*< 0.01*
Females					
1–74 years	1981–84	185 (162–207)	98.0 (64.2–131.7)	68.6 (32.8–104.5)	97.8 (94.4–101.3)
	1986–89	177 (157–198)	111 (82–140)	52.0 (25.5–78.5)	90.1 (86.9–93.3)
	1991–94	168 (150–186)	101 (78–125)	47.3 (29.2–65.5)	76.7 (73.9–79.5)
	1996–99	163 (148–178)	108 (88–128)	40.1 (28.0–52.3)	66.1 (63.6–68.6)
	2001–04	141 (129–154)	110 (93–127)	31.8 (23.9–39.7)	60.5 (58.1–63.0)
	% change	*-24%*	*12%*	*-54%*	*-38%*
	P (trend)	*0.01*	*0.25*	*< 0.01*	*< 0.01*

Non-avoidable mortality

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Males					
1–74 years	1981–84	186 (161–211)	137 (92–183)	65.3 (28.4–102.2)	88.5 (84.9–92.0)
	1986–89	169 (148–190)	142 (107–177)	66.5 (36.6–96.3)	86.2 (82.8–89.5)
	1991–94	178 (159–198)	110 (83–138)	52.8 (33.4–72.1)	85.4 (82.2–88.6)
	1996–99	172 (156–188)	143 (118–168)	38.3 (25.4–51.3)	80.1 (77.0–83.1)
	2001–04	166 (151–180)	135 (114–156)	38.5 (29.4–47.7)	80.0 (77.0–83.0)
	% change	*-11%*	*-2%*	*-41%*	*-10%*
	P (trend)	*0.14*	*0.84*	*0.04*	*0.01*
Females					
1–74 years	1981–84	114 (94–133)	93.3 (59.6–127.0)		52.6 (50.0–55.3)
	1986–89	88.8 (74.7–102.8)	88.1 (62.7–113.6)	33.3 (12.5–54.1)	49.4 (46.9–51.8)
	1991–94	101 (88–115)	80.6 (60.0–101.2)	31.2 (16.4–45.9)	48.6 (46.2–50.9)
	1996–99	96.7 (85.2–108.1)	84.1 (66.7–101.6)	30.5 (20.2–40.9)	45.5 (43.3–47.7)
	2001–04	98.7 (88.4–109.1)	80.5 (66.0–95.0)	26.7 (19.4–34.0)	48.7 (46.5–51.0)
	% change	*-13%*	*-14%*		*-7%*
	P (trend)	*0.81*	*0.10*		*0.20*

Table S5: Cardiovascular mortality rates, by ethnicity, sex and age group

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Males					
1–74 years	1981–84	417 (380–453)	242 (183–301)	181 (116–246)	233 (228–239)
	1986–89	349 (318–380)	293 (240–345)	176 (121–231)	198 (193–203)
	1991–94	369 (339–398)	244 (204–283)	125 (92–157)	153 (149–157)
	1996–99	315 (293–337)	241 (209–274)	112 (88–136)	112 (109–116)
	2001–04	250 (233–268)	196 (171–220)	63.7 (51.2–76.3)	83.7 (80.8–86.5)
	% change	*-40%*	*-19%*	*-65%*	*-64%*
	P (trend)	*0.02*	*0.09*	*< 0.01*	*< 0.01*
25–44 years	1981–84	118 (91–146)			33.8 (29.3–38.3)
	1986–89	81.9 (60.0–103.8)	77.2 (47.8–106.6)		26.4 (22.7–30.0)
	1991–94	94.5 (74.6–114.4)	47.3 (25.3–69.2)	19.2 (4.9–33.6)	20.7 (17.7–23.8)
	1996–99	70.9 (55.1–86.7)	79.1 (55.4–102.8)	15.7 (5.2–26.2)	18.1 (15.1–21.1)
	2001–04	61.3 (47.7–74.8)	50.7 (32.4–69.0)	11.8 (4.1–19.6)	14.8 (12.1–17.6)
	% change	*-48%*			*-56%*
	P (trend)	*0.03*			*< 0.01*
45–64 years	1981–84	1004 (888–1120)	537 (376–699)	399 (204–595)	487 (469–505)
	1986–89	863 (769–958)	724 (569–879)	310 (179–440)	407 (391–423)
	1991–94	861 (774–949)	653 (530–777)	293 (196–389)	295 (282–309)
	1996–99	770 (699–842)	565 (463–668)	268 (194–342)	212 (201–223)
	2001–04	605 (548–662)	447 (370–524)	121 (84–157)	158 (149–167)
	% change	*-40%*	*-17%*	*-70%*	*-67%*
	P (trend)	*< 0.01*	*0.17*	*0.02*	*< 0.01*
65–74 years	1981–84	3113 (2633–3593)	2185 (1306–3065)	1694 (772–2615)	2220 (2152–2289)
	1986–89	2631 (2209–3053)	2143 (1405–2881)	1909 (1047–2771)	1922 (1861–1983)
	1991–94	2925 (2522–3328)	1711 (1176–2247)	1063 (605–1520)	1545 (1494–1596)
	1996–99	2441 (2156–2726)	1763 (1340–2187)	951 (620–1281)	1143 (1100–1185)
	2001–04	1910 (1683–2136)	1554 (1225–1882)	622 (444–801)	833 (796–869)
	% change	*-39%*	*-29%*	*-63%*	*-62%*
	P (trend)	*0.03*	*0.02*	*0.01*	*< 0.01*

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Females					
1–74 years	1981–84	269 (241–298)	147 (105–189)	84.3 (43.9–124.7)	103 (99–106)
	1986–89	232 (208–256)	140 (104–175)	79.4 (44.9–113.8)	82.5 (79.5–85.4)
	1991–94	204 (183–224)	134 (105–162)	52.4 (31.6–73.3)	63.4 (60.9–65.9)
	1996–99	178 (162–194)	118 (98–139)	36.3 (23.4–49.2)	44.8 (42.7–46.8)
	2001–04	147 (134–160)	91.8 (76.0–107.5)	29.9 (21.7–38.0)	36.3 (34.5–38.1)
	% change	*-45%*	*-37%*	*-65%*	*-65%*
	P (trend)	*< 0.01*	*0.01*	*< 0.01*	*< 0.01*
25–44 years	1981–84	64.3 (45.4–83.2)	35.1 (11.8–58.4)		14.9 (11.9–18.0)
	1986–89	33.6 (21.7–45.5)			8.3 (6.3–10.4)
	1991–94	35.8 (24.5–47.2)	38.6 (19.6–57.7)		8.8 (6.9–10.7)
	1996–99	29.3 (21.0–37.6)	34.7 (19.4–50.1)		8.3 (6.4–10.1)
	2001–04	27.0 (19.5–34.6)	20.5 (10.1–31.0)		6.4 (4.7–8.0)
	% change	*-58%*			*-57%*
	P (trend)	*0.11*			*0.11*
45–64 years	1981–84	547 (465–628)	332 (203–461)	246 (92–400)	174 (164–185)
	1986–89	545 (473–618)	289 (194–384)	134 (46–222)	137 (128–147)
	1991–94	501 (438–565)	214 (142–286)	76.2 (26.3–126.0)	99.9 (92.2–107.6)
	1996–99	370 (323–417)	223 (163–282)	58.2 (23.5–92.9)	70.4 (64.3–76.6)
	2001–04	316 (276–355)	214 (162–266)	48.2 (27.7–68.7)	55.2 (50.1–60.3)
	% change	*-42%*	*-36%*	*-80%*	*-68%*
	P (trend)	*< 0.01*	*0.09*	*0.07*	*< 0.01*
65–74 years	1981–84	2460 (2051–2869)	1171 (596–1746)		1120 (1075–1165)
	1986–89	1977 (1646–2308)	1331 (804–1858)	946 (411–1482)	935 (896–974)
	1991–94	1618 (1341–1896)	1391 (965–1817)	651 (321–981)	722 (690–755)
	1996–99	1671 (1447–1895)	1105 (815–1395)	421 (227–616)	497 (471–523)
	2001–04	1334 (1158–1510)	746 (545–946)	329 (204–454)	409 (385–433)
	% change	*-46%*	*-36%*		*-63%*
	P (trend)	*0.02*	*0.08*		*< 0.01*

Table S6: IHD mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Males					
1–74 years	1981–84	263 (234–291)	128 (85–171)	107 (58–155)	173 (169–178)
	1986–89	228 (203–253)	184 (142–226)	101 (61–141)	149 (145–153)
	1991–94	243 (219–266)	135 (105–164)	83.1 (56.7–109.5)	111 (107–114)
	1996–99	202 (185–220)	151 (125–177)	88.3 (66.9–109.7)	80.0 (77.2–82.8)
	2001–04	160 (145–174)	110 (91–128)	42.1 (31.9–52.2)	56.9 (54.5–59.2)
	% change	*-39%*	*-14%*	*-61%*	*-67%*
	P (trend)	*0.02*	*0.27*	*0.04*	*< 0.01*
Females					
1–74 years	1981–84	137 (116–158)	52.3 (26.9–77.7)	53.7 (21.8–85.7)	63.6 (60.9–66.2)
	1986–89	130 (112–148)	72.9 (47.1–98.7)	52.4 (24.7–80.1)	51.3 (49.0–53.6)
	1991–94	106 (91–121)	65.9 (45.1–86.8)	24.9 (10.7–39.0)	37.2 (35.3–39.0)
	1996–99	92.5 (81.2–103.9)	50.7 (37.1–64.2)	19.4 (9.7–29.2)	23.9 (22.4–25.4)
	2001–04	75.7 (66.4–84.9)	41.9 (31.0–52.9)	15.3 (9.0–21.5)	19.1 (17.8–20.4)
	% change	*-45%*	*-20%*	*-72%*	*-70%*
	P (trend)	*< 0.01*	*0.14*	*0.03*	*< 0.01*

Table S7: Stroke mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Males					
1–74 years	1981–84	50.3 (37.5–63.2)	55.8 (26.6–85.0)		31.2 (29.1–33.2)
	1986–89	38.6 (27.8–49.3)	52.8 (29.5–76.1)	42.7 (12.1–73.3)	23.8 (22.1–25.5)
	1991–94	40.5 (30.2–50.7)	43.1 (27.1–59.0)		19.1 (17.6–20.5)
	1996–99	29.5 (22.6–36.4)	33.0 (20.7–45.4)	18.2 (9.0–27.5)	13.5 (12.3–14.6)
	2001–04	21.5 (16.3–26.7)	27.3 (18.0–36.6)	12.3 (6.6–18.1)	11.2 (10.2–12.2)
	% change	*-57%*	*-51%*		*-64%*
	P (trend)	*< 0.01*	*< 0.01*		*< 0.01*
Females					
1–74 years	1981–84	60.2 (46.6–73.9)	46.3 (21.0–71.5)		24.2 (22.5–25.9)
	1986–89	39.3 (29.4–49.1)	28.3 (11.6–45.0)		18.1 (16.7–19.5)
	1991–94	42.2 (32.9–51.6)	23.6 (12.1–35.1)		15.2 (13.9–16.5)
	1996–99	29.5 (22.8–36.2)	28.2 (18.0–38.4)	9.9 (3.1–16.7)	10.6 (9.5–11.6)
	2001–04	27.7 (22.1–33.2)	19.9 (12.6–27.2)	8.9 (4.6–13.1)	9.1 (8.2–9.9)
	% change	*-54%*	*-57%*		*-62%*
	P (trend)	*0.03*	*0.12*		*< 0.01*

Table S8: All-cancer mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Males					
1–74 years	1981–84	203 (178–228)	155 (108–203)	123 (72–173)	133 (128–137)
	1986–89	200 (178–223)	165 (126–204)	65.4 (35.5–95.3)	129 (125–133)
	1991–94	222 (200–244)	136 (105–166)	55.3 (34.5–76.1)	126 (123–130)
	1996–99	218 (200–235)	175 (147–204)	58.0 (42.1–73.8)	115 (112–119)
	2001–04	203 (187–219)	134 (113–156)	57.5 (46.1–68.8)	110 (107–114)
	% change	*0%*	*-13%*	*-53%*	*-17%*
	P (trend)	*0.86*	*0.54*	*0.35*	*< 0.01*
Females					
1–74 years	1981–84	170 (148–192)	97.4 (62.9–131.8)	41.3 (15.8–66.9)	102 (98–106)
	1986–89	163 (145–182)	109 (80–137)	36.3 (15.5–57.1)	101 (98–105)
	1991–94	169 (152–186)	92.8 (71.2–114.5)	57.6 (38.0–77.2)	100 (97–104)
	1996–99	190 (174–206)	124 (102–146)	48.8 (36.5–61.1)	96.0 (92.9–99.1)
	2001–04	179 (165–193)	122 (104–141)	41.7 (32.6–50.8)	88.8 (85.9–91.7)
	% change	*5%*	*26%*	*1%*	*-13%*
	P (trend)	*0.22*	*0.16*	*0.89*	*0.03*

Table S9: Lung cancer mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Males					
1–74 years	1981–84	79.8 (63.1–96.5)	23.5 (5.4–41.7)		39.8 (37.6–42.0)
	1986–89	77.7 (62.9–92.5)	40.0 (19.5–60.4)		35.4 (33.4–37.4)
	1991–94	87.5 (73.1–101.9)	37.1 (20.5–53.7)		29.9 (28.1–31.7)
	1996–99	84.4 (73.1–95.6)	54.4 (38.3–70.5)	11.3 (4.1–18.5)	24.8 (23.2–26.3)
	2001–04	60.8 (51.9–69.8)	24.1 (14.7–33.6)	11.0 (5.8–16.2)	22.6 (21.1–24.1)
	% change	*-24%*	*3%*		*-43%*
	P (trend)	*0.26*	*0.79*		*< 0.01*
Females					
1–74 years	1981–84	50.7 (37.9–63.5)			10.9 (9.8–12.0)
	1986–89	49.9 (39.4–60.5)	16.8 (4.8–28.8)		12.6 (11.4–13.8)
	1991–94	54.4 (44.4–64.4)	10.8 (3.4–18.3)		14.0 (12.8–15.2)
	1996–99	61.9 (52.4–71.4)	18.8 (9.9–27.7)	6.0 (1.4–10.5)	14.2 (13.1–15.4)
	2001–04	62.1 (53.6–70.6)	24.2 (15.9–32.4)	6.6 (2.8–10.4)	14.6 (13.4–15.7)
	% change	*22%*			*34%*
	P (trend)	*0.02*			*0.02*

Table S10: Non-lung cancer mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Males					
1–74 years	1981–84	123 (104–143)	132 (88–175)	83.7 (43.5–123.9)	92.8 (89.3–96.3)
	1986–89	122 (105–140)	125 (92–159)	62.4 (33.1–91.7)	93.5 (90.2–96.9)
	1991–94	134 (118–151)	98.6 (72.9–124.3)	44.5 (25.9–63.1)	96.3 (93.0–99.5)
	1996–99	133 (119–147)	121 (98–144)	46.6 (32.5–60.7)	90.3 (87.2–93.4)
	2001–04	142 (129–156)	110 (91–130)	46.5 (36.4–56.6)	87.8 (84.8–90.8)
	% change	*15%*	*-16%*	*-44%*	*-5%*
	P (trend)	*0.02*	*0.55*	*0.21*	*0.21*
Females					
1–74 years	1981–84	120 (102–137)	91.2 (57.5–125.0)	41.3 (15.8–66.9)	91.1 (87.7–94.6)
	1986–89	113 (98–128)	91.8 (65.5–118.0)	26.4 (9.1–43.7)	88.8 (85.6–92.0)
	1991–94	115 (101–129)	82.0 (61.6–102.4)	45.1 (28.1–62.2)	86.3 (83.3–89.3)
	1996–99	128 (115–141)	105 (85–125)	42.8 (31.4–54.3)	81.8 (78.9–84.6)
	2001–04	117 (106–128)	98.1 (81.5–114.7)	35.0 (26.8–43.3)	74.2 (71.5–76.9)
	% change	*-2%*	*8%*	*-15%*	*-19%*
	P (trend)	*0.68*	*0.36*	*0.96*	*< 0.01*

Table S11: Colorectal cancer mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Males					
1–74 years	1981–84	13.3 (7.1–19.6)			20.4 (18.7–22.0)
	1986–89	16.0 (10.2–21.9)			20.1 (18.6–21.6)
	1991–94	20.0 (13.1–26.9)			22.3 (20.8–23.9)
	1996–99	19.7 (14.5–25.0)	19.9 (10.3–29.4)	8.2 (2.2–14.2)	20.3 (18.9–21.7)
	2001–04	21.0 (15.7–26.2)	7.1 (2.4–11.8)	5.5 (2.1–9.0)	17.4 (16.1–18.7)
	% change	*58%*			*-15%*
	P (trend)	*0.02*			*0.29*
Females					
1–74 years	1981–84	6.1 (2.3–9.8)			17.7 (16.2–19.1)
	1986–89	7.7 (3.5–11.9)			17.5 (16.1–18.8)
	1991–94	7.7 (3.8–11.6)			15.0 (13.8–16.2)
	1996–99	11.6 (7.7–15.5)	7.8 (2.3–13.3)		14.3 (13.1–15.5)
	2001–04	8.6 (5.6–11.7)	9.8 (4.6–15.0)		12.6 (11.5–13.6)
	% change	*41%*			*-29%*
	P (trend)	*0.23*			*< 0.01*

Table S12: Breast cancer mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Females					
1–74 years	1981–84	28.8 (20.4–37.1)	18.9 (4.8–33.1)		24.0 (22.2–25.7)
	1986–89	29.8 (22.4–37.2)	24.4 (13.2–35.5)		24.1 (22.4–25.8)
	1991–94	31.6 (24.5–38.8)	24.5 (14.1–35.0)		22.3 (20.7–23.8)
	1996–99	34.8 (28.4–41.3)	29.5 (19.0–40.0)	13.8 (7.6–20.0)	21.1 (19.7–22.6)
	2001–04	33.2 (27.4–39.1)	23.0 (15.3–30.7)	6.7 (3.6–9.9)	19.3 (18.0–20.7)
	% change	*15%*	*22%*		*-20%*
	P (trend)	*0.06*	*0.65*		*< 0.01*

Table S13: Prostate cancer mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Males					
1–74 years	1981–84	7.5 (1.8–13.2)			7.8 (6.9–8.8)
	1986–89	11.4 (5.5–17.3)			8.9 (7.9–9.9)
	1991–94	11.1 (6.1–16.2)			9.4 (8.4–10.3)
	1996–99	11.8 (7.5–16.1)	11.3 (3.5–19.1)		8.8 (7.9–9.7)
	2001–04	14.5 (10.0–19.1)	16.5 (8.3–24.6)		8.6 (7.7–9.5)
	% change	*93%*			*10%*
	P (trend)	*0.03*			*0.53*

Table S14: Chronic lung cancer mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Males					
1–74 years	1981–84	66.9 (52.7–81.1)	49.7 (15.8–83.6)		27.9 (26.0–29.8)
	1986–89	46.2 (34.9–57.4)	63.5 (36.5–90.5)		22.6 (20.9–24.2)
	1991–94	33.9 (24.2–43.7)	34.9 (16.5–53.4)		16.1 (14.8–17.3)
	1996–99	38.3 (30.3–46.2)	28.0 (15.7–40.3)		15.3 (14.1–16.5)
	2001–04	38.2 (31.1–45.4)	17.5 (9.5–25.4)		12.1 (11.1–13.2)
	% change	*-43%*	*-65%*		*-57%*
	P (trend)	*0.20*	*0.02*		*0.01*
Females					
1–74 years	1981–84	46.7 (35.9–57.6)	18.0 (4.8–31.1)		11.5 (10.3–12.7)
	1986–89	55.2 (43.1–67.4)	28.5 (14.7–42.3)		12.7 (11.5–13.9)
	1991–94	40.1 (31.2–49.0)	15.1 (6.2–24.0)		11.1 (10.1–12.2)
	1996–99	40.3 (32.6–48.0)	8.0 (2.7–13.3)		11.2 (10.2–12.2)
	2001–04	45.3 (38.1–52.6)	13.0 (6.9–19.0)		10.1 (9.2–11.0)
	% change	*-3%*	*-28%*		*-12%*
	P (trend)	*0.56*	*0.33*		*0.13*

Table S15: Unintentional injury mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Males					
1–74 years	1981–84	92.9 (78.1–107.7)	62.4 (39.2–85.6)	31.6 (12.6–50.6)	48.1 (45.1–51.1)
	1986–89	82.5 (71.2–93.8)	55.7 (38.7–72.6)	31.9 (15.5–48.3)	48.0 (45.1–51.0)
	1991–94	76.7 (65.5–88.0)	35.3 (23.2–47.3)	26.7 (15.4–38.1)	39.7 (37.0–42.5)
	1996–99	70.8 (61.2–80.3)	39.4 (28.4–50.4)	27.4 (16.7–38.0)	30.0 (27.6–32.5)
	2001–04	56.8 (48.8–64.8)	39.3 (29.7–48.9)	16.5 (10.4–22.7)	30.1 (27.7–32.6)
	% change	*-39%*	*-37%*	*-48%*	*-37%*
	P (trend)	*< 0.01*	*0.22*	*0.03*	*0.01*
Females					
1–74 years	1981–84	24.9 (18.7–31.1)	14.4 (2.0–26.9)		16.1 (14.4–17.9)
	1986–89	27.0 (20.6–33.4)	16.4 (8.8–24.0)		15.3 (13.7–17.0)
	1991–94	27.4 (21.2–33.6)	14.3 (7.3–21.2)	11.5 (3.0–20.0)	12.8 (11.3–14.3)
	1996–99	21.3 (16.7–25.8)	10.2 (4.9–15.5)	6.8 (2.2–11.4)	10.0 (8.6–11.3)
	2001–04	22.4 (18.1–26.8)	7.2 (3.5–11.0)	7.1 (3.4–10.9)	9.7 (8.5–11.0)
	% change	*-10%*	*-50%*		*-40%*
	P (trend)	*0.21*	*0.01*		*< 0.01*

Table S16: Road traffic injury mortality rates, by ethnicity and sex, age-standardised within the 1–74 years age group

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Males					
1–74 years	1981–84	55.3 (44.3–66.4)	39.0 (20.8–57.2)		28.2 (25.9–30.5)
	1986–89	54.5 (45.5–63.4)	35.2 (23.1–47.2)	20.2 (6.8–33.7)	30.8 (28.5–33.2)
	1991–94	46.2 (37.4–54.9)	17.6 (9.5–25.7)	18.8 (8.9–28.7)	24.8 (22.6–27.0)
	1996–99	43.8 (36.6–51.1)	23.9 (15.2–32.6)	20.8 (11.2–30.3)	17.1 (15.2–19.0)
	2001–04	31.9 (25.9–37.9)	16.0 (10.1–21.9)	8.9 (4.1–13.7)	16.9 (15.0–18.8)
	% change	*-42%*	*-59%*		*-40%*
	P (trend)	*< 0.01*	*0.11*		*0.03*
Females					
1–74 years	1981–84	19.8 (14.2–25.4)			9.9 (8.6–11.3)
	1986–89	19.7 (14.3–25.0)	11.5 (4.9–18.2)		11.2 (9.8–12.6)
	1991–94	20.8 (15.4–26.2)	9.7 (4.4–15.1)	10.6 (2.3–18.9)	9.6 (8.3–10.9)
	1996–99	15.3 (11.4–19.1)	9.0 (3.9–14.1)	5.7 (1.6–9.8)	7.2 (6.1–8.3)
	2001–04	12.5 (9.3–15.7)	4.6 (1.7–7.5)	5.5 (2.3–8.8)	6.4 (5.3–7.5)
	% change	*-37%*			*-35%*
	P (trend)	*0.04*			*0.04*

Table S17: Suicide rates, by ethnicity and sex, age-standardised within the 1–74 years age group

Age group	Cohort	Total Māori	Total Pacific	Total Asian	European/Other
Males					
1–74 years	1981–84	13.4 (8.2–18.7)	13.4 (4.1–22.8)		16.2 (14.4–18.0)
	1986–89	17.5 (11.9–23.0)	17.5 (8.7–26.4)		22.9 (20.8–24.9)
	1991–94	22.6 (16.9–28.3)	17.8 (9.0–26.5)	14.9 (4.2–25.6)	24.2 (22.1–26.4)
	1996–99	39.4 (31.7–47.1)	20.1 (12.0–28.3)	11.0 (4.1–18.0)	25.6 (23.4–27.9)
	2001–04	28.0 (22.4–33.6)	17.4 (11.3–23.4)	10.4 (5.7–15.1)	20.2 (18.2–22.2)
	% change	*109%*	*30%*		*25%*
	P (trend)	*0.08*	*0.30*		*0.40*
Females					
1–74 years	1981–84	2.9 (0.6–5.2)			6.3 (5.2–7.4)
	1986–89	4.2 (2.2–6.3)			6.6 (5.5–7.6)
	1991–94	4.3 (2.0–6.7)			6.3 (5.3–7.3)
	1996–99	10.5 (7.4–13.7)	6.2 (2.4–9.9)	6.9 (2.9–10.9)	6.5 (5.4–7.5)
	2001–04	7.9 (5.3–10.4)	4.8 (1.3–8.3)	5.8 (2.2–9.3)	6.7 (5.7–7.8)
	% change	*172%*			*6%*
	P (trend)	*0.07*			*0.27*

Table S18: All-cause mortality rates, by income group, sex and age group

Age group	Cohort	Low income	Medium income	High income	Missing income
Males					
1–74 years	1981–84	670 (648–693)	554 (528–580)	455 (432–478)	598 (574–622)
	1986–89	619 (599–638)	528 (509–547)	422 (395–448)	523 (496–550)
	1991–94	566 (550–582)	466 (446–485)	353 (330–377)	445 (420–470)
	1996–99	514 (498–529)	409 (393–426)	297 (281–314)	444 (424–464)
	2001–04	471 (456–485)	343 (328–357)	269 (255–282)	375 (359–390)
	% change	*-30%*	*-38%*	*-41%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	
1–14 years	1981–84	45.1 (37.0–53.3)	36.0 (27.5–44.6)	41.4 (26.8–56.0)	48.0 (34.7–61.3)
	1986–89	44.7 (36.9–52.6)	34.3 (25.7–42.9)	30.8 (16.1–45.5)	41.1 (29.6–52.6)
	1991–94	35.4 (28.0–42.9)	25.4 (18.0–32.7)	20.6 (11.6–29.6)	32.0 (21.8–42.3)
	1996–99	33.3 (26.6–40.0)	18.3 (11.8–24.8)	20.8 (12.8–28.7)	38.0 (25.7–50.4)
	2001–04	20.5 (15.1–26.0)	23.6 (16.6–30.7)	21.5 (14.2–28.7)	22.5 (15.0–29.9)
	% change	*-55%*	*-34%*	*-48%*	
	P (trend)	*0.01*	*0.08*	*0.14*	
15–24 years	1981–84	139 (113–165)	160 (136–185)	141 (120–161)	175 (146–203)
	1986–89	157 (131–183)	174 (152–197)	161 (139–183)	169 (140–199)
	1991–94	149 (125–173)	174 (149–199)	123 (104–143)	144 (114–173)
	1996–99	136 (113–159)	126 (103–149)	107 (87–128)	143 (117–170)
	2001–04	129 (107–151)	117 (95–140)	90.8 (73.8–107.9)	108 (87–129)
	% change	*-8%*	*-27%*	*-35%*	
	P (trend)	*0.24*	*0.10*	*0.04*	
25–44 years	1981–84	214 (190–237)	170 (151–190)	155 (134–175)	164 (140–188)
	1986–89	201 (180–222)	180 (162–198)	152 (133–170)	194 (167–220)
	1991–94	227 (205–249)	180 (161–199)	127 (112–142)	168 (143–193)
	1996–99	212 (191–233)	154 (137–172)	126 (112–139)	173 (149–197)
	2001–04	201 (180–223)	134 (118–151)	102 (91–114)	145 (126–163)
	% change	*-6%*	*-21%*	*-34%*	
	P (trend)	*0.75*	*0.09*	*< 0.01*	
45–64 years	1981–84	1456 (1373–1538)	1136 (1066–1206)	947 (887–1008)	1208 (1136–1281)
	1986–89	1290 (1221–1359)	1062 (1007–1118)	799 (749–850)	1028 (953–1103)
	1991–94	1160 (1105–1215)	875 (823–928)	678 (627–729)	862 (792–931)
	1996–99	1085 (1033–1137)	776 (729–823)	513 (479–546)	847 (788–905)
	2001–04	1006 (956–1056)	637 (596–677)	488 (459–517)	693 (649–738)
	% change	*-31%*	*-44%*	*-48%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	
65–74 years	1981–84	4893 (4674–5113)	4197 (3829–4566)	3228 (2899–3556)	4659 (4364–4954)
	1986–89	4596 (4406–4785)	3902 (3648–4155)	3178 (2752–3603)	3854 (3500–4209)
	1991–94	4037 (3888–4187)	3514 (3253–3775)	2691 (2324–3057)	3326 (3000–3651)
	1996–99	3503 (3376–3629)	3191 (2985–3397)	2349 (2100–2599)	3313 (3077–3549)
	2001–04	3160 (3042–3279)	2614 (2432–2797)	2099 (1896–2303)	2965 (2775–3155)
	% change	*-35%*	*-38%*	*-35%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	

Age group	Cohort	Low income	Medium income	High income	Missing income
Females					
1–74 years	1981–84	358 (343–372)	321 (300–342)	270 (247–294)	346 (328–364)
	1986–89	343 (330–357)	293 (279–307)	239 (219–260)	317 (296–338)
	1991–94	313 (302–324)	265 (251–280)	207 (189–225)	266 (248–285)
	1996–99	291 (281–301)	237 (225–249)	186 (172–200)	268 (253–282)
	2001–04	262 (253–272)	209 (198–220)	171 (160–181)	267 (255–280)
	% change	*-27%*	*-35%*	*-37%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	
1–14 years	1981–84	34.0 (26.6–41.3)	27.6 (20.1–35.1)	20.1 (10.7–29.4)	23.2 (14.3–32.1)
	1986–89	26.3 (20.4–32.3)	20.5 (13.7–27.2)	22.5 (11.3–33.7)	34.5 (24.0–45.0)
	1991–94	24.3 (18.2–30.4)	19.0 (12.3–25.6)	19.3 (9.1–29.5)	31.9 (21.7–42.2)
	1996–99	20.9 (15.6–26.2)	22.5 (15.3–29.8)	13.0 (7.1–19.0)	23.8 (13.8–33.8)
	2001–04	21.9 (15.9–27.8)	20.2 (13.3–27.2)	14.4 (8.4–20.4)	23.1 (14.8–31.4)
	% change	*-36%*	*-27%*	*-28%*	
	P (trend)	*0.05*	*0.33*	*0.09*	
15–24 years	1981–84	54.2 (39.5–69.0)	54.7 (41.3–68.2)	51.1 (37.8–64.4)	56.2 (39.1–73.4)
	1986–89	69.6 (53.0–86.1)	57.6 (44.8–70.5)	51.1 (37.7–64.5)	38.4 (24.5–52.3)
	1991–94	58.6 (44.8–72.4)	49.9 (37.1–62.7)	40.5 (29.3–51.6)	58.3 (41.0–75.5)
	1996–99	46.4 (34.7–58.0)	50.8 (37.3–64.3)	51.8 (38.0–65.6)	55.9 (38.9–72.8)
	2001–04	38.8 (28.0–49.5)	39.9 (27.6–52.1)	44.0 (31.6–56.4)	41.8 (29.7–53.8)
	% change	*-28%*	*-27%*	*-14%*	
	P (trend)	*0.11*	*0.06*	*0.50*	
25–44 years	1981–84	107 (92–121)	104 (89–119)	101 (83–119)	131 (110–152)
	1986–89	103 (90–115)	92.9 (80.6–105.3)	80.3 (66.4–94.1)	91.9 (75.7–108.2)
	1991–94	101 (89–112)	79.3 (67.6–91.0)	69.4 (58.2–80.5)	95.1 (79.8–110.4)
	1996–99	104 (93–115)	71.4 (61.1–81.6)	59.8 (50.6–69.1)	82.0 (68.6–95.5)
	2001–04	95.5 (84.2–106.9)	72.5 (61.8–83.3)	55.6 (47.8–63.4)	84.8 (72.9–96.7)
	% change	*-11%*	*-30%*	*-45%*	
	P (trend)	*0.15*	*0.02*	*< 0.01*	
45–64 years	1981–84	795 (741–848)	679 (621–737)	517 (469–566)	672 (620–724)
	1986–89	759 (711–807)	637 (594–679)	471 (423–518)	663 (602–724)
	1991–94	707 (669–746)	560 (518–602)	383 (347–419)	564 (508–621)
	1996–99	636 (601–672)	507 (470–544)	357 (326–387)	521 (478–564)
	2001–04	581 (548–615)	419 (387–451)	326 (301–352)	532 (495–568)
	% change	*-27%*	*-38%*	*-37%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	
65–74 years	1981–84	2599 (2458–2740)	2408 (2108–2708)	2163 (1786–2541)	2765 (2536–2995)
	1986–89	2485 (2358–2612)	2154 (1975–2334)	1874 (1562–2187)	2494 (2207–2782)
	1991–94	2182 (2083–2281)	2039 (1842–2237)	1728 (1449–2007)	1867 (1623–2110)
	1996–99	2077 (1982–2173)	1748 (1601–1894)	1489 (1268–1710)	2174 (1990–2358)
	2001–04	1833 (1748–1918)	1602 (1459–1746)	1363 (1201–1526)	2159 (2007–2311)
	% change	*-29%*	*-33%*	*-37%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	

Table S19: Avoidable, amenable and non-avoidable mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group

Avoidable

Age group	Cohort	Low income	Medium income	High income	Missing income
Males					
1–74 years	1981–84	549 (528–569)	460 (436–483)	369 (348–389)	481 (460–503)
	1986–89	502 (485–520)	428 (411–445)	325 (303–346)	433 (409–458)
	1991–94	450 (436–465)	370 (352–388)	274 (254–295)	345 (323–367)
	1996–99	399 (386–413)	317 (302–331)	221 (207–235)	351 (333–369)
	2001–04	355 (342–367)	251 (238–264)	187 (176–199)	284 (270–297)
	% change	*-35%*	*-45%*	*-49%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	
Females					
1–74 years	1981–84	287 (274–300)	267 (247–287)	214 (195–233)	273 (257–289)
	1986–89	279 (268–291)	236 (224–249)	195 (176–213)	260 (241–280)
	1991–94	247 (238–257)	207 (194–220)	167 (150–183)	214 (197–231)
	1996–99	228 (219–237)	184 (174–195)	143 (130–155)	208 (195–221)
	2001–04	198 (189–206)	153 (143–163)	123 (114–133)	206 (195–216)
	% change	*-31%*	*-43%*	*-42%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	

Amenable

Age group	Cohort	Low income	Medium income	High income	Missing income
Males					
1–74 years	1981–84	190 (179–202)	157 (144–170)	125 (113–137)	170 (157–182)
	1986–89	173 (163–183)	140 (130–150)	108 (95–121)	140 (126–154)
	1991–94	147 (140–155)	120 (110–131)	90.9 (77.8–104.1)	111 (99–124)
	1996–99	131 (124–138)	103 (94–111)	70.0 (61.5–78.4)	111 (101–121)
	2001–04	109 (103–116)	78.7 (71.9–85.5)	67.1 (60.1–74.1)	94.6 (86.9–102.3)
	% change	*-43%*	*-50%*	*-46%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	
Females					
1–74 years	1981–84	118 (110–126)	111 (99–123)	87.8 (76.6–98.9)	115 (105–125)
	1986–89	118 (110–125)	97.7 (90.1–105.2)	86.0 (73.5–98.5)	107 (95–120)
	1991–94	99.8 (94.0–105.6)	91.0 (82.5–99.6)	68.1 (58.6–77.5)	78.3 (68.2–88.5)
	1996–99	92.4 (86.9–97.8)	79.5 (72.8–86.3)	61.4 (53.4–69.4)	86.8 (78.6–95.0)
	2001–04	80.8 (75.7–85.9)	68.1 (61.9–74.4)	56.3 (50.4–62.3)	89.3 (82.3–96.2)
	% change	*-32%*	*-39%*	*-36%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	

Non-avoidable

Age group	Cohort	Low income	Medium income	High income	Missing income
Males					
1–74 years	1981–84	122 (112–132)	94.2 (83.0–105.4)	86.6 (76.2–97.0)	116 (105–128)
	1986–89	117 (108–125)	100 (92–109)	97.2 (81.9–112.5)	89.9 (78.7–101.0)
	1991–94	115 (108–123)	95.6 (87.4–103.7)	79.0 (67.2–90.8)	100 (88–112)
	1996–99	114 (107–121)	92.6 (85.0–100.2)	76.3 (67.9–84.7)	93.1 (84.1–102.2)
	2001–04	116 (109–123)	91.5 (84.0–99.0)	81.3 (74.2–88.5)	91.1 (83.4–98.7)
	% change	*-5%*	*-3%*	*-6%*	
	P (trend)	*0.18*	*0.16*	*0.32*	
Females					
1–74 years	1981–84	70.1 (63.4–76.9)	53.8 (46.8–60.9)	56.5 (42.2–70.9)	73.0 (63.9–82.2)
	1986–89	63.9 (58.3–69.6)	57.0 (50.9–63.1)	44.7 (35.4–54.1)	57.0 (48.3–65.7)
	1991–94	65.8 (61.0–70.6)	58.1 (51.6–64.5)	40.5 (34.0–47.1)	52.8 (44.6–61.1)
	1996–99	62.8 (58.2–67.4)	52.9 (47.3–58.4)	43.3 (36.2–50.5)	59.8 (53.0–66.6)
	2001–04	64.7 (60.1–69.3)	55.8 (50.4–61.2)	47.2 (41.4–53.0)	61.6 (55.8–67.5)
	% change	*-8%*	*4%*	*-16%*	
	P (trend)	*0.29*	*0.88*	*0.99*	

Table S20: Cardiovascular mortality rates, by income group, sex and age group

Age group	Cohort	Low income	Medium income	High income	Missing income
Males					
1–74 years	1981–84	303 (289–318)	255 (238–273)	203 (187–219)	269 (253–285)
	1986–89	259 (247–272)	224 (211–236)	178 (160–197)	227 (209–246)
	1991–94	220 (211–230)	192 (179–206)	143 (127–159)	171 (156–186)
	1996–99	182 (173–190)	149 (139–159)	100 (90–111)	149 (138–161)
	2001–04	144 (137–152)	101 (94–109)	78.4 (70.8–86.0)	127 (118–136)
	% change	*-52%*	*-60%*	*-61%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	
25–44 years	1981–84	51.0 (39.6–62.3)	42.7 (33.6–51.9)	39.5 (28.0–51.1)	50.8 (37.0–64.6)
	1986–89	35.9 (27.1–44.7)	40.6 (32.4–48.9)	24.8 (17.1–32.4)	42.0 (29.9–54.0)
	1991–94	39.4 (31.4–47.4)	34.6 (26.7–42.5)	26.6 (18.8–34.4)	30.1 (20.5–39.7)
	1996–99	35.9 (27.9–44.0)	28.4 (21.3–35.4)	21.1 (15.4–26.8)	29.1 (20.6–37.7)
	2001–04	26.2 (19.3–33.2)	23.6 (16.8–30.3)	20.0 (14.8–25.2)	27.4 (20.0–34.8)
	% change	*-49%*	*-45%*	*-49%*	
	P (trend)	*0.05*	*< 0.01*	*0.07*	
45–64 years	1981–84	702 (646–759)	573 (524–623)	455 (416–495)	579 (529–628)
	1986–89	593 (546–640)	508 (469–547)	390 (354–426)	498 (446–550)
	1991–94	499 (464–535)	399 (363–435)	285 (251–319)	414 (366–462)
	1996–99	439 (405–472)	313 (282–343)	197 (176–219)	334 (297–371)
	2001–04	338 (310–367)	219 (195–242)	165 (147–182)	267 (240–294)
	% change	*-52%*	*-62%*	*-64%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	
65–74 years	1981–84	2585 (2431–2738)	2238 (1986–2490)	1749 (1511–1988)	2426 (2216–2635)
	1986–89	2281 (2151–2410)	1927 (1759–2096)	1636 (1323–1949)	2024 (1766–2281)
	1991–94	1905 (1803–2006)	1796 (1595–1996)	1366 (1103–1629)	1378 (1176–1580)
	1996–99	1459 (1378–1541)	1364 (1226–1501)	968 (803–1134)	1284 (1137–1431)
	2001–04	1189 (1115–1262)	884 (777–991)	679 (560–797)	1148 (1031–1266)
	% change	*-54%*	*-60%*	*-61%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	

Age group	Cohort	Low income	Medium income	High income	Missing income
Females					
1–74 years	1981–84	141 (132–149)	118 (105–132)	98.2 (82.7–113.8)	146 (134–158)
	1986–89	123 (115–131)	99.3 (90.6–108.0)	83.3 (68.4–98.1)	110 (98–123)
	1991–94	101 (95–107)	82.1 (73.2–91.1)	59.7 (48.2–71.1)	80.4 (69.5–91.4)
	1996–99	78.1 (72.9–83.2)	63.3 (56.8–69.8)	44.3 (36.5–52.1)	77.6 (69.7–85.4)
	2001–04	64.0 (59.5–68.4)	48.4 (42.7–54.0)	38.5 (32.4–44.5)	67.4 (61.4–73.5)
	% change	*-54%*	*-59%*	*-61%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	
25–44 years	1981–84	21.7 (14.7–28.6)	25.9 (18.1–33.8)	16.6 (9.5–23.7)	27.8 (18.1–37.4)
	1986–89	14.2 (9.4–19.0)	11.9 (7.6–16.3)	9.1 (3.7–14.5)	12.9 (7.2–18.7)
	1991–94	17.3 (12.4–22.1)	12.7 (8.1–17.3)	13.7 (7.7–19.7)	13.0 (7.2–18.7)
	1996–99	14.9 (10.9–18.9)	10.5 (6.6–14.5)	9.4 (5.3–13.6)	16.4 (10.5–22.4)
	2001–04	11.9 (8.2–15.5)	6.9 (3.7–10.0)	5.2 (3.1–7.4)	12.7 (8.4–17.0)
	% change	*-45%*	*-73%*	*-69%*	
	P (trend)	*0.12*	*0.08*	*0.05*	
45–64 years	1981–84	278 (247–309)	229 (193–266)	180 (149–211)	265 (232–299)
	1986–89	256 (228–284)	202 (176–227)	131 (103–159)	226 (190–262)
	1991–94	214 (192–235)	149 (125–172)	82.5 (64.5–100.5)	172 (139–204)
	1996–99	163 (145–181)	122 (103–141)	62.8 (48.6–77.1)	127 (106–148)
	2001–04	140 (123–157)	91.5 (76.1–106.9)	56.8 (45.1–68.6)	117 (100–134)
	% change	*-50%*	*-60%*	*-68%*	
	P (trend)	*< 0.01*	*< 0.01*	*0.03*	
65–74 years	1981–84	1364 (1267–1461)	1132 (934–1330)	1014 (758–1270)	1485 (1318–1652)
	1986–89	1195 (1108–1281)	970 (847–1094)	977 (729–1225)	1073 (884–1262)
	1991–94	927 (861–993)	857 (722–991)	697 (502–892)	745 (589–900)
	1996–99	716 (658–774)	629 (538–721)	510 (380–640)	829 (715–943)
	2001–04	572 (524–619)	488 (405–571)	448 (349–548)	704 (618–789)
	% change	*-58%*	*-57%*	*-56%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	

Table S21: IHD mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group

Age group	Cohort	Low income	Medium income	High income	Missing income
Males					
1–74 years	1981–84	208 (196–220)	185 (172–199)	147 (135–159)	185 (172–197)
	1986–89	186 (176–196)	163 (153–174)	124 (110–137)	161 (146–176)
	1991–94	155 (147–163)	135 (123–146)	100 (88–113)	116 (104–129)
	1996–99	124 (117–131)	100 (92–108)	69.4 (61.5–77.2)	98.6 (89.3–107.8)
	2001–04	93.2 (87.3–99.2)	68.1 (61.7–74.4)	51.7 (45.7–57.7)	83.4 (76.2–90.6)
	% change	*-55%*	*-63%*	*-65%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	
Females					
1–74 years	1981–84	78.7 (72.7–84.6)	69.6 (59.0–80.2)	52.2 (42.1–62.3)	86.2 (77.4–94.9)
	1986–89	72.8 (67.3–78.3)	59.0 (52.3–65.6)	52.0 (39.5–64.5)	63.7 (53.9–73.4)
	1991–94	56.8 (52.5–61.1)	45.3 (38.4–52.2)	29.8 (21.8–37.8)	42.1 (34.2–50.0)
	1996–99	40.8 (37.2–44.4)	32.8 (28.2–37.4)	23.3 (17.5–29.1)	40.2 (34.5–45.8)
	2001–04	34.8 (31.5–38.0)	22.4 (18.7–26.2)	18.5 (14.1–22.8)	35.1 (30.7–39.5)
	% change	*-56%*	*-68%*	*-65%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	

Table S22: Stroke mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group

Age group	Cohort	Low income	Medium income	High income	Missing income
Males					
1–74 years	1981–84	43.3 (37.9–48.7)	30.9 (24.7–37.0)	23.2 (18.4–28.0)	43.1 (36.2–49.9)
	1986–89	33.6 (29.0–38.1)	24.6 (20.4–28.8)	23.4 (15.0–31.8)	30.9 (23.5–38.3)
	1991–94	26.9 (23.5–30.2)	26.9 (21.4–32.3)	16.3 (9.4–23.1)	18.8 (14.0–23.6)
	1996–99	20.8 (17.9–23.6)	17.0 (13.5–20.5)	11.4 (7.3–15.6)	20.8 (16.5–25.1)
	2001–04	16.6 (14.1–19.1)	12.5 (9.8–15.1)	9.2 (6.7–11.8)	16.3 (13.2–19.4)
	% change	*-62%*	*-60%*	*-60%*	
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*	
Females					
1–74 years	1981–84	32.0 (27.6–36.5)	28.8 (22.1–35.6)	33.0 (23.5–42.4)	29.5 (24.0–35.1)
	1986–89	25.3 (21.7–28.9)	19.0 (15.5–22.5)	15.4 (12.1–18.8)	24.5 (18.3–30.8)
	1991–94	20.7 (17.9–23.5)	20.8 (16.5–25.0)	18.2 (10.8–25.5)	20.1 (14.5–25.7)
	1996–99	17.0 (14.6–19.5)	13.3 (10.5–16.1)	7.1 (5.1–9.0)	15.8 (12.1–19.5)
	2001–04	13.1 (11.1–15.1)	13.4 (10.3–16.5)	8.4 (6.1–10.8)	15.5 (12.6–18.4)
	% change	*-59%*	*-53%*	*-75%*	
	P (trend)	*< 0.01*	*0.06*	*0.13*	

Table S23: All-cancer mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group

Age group	Cohort	Low income	Medium income	High income	Missing income
Males					
1–74 years	1981–84	162 (151–173)	141 (129–153)	127 (113–140)	148 (136–159)
	1986–89	162 (152–171)	144 (134–154)	114 (100–127)	128 (115–141)
	1991–94	158 (150–166)	132 (123–141)	113 (101–124)	123 (110–136)
	1996–99	153 (145–160)	130 (121–139)	102 (92–111)	137 (126–148)
	2001–04	152 (144–160)	123 (115–132)	105 (97–114)	113 (105–121)
	% change	*-6%*	*-13%*	*-17%*	
	P (trend)	*0.01*	*0.02*	*0.06*	
Females					
1–74 years	1981–84	115 (107–123)	121 (109–133)	102 (90–113)	108 (98–118)
	1986–89	116 (109–124)	115 (107–123)	91.6 (83.0–100.2)	117 (104–129)
	1991–94	117 (111–124)	110 (101–118)	94.3 (84.8–103.9)	94.7 (84.1–105.2)
	1996–99	123 (117–129)	109 (102–117)	91.8 (82.4–101.1)	107 (98–116)
	2001–04	108 (102–114)	96.5 (89.3–103.7)	85.0 (78.2–91.8)	116 (108–124)
	% change	*-6%*	*-20%*	*-17%*	
	P (trend)	*0.60*	*0.02*	*0.05*	

Table S24: Lung cancer mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group

Age group	Cohort	Low income	Medium income	High income	Missing income
Males					
1–74 years	1981–84	53.8 (47.5–60.1)	43.9 (37.0–50.8)	37.2 (29.3–45.2)	45.3 (38.9–51.7)
	1986–89	51.1 (45.7–56.4)	42.7 (36.7–48.7)	25.0 (20.2–29.9)	38.5 (30.9–46.0)
	1991–94	47.3 (42.9–51.8)	34.3 (28.6–40.0)	23.0 (18.1–27.9)	34.2 (26.8–41.5)
	1996–99	43.0 (38.9–47.0)	34.7 (29.7–39.7)	19.4 (14.8–24.0)	38.5 (32.6–44.3)
	2001–04	38.5 (34.7–42.3)	28.3 (23.9–32.6)	16.1 (12.8–19.3)	27.3 (23.2–31.5)
	% change	*-28%*	*-36%*	*-57%*	
	P (trend)	*< 0.01*	*0.01*	*0.02*	
Females					
1–74 years	1981–84	16.6 (13.2–20.0)	18.0 (12.3–23.7)	15.9 (9.6–22.2)	17.1 (12.9–21.3)
	1986–89	19.3 (16.2–22.4)	19.8 (15.6–24.0)	12.0 (8.9–15.1)	22.9 (17.1–28.7)
	1991–94	22.9 (20.0–25.8)	19.3 (14.7–23.8)	14.2 (8.5–19.9)	17.8 (12.9–22.7)
	1996–99	26.6 (23.6–29.6)	18.3 (14.7–22.0)	12.2 (8.5–15.8)	18.5 (14.6–22.5)
	2001–04	24.0 (21.3–26.8)	19.6 (16.0–23.2)	14.2 (11.3–17.1)	25.6 (21.8–29.5)
	% change	*45%*	*9%*	*-11%*	
	P (trend)	*0.06*	*0.77*	*0.71*	

Table S25: Non-lung cancer mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group

Age group	Cohort	Low income	Medium income	High income	Missing income
Males					
1–74 years	1981–84	108 (99–117)	96.9 (87.0–106.8)	89.3 (78.3–100.2)	102 (93–112)
	1986–89	111 (103–118)	102 (94–110)	88.5 (75.5–101.4)	89.2 (78.5–100.0)
	1991–94	111 (104–118)	97.4 (90.3–104.5)	89.7 (79.4–100.0)	88.8 (78.0–99.6)
	1996–99	110 (103–116)	95.5 (88.2–102.8)	82.3 (74.2–90.4)	98.5 (89.4–107.6)
	2001–04	113 (107–120)	94.9 (87.8–102.1)	89.2 (81.5–97.0)	85.6 (78.3–92.9)
	% change	*5%*	*-2%*	*-0%*	
	P (trend)	*0.21*	*0.19*	*0.71*	
Females					
1–74 years	1981–84	98.1 (90.7–105.4)	103 (92–113)	85.9 (76.1–95.7)	90.7 (81.7–99.7)
	1986–89	97.0 (90.2–103.8)	94.8 (87.9–101.7)	79.6 (71.6–87.7)	93.8 (83.0–104.6)
	1991–94	94.5 (89.0–100.0)	90.3 (83.2–97.3)	80.1 (72.4–87.8)	76.9 (67.5–86.3)
	1996–99	96.4 (90.8–101.9)	91.1 (84.4–97.8)	79.6 (71.0–88.2)	88.1 (80.0–96.2)
	2001–04	83.7 (78.6–88.8)	76.9 (70.7–83.1)	70.8 (64.6–76.9)	90.8 (83.8–97.8)
	% change	*-15%*	*-25%*	*-18%*	
	P (trend)	*0.11*	*0.03*	*0.04*	

Table S26: Colorectal cancer mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group

Age group	Cohort	Low income	Medium income	High income	Missing income
Males					
1–74 years	1981–84	20.3 (16.9–23.8)	19.0 (15.5–22.5)	19.1 (13.5–24.8)	14.4 (11.2–17.7)
	1986–89	20.1 (16.9–23.3)	21.1 (18.0–24.2)	16.1 (13.3–18.9)	15.8 (11.3–20.4)
	1991–94	22.6 (19.8–25.5)	19.1 (16.2–21.9)	20.9 (16.9–24.9)	16.4 (12.1–20.7)
	1996–99	23.6 (20.7–26.4)	20.8 (17.5–24.1)	16.8 (13.0–20.5)	18.9 (15.0–22.9)
	2001–04	19.9 (17.3–22.5)	14.5 (11.8–17.2)	16.9 (13.5–20.3)	16.6 (13.4–19.8)
	% change	*-2%*	*-24%*	*-12%*	
	P (trend)	*0.84*	*0.23*	*0.89*	
Females					
1–74 years	1981–84	16.7 (14.1–19.4)	13.9 (11.2–16.5)	15.6 (12.4–18.9)	13.1 (10.3–15.9)
	1986–89	15.3 (12.9–17.8)	16.8 (14.4–19.1)	15.4 (12.0–18.8)	15.0 (10.7–19.3)
	1991–94	13.4 (11.5–15.3)	14.5 (11.9–17.1)	12.8 (10.5–15.0)	8.9 (5.7–12.2)
	1996–99	13.5 (11.6–15.4)	13.9 (11.4–16.4)	12.9 (10.0–15.9)	14.5 (11.2–17.8)
	2001–04	11.2 (9.6–12.8)	10.5 (8.6–12.5)	10.4 (8.2–12.6)	13.1 (10.4–15.8)
	% change	*-33%*	*-24%*	*-33%*	
	P (trend)	*< 0.01*	*0.13*	*0.01*	

Table S27: Breast cancer mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group

Age group	Cohort	Low income	Medium income	High income	Missing income
Females					
1–74 years	1981–84	25.1 (21.0–29.2)	29.3 (24.6–34.1)	19.8 (16.9–22.7)	20.1 (16.3–24.0)
	1986–89	27.0 (23.3–30.7)	24.6 (21.3–27.8)	24.6 (19.4–29.7)	25.1 (19.7–30.4)
	1991–94	23.4 (20.5–26.3)	24.9 (21.2–28.5)	23.9 (19.6–28.2)	19.2 (14.9–23.5)
	1996–99	25.9 (22.9–28.9)	25.8 (22.2–29.4)	22.0 (18.1–26.0)	20.1 (16.3–23.9)
	2001–04	22.1 (19.4–24.8)	20.3 (17.1–23.6)	19.2 (16.4–22.0)	23.6 (20.1–27.1)
	% change	*-12%*	*-31%*	*-3%*	
	P (trend)	*0.29*	*0.11*	*0.75*	

Table S28: Prostate cancer mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group

Age group	Cohort	Low income	Medium income	High income	Missing income
Males					
1–74 years	1981–84	10.3 (7.1–13.5)	4.3 (2.9–5.7)	6.6 (4.3–8.9)	9.9 (6.6–13.2)
	1986–89	11.1 (8.8–13.4)	8.1 (6.0–10.2)	13.8 (5.1–22.5)	6.8 (3.8–9.9)
	1991–94	12.0 (9.9–14.0)	8.9 (6.9–11.0)	7.1 (4.3–9.9)	7.0 (3.9–10.1)
	1996–99	8.6 (7.1–10.1)	10.5 (8.0–13.0)	11.2 (7.4–15.1)	7.5 (4.9–10.0)
	2001–04	10.1 (8.3–11.8)	9.0 (6.7–11.4)	10.6 (7.6–13.6)	8.5 (6.2–10.8)
	% change	*-2%*	*109%*	*61%*	
	P (trend)	*0.45*	*0.06*	*0.14*	

Table S29: Chronic lung disease mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group

Age group	Cohort	Low income	Medium income	High income	Missing income
Males					
1–74 years	1981–84	42.7 (37.2–48.2)	31.0 (22.5–39.4)	22.3 (17.4–27.2)	40.4 (33.8–46.9)
	1986–89	39.7 (34.7–44.7)	23.4 (18.5–28.2)	15.4 (10.2–20.6)	27.0 (20.7–33.3)
	1991–94	26.2 (22.8–29.6)	14.7 (11.6–17.8)	10.5 (3.2–17.9)	20.8 (14.9–26.7)
	1996–99	25.6 (22.6–28.6)	16.7 (13.2–20.2)	8.2 (4.8–11.7)	22.1 (17.7–26.6)
	2001–04	23.5 (20.7–26.3)	11.7 (8.9–14.5)	7.9 (4.9–11.0)	18.2 (14.8–21.6)
	% change	*-45%*	*-62%*	*-65%*	
	P (trend)	*0.04*	*0.07*	*0.02*	
Females					
1–74 years	1981–84	18.0 (14.9–21.2)	17.8 (12.4–23.3)	11.3 (6.1–16.5)	20.8 (16.5–25.0)
	1986–89	23.8 (20.1–27.6)	15.5 (12.1–18.8)	12.1 (6.0–18.3)	23.9 (17.8–29.9)
	1991–94	20.2 (17.6–22.9)	12.5 (9.1–16.0)	6.8 (3.4–10.1)	13.7 (9.2–18.3)
	1996–99	17.9 (15.7–20.2)	12.4 (9.5–15.3)	7.9 (4.8–10.9)	17.1 (13.4–20.8)
	2001–04	20.1 (17.6–22.6)	11.2 (8.5–13.9)	6.8 (4.3–9.3)	18.6 (15.4–21.9)
	% change	*12%*	*-37%*	*-40%*	
	P (trend)	*0.88*	*0.02*	*0.13*	

Table S30: Unintentional injury mortality rates, by income group, sex and age group

Age group	Cohort	Low income	Medium income	High income	Missing income
Males					
1–74 years	1981–84	58.1 (51.1–65.1)	51.4 (45.1–57.6)	51.2 (44.3–58.1)	58.2 (50.5–65.9)
	1986–89	54.9 (48.6–61.3)	52.9 (47.5–58.3)	45.9 (40.2–51.7)	58.7 (50.7–66.7)
	1991–94	48.9 (43.2–54.6)	50.1 (44.4–55.9)	30.6 (25.5–35.6)	49.9 (41.9–57.9)
	1996–99	41.5 (36.2–46.7)	34.5 (29.5–39.5)	29.6 (25.0–34.1)	39.9 (33.5–46.3)
	2001–04	42.5 (37.1–47.9)	34.2 (29.1–39.4)	26.0 (22.4–29.6)	36.1 (30.8–41.3)
	% change	*-27%*	*-33%*	*-49%*	
	P (trend)	*0.01*	*0.04*	*0.02*	
1–14 years	1981–84	23.6 (17.6–29.6)	14.4 (9.0–19.8)	22.8 (12.1–33.5)	21.3 (12.6–29.9)
	1986–89	20.0 (14.8–25.3)	17.8 (11.6–24.0)		16.4 (9.1–23.7)
	1991–94	15.4 (10.4–20.5)	10.9 (6.1–15.7)	7.8 (2.5–13.0)	16.6 (9.2–24.0)
	1996–99	15.5 (10.8–20.3)	9.2 (4.6–13.8)	7.5 (2.7–12.3)	18.8 (10.2–27.3)
	2001–04	10.6 (6.8–14.4)	8.5 (4.4–12.6)	7.4 (3.4–11.3)	10.3 (5.3–15.2)
	% change	*-55%*	*-41%*		
	P (trend)	*< 0.01*	*0.06*		
15–24 years	1981–84	84.6 (64.7–104.5)	99.9 (81.3–118.6)	103 (85–120)	113 (91–136)
	1986–89	99.0 (78.3–119.7)	105 (88–122)	101 (83–119)	111 (87–135)
	1991–94	82.3 (64.6–100.0)	96.9 (78.9–114.9)	67.6 (53.9–81.3)	70.7 (51.0–90.5)
	1996–99	60.3 (45.0–75.6)	54.7 (39.4–70.0)	47.9 (34.2–61.6)	65.2 (46.5–83.9)
	2001–04	56.9 (42.2–71.7)	65.8 (48.6–82.9)	37.4 (26.4–48.4)	49.7 (34.7–64.7)
	% change	*-33%*	*-34%*	*-64%*	
	P (trend)	*0.06*	*0.08*	*< 0.01*	

Age group	Cohort	Low income	Medium income	High income	Missing income
25–44 years	1981–84	67.1 (53.9–80.3)	49.0 (37.8–60.3)	51.2 (39.0–63.3)	46.7 (33.9–59.5)
	1986–89	66.2 (53.9–78.5)	58.8 (48.3–69.4)	50.9 (39.6–62.1)	71.0 (54.4–87.5)
	1991–94	66.3 (53.8–78.8)	65.4 (53.3–77.5)	27.4 (20.7–34.1)	57.4 (42.5–72.4)
	1996–99	51.1 (39.4–62.8)	47.8 (37.3–58.3)	39.5 (31.4–47.7)	35.5 (23.7–47.3)
	2001–04	57.7 (45.1–70.4)	34.2 (25.2–43.2)	26.8 (20.8–32.9)	44.3 (33.0–55.5)
	% change	*-14%*	*-30%*	*-48%*	
	P (trend)	*0.14*	*0.24*	*0.19*	
45–64 years	1981–84	51.2 (35.3–67.1)	65.1 (47.1–83.1)	37.6 (24.6–50.6)	63.4 (44.2–82.6)
	1986–89	44.7 (30.1–59.3)	46.4 (34.4–58.4)	44.8 (31.8–57.9)	52.5 (34.7–70.3)
	1991–94	37.7 (26.5–48.9)	37.7 (25.7–49.7)	27.1 (14.8–39.3)	43.5 (27.2–59.9)
	1996–99	42.9 (31.8–54.1)	29.2 (19.9–38.5)	22.2 (15.9–28.5)	48.2 (33.6–62.9)
	2001–04	45.4 (33.9–57.0)	32.5 (22.8–42.1)	34.3 (26.6–42.0)	40.5 (29.3–51.7)
	% change	*-11%*	*-50%*	*-9%*	
	P (trend)	*0.69*	*0.06*	*0.52*	
65–74 years	1981–84	110 (61–159)	28.9 (12.5–45.3)	71.0 (14.7–127.3)	99.3 (51.1–147.5)
	1986–89	51.7 (26.6–76.8)	40.5 (19.3–61.7)	27.4 (10.3–44.5)	
	1991–94	42.4 (28.0–56.9)	44.4 (21.8–67.1)	49.3 (0.7–97.9)	120 (47–193)
	1996–99	41.9 (29.0–54.8)	32.3 (5.5–59.1)	45.7 (3.0–88.4)	51.2 (17.8–84.5)
	2001–04	47.8 (33.1–62.5)	60.2 (21.3–99.1)	40.4 (13.3–67.5)	49.7 (24.9–74.4)
	% change	*-57%*	*108%*	*-43%*	
	P (trend)	*0.53*	*0.19*	*0.66*	
Females					
1–74 years	1981–84	19.0 (15.4–22.5)	16.8 (13.6–19.9)	15.3 (11.8–18.8)	15.7 (11.8–19.5)
	1986–89	16.5 (13.5–19.5)	17.2 (14.2–20.2)	15.8 (12.3–19.3)	18.3 (13.7–22.9)
	1991–94	17.9 (15.0–20.9)	12.1 (9.2–15.0)	13.8 (8.6–19.0)	16.8 (12.7–20.9)
	1996–99	12.0 (9.8–14.3)	10.4 (8.0–12.9)	10.5 (7.8–13.2)	12.5 (9.1–15.9)
	2001–04	13.0 (10.6–15.4)	10.0 (7.5–12.5)	8.9 (6.8–11.1)	12.6 (9.9–15.3)
	% change	*-32%*	*-40%*	*-42%*	
	P (trend)	*0.08*	*0.02*	*< 0.01*	
1–14 years	1981–84	15.7 (10.6–20.7)	13.3 (7.9–18.6)	10.1 (3.8–16.3)	7.1 (1.7–12.5)
	1986–89	8.9 (5.4–12.5)	9.0 (4.5–13.5)	10.1 (2.7–17.5)	18.9 (10.7–27.0)
	1991–94	10.2 (6.2–14.1)	6.7 (2.3–11.0)		13.4 (6.8–20.0)
	1996–99	9.0 (5.4–12.7)	9.1 (4.5–13.8)		6.6 (0.6–12.6)
	2001–04	10.1 (6.0–14.2)			10.0 (4.8–15.3)
	% change	*-36%*			
	P (trend)	*0.40*			
15–24 years	1981–84	18.7 (10.4–27.0)	28.7 (19.4–38.1)	23.2 (14.1–32.3)	25.9 (13.8–38.0)
	1986–89	29.1 (18.5–39.7)	28.7 (19.5–37.8)	28.4 (18.0–38.9)	16.5 (7.2–25.7)
	1991–94	30.5 (20.3–40.6)	22.1 (13.8–30.3)	20.3 (12.8–27.9)	26.6 (14.9–38.3)
	1996–99	16.1 (9.1–23.1)	16.3 (8.6–23.9)	23.2 (13.2–33.1)	19.1 (9.1–29.2)
	2001–04	14.3 (7.7–21.0)	11.7 (5.0–18.4)	15.7 (8.1–23.3)	11.8 (5.4–18.1)
	% change	*-24%*	*-59%*	*-32%*	
	P (trend)	*0.36*	*< 0.01*	*0.15*	
25–44 years	1981–84	14.2 (8.7–19.7)	10.4 (5.5–15.3)	13.3 (6.4–20.2)	12.5 (5.9–19.1)
	1986–89	13.9 (9.2–18.6)	10.9 (6.4–15.5)	15.8 (10.2–21.4)	15.1 (8.1–22.2)
	1991–94	18.8 (13.7–24.0)	7.5 (4.0–11.0)	11.4 (5.9–16.9)	12.5 (6.7–18.4)
	1996–99	14.5 (10.1–18.9)	5.4 (2.5–8.3)	5.1 (2.5–7.6)	13.1 (7.2–19.0)
	2001–04	15.2 (10.4–20.1)	11.3 (6.8–15.8)	7.4 (4.6–10.3)	11.7 (7.0–16.5)
	% change	*7%*	*9%*	*-44%*	
	P (trend)	*0.77*	*0.59*	*0.16*	

Age group	Cohort	Low income	Medium income	High income	Missing income
45–64 years	1981–84	25.9 (14.6–37.2)	14.0 (7.2–20.8)	10.9 (5.3–16.5)	14.6 (6.1–23.0)
	1986–89	17.3 (9.7–24.9)	22.6 (14.7–30.5)	10.4 (4.5–16.4)	15.2 (5.6–24.8)
	1991–94	14.2 (7.9–20.5)	13.2 (5.6–20.8)	8.3 (3.8–12.8)	16.0 (6.3–25.8)
	1996–99	7.9 (3.5–12.3)	10.6 (4.7–16.5)	14.2 (6.6–21.7)	13.1 (6.0–20.1)
	2001–04	8.7 (4.6–12.8)	12.4 (6.7–18.0)	10.3 (6.1–14.6)	15.7 (9.5–22.0)
	% change	*-66%*	*-11%*	*-6%*	
	P (trend)	*0.04*	*0.37*	*0.92*	
65–74 years	1981–84	35.3 (23.1–47.6)	41.1 (22.6–59.6)	42.9 (22.2–63.5)	44.8 (24.1–65.5)
	1986–89	23.0 (12.6–33.3)	33.9 (21.1–46.6)	21.6 (6.6–36.7)	
	1991–94	23.1 (14.3–31.9)	27.8 (5.8–49.8)		
	1996–99	15.0 (9.1–20.9)	25.6 (12.4–38.8)		
	2001–04	25.7 (16.3–35.0)			
	% change	*-27%*			
	P (trend)	*0.34*			

Table S31: Road traffic injury mortality rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group

Age group	Cohort	Low income	Medium income	High income	Missing income
Males					
1–74 years	1981–84	35.9 (30.3–41.5)	32.4 (27.4–37.3)	29.7 (24.8–34.5)	29.9 (24.6–35.2)
	1986–89	36.5 (31.4–41.7)	34.3 (29.9–38.7)	29.3 (24.8–33.8)	38.7 (32.2–45.2)
	1991–94	29.1 (24.6–33.5)	32.9 (28.1–37.7)	19.6 (15.3–23.9)	27.4 (21.2–33.5)
	1996–99	24.6 (20.5–28.8)	20.8 (17.0–24.6)	17.1 (13.4–20.8)	24.7 (19.6–29.7)
	2001–04	22.0 (18.1–25.9)	18.4 (14.6–22.1)	14.7 (11.8–17.5)	20.6 (16.5–24.7)
	% change	*-39%*	*-43%*	*-51%*	
	P (trend)	*< 0.01*	*0.04*	*< 0.01*	
Females					
1–74 years	1981–84	11.0 (8.1–13.8)	11.2 (8.6–13.7)	11.0 (7.9–14.1)	11.5 (8.2–14.9)
	1986–89	12.2 (9.5–14.8)	13.0 (10.4–15.7)	11.4 (8.6–14.2)	12.9 (9.0–16.8)
	1991–94	13.6 (11.0–16.2)	8.8 (6.5–11.2)	10.1 (5.6–14.6)	13.1 (9.4–16.8)
	1996–99	8.6 (6.6–10.6)	7.0 (5.0–9.0)	8.5 (6.0–10.9)	9.7 (6.7–12.7)
	2001–04	7.8 (5.9–9.7)	6.3 (4.4–8.3)	6.6 (4.7–8.5)	8.4 (6.2–10.7)
	% change	*-29%*	*-44%*	*-40%*	
	P (trend)	*0.15*	*0.03*	*< 0.01*	

Table S32: Suicide rates, by income group and sex, age- and ethnic-standardised within the 1–74 years age group

Age group	Cohort	Low income	Medium income	High income	Missing income
Males					
1–74 years	1981–84	18.6 (14.5–22.6)	15.1 (11.7–18.6)	13.9 (11.0–16.8)	15.6 (11.6–19.5)
	1986–89	23.2 (18.9–27.5)	22.6 (19.0–26.2)	20.6 (17.3–24.0)	20.0 (15.0–25.0)
	1991–94	29.1 (24.6–33.6)	24.5 (20.5–28.5)	19.7 (16.2–23.2)	24.0 (18.5–29.5)
	1996–99	32.1 (27.3–36.8)	26.6 (22.3–30.9)	21.7 (18.3–25.0)	27.5 (22.0–33.0)
	2001–04	30.1 (25.5–34.6)	21.5 (17.7–25.2)	15.4 (12.8–18.0)	19.6 (15.7–23.5)
	% change	*62%*	*42%*	*11%*	
	P (trend)	*0.03*	*0.26*	*0.85*	
Females					
1–74 years	1981–84	5.9 (4.0–7.9)	4.1 (2.5–5.7)	7.1 (5.1–9.0)	5.4 (3.0–7.9)
	1986–89	7.7 (5.6–9.8)	6.9 (5.0–8.8)	5.3 (3.5–7.1)	4.3 (2.2–6.4)
	1991–94	6.9 (5.0–8.9)	5.6 (3.8–7.5)	5.0 (3.5–6.6)	6.4 (3.8–8.9)
	1996–99	8.7 (6.8–10.7)	6.4 (4.4–8.4)	6.4 (4.6–8.2)	6.9 (4.3–9.5)
	2001–04	8.6 (6.5–10.7)	6.3 (4.5–8.2)	6.6 (4.8–8.4)	6.4 (4.4–8.4)
	% change	*46%*	*54%*	*-7%*	
	P (trend)	*0.06*	*0.24*	*0.91*	

Table S33: All-cause mortality rates, cross-classified by income and age group within Māori

Age group	Cohort	Low income	Medium income	High income
Males				
1–74 years	1981–84	1011 (917–1104)	893 (764–1022)	733 (605–862)
	1986–89	942 (860–1023)	858 (764–951)	721 (568–874)
	1991–94	984 (916–1051)	816 (716–916)	627 (494–760)
	1996–99	958 (897–1019)	772 (695–849)	495 (409–580)
	2001–04	842 (786–898)	634 (566–701)	489 (418–559)
	% change	*-17%*	*-29%*	*-33%*
	P (trend)	*0.11*	*0.01*	*0.01*
1–14 years	1981–84	60.9 (42.0–79.9)	38.9 (14.3–63.5)	
	1986–89	48.3 (31.7–64.9)	53.0 (26.0–79.9)	
	1991–94	40.3 (25.7–54.8)		
	1996–99	46.3 (31.8–60.7)	31.5 (10.9–52.1)	
	2001–04	39.5 (25.5–53.4)	39.9 (15.5–64.2)	
	% change	*-35%*		
	P (trend)	*0.12*		
15–24 years	1981–84	181 (120–243)	222 (145–300)	167 (93–241)
	1986–89	219 (147–291)	258 (186–331)	211 (125–297)
	1991–94	250 (183–317)	188 (118–258)	114 (54–175)
	1996–99	212 (149–276)	177 (107–246)	210 (118–303)
	2001–04	186 (125–246)	166 (100–231)	100 (48–153)
	% change	*2%*	*-25%*	*-40%*
	P (trend)	*0.98*	*0.08*	*0.32*

Age group	Cohort	Low income	Medium income	High income
25–44 years	1981–84	412 (322–502)	290 (207–373)	298 (191–405)
	1986–89	336 (259–413)	314 (240–387)	220 (137–303)
	1991–94	439 (363–515)	345 (266–423)	184 (120–248)
	1996–99	388 (318–458)	296 (226–366)	167 (117–216)
	2001–04	361 (294–428)	203 (149–257)	202 (151–252)
	% change	*-12%*	*-30%*	*-32%*
	P (trend)	*0.76*	*0.18*	*0.33*
45–64 years	1981–84	2475 (2131–2819)	2115 (1748–2482)	1649 (1331–1966)
	1986–89	2185 (1894–2477)	1866 (1615–2117)	1390 (1123–1657)
	1991–94	2160 (1935–2384)	1652 (1401–1902)	1413 (1132–1695)
	1996–99	2304 (2081–2526)	1529 (1319–1739)	932 (770–1095)
	2001–04	1908 (1709–2106)	1194 (1020–1369)	911 (774–1047)
	% change	*-23%*	*-44%*	*-45%*
	P (trend)	*0.15*	*< 0.01*	*0.02*
65–74 years	1981–84	5935 (4970–6899)	5808 (3973–7643)	4678 (2775–6580)
	1986–89	6139 (5265–7012)	5791 (4459–7122)	5703 (3175–8232)
	1991–94	6359 (5615–7104)	6039 (4553–7525)	4560 (2415–6706)
	1996–99	5730 (5145–6315)	5951 (4881–7021)	3769 (2401–5138)
	2001–04	5370 (4828–5913)	5212 (4242–6183)	3877 (2750–5004)
	% change	*-10%*	*-10%*	*-17%*
	P (trend)	*0.14*	*0.27*	*0.13*
Females				
1–74 years	1981–84	688 (619–757)	630 (516–745)	424 (314–534)
	1986–89	650 (590–710)	518 (447–588)	381 (278–484)
	1991–94	617 (570–664)	573 (492–654)	342 (241–443)
	1996–99	609 (566–653)	472 (411–532)	378 (297–459)
	2001–04	505 (467–544)	434 (378–490)	328 (271–384)
	% change	*-27%*	*-31%*	*-23%*
	P (trend)	*0.02*	*0.05*	*0.07*
1–14 years	1981–84	47.9 (30.8–65.1)		
	1986–89	28.9 (15.1–42.6)		
	1991–94	31.3 (19.0–43.6)		
	1996–99	36.9 (23.4–50.4)	33.6 (13.6–53.7)	
	2001–04	33.3 (20.7–45.9)		
	% change	*-30%*		
	P (trend)	*0.62*		
15–24 years	1981–84	116 (70–163)	101 (48–154)	
	1986–89	105 (60–151)	68.0 (32.3–103.7)	76.7 (19.7–133.6)
	1991–94	75.7 (44.3–107.0)	52.2 (19.4–85.0)	
	1996–99	103 (66–141)	60.0 (22.6–97.4)	94.9 (34.8–154.9)
	2001–04	65.5 (37.4–93.7)	62.1 (26.6–97.7)	64.2 (19.7–108.7)
	% change	*-44%*	*-39%*	
	P (trend)	*0.15*	*0.31*	
25–44 years	1981–84	225 (166–285)	193 (128–257)	210 (118–301)
	1986–89	195 (147–244)	128 (83–172)	142 (77–206)
	1991–94	186 (147–225)	137 (89–186)	103 (57–148)
	1996–99	199 (162–235)	102 (66–138)	105 (66–144)
	2001–04	172 (138–206)	97.2 (63.3–131.1)	92.3 (59.7–124.9)
	% change	*-24%*	*-50%*	*-56%*
	P (trend)	*0.11*	*0.05*	*0.08*

Age group	Cohort	Low income	Medium income	High income
45–64 years	1981–84	1577 (1339–1815)	1356 (1053–1658)	921 (664–1178)
	1986–89	1601 (1383–1819)	1282 (1065–1498)	834 (598–1070)
	1991–94	1642 (1470–1814)	1288 (1070–1506)	661 (477–845)
	1996–99	1432 (1274–1590)	1096 (915–1277)	754 (588–920)
	2001–04	1174 (1037–1311)	870 (721–1018)	658 (530–786)
	% change	*-26%*	*-36%*	*-29%*
	P (trend)	*0.07*	*0.02*	*0.10*
65–74 years	1981–84	4750 (3958–5543)	4893 (3190–6595)	2842 (1168–4516)
	1986–89	4252 (3601–4902)	3568 (2612–4523)	2698 (1096–4301)
	1991–94	3641 (3137–4144)	4565 (3370–5760)	3033 (1354–4712)
	1996–99	4109 (3639–4578)	3557 (2731–4384)	3104 (1802–4406)
	2001–04	3471 (3060–3882)	3876 (3051–4702)	2758 (1873–3643)
	% change	*-27%*	*-21%*	*-3%*
	P (trend)	*0.12*	*0.63*	*0.91*

Table S34: All-cause mortality rates, cross-classified by income and age group within European/Other

Age group	Cohort	Low income	Medium income	High income
Males				
1–74 years	1981–84	609 (589–629)	490 (473–507)	410 (395–424)
	1986–89	559 (541–576)	455 (441–469)	361 (347–375)
	1991–94	496 (481–512)	402 (387–416)	293 (282–305)
	1996–99	436 (421–450)	332 (319–346)	250 (240–261)
	2001–04	417 (401–432)	285 (272–297)	212 (203–221)
	% change	*-32%*	*-42%*	*-48%*
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*
1–14 years	1981–84	41.2 (31.8–50.6)	34.2 (25.0–43.5)	35.1 (20.8–49.4)
	1986–89	44.3 (35.1–53.5)	26.4 (18.0–34.7)	24.4 (11.6–37.2)
	1991–94	33.0 (24.3–41.7)	24.4 (16.5–32.3)	20.2 (11.3–29.1)
	1996–99	32.0 (23.7–40.2)	12.7 (6.8–18.6)	18.1 (10.3–25.9)
	2001–04	17.6 (10.9–24.3)	22.0 (14.2–29.9)	18.9 (11.6–26.1)
	% change	*-57%*	*-36%*	*-46%*
	P (trend)	*0.03*	*0.15*	*0.09*
15–24 years	1981–84	138 (107–168)	142 (118–166)	142 (121–162)
	1986–89	150 (120–180)	154 (132–177)	148 (127–169)
	1991–94	129 (102–155)	173 (146–201)	133 (112–155)
	1996–99	132 (103–161)	126 (99–152)	87.2 (69.1–105.2)
	2001–04	135 (105–165)	109 (83–135)	86.3 (68.0–104.7)
	% change	*-2%*	*-23%*	*-39%*
	P (trend)	*0.44*	*0.28*	*0.03*
25–44 years	1981–84	181 (157–205)	152 (134–171)	130 (115–146)
	1986–89	174 (153–196)	155 (137–172)	134 (119–148)
	1991–94	201 (177–225)	150 (132–169)	116 (104–129)
	1996–99	187 (162–211)	129 (112–147)	111 (99–124)
	2001–04	182 (156–208)	124 (106–143)	82.2 (72.0–92.4)
	% change	*1%*	*-18%*	*-37%*
	P (trend)	*0.65*	*0.04*	*0.02*

Age group	Cohort	Low income	Medium income	High income
45–64 years	1981–84	1287 (1211–1363)	978 (927–1029)	812 (775–848)
	1986–89	1138 (1073–1203)	876 (834–919)	693 (659–726)
	1991–94	987 (934–1040)	733 (690–775)	517 (490–545)
	1996–99	866 (816–915)	603 (564–642)	419 (396–442)
	2001–04	875 (823–927)	522 (486–558)	383 (363–404)
	% change	*-32%*	*-47%*	*-53%*
	P (trend)	*0.02*	*< 0.01*	*< 0.01*
65–74 years	1981–84	4623 (4476–4770)	3789 (3582–3997)	3075 (2885–3265)
	1986–89	4243 (4113–4373)	3513 (3362–3665)	2642 (2461–2823)
	1991–94	3647 (3541–3752)	3064 (2912–3216)	2228 (2081–2375)
	1996–99	3068 (2974–3162)	2609 (2472–2746)	1998 (1857–2139)
	2001–04	2777 (2678–2876)	2085 (1962–2208)	1599 (1486–1712)
	% change	*-40%*	*-45%*	*-48%*
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*
Females				
1–74 years	1981–84	305 (293–317)	256 (243–268)	229 (217–240)
	1986–89	289 (278–300)	249 (239–259)	201 (190–212)
	1991–94	261 (251–270)	213 (203–223)	178 (168–187)
	1996–99	230 (221–239)	195 (186–205)	144 (136–153)
	2001–04	221 (212–230)	169 (160–178)	133 (126–141)
	% change	*-28%*	*-34%*	*-42%*
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*
1–14 years	1981–84	31.0 (22.5–39.5)	29.7 (20.9–38.5)	18.3 (9.2–27.4)
	1986–89	24.7 (17.9–31.5)	18.3 (11.4–25.1)	26.1 (12.8–39.4)
	1991–94	23.0 (15.7–30.3)	16.7 (9.7–23.7)	16.7 (7.8–25.6)
	1996–99	18.4 (12.0–24.8)	20.8 (12.6–29.0)	14.5 (7.6–21.4)
	2001–04	21.7 (14.0–29.4)	22.4 (13.9–30.9)	16.0 (8.9–23.2)
	% change	*-30%*	*-25%*	*-13%*
	P (trend)	*0.08*	*0.65*	*0.32*
15–24 years	1981–84	39.1 (23.6–54.6)	48.3 (34.5–62.2)	54.2 (40.5–67.8)
	1986–89	62.2 (43.8–80.7)	55.1 (40.8–69.3)	51.0 (37.5–64.6)
	1991–94	59.1 (42.3–75.8)	52.1 (37.1–67.1)	44.8 (32.3–57.2)
	1996–99	39.7 (25.2–54.2)	49.5 (33.7–65.2)	39.5 (27.4–51.6)
	2001–04	32.4 (19.2–45.7)	34.3 (20.5–48.1)	41.1 (28.2–54.0)
	% change	*-17%*	*-29%*	*-24%*
	P (trend)	*0.43*	*0.20*	*0.02*
25–44 years	1981–84	87.4 (73.4–101.4)	83.6 (71.1–96.0)	78.6 (66.2–91.1)
	1986–89	88.1 (75.1–101.1)	79.6 (68.0–91.2)	67.0 (55.9–78.0)
	1991–94	87.3 (74.5–100.0)	66.8 (56.0–77.7)	60.1 (51.5–68.8)
	1996–99	88.6 (75.9–101.2)	62.5 (52.1–72.9)	46.5 (39.3–53.6)
	2001–04	88.6 (74.5–102.7)	67.6 (55.5–79.6)	48.5 (41.3–55.8)
	% change	*1%*	*-19%*	*-38%*
	P (trend)	*0.18*	*0.07*	*0.02*
45–64 years	1981–84	661 (615–707)	547 (508–586)	439 (411–468)
	1986–89	610 (568–652)	524 (491–557)	375 (348–402)
	1991–94	548 (514–583)	439 (406–472)	337 (313–361)
	1996–99	493 (460–525)	403 (372–433)	281 (260–302)
	2001–04	486 (452–520)	337 (309–365)	251 (234–268)
	% change	*-26%*	*-38%*	*-43%*
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*

Age group	Cohort	Low income	Medium income	High income
65–74 years	1981–84	2321 (2231–2411)	1842 (1704–1980)	1816 (1663–1969)
	1986–89	2169.(2089–2249)	1865 (1760–1969)	1602 (1458–1746)
	1991–94	1904 (1836–1971)	1611 (1504–1717)	1412 (1291–1533)
	1996–99	1639 (1576–1703)	1439 (1342–1536)	1119 (1004–1235)
	2001–04	1500 (1435–1564)	1225 (1130–1320)	1005 (907–1104)+
	% change	*-35%*	*-33%*	*-45%*
	P (trend)	*< 0.01*	*< 0.01*	*< 0.01*