

Cancer Trends

Trends in Cancer Incidence by Ethnic
and Socioeconomic Group,
New Zealand 1981–2004

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MANATŪ HAUORA

Foreword

Cancer is a major public health issue in New Zealand, as in other established market economies. It ranks second as cause of death (after cardiovascular disease), currently accounting for almost one-third of all deaths. Furthermore, the burden of cancer – especially tobacco-related cancer – falls disproportionately on Māori and on socioeconomically disadvantaged individuals, families and communities, thus contributing to health inequality. Importantly, the causes of many cancers are now understood, meaning that a substantial proportion of the cancer burden is preventable, or amenable to early detection and cure through screening.

These facts led to the development in 2003 of a cancer control strategy for New Zealand. This strategy has two objectives: (1) to reduce the impact of cancer; and (2) to reduce inequalities in the impact of cancer. The work presented here is intended to inform the latter objective. While the broad outlines of inequalities in cancer incidence in New Zealand are well known, until now we have lacked comprehensive information on trends in these inequalities over time. Such information – including whether gaps in cancer incidence are widening or narrowing – is valuable for planning and funding purposes, from both a public health and a clinical service perspective.

This report uses linked Census and New Zealand Cancer Registry datasets to produce estimates of cancer incidence, including inequalities and trends in inequalities in cancer incidence. It is an output of an ongoing collaboration between the Ministry of Health, the University of Otago and Statistics New Zealand that has used data linkage to generate information on health outcomes and inequalities in these outcomes – including cancer mortality – for some years. The current report on cancer incidence complements these earlier reports on cancer mortality, and should be read in conjunction with them. Comments on this report are welcomed, and should be addressed to martin_tobias@moh.govt.nz.

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Statistics New Zealand security statement

CancerTrends was initiated by Professor Tony Blakely and his co-researchers from the University of Otago, Wellington. It was approved by the Government Statistician as a data laboratory project under the microdata access protocols. All research publications are based on researcher-initiated ideas.

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.

Ministry of Health 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.

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Abbreviations

BMI	Body mass index
CI	Confidence interval
HL	Hodgkin's disease
HPV	Human papilloma virus
ICD	International Classification of Diseases
NCSP	National Cervical Screening Programme
NZCMS	New Zealand Census-Mortality Study
NZCR	New Zealand Cancer Registry
NHI	National Health Index
NZHIS	New Zealand Health Information Service
NHL	Non-Hodgkin's lymphoma
nMPA	Non-Māori/Pacific/Asian
PSA	Prostate-specific antigen
RII	Relative index of inequality
SAS	Statistical Analysis System
SEP	Socioeconomic position
SII	Slope index of inequality
SRD	Standardised rate difference
SRR	Standardised rate ratio
WHO	World Health Organization

Executive Summary

Background

Inequalities in cancer incidence are known to exist in New Zealand between ethnic and socioeconomic groups, but trends over time in these inequalities have not previously been analysed, due to a lack of accurate data on ethnicity and socioeconomic position comparable between Census and cancer registration records. CancerTrends, a record linkage study of Census and cancer registrations from 1981 onwards, allows estimation of trends in social inequalities in relation to cancer incidence. This report presents trends within ethnic and income groups, and measures of difference or inequality between ethnic and income groups, from 1981 to 2004.

Methods

Record linkage

Five Censuses (1981–2001) were anonymously and probabilistically linked to cancer registrations, creating five separate cohort studies of the entire population. 73–82 percent of eligible cancer registrations were linked, of which at least 95 percent were estimated to be correct linkages. To avoid underestimation of rates using the linked datasets, linkage weights were calculated for strata of age, sex, ethnicity and deprivation.

Variables

For each of the cohorts ethnicity was categorised as Māori, Pacific or Asian using a total response definition of ethnicity. The residual group (that is, those who did not identify as Māori, Pacific or Asian) were categorised as non-Māori non-Pacific non-Asian (described herein as European/Other). Household income, equivalised for the number of children and adults in the household and inflation-adjusted across cohorts, was categorised into tertiles. Cancer sites were categorised using International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10) coding (having excluded in situ cases and second diagnoses of the same cancer within one cohort) for 24 adult cancer sites, 'other' adult cancers, 'ill-defined' adult cancers, child cancers and adolescent cancers.

Incidence rates

Age-standardised rates of cancer by ethnic group, and age- and ethnicity-standardised rates of cancer by income group, were calculated for each cohort. Standardised rate differences and ratios (SRDs and SRRs) were calculated within each cohort, and pooled over time, to quantify absolute and relative differences in cancer incidence between ethnic and income groups. For income differences, regression-based measures of inequality, the slope and relative indices of inequality (SII and RII), were also calculated. P values were calculated for statistical tests of linear trends over time in rates and measures of association.

Results

Information on selected cancer sites only is reported in this Executive Summary.

Bladder:	Incidence increased by one-quarter overall. European/Other rates were about one-third greater than Māori or Pacific rates. Rates were 10–20 percent higher among lower income groups.
Brain:	Incidence increased modestly, and European/Other rates were usually highest. There were no consistent differences by income.
Breast (female):	Rates increased more among Māori, such that the Māori rate was one-quarter higher than the European/Other rate by 2001–2004. Incidence was consistently 10–20 percent higher among high-income women.
Cervix:	Incidence halved over the 25 years, and decreased dramatically among Māori and Pacific women. Nevertheless, the Māori rate was still at least twice the European/Other rate by 2001–2004. Gaps by income closed markedly.
Colorectal:	Incidence increased overall by 10–20 percent, and more so among Māori. Pacific rates tended to increase, but were usually less than Māori rates.
Endometrial:	There was no notable change in incidence over time. Pacific rates were consistently highest (up to three times that of European/Other).
Liver:	Rates increased over time, and rates were five to ten times higher among Māori and Pacific than among European/Other.
Lung:	Rates halved over time among males, but were stable among females. Disparities between Māori and European/Other widened: Māori rates were three- to five-fold higher in 2001–2004. Rates among low-income people were up to twice those of high-income people.
Melanoma:	Incidence increased (although note that figures may have been influenced by the Cancer Registry Act 1993). Consistent relative inequalities were recorded over time: high-income people had rates one-quarter to one-third higher than low-income people; Pacific rates were 10 percent of European/Other rates; Māori rates were 20 percent of European/Other rates.
Prostate:	Rates increased profoundly over time (probably due to prostate-specific antigen testing). Māori, Pacific and European/Other rates were very similar at all points in time. Modest income differences were evident over time, rates among higher-income men being 10–20 percent higher in 2001–2004.
Stomach:	Rates fell over time; more so for males. Rates among Māori and Pacific people were at least twice those among European/Other. Rates tended to be higher in low-income people.

Testicular:	Rates increased by about one-third over time. Māori rates were usually greater than European/Other rates, and Pacific rates consistently lower than European/Other. There was a modest tendency towards higher rates among low-income men.
Thyroid:	Rates increased moderately over time. The only clear social patterning was evident in consistently elevated rates among Pacific women (often four times higher than those among European/Other).

Conclusions

Incidence of different cancers by ethnicity and socioeconomic position changed over time, leading to variation in both absolute and relative inequalities. In general, inequalities (among both ethnic and socioeconomic groups) in smoking-related cancer incidence were wide and mainly increased over the study period. By contrast, inequalities in most non-smoking-related cancers were narrower and largely remained stable over time, with some notable exceptions.

Of particular policy relevance is the finding of dramatic falls in cervical cancer incidence among all ethnic and income groups, with a pronounced narrowing in inequalities; this is a notable public health success story. Much of this success is almost certainly due to screening, and (perhaps surprisingly) demonstrates that even without equivalent programme coverage across all ethnic and socioeconomic groups, a screening programme can contribute to marked reductions in absolute inequalities.

Ethnic inequalities in colorectal cancer incidence are also narrowing – but this results from increasing rates among Māori and Pacific ethnic groups (who historically experienced very low incidence rates of this cancer).

Understanding trends in cancer incidence, and in social inequalities in cancer incidence, can help policy-makers to optimise cancer control programmes, as well as affording insight into patterns of distribution of risk factors, so guiding wider public health action.

Part A:

Background and Methods

Chapter 1: Background

Nearly one-third of all deaths in New Zealand in 2006 were due to cancer, and mortality rates for cancer now approach those for cardiovascular disease. Cancer is among the largest contributors to the burden of disease in New Zealand, and its percentage contribution will probably increase in the future as the incidence and mortality of other diseases (in particular cardiovascular disease) diminishes. For these and other reasons, New Zealand, like many other countries, now has a Cancer Control Strategy.¹ That strategy has two purposes: (1) to reduce the impact of cancer; and (2) to reduce inequalities in the impact of cancer.

Cancer is a generic term that describes many different pathological processes arising from different body organs, but sharing the characteristic of abnormal and uncontrolled growth of cells. Metastatic cancer occurs when these abnormally growing cells spread to different body organs and reduce their functional capacity such that, in the absence of treatment, death results. The scope of this report excludes those cancers that do not have the potential to metastasize – so-called benign tumours.

Understanding of which risk factors cause different types of cancer has steadily improved in recent times. In high-income countries 37 percent of cancer deaths have been attributed to one or a combination of alcohol (4 percent), smoking (29 percent), low fruit and vegetable intake (3 percent), urban air pollution (1 percent), overweight and obesity (3 percent), physical inactivity (2 percent) and unsafe sex (1 percent).² Cancer incidence is known to vary between ethnic and income groups, reflecting differences in the distribution of risk and protective factors.

1.1 What do we know, and what more do we need to know, about cancer by social group in New Zealand?

A certain amount of information has already been gathered in New Zealand on cancer by ethnicity and socioeconomic position (SEP). First, the Ministry of Health has collated cross-sectional data for the late 1990s on cancer incidence and mortality (for 26 cancer types) by ethnicity and small area socioeconomic deprivation.³ Second, researchers have determined cancer survival and case fatality by ethnicity^{4 5} and small area deprivation⁶ for the late 1990s. Third, the New Zealand Census Mortality Study (NZCMS) has provided trend data on cancer mortality (for breast, colorectal, prostate and lung cancer only) by ethnicity and SEP from 1981–1984 to 2001–2006.⁷⁻⁹ Fourth, a range of separate research projects has determined ethnic and socioeconomic differences in cancer incidence and mortality over the last 20 years, along with risk factors for various types of cancer in the New Zealand setting.¹⁰⁻²⁸ However, no accurate and comprehensive information exists in New Zealand on *trends* by ethnicity and SEP in cancer incidence.

Why is trend data important? Because it informs us what the situation was, is and will be – the latter aspect being particularly important for the purposes of health service planning and evaluation and for the planning, funding and prioritisation of public health research. Understanding trends may also contribute to understanding of the causes of cancer.

Trends by *ethnicity* are important for several reasons. First, and very importantly, currently published comparisons of cancer incidence by ethnicity in New Zealand are probably incorrect due to numerator-denominator bias. Such a bias has been shown to be profound for *mortality* data up to the mid-1990s, in that the number of Māori and Pacific deaths (the numerator in the rate calculation) until that time were severely undercounted relative to Census counts (the denominator).²⁹⁻³² Most recently, data from CancerTrends (the study used in this report) linking Census and cancer registration data show that Māori and Pacific cancer registrations have been underestimated by between 10 and 30 percent since the 1980s.³³ This report presents ethnic trends in cancer incidence, unbiased by undercounting of ethnic groups in cancer registry data. Second, health inequalities by ethnicity in New Zealand are stark.^{7 34-37} There is both a social justice and a Treaty of Waitangi imperative to determine, monitor and understand ethnic inequalities in health. Third, inequalities in life expectancy (mortality) by ethnicity widened during the 1980s and 1990s (although they have since stabilised or begun to narrow), and cancers were part of the explanation for this widening gap.^{7 8 36} Understanding which cancers are contributing to ethnic inequalities is important. Fourth, international cancer incidence trends by ethnicity have demonstrated that disparities change over time – it is likely that the same is true in New Zealand. Fifth, by linking Census and cancer registrations, cancer incidence rates for Asian people are determinable: this information was not previously available.

Trends by *socioeconomic position (SEP)* are also important. First, relative inequalities in mortality by income increased during the 1980s and 1990s in New Zealand – and again, cancer was one of the drivers of this widening inequality.³⁸ It is important to understand whether it is incidence that is driving this trend (as opposed to, say, increasing survival rates among the rich but not the poor), which cancers are driving the trend, and which aetiological factors are behind the changes (for example, whether the trends apply to smoking-related cancers only). Potential policy interventions responding to these explanations are very different. Second, information already exists on the effect of occupational class differences on 25–64 year-old male cancer *mortality* at times during the 1970s and 1980s,^{20 21} cancer mortality differences by income from 1981 to 2004^{39 40} and differences in mortality and incidence by small-area socioeconomic deprivation in the 1990s.³ However, until now there has been no trend information on cancer incidence by personal SEP, and estimating such trends is only possible by linking cancer registrations with Census data. Third, internationally, socioeconomic differences in cancer incidence have been shown to change over time. For example, the traditionally higher rate of breast cancer among women of higher socioeconomic status has been shown to be diminishing over time, presumably as risk factors such as parity change in their social patterning.⁴¹ Likewise, socioeconomic differences in rates of colorectal cancer mortality have changed over time.⁴²

1.2 Data and methodological issues relevant to this report

1.2.1 The New Zealand Cancer Registry (NZCR)

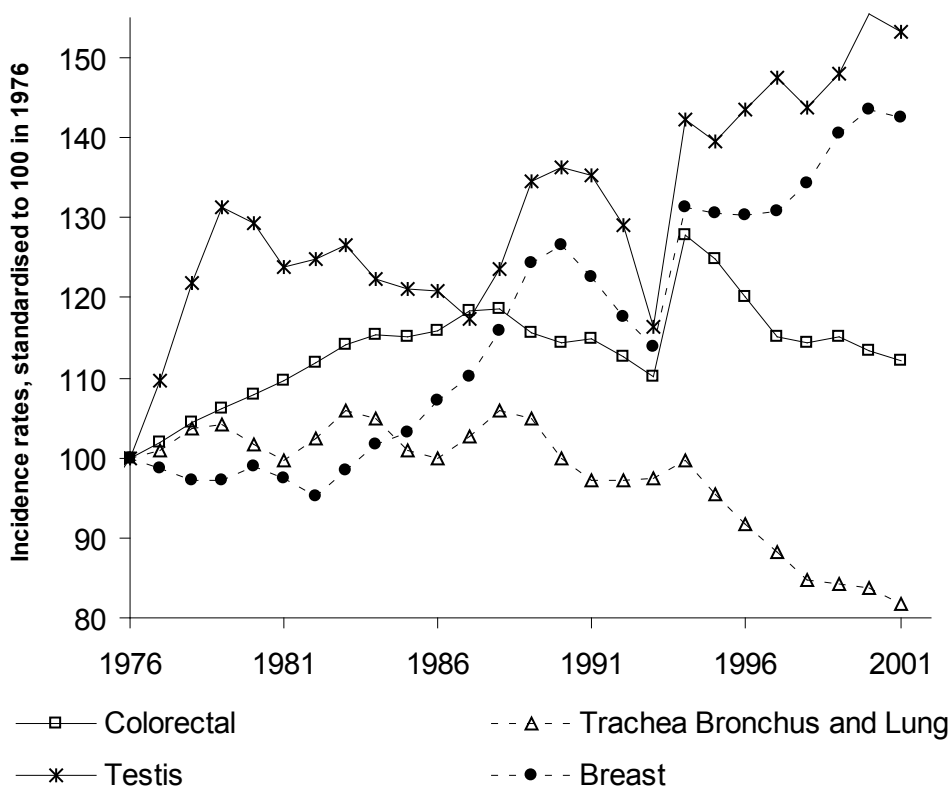
The NZCR started in 1948, and is one of a number of national population-based cancer registries around the world. On 1 July 1994 the Cancer Registry Act 1993 and associated Cancer Registry Act Regulations came into force, mandating that all newly diagnosed malignant disease (with the exception of basal and squamous cell carcinomas of the skin) be notified to the NZCR. The Act and associated regulations defined, among other things, the scope of information to be reported to the NZCR, timeframes within which new cancers were to be reported and the manner in which they were to be reported. Importantly, the Act mandated reporting by pathologists in laboratories. The Act and Regulations are available at www.moh.govt.nz. Note that benign neoplasms are not required to be reported to the NZCR.

Prior to the passing of the Act and Regulations, notification was conducted on a voluntary basis, through forms that were sent to the Cancer Registry. Despite this, case ascertainment was thought to be relatively complete, for some cancers at least. However, from the mid-1980s, changes in the health system and increasing societal concerns around patient privacy resulted in declining case ascertainment and case information. This was thought to be particularly problematic in the case of cancers that did not require admission to hospital, such as melanoma and some cancers of the breast.⁴³ There has been no formal assessment of the extent of under-reporting of cancer incidence prior to the passing of the Act. Implementation of the Act resulted in a sharp increase in the number of melanomas registered. However, for other cancers the impact was much smaller. Consequently, the Ministry of Health concluded that 'adjustment of the registration data was not considered necessary' when determining trends for cancers other than melanoma (Ministry of Health, 2002, p.19).

Figure 1 shows incidence rates (standardised to 100 in 1976 for each site) for four cancer sites (data from Chris Lewis, NZHIS, 15 March 2006). The rates are by date of registration. Backlogs and batch processing presumably account for jumps and falls immediately around 1994; it is thus advisable to look at the long-run continuity of trends from the 1980s and early 1990s to the late 1990s. Lung cancer rates showed no particular jump around 1994. Testicular cancer incidence dipped in 1992 and 1993 (probably due only to statistical chance), but its trajectory from 1994 onwards is consistent with that of the late 1980s. Similarly, breast cancer incidence dipped prior to 1994, but the trend after 1994 is consistent with that of the 1980s. There was a jump in the incidence of colorectal cancer (≈ 10 percent) that probably reflects improved notification, although the shape of the curve is far from a step function and may more reflect a 'holding over' of registrations from one year to the next.

For any artefactual increase in cancer registrations to bias trends in ethnic and socioeconomic differences would require that under-registration of cancer before 1994 varied by ethnicity and socioeconomic status – and there is no empirical evidence for this. However, it is widely suspected that non-public-hospitalised cancer cases were those least likely to be registered prior to 1994, and therefore most likely to show an increase in incidence due to registration changes. In turn, people with these cancers were probably more likely to have a higher SEP and to be of European ethnicity. If that is true, it may reflect a modest increase in cancer incidence ratios among low compared to high income, and among Māori and Pacific compared to European/Other after 1994. But the effects of any such differential outcome ascertainment bias by social position are likely to be modest.

Figure 1: Cancer registrations before and after implementation of the Cancer Registry Act (1993) and Regulations (1994) (data from NZHIS)



1.2.2 Measuring ethnicity

The classification of ethnicity used in this report reflects the new statistical standard for ethnicity.⁴⁴ The new standard rejects the notion of prioritising one ethnicity over others for people who identify with multiple ethnicities in favour of a ‘total response’ concept. Another aspect to note in relation to the treatment of ethnicity in this report is the fact that the rapid growth of the Asian population in the 1990s and early 2000s has enabled this ethnic grouping to be analysed separately for the first time, at least for the more recent cohorts.

The following approach has been adopted for the purposes of this report:

- Multiple ethnic group comparisons have been carried out using three groupings based on total response output: Māori, Pacific and Asian (where possible).
- The remaining New Zealand population (that is, non-Māori non-Pacific non-Asian) has been used as the reference group, called European/Other in this report. As such it approximates a 'sole' European/Other group that is mutually exclusive from the three total ethnic groups, allowing easy calculation of rate ratios and rate differences (and their 95 percent confidence intervals), despite the fact that the three total response ethnic groups of Māori, Pacific and Asian overlap with one another.

It was not possible to classify a stable 'New Zealand European' or 'European' series over time for the purposes of this report, due to changing definitions and classifications over time, and the difficulty of classifying people identifying as 'British', 'Australian', 'South African' and the like. The 'European/Other' classification addresses this problem.

It is acknowledged that, like any social grouping schema, ethnic categories represent heterogeneous groupings. The 'Pacific' ethnic group includes people from many different Pacific Island countries and cultures. Similarly the 'Asian' group consists of people from very diverse geographic and cultural backgrounds. Additionally, both groups include people whose ancestors migrated to New Zealand as many as 150 years ago, alongside those who are themselves migrants to New Zealand. Even the most coherent grouping, Māori, is heterogeneous, containing people from different iwi, people who self-identify solely as Māori and people who self-identify as both being Māori and belonging to another ethnic group or groups.

1.2.3 Measuring socioeconomic position

This report has used equivalised household income as the main measure of SEP, for the following reasons.

- Income can be inflation-adjusted for each of the five cohorts.
- Income can be divided into groups by five-year age group to take into account changes in the distribution of income over a life course.
- 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, rendering analytical and interpretational tasks easier.
- Income correlates strongly with other measures of SEP, such as education and occupation.
- Equivalised household income allows for economies of scale.

Both social (occupational) class and educational status (qualifications) are also central to sociological theories of social stratification; however, they both pose measurement challenges over time. 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 analysis of trends. Occupational class is only assignable to people who are currently employed, and therefore the classification excludes a substantial and varying proportion of the adult population and generates severe health selection effects. While these challenges are not insurmountable, it is believed the advantages of using equivalised household income as a measure of SEP justify reliance on it in this report. Results generated according to educational status are available from the authors on request.

1.2.4 Measures of inequality

The strength of an association between an exposure (such as SEP or ethnicity) and an outcome (such as cancer) can be measured on absolute or relative scales. Absolute scales indicate the absolute difference in rates (for example, number of cancer cases per 100,000 people), 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. To illustrate: cancer mortality has been declining among all population groups over time, yet over this same period absolute inequalities (rate differences) have tended to remain stable or decrease, while relative inequalities (rate ratios) have increased. If researchers only examined rate ratios, they would conclude that inequalities have widened. However, the importance of this is arguably not relevant 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, there is also a question as to whether measures of inequality should be sensitive to changes in the relative sizes of the groups being compared. It is arguable that it does not matter if the ratio of cancer incidence rates between the poor and the rich has increased over time if the proportion of poor to rich in the population has simultaneously declined. The interpretation of trends in socioeconomic cancer incidence gradients may depend on whether measures of association compare fixed groups (rate differences and rate ratios) or compare across ranking by socioeconomic factor (such as the slope index of inequality (SII) and relative index of inequality (RII)). Considering income per se, the latter comparisons by income are sensitive to the underlying income distribution – for a given fixed-rate ratio comparing incidence rates at \$X and \$Y across two time periods, the RII will increase if the underlying income distribution widens. Thus, RIIs and SIIs using income as the measure of socioeconomic position do not just have statistical advantages, but also function as measures of impact in addition to association.

Table 1: Measures of disease inequality

Measure of association	Definition
Absolute measures Standardised rate difference (SRD) Slope index of inequality* (SII)	The differences between rates (in two or more groups) The difference between rates in two or more sub-populations (for example Māori and European/Other), having adjusted for differences in age structure between those sub-populations. The absolute difference in rates between the (theoretically) richest and poorest individuals, taking account of rates across all levels of income using regression techniques.
Relative differences Standardised rate ratio (SRR) Relative index of inequality* (RII)	The ratio of rates (between two or more groups) The ratio of rates between two or more sub-populations (for example Māori and European/Other), having adjusted for differences in age structure between those sub-populations. A value equivalent to relative risk measure for the (theoretically) poorest individual compared to the richest, taking into account rates across all levels of income using regression techniques.

* Unlike income, ethnicity can not be ordered from lowest to highest; therefore these measures are not appropriate for measuring ethnic inequalities in cancer incidence.

The simultaneous presentation of absolute and relative types of measures effectively provides a full picture. When background rates of disease are not changing dramatically over time, trends in absolute and relative measures should be similar. When rates are changing dramatically (for example in the way that rates of melanoma and cervical cancer incidence are seen to have changed in this report), trends in absolute and relative measures of inequality are more likely to vary.

1.3 Report objectives

In summary, the objectives of this report are to:

- describe trends in cancer incidence by ethnic and income group from 1981 to 2004
- describe trends in absolute and relative inequalities in cancer incidence between ethnic and income groups from 1981 to 2004.

Chapter 2: Methods

2.1 Ethics and privacy

Approval for this project required a number of steps. In addition to procedures to gain routine ethics approval, a detailed application process was undertaken to gain approval for the data linkage from Statistics New Zealand (the government agency that conducts and analyses the Census), under that agency's data integration policy. The process of gaining approval under this policy includes obtaining a privacy impact assessment, consulting with the Privacy Commissioner and seeking the approval of the Government Statistician.

2.2 Datasets

2.2.1 New Zealand Cancer Registry

An overview of the NZCR has been provided in Chapter 1: Background. Information collected by the NZCR includes sociodemographic information as well as cancer-specific information, including site of the cancer (according to ICD classification), morphology and extent (stage) of disease.

2.2.2 New Zealand Census

The New Zealand Census of Population and Dwellings occurs five-yearly, around the first week of March, and is conducted by Statistics New Zealand. Post-enumeration surveys estimate that above 97 percent of the population completed a Census form in each of 1996 and 2001.⁴⁵ Information is collected on individuals and households, covering demographic, socioeconomic, and some health and disability issues (for example, the Census periodically asks about smoking and disability status – the latter solely to provide a sampling frame for the Postcensal Disability Survey).

2.3 Data linkage

The CancerTrends dataset was created by linking Census and NZCR records. Five closed cohorts were created, being the New Zealand usual resident population (all ages) on Census night 1981, 1986, 1991, 1996 and 2001, followed up for incident cancer(s) until the subsequent Census or, in the case of the 2001 cohort, until 31 December 2004 (the date of the most recent data available at the time of the study). Privacy concerns prevented linking information on individuals between Censuses. Each cohort is therefore a closed cohort with short-duration (five years) follow-up for cancer incidence outcome. Correspondingly, most New Zealand residents will appear in more than one cohort, but cannot be identified across the cohorts.

Cohorts were created using probabilistic record linkage software (QualityStage). The software linked anonymised Census and NZCR records within a geographic area (meshblock or census area unit) on sex, date of birth, ethnicity and country of birth, using the same method as that in the NZCMS.⁴⁶⁻⁴⁹ Table 2 shows the number of Census records, the number of individuals with incident cancer, the proportion of records linked and the positive predictive value (PPV) of those links. The method for calculating the PPV has been detailed elsewhere;⁴⁷ further detail of the record linkage is also available elsewhere.⁵⁰

Table 2: Summary of data linkage results by cohort

Cohort	Usual resident population on Census night	People with incident cancers in period of follow-up	People with cancer who were linked to Census record (%)	Positive predictive value (PPV) of links (%)
1981–1986	3,143,307	52,699	73.2	95.2
1986–1991	3,263,283	63,626	77.1	95.7
1991–1996	3,373,926	77,159	79.2	95.1
1996–2001	3,516,513	96,422	79.7	95.8
2001–2004	3,630,534	83,789	81.7	96.9

Notes: Each five-year period is from Census night to Census night (about 7 March on average) except for the 2001 cohort, which ended on 31 December 2004. PPV can only be calculated on links made by linkage software passes, not on the additional proportion made through clerical review, and is therefore an estimate. Census counts were random rounded in accordance with Statistics New Zealand policy.

2.4 Data preparation

Once the data were linked a number of steps were required to prepare it for analysis. The main steps are detailed in this section; further information is available in the CancerTrends Technical Report,⁵¹ available at www.uow.otago.ac.nz/cancertrends-info.html

2.4.1 Adjusting for linkage bias

As Table 2 shows, for any Census between 18.3 and 26.8 percent of records were unable to be linked. The fact that this percentage varies by sociodemographic variables could generate a differential misclassification bias of the cancer outcome in subsequent analyses. For example, if a lower percentage of people living in deprived areas had their cancer registration linked to a Census record, then an unadjusted rate ratio comparing cancer incidence for deprived compared to non-deprived people will be biased downwards. To correct for any linkage bias, and to avoid underestimation of rates using the linked datasets, weights were calculated for strata based on age, sex, ethnicity and small-area deprivation. For example, if 20 out of 30 Māori men who developed cancer aged 45–64 years and had lived in moderately deprived small areas of New Zealand were linked to a Census record, each of the 20 linked records received a weight of 1.5 (30/20). ‘Weighting up’ of linked Census-NZCR records requires a consequent ‘weighting down’ of unlinked Census records (usually by a very small percentage) such that the total of all weighted Census records still tallies to that of the total of all unweighted Census records. This process was repeated across hundreds of strata using an iterative process of regression models and strata aggregation, as described elsewhere.⁵¹

Table 3 shows the results of this weighting for the 1996–2001 cohort only. Linkage rates were lower among the 15–24 years than other age groups, and (for adults at least) greatest among non-Māori non-Pacific non-Asian (according to ethnicity variables as recorded by the NZCR or other health file – not that on the linked Census file). It should also be noted that the ratio of weighted to eligible records is (as it should be) close to 1.000 in most instances. This ratio of weighted to eligible cancer records is somewhat unstable for child and youth statistics, suggesting the need for caution in interpreting ethnic differences in childhood and youth cancer rates. Further details can be found in the Technical Report.⁵¹

Table 3: Results of weighting linked Census-NZCR records for 1996–2001 cohort

	Females					Males				
	Eligible cancer registrations for linkage	Actual links to Census	Weighted number of links	% of eligible linked	Ratio of weighted links to eligible	Eligible cancer registrations for linkage	Actual links to Census	Weighted number of links	% of eligible linked	Ratio of weighted links to eligible
All ages										
All	45,075	36,642	45,072	81.3%	1.000	51,369	40,248	51,369	78.4%	1.000
Total Māori	2,334	1,752	2,337	75.1%	1.001	4,386	3,423	4,389	78.0%	1.001
Total Pacific	930	687	921	73.9%	0.990	1,164	918	1,158	78.9%	0.995
Total Asian	567	378	555	66.7%	0.979	951	693	948	72.9%	0.997
Non-MPA	36,798	30,480	37,191	82.8%	1.011	41,295	32,541	41,580	78.8%	1.007
Missing	3,594	2,826	3,393	78.6%	0.944	3,114	2,424	2,985	77.8%	0.959
0–14 years										
All	387	279	423	72.1%	1.093	408	285	474	69.9%	1.162
Total Māori	54	42	54	77.8%	1.000	81	69	90	85.2%	1.111
Total Pacific	33	27	27	81.8%	0.818	45	30	39	66.7%	0.867
Total Asian	30	24	33	80.0%	1.100	18	12	15	66.7%	0.833
Non-MPA	264	186	306	70.5%	1.159	261	171	315	65.5%	1.207
Missing	15	9	15	60.0%	1.000	15	12	18	80.0%	1.200
15–24 years										
All	549	324	513	59.0%	0.934	3,852	2,214	3,786	57.5%	0.983
Total Māori	69	54	69	78.3%	1.000	582	417	576	71.6%	0.990
Total Pacific	27	24	30	88.9%	1.111	72	60	78	83.3%	1.083
Total Asian	18	12	15	66.7%	0.833	60	45	66	75.0%	1.100
Non-MPA	384	213	360	55.5%	0.938	3,009	1,635	2,952	54.3%	0.981
Missing	45	27	36	60.0%	0.800	126	69	123	54.8%	0.976
25–44 years										
All	3,387	2,199	3,363	64.9%	0.993	11,904	8,403	11,904	70.6%	1.000
Total Māori	348	240	351	69.0%	1.009	1,638	1,299	1,623	79.3%	0.991
Total Pacific	141	114	138	80.9%	0.979	399	333	399	83.5%	1.000
Total Asian	102	75	99	73.5%	0.971	396	291	396	73.5%	1.000
Non-MPA	2,331	1,503	2,364	64.5%	1.014	8,799	6,063	8,901	68.9%	1.012
Missing	330	204	303	61.8%	0.918	606	408	570	67.3%	0.941

	Females						Males								
	Eligible cancer registrations for linkage	Actual links to Census	Weighted number of links	% of eligible linked	Ratio of weighted links to eligible	Eligible cancer registrations for linkage	Actual links to Census	Weighted number of links	% of eligible linked	Ratio of weighted links to eligible	Eligible cancer registrations for linkage	Actual links to Census	Weighted number of links	% of eligible linked	Ratio of weighted links to eligible
45–64 years															
All	15,702	12,069	15,639	76.9%	0.996	16,230	12,702	16,179	78.3%	0.997	16,230	12,702	16,179	78.3%	0.997
Total Māori	1,098	825	1,095	75.1%	0.997	1,458	1,143	1,458	78.4%	1.000	1,458	1,143	1,458	78.4%	1.000
Total Pacific	384	276	372	71.9%	0.969	429	345	426	80.4%	0.993	429	345	426	80.4%	0.993
Total Asian	237	150	231	63.3%	0.975	303	219	300	72.3%	0.990	303	219	300	72.3%	0.990
Non-MPA	11,952	9,327	12,075	78.0%	1.010	12,345	9,696	12,393	78.5%	1.004	12,345	9,696	12,393	78.5%	1.004
Missing	1,518	1,161	1,428	76.5%	0.941	1,410	1,104	1,350	78.3%	0.957	1,410	1,104	1,350	78.3%	0.957
65–74 years															
All	15,147	13,038	15,246	86.1%	1.007	9,780	8,502	9,828	86.9%	1.005	9,780	8,502	9,828	86.9%	1.005
Total Māori	573	447	573	78.0%	1.000	456	357	468	78.3%	1.026	456	357	468	78.3%	1.026
Total Pacific	249	177	255	71.1%	1.024	150	105	153	70.0%	1.020	150	105	153	70.0%	1.020
Total Asian	114	75	117	65.8%	1.026	99	69	99	69.7%	1.000	99	69	99	69.7%	1.000
Non-MPA	12,837	11,211	13,026	87.3%	1.015	8,433	7,440	8,535	88.2%	1.012	8,433	7,440	8,535	88.2%	1.012
Missing	1,200	1,005	1,140	83.8%	0.950	561	474	525	84.5%	0.936	561	474	525	84.5%	0.936
75+ years															
All	9,903	8,730	9,891	88.2%	0.999	9,195	8,145	9,201	88.6%	1.001	9,195	8,145	9,201	88.6%	1.001
Total Māori	189	144	195	76.2%	1.032	171	141	174	82.5%	1.018	171	141	174	82.5%	1.018
Total Pacific	93	66	90	71.0%	0.968	69	51	66	73.9%	0.957	69	51	66	73.9%	0.957
Total Asian	60	42	57	70.0%	0.950	78	54	69	69.2%	0.885	78	54	69	69.2%	0.885
Non-MPA	9,030	8,037	9,066	89.0%	1.004	8,454	7,539	8,484	89.2%	1.004	8,454	7,539	8,484	89.2%	1.004
Missing	492	423	468	86.0%	0.951	399	357	396	89.5%	0.992	399	357	396	89.5%	0.992

2.4.2 Missing data

Inevitably in a large dataset a certain amount of data will be missing. Table 4 shows the amount of data missing for household income by each cohort. Household income data is often missing, as it cannot be calculated if a resident adult is absent on Census night or refuses to provide a personal income. (Ethnicity was also missing on occasion, but more rarely.)

The authors attempted to impute for missing income, but the result was deemed unsatisfactory (see the Technical Report for details).⁵¹ This study therefore only carried out analyses where complete data for the variables was available.

Table 4: Percentage of adults (15+) missing data on key analysis variables by cohort

	% by cohort total aged 15+				
	1981–1986	1986–1991	1991–1996	1996–2001	2001–2004
Household income data present	81.1%	83.5%	84.3%	81.6%	79.9%
Household income data absent	18.9%	16.5%	15.7%	18.4%	20.1%

2.5 Variable definitions and categorisation

2.5.1 Ethnicity

The conceptually important aspect of classifying ethnicity has been addressed above in Chapter 1: Background. The wording of ethnicity questions has varied across Censuses, rendering consistent ethnic classification problematic. In particular, the authors of this report 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. A further issue was the fact that the 1981 ethnicity question solicited fractionated origin responses (such as ‘one-quarter Māori, three-quarters European’): for 1981 Census data this report categorised a person as Māori if they nominated any fraction as Māori, and likewise for 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.

Table 5 shows the distribution of person years and cancers (weighted for linkage bias as described above) by ethnicity.

Table 5: Cancers (weighted for linkage bias) and person years by ethnic group

Cohort	Total Māori		Total Pacific		Total Asian		European/Other		Missing ethnicity	
	No. of cancers	Person years	No. of cancers	Person years	No. of cancers	Person years	No. of cancers	Person years	No. of cancers	Person years
Males										
25+ years										
1981–1986	1,260	351,852	270	105,977	99	53,179	21,369	3,702,056	357	45,831
1986–1991	1,368	395,496	426	134,039	171	70,440	24,168	3,961,035	234	48,354
1991–1996	1,869	433,603	549	170,050	279	136,736	30,555	4,088,779	108	43,558
1996–2001	2,718	559,208	924	212,126	630	221,169	36,234	4,175,105	339	66,727
2001–2004	2,283	418,212	714	183,348	663	231,181	30,780	3,199,458	396	52,978
25–44 years										
1981–1986	192	227,787	63	77,526	24	36,510	1,449	1,758,940	15	17,549
1986–1991	189	260,319	108	94,528	36	47,503	1,632	1,911,738	9	22,952
1991–1996	282	281,515	84	114,636	63	96,321	1,752	1,899,638	9	20,057
1996–2001	372	353,073	114	136,196	135	139,305	1,815	1,856,802	24	34,058
2001–2004	273	251,071	66	113,796	87	132,259	1,488	1,307,428	12	23,484
45–64 years										
1981–1986	606	99,556	141	24,428	36	13,128	6,957	1,272,213	66	12,625
1986–1991	672	109,698	186	33,835	69	18,895	7,233	1,305,846	48	15,093
1991–1996	858	122,573	252	45,662	108	33,600	8,265	1,376,015	18	13,526
1996–1991	1,158	164,260	375	61,093	261	68,280	10,038	1,472,923	90	19,997
2001–2004	990	133,187	279	55,751	285	78,343	9,342	1,224,088	96	17,416
65–74 years										
1981–1986	312	17,743	51	3,188	21	1,935	7,086	428,870	120	8,205
1986–1991	342	17,918	93	4,281	27	2,520	7,845	455,626	78	5,010
1991–1996	498	21,674	153	7,294	63	4,714	10,557	492,137	33	5,401
1996–2001	795	30,787	279	10,702	156	9,694	12,480	489,935	102	6,634
2001–2004	726	25,153	243	9,751	192	15,210	9,714	365,213	114	5,837
75+ years										
1981–1986	153	6,766	15	836	15	1,606	5,877	242,033	156	7,453
1986–1991	165	7,561	42	1,394	39	1,522	7,455	287,825	99	5,299
1991–1996	231	7,841	57	2,458	39	2,101	9,978	320,989	51	4,575
1996–2001	393	11,088	153	4,135	78	3,889	11,904	355,445	123	6,039
2001–2004	294	8,801	126	4,050	105	5,368	10,233	302,730	174	6,242
75–84 years										
1981–1986	129	5,808	15	736	15	1,251	4,890	199,232	126	6,059
1986–1991	150	6,329	39	1,210	24	1,117	6,099	233,439	72	3,686
1991–1996	195	6,561	51	2,099	30	1,560	7,947	253,539	39	3,395
1996–2001	330	9,135	138	3,442	63	3,124	9,342	274,648	96	4,253
2001–2004	255	7,491	111	3,470	93	4,455	8,118	235,104	138	4,282
85+ years										
1981–1986	24	958			6	355	987	42,801	27	1,395
1986–1991	15	1,232	6	185	15	405	1,356	54,386	27	1,613
1991–1996	33	1,280	9	359	9	541	2,031	67,450	6	1,179
1996–2001	63	1,954	15	693	15	766	2,559	80,798	24	1,786
2001–2004	39	1,310	15	580	9	914	2,115	67,626	36	1,960

Cohort	Total Māori		Total Pacific		Total Asian		European/Other		Missing ethnicity	
	No. of cancers	Person years	No. of cancers	Person years	No. of cancers	Person years	No. of cancers	Person years	No. of cancers	Person years
Females										
25+ years										
1981–1986	1,380	365,327	300	104,855	105	50,343	20,778	3,918,936	528	69,205
1986–1991	1,737	421,698	486	137,644	177	71,404	24,990	4,228,272	327	60,009
1991–1996	2,214	481,910	606	188,017	330	144,701	28,665	4,420,893	132	45,726
1996–2001	3,189	622,924	957	237,343	816	259,748	31,782	4,563,526	399	70,147
2001–2004	2,649	481,115	891	204,480	903	281,610	27,108	3,549,835	387	52,258
25–44 years										
1981–1986	375	238,521	111	76,965	39	33,778	2,664	1,775,915	21	16,688
1986–1991	438	279,969	171	97,796	54	47,988	3,324	1,942,009	12	22,074
1991–1996	534	319,801	201	128,799	108	102,899	3,198	1,963,948	15	18,600
1996–2001	735	400,886	273	154,639	252	169,025	3,447	1,952,849	21	29,097
2001–2004	549	297,098	177	128,257	249	167,545	2,721	1,419,545	15	17,142
45–64 years										
1981–1986	675	100,600	138	22,561	39	11,963	7,299	1,251,508	75	17,740
1986–1991	855	112,067	216	32,490	78	17,721	8,220	1,283,619	69	16,747
1991–1996	1,095	127,071	240	46,524	156	32,679	9,201	1,370,181	27	12,988
1996–2001	1,524	170,667	405	62,981	363	72,769	10,617	1,494,045	90	18,731
2001–2004	1,302	143,044	411	57,879	426	90,801	9,573	1,259,768	81	15,461
65–74 years										
1981–1986	243	18,560	30	3,582	15	2,665	5,364	498,002	198	16,918
1986–1991	312	19,868	63	5,030	27	3,150	6,477	534,120	90	9,280
1991–1996	375	24,259	123	8,777	36	5,570	7,203	550,398	30	6,314
1996–2001	639	34,938	177	12,984	111	11,564	7,512	528,247	87	7,831
2001–2004	552	28,095	198	11,929	153	15,801	6,033	393,701	81	6,729
75+ years										
1981–1986	90	7,646	18	1,748	12	1,937	5,448	393,510	237	17,859
1986–1991	135	9,794	33	2,328	18	2,545	6,969	468,524	156	11,909
1991–1996	213	10,779	39	3,918	33	3,553	9,060	536,366	57	7,823
1996–2001	288	16,433	102	6,740	84	6,391	10,209	588,384	204	14,488
2001–2004	249	12,878	102	6,414	78	7,462	8,781	476,821	210	12,927
75–84 years										
1981–1986	78	6,339	18	1,477	12	1,593	4,071	287,680	183	13,834
1986–1991	114	7,818	27	1,800	12	1,900	5,214	340,984	114	8,413
1991–1996	192	8,759	30	3,102	27	2,606	6,489	381,348	33	5,318
1996–2001	234	12,868	84	5,317	63	4,869	7,260	404,795	132	9,240
2001–2004	198	10,376	87	5,143	60	5,747	6,084	323,480	132	7,634
85+ years										
1981–1986	12	1,308	6	271			1,377	105,831	48	4,025
1986–1991	21	1,976	6	528	6	644	1,758	127,541	42	3,496
1991–1996	24	2,020	9	816	6	947	2,574	155,019	24	2,505
1996–2001	54	3,565	18	1,423	24	1,522	2,949	183,589	69	5,248
2001–2004	51	2,503	15	1,272	15	1,716	2,694	153,341	75	5,292

Note: The sum of the row percentages is greater than 100 percent, as total groupings are used for Māori, Pacific and Asian.

2.5.2 Equivalised household income

Equivalised household income is the main measure of SEP used in this report. In households of different size and composition, different incomes produce similar standards of living (because of economies of scale). The revised Jensen index^{52 53} has been used to equalise household incomes for this report. Household income has also been adjusted for inflation using the consumer price index (CPI; base year 2001).

The analyses in this report employ tertiles or quintiles of CPI-adjusted equivalised household incomes. To create these, first, household equivalised incomes were calculated for each household. Then each individual in that household was assigned the value of the household equivalised income. All cohorts were then pooled together, and individuals were grouped into five-year age groups (sexes combined), up to the age of 65 (one group comprised everyone aged over 65). The individuals in each age group were then ranked by household income and divided into three or five equal-sized groups for tertiles and quintiles respectively. Records were then disaggregated back to their original cohorts.

This approach to creating income tertiles and quintiles differs from that of the NZCMS. A new approach was needed due to the inclusion of older age groups in CancerTrends (the NZCMS did not analyse data for people older than 77 years). The clustering of incomes around the dollar value of New Zealand's Government-funded superannuation entitlement in this older age group means that its income distribution is very different to that of younger ages, making age-specific income thresholds helpful for interpretation purposes. However, by pooling all cohorts before determining age-specific cut-points, the impact of widening income inequality between the 1980s and 1990s will still be evident in regression-based measures of inequality (that is, SII and RII – see later in this section), as the proportionate distribution of any given age group by income tertile or quintile varies over time due to underlying changes in income inequality. The income thresholds for tertiles and quintiles by age groups are shown in Appendix 1 (Table 131 and Table 132)

Table 6 shows the distribution of person years and cancer diagnoses (weighted for linkage bias) by income. Examining 45–64 year-old males as an example, the percentage in the top tertile of incomes (excluding missing incomes) was 36 percent in 1981, increasing to 43 percent in 2001. The percentage in the low-income tertile stayed much the same (26 percent and 27 percent), and in the middle income tertile decreased over time (37–29 percent). This pattern reflects both an increasing 'real' average household income over time and also widening income inequalities (that is, the middle income group thins as the top grows and the lowest income tertile remains unchanged).

Table 6: Cancer (weighted for linkage bias) and person years by tertile of equivalised household income

Sex / age group	Cohort	Low income		Medium income		High income		Missing income	
		No. of cancers	Person years	No. of cancers	Person years	No. of cancers	Person years	No. of cancers	Person years
Males									
25+ years	1981–1986	7,062	1,033,329	5,988	1,245,361	6,534	1,226,667	3,756	748,780
	1986–1991	8,352	1,195,948	8,289	1,458,011	6,909	1,231,050	2,808	715,839
	1991–1996	6,807	1,134,249	14,169	1,535,557	9,243	1,472,186	3,135	721,968
	1996–2001	10,518	1,237,911	13,971	1,463,879	11,226	1,650,152	5,034	856,784
	2001–2004	8,958	902,877	10,359	1,026,876	10,494	1,409,892	4,995	727,924
25–44 years	1981–1986	402	487,105	528	652,969	534	607,496	270	366,850
	1986–1991	495	580,875	633	733,250	534	621,513	306	394,607
	1991–1996	534	571,535	639	683,708	681	751,178	339	398,743
	1996–2001	657	563,283	660	664,309	759	836,132	375	437,070
	2001–2004	402	367,115	468	431,775	753	674,626	303	341,480
45–64 years	1981–1986	1,698	309,179	2,421	435,444	2,391	423,102	1,293	253,413
	1986–1991	2,064	354,377	2,847	495,256	2,175	393,372	1,116	238,800
	1991–1996	2,907	419,297	2,736	449,403	2,715	486,719	1,137	234,370
	1996–2001	2,862	431,895	3,288	470,134	3,978	587,683	1,752	290,976
	2001–2004	2,511	340,948	2,607	361,188	4,161	540,395	1,695	262,343
65–74 years	1981–1986	2,553	142,097	1,683	101,261	2,214	140,094	1,140	76,443
	1986–1991	2,844	152,540	2,508	146,274	2,322	144,492	705	41,922
	1991–1996	2,004	98,186	5,352	236,468	3,159	151,533	792	44,899
	1996–2001	3,993	156,732	4,650	176,169	3,729	147,072	1,410	66,978
	2001–2004	3,165	114,757	3,228	119,129	3,234	126,291	1,356	60,522
75+ years	1981–1986	2,409	94,948	1,356	55,687	1,392	55,975	1,053	52,074
	1986–1991	2,946	108,156	2,298	83,232	1,878	71,673	678	40,511
	1991–1996	1,362	45,231	5,439	165,978	2,685	82,756	867	43,957
	1996–2001	3,006	86,001	5,373	153,267	2,763	79,266	1,497	61,759
	2001–2004	2,883	80,057	4,056	114,784	2,346	68,580	1,635	63,579
75–84 years	1981–1986	2,028	79,645	1,164	47,626	1,137	46,995	843	38,813
	1986–1991	2,472	91,085	1,908	69,350	1,554	59,540	456	25,781
	1991–1996	1,056	35,461	4,509	138,299	2,130	66,621	573	26,744
	1996–2001	2,475	70,185	4,263	122,515	2,163	62,406	1,062	39,254
	2001–2004	2,358	64,290	3,285	93,873	1,893	55,521	1,173	40,999
85+ years	1981–1986	384	15,303	195	8,061	255	8,980	210	13,261
	1986–1991	477	17,070	393	13,881	324	12,133	219	14,730
	1991–1996	306	9,770	933	27,679	555	16,135	291	17,212
	1996–2001	531	15,816	1,110	30,752	597	16,860	438	22,505
	2001–2004	525	15,767	768	20,911	450	13,059	465	22,580

Sex / age group	Cohort	Low income		Medium income		High income		Missing income	
		No. of cancers	Person years	No. of cancers	Person years	No. of cancers	Person years	No. of cancers	Person years
Females									
25+ years	1981–1986	8,151	1,389,530	5,688	1,240,974	5,394	1,090,218	3,846	783,183
	1986–1991	9,141	1,528,001	8,970	1,517,507	6,147	1,087,627	3,438	776,950
	1991–1996	8,733	1,492,001	12,051	1,621,655	7,323	1,356,910	3,822	800,583
	1996–2001	10,134	1,564,664	12,651	1,625,123	8,658	1,547,184	5,592	988,837
	2001–2004	9,525	1,231,228	8,703	1,095,430	8,031	1,344,067	5,625	879,003
25–44 years	1981–1986	882	620,651	1,026	650,142	786	511,528	507	355,579
	1986–1991	1,110	728,693	1,269	711,247	909	524,371	702	418,216
	1991–1996	1,137	747,893	1,116	662,393	1,095	683,745	699	431,888
	1996–2001	1,350	761,996	1,212	665,612	1,404	784,029	726	474,229
	2001–2004	915	517,457	861	448,152	1,215	661,399	699	387,709
45–64 years	1981–1986	2,529	395,315	2,337	401,049	2,121	373,158	1,239	234,115
	1986–1991	2,934	428,230	3,027	470,546	2,190	340,248	1,278	222,192
	1991–1996	3,819	497,941	2,907	436,003	2,634	430,263	1,344	223,468
	1996–2001	3,912	504,833	3,369	471,688	3,621	528,734	2,058	308,068
	2001–2004	3,222	407,104	2,892	370,272	3,702	498,449	1,953	287,170
65–74 years	1981–1986	2,262	205,325	1,248	116,191	1,428	131,639	915	86,530
	1986–1991	2,523	204,649	2,307	186,721	1,680	138,568	459	41,365
	1991–1996	1,776	134,319	3,753	278,119	1,785	141,514	459	41,199
	1996–2001	2,892	192,389	2,994	202,297	1,704	130,498	912	69,389
	2001–2004	2,289	145,852	2,139	137,431	1,611	107,231	972	65,232
75+ years	1981–1986	2,478	168,239	1,077	73,592	1,056	73,893	1,188	106,958
	1986–1991	2,574	166,428	2,367	148,993	1,368	84,440	1,005	95,177
	1991–1996	2,001	111,850	4,272	245,140	1,815	101,388	1,314	104,029
	1996–2001	1,977	105,446	5,076	285,526	1,929	103,922	1,893	137,152
	2001–2004	3,096	160,815	2,814	139,575	1,506	76,988	2,004	138,893
75–84 years	1981–1986	1,950	132,902	846	58,675	813	57,097	747	62,235
	1986–1991	2,046	133,127	1,827	116,488	1,083	65,814	525	45,440
	1991–1996	1,482	84,122	3,324	192,565	1,371	78,597	594	45,820
	1996–2001	1,506	81,996	3,801	211,687	1,419	77,267	1,035	65,800
	2001–2004	2,199	117,413	2,115	107,214	1,110	58,139	1,137	69,432
85+ years	1981–1986	525	35,337	231	14,918	243	16,797	444	44,724
	1986–1991	528	33,301	540	32,504	285	18,626	480	49,737
	1991–1996	519	27,728	951	52,575	444	22,791	723	58,209
	1996–2001	468	23,449	1,278	73,839	507	26,656	858	71,352
	2001–2004	894	43,403	696	32,361	396	18,849	864	69,461

Cancer diagnosis

Cancers are grouped by ICD-10 codes (see the Technical Report for details of mapping cancer prior to 2000 from ICD-9/10).⁵¹ All in situ cancers were excluded from analyses in this report. All methods of cancer registrations were included. For the purposes of analysis of cancers in children (aged 0–14) and adolescents (aged 15–24), all cancers were grouped together due to small numbers. For adults, chapter groupings and associated ICD-10 codes are shown in Table 7.

Table 7: Cancer groupings for adults used in this report

Cancer	Abbreviation for use in figures	ICD-10 code
First incident cancer	First	C00–97
Bladder	Bladder	C67
Brain	Brain	C71
Breast	Breast	C50
Cervix	Cervix	C53
Colorectal (excluding anal)	Colorectal	C18–20
Endometrium	Endometrium	C54–55
Gallbladder and bile ducts	Gallbladder	C23–24
Hodgkin’s disease	Hodgkin’s	C81
Kidney	Kidney	C64
Larynx, nasal, ear and sinus	Larynx etc	C30–32
Leukaemia	Leukaemia	C91–95
Lip, mouth and pharynx	Oropharynx	C00–14
Liver	Liver	C22
Lung, bronchus and trachea	Lung	C33–34
Melanoma	Melanoma	C43
Myeloma	Myeloma	C90
Non-Hodgkin’s lymphoma	NHL	C82–85
Oesophagus	Oesophagus	C15
Ovary	Ovary	C56
Pancreas	Pancreas	C25
Prostate	Prostate	C61
Stomach	Stomach	C16
Testicular	Testicular	C62
Thyroid	Thyroid	C73
Ill-defined	Ill-def	C76–80

2.6 Analyses

2.6.1 Dataset restrictions

Analyses were restricted to individuals at their usual residence on Census night. Other restrictions to the data pertaining to the inclusion of Census respondents were due to missing data.

2.6.2 Person time

After the above data restrictions had been applied, all remaining Census respondents were eligible to contribute person time to the denominator from Census night until the end of the follow-up period (the day before the following Census). Thus an individual who did not develop cancer would contribute five person years to the denominator and no events to the numerator.

Constructing person time in CancerTrends is more complex than it is in the NZCMS, as potentially people can experience more than one cancer outcome. The majority of people experiencing cancer incidence had only one cancer per cohort, but about 2.8 percent had two or more newly registered cancers within the five years following each census.

For the overall analysis (known as first incident cancer), everyone for whom information was complete contributed person time to the denominator. If a person developed one or more cancers in the cohort they contributed person time to the denominator until the date of developing their first incident cancer. Such people were then censored at the date of their first incident cancer; thus people who had more than one cancer in a cohort only contributed one event to the numerator for the first incident cancer analyses. It would have been possible to censor only at death from a cancer included in the cohort linkage, and allow Census respondents to contribute two or more incident cancers. However, this latter approach was not chosen, for two reasons. First, cancer records had (necessarily) been simplified prior to the linkage process for confidentiality reasons to include a maximum of four separate cancer diagnoses, as a confidentiality and privacy measure. Thus, conceptually at least, we did not have the ability to undertake 'proper' analyses of all incident cancers. Second, and more importantly, in CancerTrends it is only possible to learn of a person's death if that person has first developed a cancer. That is, all deaths among people who had not developed a cancer in the five years after a Census were unknown to us, and censoring fully by death was therefore impossible. (In the future, it is hoped that the record linkage of mortality (through NZCMS) and cancer (through CancerTrends) can be combined with the 2006 Census, allowing more comprehensive data management and analyses.)

For analyses of specific cancer sites (that is, everything other than the 'first incident cancer' analyses), Census respondents contributed person time from the date of the Census to development of that specified cancer site, and were then censored. Thus, if an individual developed a colorectal cancer two years after the Census and then a melanoma a year later, they would contribute two years of person time to the denominator of the colorectal cancer analysis and one 'event' to the numerator, and three years' person time to the melanoma analysis denominator and one event to the numerator. People who did not develop cancer contributed five years of person time to the denominator.

2.6.3 Standardisation

To compare cancer incidence 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 and over time through direct standardisation using a 'standard population' as the reference population. For CancerTrends the World Health Organization (WHO)

world population was used as the reference population, as it facilitates international comparison, approximates the expected age structure of the global population in 2025 and represents a population that is young compared to the European/Other population, but not the Māori, Asian or Pacific ethnic groups, thus increasing the stability and statistical precision of estimates for the latter groups.

To compare cancer incidence rates across income groups it was necessary to standardise for both age and ethnicity: the latter because ethnicity is prior to SEP (that is, ethnicity is one determinant of income) in causal associations with disease risk, and so potentially confounds the association of SEP with cancer incidence. A matrix of standardisation weights by ethnicity and age were used for the income analyses, as Table 8 shows. The following points should be noted.

- The sum of weights for each ethnic group is the proportion of that ethnic group in the 2001 Census, with a necessary prioritisation definition of ethnicity to ensure weights sum to 1.0.
- Only Māori, Pacific and non-Māori non-Pacific ethnic groups are incorporated into the ethnic standardisation – including Asian as well would have made the data too sparse, especially in that data pertaining to the 1980s.
- Within each of the three ethnic groups, the distribution of weights by age is exactly that of the overall WHO standard.

Table 8: Age and age-ethnicity weights used to standardise cancer incidence rates

Age group	Age weights	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: 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).

† As the CancerTrends cohorts are 'closed' cohort study designs, they are not well suited to analysing infant mortality. Therefore, <1 year-olds were excluded from analyses and a weight for 1–4 year-olds was used.

Finally, it must be noted that while standardising income analyses for both age and ethnicity has strong theoretical grounds, it creates a risk of unstable estimates due to the small cell sizes in the analyses – especially in the case of Pacific people in the 1980s, among whom, for specific cancer sites, there may have been few observations of cancer incidence (and fewer still of cancer outcomes) in some age groups. These analyses rely on the assumption that with 54 separate strata for weighting (that is, 18 age groups for three ethnic groups) ‘the unders and overs will balance out’. This will be true when solely considering observed cancer cases. However, if the actual number of Census respondents pertaining to a given cell is very small relative to the weight, instability may arise. For example, there may have been only 10 Census respondents who were Pacific and aged 80–84 in the 1981 census – approximately $10/3,000,000 = 0.0000033$ of the total population. Yet the weight for this stratum in the above table is 0.00047: 141 times greater than that actual proportion. If just one cancer occurred among Pacific people in this stratum, then this very high stratum rate (10,000 per 100,000) will be ‘weighted up’ by 141 times its ‘observed’ importance. Indeed, in this study such an eventuality did occur in the case of non-Hodgkin’s lymphoma among Pacific people: the rates in 1981–1986 for one income tertile were spuriously elevated. In this case, the rate was suppressed.

Standardisation of income rates for both ethnicity and age in this report reflects conceptual priorities, but in parallel all income rates and measures of association for just age standardisation have also been produced. This report did not find strong evidence of instability for any other age- and ethnicity-standardised rates by income, other than for NHL among Pacific people, as mentioned above.

2.6.4 Measures of association and impact

For ethnic group comparisons, absolute and relative inequalities in cancer incidence are presented as standardised rate differences (SRDs) and standardised rate ratios (SRRs), 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, in each case comparing the low- (bottom tertile) with the high- (top tertile) income group. In addition, the SII and RII were also calculated using the Mackenbach and Kunst approach.^{54 55} A three-bin (tertiles) categorisation was used in analysis of equivalised household income, and a five-bin (quintiles) categorisation was used in the SII and RII analyses.

The SII and RII are regression-based measures of absolute and relative differences, respectively, and therefore parallel the SRD and SRR. They have several advantages over the latter measures, however. The regression-based measures make use of incidence rate estimates for all income bands, rather than just comparing extreme groups (that is, comparing the highest income band with the lowest). They also incorporate changes in the sizes of income bands over time by regressing rates on the mid-point of each income group’s rank on a scale from zero to one (that is, the riddit score, which may change over time due to changing levels of income inequality). Because New Zealand’s income distribution widened over the 1980s and 1990s, it is to

be expected that income gradients in cancer incidence will be seen to have increased more when measured using the SII as opposed to the SRD, and that a similar effect would be evident using the RII as opposed to the SRR.

This report presents both SRDs and SRRs, and SIIs and RIIs. The former are more readily interpretable by non-specialist audiences, and the latter have the advantages described above.

2.6.5 Analyses

Primary analyses on unit record CancerTrends data (that is, the linked datasets) were conducted in the data laboratory of Statistics New Zealand, and secondary analyses at the University of Otago, Wellington. All analyses were conducted using SAS (Statistical Analysis System) software.

Standardised rates, SRDs, SRRs, SIIs and RIIs were calculated with 95 percent confidence intervals.^{54 56} Tests for linear trends in rates, SRDs, SRRs, SIIs and RIIs were also calculated. As SRRs and RIIs are ratio measures, linear trends of the log transformations of these variables were tested for.

Because this study entailed the examination of many cancers, and associations with either SEP or ethnicity were often modest, pooled standardised rates, SRDs, SRRs, SIIs and RIIs are also presented across the full 23 years of follow-up. (See Appendix 2 for more details of the pooling of measures.)

Results are presented by as many age group strata as the data would support. This often means that fewer age group strata are presented for analyses by ethnicity compared to income. For many cancers, results could be presented only for the 25+ years age group.

Part B: Adult Cancers

Chapter 3: First Incident Cancer

Increased incidence of cancer over time may be due to a true increase in disease, or to improved diagnosis or registration of cancer. For example, in 1994 the implementation of the Cancer Registry Act 1993 resulted in a 12.5 percent increase in total registrations, largely due to stricter requirements for reporting of melanoma. However, if the percentage of cases captured over time changes in a similar manner among different ethnic and socioeconomic groups, then inequalities in first cancer incidence rates are still interpretable over time. (These issues are further canvassed in Chapter 1: Background.)

3.1 Ethnic trends

Incidence rates of any first diagnosis of cancer (in those aged 25+) increased steadily for all ethnic groups over the study period (1981–1986 to 2001–2004): 37 percent and 36 percent for Māori males and females respectively; 18 percent and 24 percent for Pacific peoples; 42 percent and 30 percent for European/Other; and 30 percent and 38 percent for Asian people (Figure 2 and Table 75 in Appendix 1). Percentage increases over time in first cancer incidence for all ethnic groups were smallest among 25–44 year-olds, but were otherwise similar across all age groups.

Among males aged 25+ years, Māori first cancer incidence was 10 percent higher than European/Other in 1981–1986, but a faster increase in European/Other first cancer resulted in there being no difference by 2001–2004 (Figure 3 and Table 9). A similar convergence was seen among 45–64 year-old males, but other age groups showed varying and more unstable differences. Among females, Māori first cancer rates were higher than European/Other rates at nearly all time points for all age groups by about 5–25 percent, other than among those aged 75+ years in the 1980s and early 1990s (Figure 3 and Table 9).

Pacific male first cancer rates increased in tandem with European/Other rates in 65+ year-olds, but did not increase over time among 25–64 year-olds, such that Pacific male first cancer rates were one-half to three-quarters of the rate for European/Other males aged up to 65 years by 2001–2004 (Figure 3 and Table 9). Pacific female first cancer rates tended to be lower than European/Other female rates at all ages, and to increase less over time than European/Other rates (although none of the p values for trend of the SRRs were statistically significant; Table 9).

Asian first cancer rates remained at about two-thirds of European/Other rates, for both sexes, among all ages – although these estimates were often imprecise due to small numbers of cases.

Trends in first diagnosed cancer rates, and in inequalities in these rates, should not be over-interpreted, for two reasons. First, they may reflect changes in diagnosis and reporting processes rather than true incidence. Second, they may reflect differences in the mix of cancer types (sites) between ethnic groups – different cancers behave differently.

Figure 2: Standardised rates of first cancer for 25+ year-olds, by ethnicity by sex

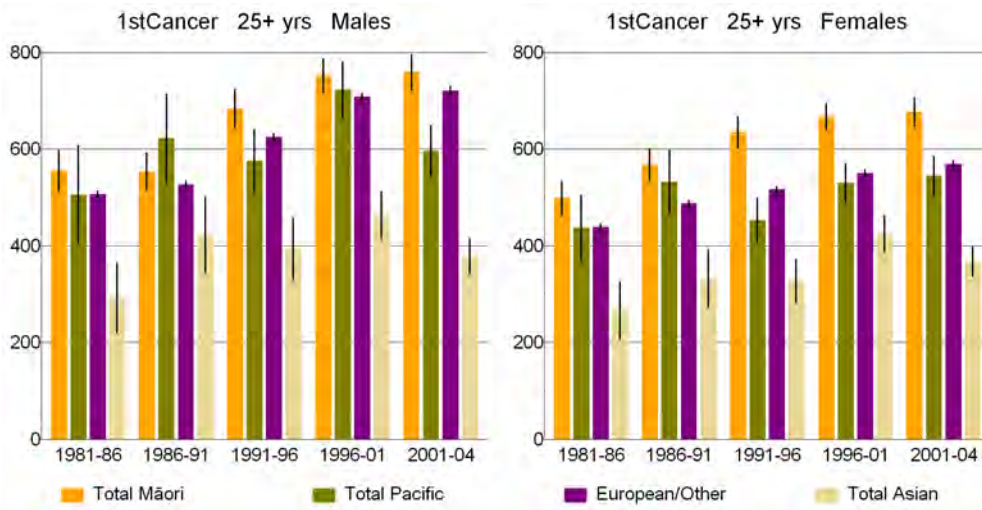


Figure 3: Standardised rates of first cancer, by ethnicity by sex and age group

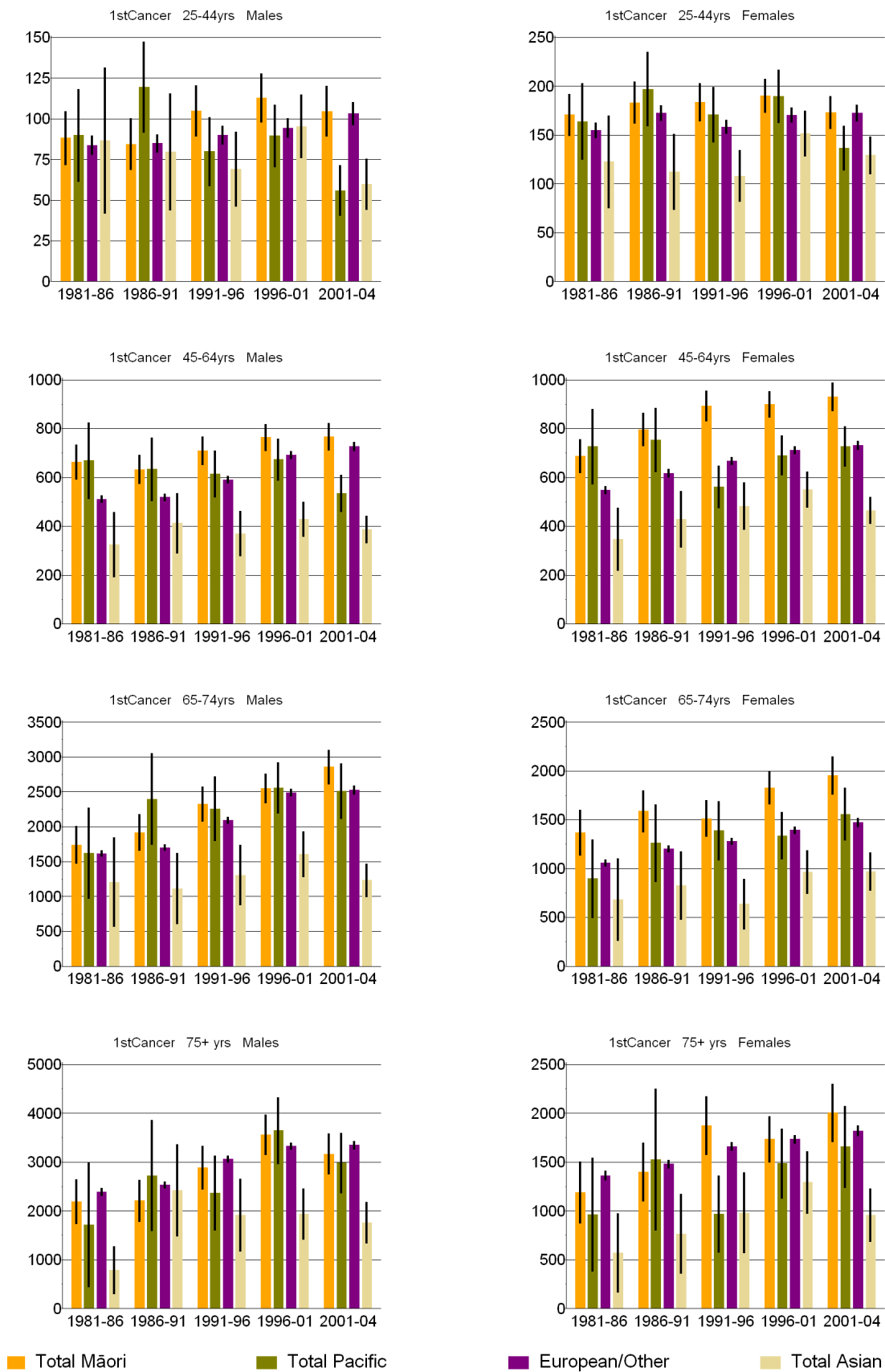


Table 9: Age-standardised rate ratios (SRR) of first cancer, for Māori, Pacific and Asian compared to European/Other, by sex

Exposure First cancer Total ethnicity	Cohort	25+ years SRR (95% CI)	25–44 years SRR (95% CI)	45–64 years SRR (95% CI)	65–74 years SRR (95% CI)	75+ years SRR (95% CI)
Males						
Total Māori vs European	1981–1986	1.10 (1.01–1.19)	1.05 (0.86–1.29)	1.30 (1.16–1.45)	1.08 (0.92–1.26)	0.92 (0.74–1.13)
	1986–1991	1.05 (0.98–1.13)	1.00 (0.82–1.21)	1.22 (1.11–1.35)	1.13 (0.98–1.29)	0.87 (0.72–1.06)
	1991–1996	1.10 (1.03–1.16)	1.17 (0.99–1.37)	1.20 (1.10–1.31)	1.11 (0.99–1.24)	0.94 (0.81–1.10)
	1996–2001	1.06 (1.01–1.11)	1.20 (1.03–1.38)	1.10 (1.03–1.19)	1.02 (0.94–1.11)	1.07 (0.95–1.20)
	2001–2004	1.05 (1.00–1.11)	1.01 (0.86–1.19)	1.05 (0.98–1.14)	1.13 (1.03–1.23)	0.95 (0.83–1.08)
	P (trend)	0.29	0.81	<.01	0.99	0.43
	Pooled	1.07 (1.04–1.10)	1.09 (1.01–1.18)	1.17 (1.12–1.22)	1.09 (1.04–1.15)	0.96 (0.89–1.03)
Total Pacific vs European	1981–1986	1.00 (0.82–1.22)	1.07 (0.78–1.48)	1.31 (1.03–1.65)	1.00 (0.67–1.50)	0.72 (0.34–1.51)
	1986–1991	1.18 (1.02–1.37)	1.41 (1.11–1.80)	1.22 (0.99–1.50)	1.41 (1.07–1.85)	1.07 (0.71–1.63)
	1991–1996	0.92 (0.82–1.03)	0.89 (0.68–1.17)	1.04 (0.89–1.22)	1.08 (0.88–1.32)	0.77 (0.56–1.07)
	1996–2001	1.02 (0.94–1.11)	0.95 (0.76–1.18)	0.97 (0.86–1.11)	1.03 (0.89–1.19)	1.10 (0.91–1.32)
	2001–2004	0.83 (0.76–0.90)	0.54 (0.41–0.72)	0.74 (0.64–0.85)	0.99 (0.85–1.16)	0.89 (0.72–1.10)
	P (trend)	0.21	0.12	<.01	0.25	0.96
	Pooled	0.99 (0.93–1.05)	0.98 (0.86–1.10)	1.05 (0.96–1.14)	1.09 (0.98–1.22)	0.92 (0.78–1.08)
Total Asian vs European	1981–1986	0.58 (0.45–0.74)	1.03 (0.61–1.74)	0.63 (0.42–0.96)	0.75 (0.44–1.26)	0.33 (0.18–0.61)
	1986–1991	0.80 (0.67–0.97)	0.94 (0.60–1.48)	0.80 (0.59–1.07)	0.65 (0.42–1.03)	0.96 (0.65–1.41)
	1991–1996	0.63 (0.53–0.74)	0.77 (0.55–1.08)	0.63 (0.49–0.80)	0.62 (0.45–0.87)	0.62 (0.42–0.92)
	1996–2001	0.65 (0.59–0.73)	1.01 (0.82–1.25)	0.62 (0.53–0.73)	0.65 (0.53–0.79)	0.58 (0.44–0.76)
	2001–2004	0.52 (0.48–0.58)	0.58 (0.44–0.76)	0.53 (0.46–0.62)	0.49 (0.40–0.59)	0.53 (0.41–0.67)
	P (trend)	0.20	0.37	0.09	0.09	0.46
	Pooled	0.64 (0.59–0.69)	0.87 (0.73–1.04)	0.64 (0.57–0.72)	0.63 (0.53–0.74)	0.61 (0.51–0.72)

Exposure First cancer Total ethnicity	Cohort	25+ years SRR (95% CI)	25–44 years SRR (95% CI)	45–64 years SRR (95% CI)	65–74 years SRR (95% CI)	75+ years SRR (95% CI)
Females						
Total Māori vs European	1981–1986	1.14 (1.06–1.22)	1.10 (0.96–1.26)	1.26 (1.13–1.39)	1.29 (1.09–1.53)	0.87 (0.67–1.14)
	1986–1991	1.17 (1.10–1.24)	1.06 (0.94–1.20)	1.29 (1.18–1.41)	1.32 (1.15–1.52)	0.95 (0.76–1.17)
	1991–1996	1.23 (1.17–1.30)	1.16 (1.03–1.30)	1.34 (1.24–1.44)	1.18 (1.04–1.34)	1.13 (0.96–1.33)
	1996–2001	1.21 (1.16–1.27)	1.12 (1.01–1.23)	1.26 (1.19–1.35)	1.31 (1.19–1.44)	1.00 (0.87–1.15)
	2001–2004	1.19 (1.14–1.25)	1.00 (0.90–1.12)	1.27 (1.19–1.36)	1.33 (1.20–1.47)	1.10 (0.95–1.28)
	P (trend)	0.40	0.52	0.70	0.60	0.30
	Pooled	1.19 (1.16–1.22)	1.09 (1.04–1.15)	1.29 (1.24–1.33)	1.29 (1.22–1.36)	1.01 (0.93–1.10)
Total Pacific vs European	1981–1986	1.00 (0.85–1.17)	1.06 (0.83–1.35)	1.33 (1.07–1.64)	0.85 (0.54–1.33)	0.71 (0.39–1.29)
	1986–1991	1.09 (0.96–1.24)	1.14 (0.94–1.39)	1.22 (1.03–1.45)	1.05 (0.77–1.44)	1.03 (0.64–1.66)
	1991–1996	0.88 (0.79–0.97)	1.08 (0.91–1.28)	0.84 (0.72–0.98)	1.09 (0.87–1.35)	0.58 (0.39–0.87)
	1996–2001	0.96 (0.89–1.04)	1.11 (0.96–1.29)	0.97 (0.86–1.09)	0.96 (0.80–1.15)	0.86 (0.67–1.09)
	2001–2004	0.96 (0.89–1.03)	0.79 (0.66–0.94)	0.99 (0.88–1.11)	1.06 (0.89–1.26)	0.91 (0.71–1.17)
	P (trend)	0.57	0.25	0.26	0.68	0.60
	Pooled	0.98 (0.93–1.03)	1.05 (0.96–1.14)	1.06 (0.98–1.14)	1.00 (0.89–1.13)	0.81 (0.68–0.97)
Total Asian vs European	1981–1986	0.61 (0.48–0.76)	0.79 (0.54–1.17)	0.63 (0.44–0.92)	0.64 (0.35–1.19)	0.42 (0.21–0.85)
	1986–1991	0.68 (0.57–0.82)	0.65 (0.46–0.92)	0.69 (0.53–0.91)	0.69 (0.45–1.05)	0.52 (0.30–0.88)
	1991–1996	0.63 (0.55–0.73)	0.68 (0.53–0.87)	0.72 (0.59–0.88)	0.50 (0.33–0.75)	0.59 (0.39–0.90)
	1996–2001	0.77 (0.71–0.84)	0.89 (0.76–1.04)	0.77 (0.68–0.89)	0.69 (0.55–0.87)	0.74 (0.58–0.95)
	2001–2004	0.65 (0.59–0.70)	0.75 (0.64–0.87)	0.64 (0.56–0.71)	0.66 (0.54–0.80)	0.53 (0.40–0.70)
	P (trend)	0.89	0.73	0.66	0.73	0.75
	Pooled	0.67 (0.63–0.72)	0.75 (0.67–0.85)	0.70 (0.63–0.77)	0.64 (0.53–0.75)	0.57 (0.47–0.68)

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

Table 10: Age-standardised rate differences (SRD) of first cancer, for Māori, Pacific and Asian compared to European/Other, by sex

Exposure First cancer Total ethnicity	Cohort	25+ years SRD (95% CI)	25–44 years SRD (95% CI)	45–64 years SRD (95% CI)	65–74 years SRD (95% CI)	75+ years SRD (95% CI)
Males						
Total Māori vs European	1981–1986	48 (4.9–92)	4.5 (-13–22)	151 (78–224)	124 (-146–393)	-200 (-664–264)
	1986–1991	27 (-13–66)	-0.3 (-17–17)	114 (53–176)	217 (-48–481)	-330 (-764–105)
	1991–1996	59 (18–101)	15 (-1.7–32)	119 (59–179)	228 (-24–480)	-174 (-622–274)
	1996–2001	44 (7.4–80)	19 (2.5–34)	72 (17–128)	61 (-152–274)	235 (-175–645)
	2001–2004	38 (-0.3–77)	1.4 (-16–18)	40 (-18–97)	327 (76–579)	-182 (-604–239)
	P (trend)	0.98	0.68	<.01	0.65	0.46
	Pooled	44 (26–62)	8.1 (0.6–16)	102 (74–130)	184 (72–297)	-127 (-324–69)
Total Pacific vs European	1981–1986	-0.8 (-103–102)	6.1 (-23–35)	157 (0.2–314)	4.1 (-644–652)	-679 (-1951–593)
	1986–1991	95 (2.7–188)	35 (6.3–63)	115 (-15–245)	697 (43–1351)	187 (-946–1320)
	1991–1996	-49 (-116–17)	-10 (-32–12)	23 (-74–119)	163 (-301–628)	-699 (-1463–66)
	1996–2001	15 (-45–74)	-4.9 (-25–15)	-18 (-105–68)	69 (-299–437)	321 (-361–1002)
	2001–2004	-125 (-178– -71)	-47 (-64– -30)	-191 (-268– -115)	-21 (-420–378)	-366 (-988–256)
	P (trend)	0.20	0.08	0.01	0.40	0.79
	Pooled	-7.4 (-43–28)	-2.1 (-13–8.8)	27 (-25–80)	193 (-46–431)	-241 (-670–188)
Total Asian vs European	1981–1986	-215 (-288– -141)	2.9 (-42–48)	-187 (-321– -53)	-410 (-1048–227)	-1603 (-2095– -1110)
	1986–1991	-105 (-184– -26)	-5.3 (-42–31)	-106 (-230–18)	-587 (-1093– -82)	-114 (-1058–830)
	1991–1996	-232 (-296– -167)	-21 (-45–2.8)	-221 (-314– -128)	-788 (-1222– -354)	-1150 (-1890– -409)
	1996–2001	-245 (-294– -196)	0.9 (-19–21)	-263 (-335– -191)	-882 (-1211– -552)	-1391 (-1914– -868)
	2001–2004	-343 (-381– -304)	-44 (-61– -27)	-339 (-397– -282)	-1299 (-1544– -1054)	-1584 (-2012– -1156)
	P (trend)	0.08	0.22	0.03	<.01	0.77
	Pooled	-222 (-251– -193)	-12 (-26–2.4)	-217 (-264– -171)	-768 (-977– -559)	-1147 (-1449– -846)

Exposure First cancer Total ethnicity	Cohort	25+ years SRD (95% CI)	25–44 years SRD (95% CI)	45–64 years SRD (95% CI)	65–74 years SRD (95% CI)	75+ years SRD (95% CI)
Females						
Total Māori vs European	1981–1986	60 (24–96)	16 (-7.0–38)	140 (71–210)	309 (76–542)	-174 (-493–146)
	1986–1991	81 (47–115)	11 (-12–33)	179 (111–248)	386 (170–601)	-79 (-381–223)
	1991–1996	119 (85–152)	25 (4.8–46)	226 (161–290)	235 (47–424)	213 (-88–514)
	1996–2001	117 (88–145)	20 (1.3–38)	188 (133–244)	433 (262–604)	-0.3 (-238–238)
	2001–2004	108 (77–139)	0.6 (-18–19)	198 (138–258)	480 (282–679)	185 (-116–486)
	P (trend)	0.10	0.49	0.29	0.26	0.18
	Pooled	96 (82–111)	15 (5.8–24)	186 (157–215)	363 (272–454)	21 (-110–153)
Total Pacific vs European	1981–1986	-0.9 (-69–67)	8.9 (-31–49)	179 (25–333)	-162 (-565–241)	-401 (-981–179)
	1986–1991	45 (-22–111)	25 (-14–63)	136 (5.6–267)	60 (-337–456)	47 (-676–771)
	1991–1996	-63 (-109– -17)	13 (-17–42)	-106 (-193– -19)	109 (-193–412)	-695 (-1089– -300)
	1996–2001	-20 (-61–21)	19 (-9.1–47)	-21 (-103–61)	-56 (-299–187)	-250 (-610–110)
	2001–2004	-25 (-67–18)	-36 (-61– -12)	-5.5 (-89–78)	84 (-186–354)	-164 (-584–257)
	P (trend)	0.59	0.19	0.42	0.50	0.60
	Pooled	-12 (-37–12)	7.8 (-7.1–23)	39 (-12–90)	3.2 (-147–154)	-299 (-533– -64)
Total Asian vs European	1981–1986	-173 (-234– -112)	-32 (-80–16)	-200 (-329– -72)	-377 (-799–44)	-792 (-1199– -386)
	1986–1991	-154 (-214– -95)	-60 (-100– -21)	-189 (-304– -74)	-375 (-725– -25)	-715 (-1122– -307)
	1991–1996	-190 (-236– -144)	-50 (-78– -23)	-185 (-282– -87)	-642 (-902– -382)	-680 (-1094– -266)
	1996–2001	-126 (-164– -87)	-19 (-43–5.2)	-161 (-236– -86)	-430 (-654– -207)	-443 (-763– -123)
	2001–2004	-202 (-233– -171)	-44 (-64– -23)	-267 (-324– -211)	-506 (-705– -306)	-863 (-1138– -589)
	P (trend)	0.63	0.73	0.28	0.71	0.93
	Pooled	-167 (-190– -145)	-41 (-56– -25)	-197 (-242– -152)	-464 (-603– -325)	-690 (-859– -521)

Notes: 95 percent confidence intervals in brackets. Underlying non-linear trends mean the p for trend value must be interpreted cautiously, particularly for all first cancer combined, which includes artefactual increases around 1994 due to melanoma registrations increasing.

3.2 Socioeconomic trends

Incidence rates of any first diagnosis of cancer (in those aged 25+) increased steadily for all income groups over time: by 40 percent and 29 percent for low-income males and females respectively; by 37 percent and 31 percent for medium-income earners; and by 37 percent and 30 percent for high income (Figure 4 and Table 76 in Appendix 1). Regardless of income level, rates of first cancer increased less over time among younger age groups. There was a tendency for first cancers among low-income males to be slightly (approximately 5 percent) more common than among high-income males, but the rate was not different by income for females (as evidenced by the pooled SRR and RII in Table 11, which are both approximately 1.00). There were no clear patterns of variation by age in relative inequalities (if any) of first cancer (Figure 5 and Table 11).

Figure 4: Standardised rates of first cancer for 25+ year-olds, by income by sex

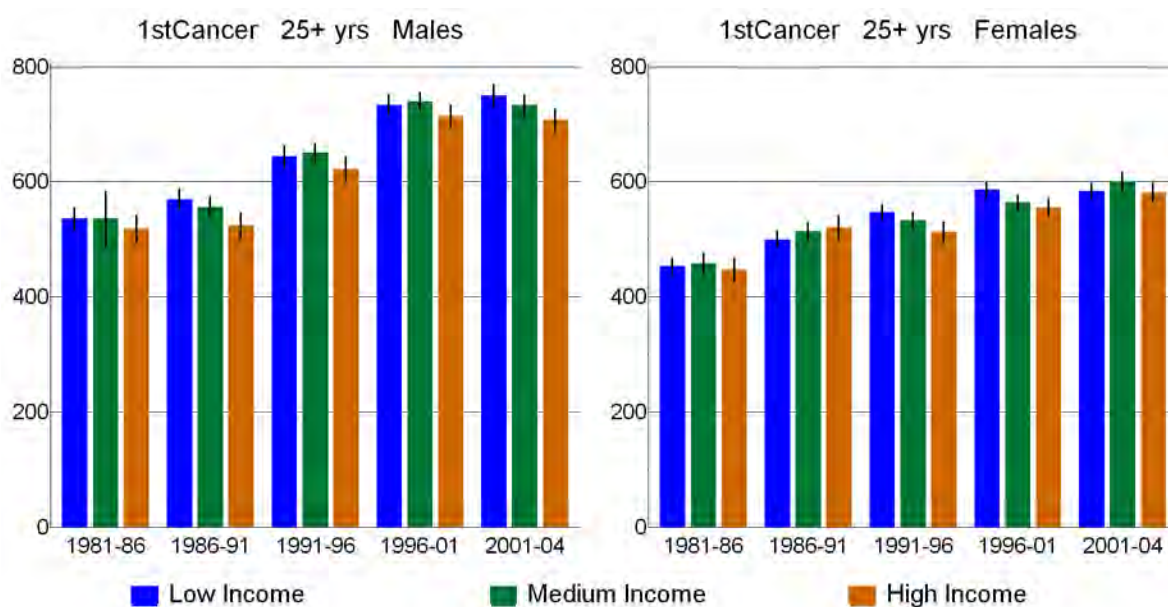


Figure 5: Standardised rates of first cancer, by income by sex and age group

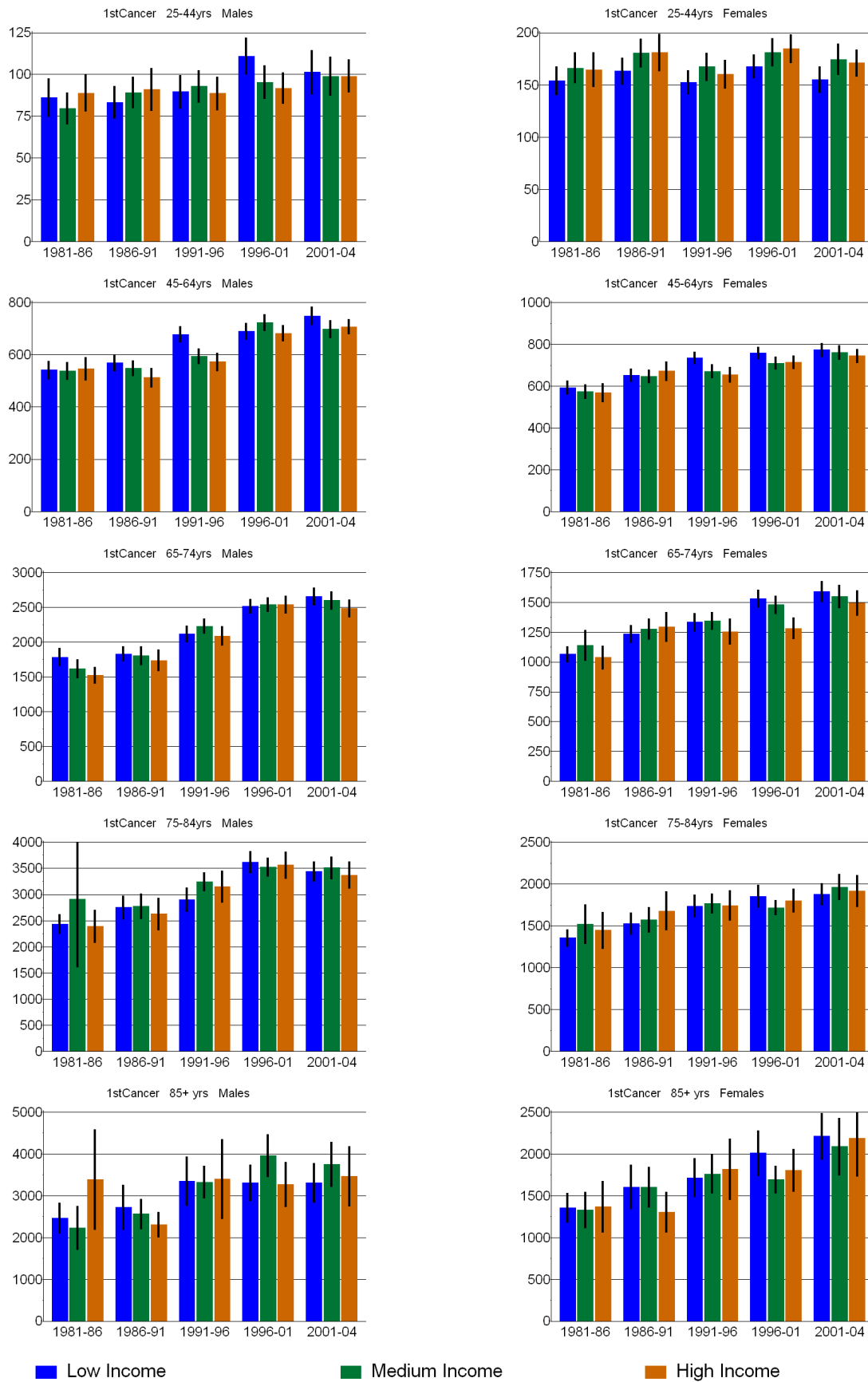


Table 11: Age- and ethnicity-standardised income rate ratios (SRR), rate differences (SRD), relative indices of equality (RII) and slope indices of inequality (SII) of first cancer, by sex

Age	Cohort	Males				Females			
		Relative inequalities		Absolute inequalities		Relative inequalities		Absolute inequalities	
		SRR	RII (95% CI)	SRD	SII (95% CI)	SRR	RII (95% CI)	SRD	SII (95% CI)
25+ years	1981–1986	1.03	0.9 (0.6–1.4)	18	-37 (-254–179)	1.01	1.0 (0.9–1.1)	6.1	-7.0 (-54–39)
	1986–1991	1.09	1.2 (1.1–1.3)	46	86 (43–129)	0.96	0.9 (0.9–1.0)	-21	-30 (-69–7.8)
	1991–1996	1.04	1.1 (1.0–1.2)	22	61 (-6.9–129)	1.07	1.1 (1.1–1.2)	35	65 (25–105)
	1996–2001	1.03	1.0 (1.0–1.1)	19	20 (-16–55)	1.06	1.1 (1.0–1.1)	31	42 (-30–115)
	2001–2004	1.06	1.1 (1.0–1.1)	43	50 (-0.3–99)	1.01	1.0 (0.9–1.1)	3.0	-3.0 (-55–48)
	P (trend)	0.99	0.32	0.69	0.29	0.65	0.67	0.63	0.58
	Pooled	1.05	1.1 (1.0–1.1)	29	34 (-22–90)	1.02	1.0 (1.0–1.1)	11	15 (-8.2–38)
25–44 years	1981–1986	0.97	1.0 (0.8–1.3)	-2.7	2.0 (-18–23)	0.94	0.9 (0.8–1.1)	-11	-15 (-41–9.9)
	1986–1991	0.91	0.9 (0.7–1.2)	-7.7	-7.0 (-17–3.0)	0.90	0.9 (0.7–1.0)	-18	-25 (-45– -5.2)
	1991–1996	1.01	1.0 (0.8–1.2)	0.9	-2.0 (-14–9.1)	0.95	1.0 (0.8–1.1)	-7.7	-8.0 (-35–19)
	1996–2001	1.21	1.3 (1.0–1.6)	19	23 (-16–61)	0.91	0.9 (0.8–1.0)	-17	-25 (-38– -11)
	2001–2004	1.02	1.1 (0.8–1.3)	2.3	4.0 (-17–26)	0.91	0.9 (0.7–1.0)	-16	-26 (-59–8.3)
	P (trend)	0.33	0.42	0.29	0.39	0.52	0.50	0.51	0.46
	Pooled	1.03	1.1 (1.0–1.2)	2.4	6.0 (-1.8–13)	0.92	0.9 (0.8–1.0)	-14	-17 (-36–2.0)
45–64 years	1981–1986	0.99	1.0 (0.9–1.2)	-4.2	-5.0 (-106–95)	1.04	1.1 (0.9–1.2)	24	44 (0.6–87)
	1986–1991	1.11	1.2 (1.1–1.3)	57	92 (71–113)	0.97	1.0 (0.9–1.1)	-19	-4.0 (-39–32)
	1991–1996	1.18	1.3 (1.2–1.4)	104	149 (71–227)	1.12	1.2 (1.1–1.4)	80	146 (124–168)
	1996–2001	1.01	1.0 (0.9–1.1)	8.3	-7.0 (-108–94)	1.06	1.1 (1.0–1.2)	44	48 (-84–181)
	2001–2004	1.06	1.1 (1.0–1.2)	42	45 (-37–127)	1.04	1.0 (1.0–1.1)	28	30 (-18–79)
	P (trend)	0.84	0.68	0.96	0.69	0.78	0.87	0.67	0.68
	Pooled	1.07	1.1 (1.1–1.2)	41	58 (15–102)	1.05	1.1 (1.0–1.1)	31	56 (26–86)

Age	Cohort	Males				Females			
		Relative inequalities		Absolute inequalities		Relative inequalities		Absolute inequalities	
		SRR	RII (95% CI)	SRD	SII (95% CI)	SRR	RII (95% CI)	SRD	SII (95% CI)
65–74 years	1981–1986	1.17	1.2 (1.1–1.5)	258	356 (132–581)	1.03	1.0 (0.8–1.2)	27	-40 (-259–178)
	1986–1991	1.05	1.2 (1.0–1.4)	95	264 (-36–564)	0.95	0.9 (0.8–1.1)	-60	-102 (-297–92)
	1991–1996	1.01	1.1 (1.0–1.2)	29	213 (29–398)	1.06	1.1 (0.9–1.2)	79	69 (-246–383)
	1996–2001	0.99	1.0 (0.9–1.1)	-25	24 (-136–184)	1.19	1.2 (1.1–1.4)	248	281 (79–483)
	2001–2004	1.07	1.1 (1.0–1.2)	170	169 (-205–542)	1.06	1.1 (0.9–1.2)	94	96 (-42–234)
	P (trend)	0.46	0.10	0.45	0.05	0.37	0.23	0.25	0.23
	Pooled	1.05	1.1 (1.0–1.2)	102	176 (42–311)	1.06	1.1 (1.0–1.1)	77	67 (-64–197)
75+ years	1981–1986	0.97	0.8 (0.3–1.9)	-85	-660 (-3023–1703)	0.92	0.8 (0.7–1.0)	-109	-259 (-551–34)
	1986–1991	1.08	1.2 (1.0–1.4)	201	462 (40–885)	0.97	0.9 (0.7–1.1)	-55	-193 (-601–214)
	1991–1996	0.92	1.0 (0.8–1.1)	-268	-123 (-694–449)	0.97	1.0 (0.8–1.1)	-45	-73 (-253–106)
	1996–2001	1.03	1.0 (0.9–1.1)	89	76 (-105–256)	1.05	1.1 (0.9–1.2)	89	86 (-305–477)
	2001–2004	1.01	1.0 (0.9–1.1)	48	12 (-133–158)	0.98	1.0 (0.9–1.2)	-34	-26 (-403–350)
	P (trend)	0.82	0.46	0.78	0.23	0.30	0.09	0.25	0.05
	Pooled	1.00	1.0 (0.8–1.2)	-5.7	-80 (-712–552)	0.98	1.0 (0.9–1.0)	-31	-86 (-210–38)
75–84 years	1981–1986	1.02	0.8 (0.3–2.1)	38	-607 (-3541–2327)	0.94	0.8 (0.6–1.1)	-92	-292 (-773–189)
	1986–1991	1.05	1.1 (0.9–1.3)	125	258 (-131–648)	0.91	0.8 (0.7–1.0)	-152	-291 (-702–121)
	1991–1996	0.92	1.0 (0.8–1.2)	-247	-18 (-787–751)	1.00	0.9 (0.8–1.1)	-6.3	-103 (-291–85)
	1996–2001	1.02	1.0 (0.9–1.1)	56	22 (-36–80)	1.03	1.0 (0.9–1.2)	52	28 (-305–362)
	2001–2004	1.02	1.0 (0.9–1.2)	72	66 (-59–191)	0.98	1.0 (0.8–1.2)	-39	-48 (-447–350)
	P (trend)	0.93	0.47	0.94	0.89	0.28	0.06	0.27	0.07
	Pooled	1.00	1.0 (0.8–1.2)	5.7	-63 (-794–668)	0.97	0.9 (0.8–1.0)	-48	-175 (-291–60)
85+ years	1981–1986	0.73	0.7 (0.4–1.2)	-923	-975 (-2598–648)	0.99	1.0 (0.7–1.3)	-12	-58 (-393–278)
	1986–1991	1.18	1.4 (0.6–2.9)	419	829 (-2320–3977)	1.23	1.2 (0.8–1.7)	302	259 (-471–989)
	1991–1996	0.98	1.0 (0.7–1.5)	-54	129 (-908–1166)	0.94	0.9 (0.7–1.3)	-102	-128 (-660–404)
	1996–2001	1.01	1.0 (0.7–1.3)	42	-141 (-1394–1113)	1.12	1.2 (0.9–1.5)	209	296 (-369–961)
	2001–2004	0.95	0.9 (0.7–1.3)	-157	-299 (-931–333)	1.01	1.1 (0.8–1.5)	22	115 (-476–706)
	P (trend)	0.88	0.71	0.89	0.91	0.91	0.57	0.91	0.39
	Pooled	0.96	1.0 (0.8–1.4)	-133	41 (-1584–1667)	1.05	1.2 (0.9–1.4)	87	244 (-308–797)

Notes: 95 percent confidence intervals in brackets. SRRs and SRDs compare low- and high-income tertiles. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

Chapter 4: Bladder Cancer

In 2005, 332 cases of bladder cancer were registered in New Zealand, the majority (253) of which occurred in men.⁵⁷ Bladder cancer had a 73 percent five-year survival rate during 1994–2003 in New Zealand.⁵⁸ Over 90 percent of bladder cancer is transitional cell carcinoma.⁵⁹

Bladder cancer is more common in older age groups and in men. Tobacco smoking is the most important risk factor for bladder cancer. There is also evidence for gene-environment interaction in the development of bladder cancer – the presence of the combination of a specific polymorphism (which codes for the breakdown of toxic products from tobacco) and tobacco consumption considerably raises the risk.⁵⁹ After smoking, the most important risk factor is occupational exposure to chemicals that are proven carcinogens.⁵⁹ The role of diet in the development of bladder cancer is not clear.⁶⁰ Other risk factors include ionising radiation, contaminated drinking water, and specific medications and medical conditions, although these probably only account for a small proportion of cases.⁵⁹

4.1 Ethnic trends

Incidence rates of bladder cancer (in those aged 25+) increased steadily over time for European/Other (35 percent and 27 percent for males and females respectively; p for trend <0.01 and 0.03) and for Māori (70 percent and 146 percent; p for trend 0.07 and 0.02) (Figure 6 and Table 77 in Appendix 1). Trends for Pacific and Asian were unstable.

Pooled over time for those aged 25+ years, Māori, Pacific and Asian bladder cancer rates were similar among males, but European/Other rates were up to twice as high (Table 12). Among females, European/Other rates were also up to twice the rates of the three other ethnic groups. There was no statistical evidence of changing relative inequalities over time in bladder cancer.

Notably, across all ethnic groups and age groups, rates of bladder cancer among males were about four times those of females.

Figure 6: Standardised rates of bladder cancer for 25+ year-olds, by ethnicity by sex

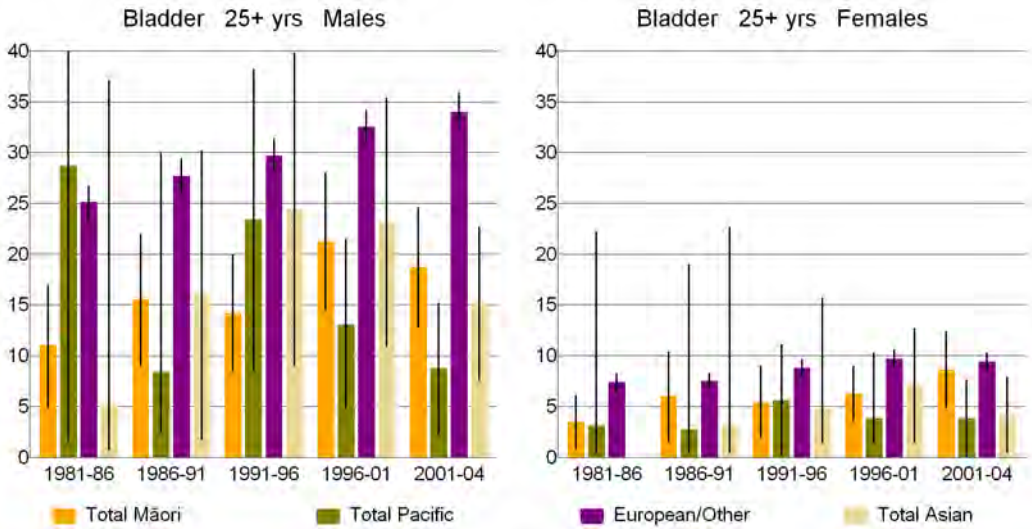


Table 12: Age-standardised rate ratios (SRR) and rate differences (SRD) of bladder cancer, for Māori, Pacific and Asian compared to European/Other, by sex

Exposure Bladder 25+ years	Cohort	Males		Females	
		SRR (95% CI)	SRD (95% CI)	SRR (95% CI)	SRD (95% CI)
Total Māori vs European	1981–1986	0.44 (0.25–0.76)	-14 (-20– -7.8)	0.47 (0.21–1.03)	-3.9 (-6.7– -1.1)
	1986–1991	0.56 (0.37–0.86)	-12 (-19– -5.5)	0.80 (0.38–1.69)	-1.5 (-6.0–3.0)
	1991–1996	0.48 (0.32–0.72)	-16 (-21– -9.6)	0.62 (0.32–1.19)	-3.4 (-7.0–0.3)
	1996–2001	0.65 (0.47–0.90)	-11 (-18– -4.4)	0.65 (0.42–1.00)	-3.4 (-6.3– -0.6)
	2001–2004	0.55 (0.40–0.76)	-15 (-21– -9.1)	0.91 (0.58–1.43)	-0.8 (-4.7–3.1)
	P (trend)	0.41	0.79	0.19	0.35
	Pooled	0.54 (0.45–0.64)	-14 (-16– -11)	0.68 (0.52–0.90)	-2.7 (-4.3– -1.1)
Total Pacific vs European	1981–1986	1.15 (0.44–2.96)	3.7 (-24–31)	0.42 (0.06–3.01)	-4.3 (-10–1.9)
	1986–1991	0.30 (0.09–1.08)	-19 (-30– -8.4)	0.36 (0.05–2.54)	-4.8 (-10–0.5)
	1991–1996	0.79 (0.42–1.49)	-6.4 (-21–8.6)	0.64 (0.24–1.69)	-3.2 (-8.7–2.3)
	1996–2001	0.40 (0.21–0.77)	-19 (-28– -11)	0.39 (0.14–1.06)	-6.0 (-9.8– -2.1)
	2001–2004	0.26 (0.12–0.54)	-25 (-32– -19)	0.41 (0.15–1.10)	-5.6 (-9.5– -1.7)
	P (trend)	0.09	0.18	0.61	0.28
	Pooled	0.57 (0.37–0.87)	-13 (-20– -5.5)	0.45 (0.24–0.81)	-4.7 (-7.0– -2.4)
Total Asian vs European	1981–1986	0.21 (0.03–1.48)	-20 (-30– -9.4)	0.43 (0.06–3.04)	-4.3 (-11–2.0)
	1986–1991	0.58 (0.24–1.41)	-12 (-26–2.6)	0.43 (0.06–3.04)	-4.3 (-11–2.0)
	1991–1996	0.82 (0.43–1.55)	-5.3 (-21–10)	0.53 (0.16–1.79)	-4.1 (-9.9–1.6)
	1996–2001	0.71 (0.42–1.21)	-9.4 (-22–3.0)	0.73 (0.33–1.61)	-2.6 (-8.3–3.0)
	2001–2004	0.45 (0.27–0.74)	-19 (-27– -11)	0.44 (0.18–1.08)	-5.2 (-9.1– -1.4)
	P (trend)	0.52	0.96		
	Pooled	0.57 (0.41–0.80)	-13 (-18– -7.0)	0.55 (0.33–0.92)	-4.0 (-6.5– -1.5)

Notes: 95 percent confidence intervals in brackets. Missing values occur when data is too sparse to reliably calculate rate ratios or differences. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

4.2 Socioeconomic trends

Incidence rates of bladder cancer (in those aged 25+) increased steadily over time by 22–73 percent for all income groups in both sexes (p for trend 0.02 or less in all instances other than low-income males; Figure 7 and Table 78 in Appendix 1). Percentage increases over time were greatest among the high-income group (adjusting for age and ethnic mix).

Averaged over time, rates of bladder cancer among low-income people tended to be 10–20 percent greater than among high-income people, across both sexes. Corresponding to the greater increase over time in rates among the high-income group, there was some evidence of narrowing in inequalities over time – but not strongly so (Table 13).

Across all income groups and age groups, bladder cancer rates among males were about four times those of females.

Figure 7: Standardised rates of bladder cancer for 25+ year-olds, by income by sex

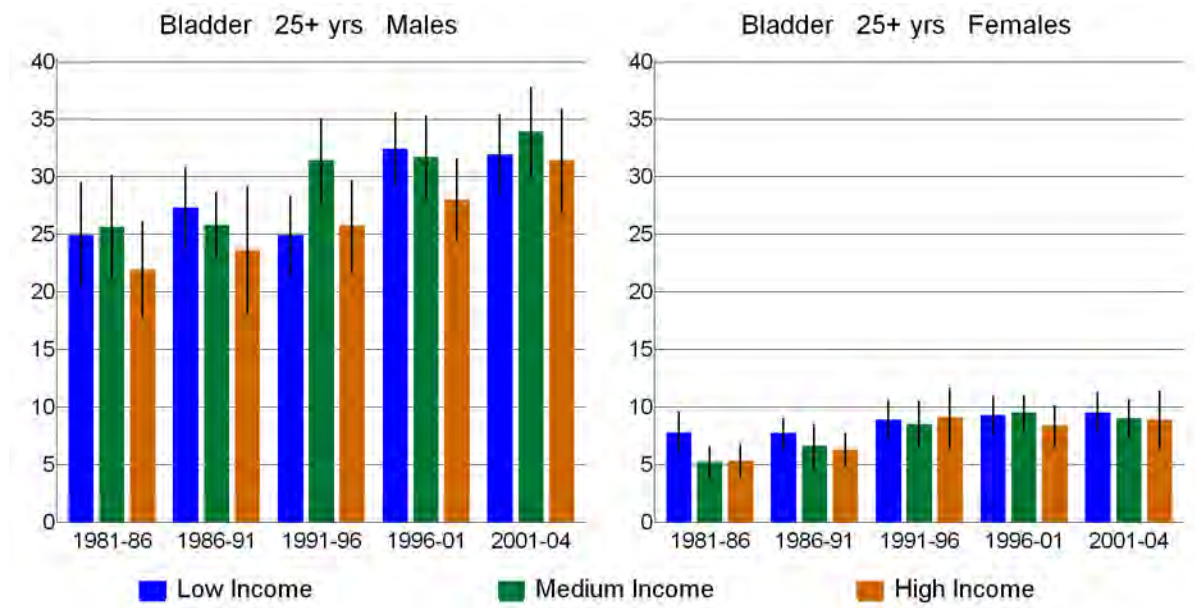


Table 13: Age- and ethnicity-standardised income rate ratios (SRR), rate differences (SRD), relative indices of inequality (RII) and slope indices of inequality (SII) of bladder cancer, by sex

Age group	Cohort	Males				Females			
		Relative inequalities		Absolute inequalities		Relative inequalities		Absolute inequalities	
		SRR	RII (95% CI)	SRD	SII (95% CI)	SRR	RII (95% CI)	SRD	SII (95% CI)
Bladder									
25+ years	1981–1986	1.14	1.2 (0.8–1.7)	3.0	4.0 (-7.4–16)	1.46	2.4 (0.7–8.9)	2.5	6.0 (-4.7–17)
	1986–1991	1.16	1.2 (0.9–1.7)	3.7	5.0 (-0.6–12)	1.22	1.3 (0.8–2.1)	1.4	2.0 (0.4–3.3)
	1991–1996	0.97	1.5 (0.8–2.6)	-0.8	12 (-16–40)	0.99	0.9 (0.5–1.5)	-0.1	-1.0 (-6.0–3.6)
	1996–2001	1.16	1.1 (0.9–1.5)	4.4	4.0 (-7.2–15)	1.11	1.2 (0.8–1.7)	0.9	1.0 (-2.2–5.0)
	2001–2004	1.02	1.0 (0.8–1.3)	0.5	-1.0 (-8.3–6.9)	1.07	1.2 (0.7–1.8)	0.6	1.0 (-1.5–4.1)
	P (trend)	0.63	0.16	0.77	0.13	0.13	0.62	0.13	0.31
	Pooled	1.09	1.2 (1.0–1.4)	2.2	5.0 (-0.4–10)	1.14	1.3 (1.0–1.7)	1.1	2.0 (-0.8–4.6)

Notes: 95 percent confidence intervals in brackets. SRRs and SRDs compare low- and high-income tertiles. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

Chapter 5: Brain Cancer

Brain cancer is relatively uncommon and is made up of a group of heterogeneous tumours with distinct pathological, clinical, epidemiological and probably aetiological factors. In New Zealand in 2005, there were 256 brain cancers registered.⁵⁷

In general, there is a small peak of brain cancer incidence among children aged under 10 years, then incidence declines until age 20, after which it increases gradually until age 70 years, when incidence appears to plateau or decline.⁶¹ Genetic syndromes are responsible for a small proportion of brain cancers.

The aetiology of brain cancer is poorly understood, and there are few established risk factors. Perhaps the only well-established cause of brain cancer is ionising radiation. There is some (albeit inconsistent) evidence that some occupational groups are at increased risk of brain cancer; for example, workers exposed to vinyl chloride, petrochemical workers, electrical workers, health professionals and agricultural workers. There is little evidence that diet, alcohol, tobacco, head trauma or mobile telephone use have an impact on risk of brain cancer.⁶¹

5.1 Ethnic trends

Incidence rates of brain cancer (in those aged 25+) more than doubled in the period surveyed among Māori (increasing by 153 percent and 181 percent for males and females, respectively), although this mainly occurred in the last cohort (p for trend 0.12 and 0.24; Figure 8 and Table 79 in Appendix 1). There were no obvious trends in European/Other and Pacific brain cancer rates. Asian male brain cancer rates increased by 123 percent (p for trend <0.01) over the period, but there was no obvious trend among Asian females.

Ethnic trends by age group were too imprecise for confident interpretation.

Pooled over time for those aged 25+ years, Māori, Pacific and Asian brain cancer rates were similar, and European/Other rates a third or more higher. Regarding trends over time in relative inequalities, the SRR comparing Māori to European/Other increased from 0.46 (95 percent confidence interval 0.24–0.89) in 1981–1986 to 1.07 (0.72–1.58) in 2001–2004 for males, and from 0.42 (0.18–0.99) in 1981–1986 to 1.04 (0.67–1.62) in 2001–2004 for females (Table 14). These trends meant that while Māori had lower rates of brain cancer than European/Other in the earlier time periods, rates were similar in the most recent period. However, the trend in SRRs was not linear over time: for this reason the statistical tests of trend are non-significant. Nevertheless, the similar increasing pattern by sex for the Māori-European/Other SRRs suggests that the trend is real. The Asian-European/Other rate ratio among males did exhibit a statistically significant increase over time ($p<0.01$), from 0.40 (0.06–2.82) to 0.80 (0.44–1.45).

Figure 8: Standardised rates of brain cancer for 25+ year-olds, by ethnicity by sex

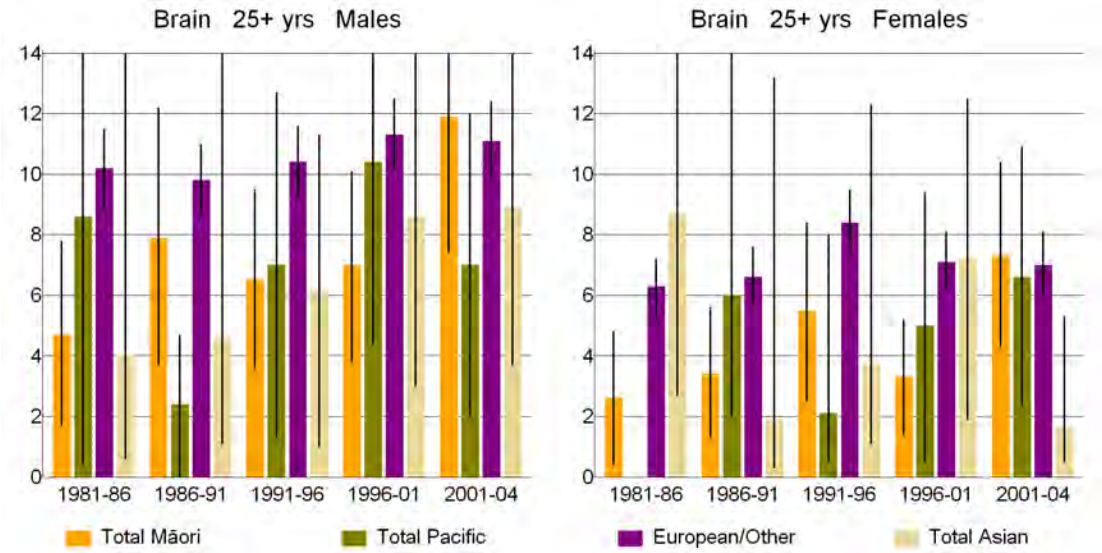


Table 14: Age-standardised rate ratios (SRR) and standardised rate differences (SRDs) of brain cancer, for Māori, Pacific and Asian compared to European/Other, by sex

Exposure Brain 25+ years	Cohort	Males		Females	
		SRR (95% CI)	SRD (95% CI)	SRR (95% CI)	SRD (95% CI)
Total Māori vs European	1981–1986	0.46 (0.24–0.89)	-5.5 (-8.8– -2.2)	0.42 (0.18–0.99)	-3.6 (-6.1– -1.2)
	1986–1991	0.81 (0.47–1.39)	-1.9 (-6.3–2.5)	0.52 (0.27–0.98)	-3.2 (-5.5– -0.9)
	1991–1996	0.63 (0.39–1.00)	-3.9 (-7.1– -0.7)	0.65 (0.37–1.13)	-3.0 (-6.1– -0.2)
	1996–2001	0.61 (0.39–0.98)	-4.4 (-7.7– -1.0)	0.47 (0.26–0.83)	-3.8 (-5.9– -1.7)
	2001–2004	1.07 (0.72–1.58)	0.7 (-3.9–5.4)	1.04 (0.67–1.62)	0.3 (-2.9–3.5)
	P (trend)	0.18	0.28	0.11	0.37
	Pooled	0.70 (0.56–0.88)	-3.1 (-4.8– -1.5)	0.60 (0.46–0.78)	-2.8 (-4.0– -1.6)
Total Pacific vs European	1981–1986	0.84 (0.32–2.20)	-1.6 (-10–6.7)	0.90 (0.31–2.65)	-0.7 (-7.1–5.8)
	1986–1991	0.24 (0.09–0.66)	-7.5 (-10– -4.9)	0.25 (0.06–0.96)	-6.3 (-9.3– -3.4)
	1991–1996	0.67 (0.29–1.53)	-3.4 (-9.3–2.4)	0.70 (0.28–1.72)	-2.2 (-6.7–2.4)
	1996–2001	0.92 (0.51–1.65)	-0.9 (-7.1–5.2)	0.70 (0.28–1.72)	-2.2 (-6.7–2.4)
	2001–2004	0.63 (0.30–1.30)	-4.1 (-9.3–1.0)	0.95 (0.49–1.83)	-0.4 (-4.8–4.0)
	P (trend)	0.75	0.35		
	Pooled	0.67 (0.46–0.98)	-3.4 (-6.1– -0.8)	0.66 (0.43–1.03)	-2.5 (-4.6– -0.3)
Total Asian vs European	1981–1986	0.40 (0.06–2.82)	-6.2 (-14–1.8)	1.39 (0.43–4.51)	2.5 (-7.7–13)
	1986–1991	0.46 (0.11–1.99)	-5.3 (-12–1.4)	0.28 (0.04–2.00)	-4.8 (-8.6– -1.0)
	1991–1996	0.59 (0.25–1.38)	-4.3 (-9.6–1.0)	0.44 (0.13–1.47)	-4.7 (-9.3– -0.1)
	1996–2001	0.76 (0.39–1.47)	-2.7 (-8.5–3.0)	1.01 (0.48–2.14)	0.1 (-5.4–5.5)
	2001–2004	0.80 (0.44–1.45)	-2.2 (-7.6–3.1)	0.23 (0.07–0.76)	-5.4 (-7.6– -3.2)
	P (trend)	<.01	<.01	0.38	0.55
	Pooled	0.60 (0.38–0.94)	-4.2 (-7.1– -1.3)	0.67 (0.38–1.19)	-2.3 (-5.1–0.4)

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

5.2 Socioeconomic trends

Incidence rates of brain cancer (in those aged 25+) appeared to increase for both sexes and all income groups over time. The largest increase (84 percent) was evident among low-income females (p for trend less than 0.05 for low-income females only; Figure 9 and Table 80 in Appendix 1). Rates of brain cancer showed no systematic variation by income at any point in time, or pooled over time (Table 15).

Figure 9: Standardised rates of brain cancer for 25+ year-olds, by income by sex

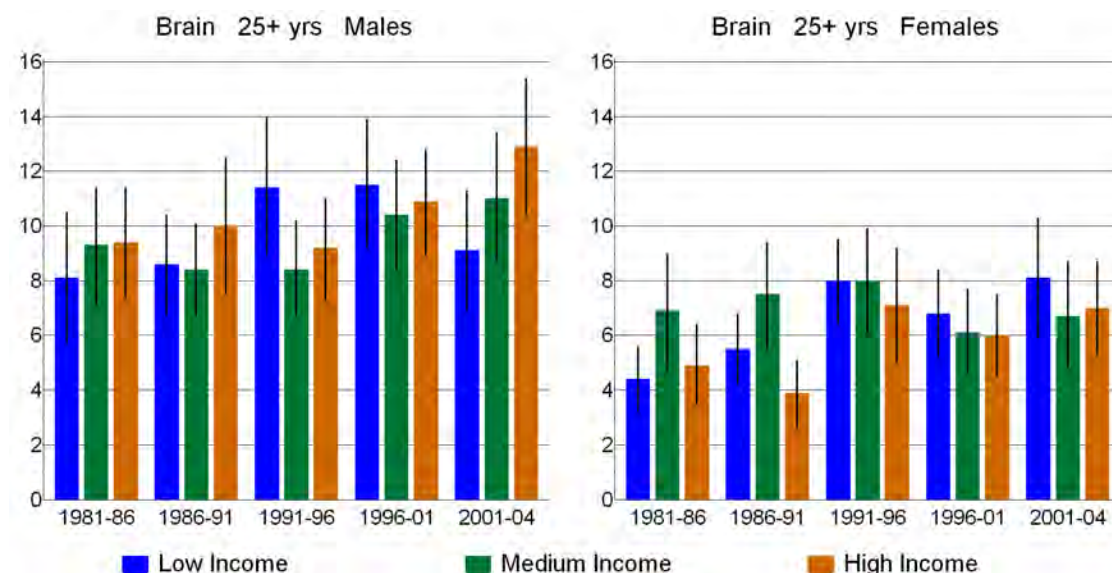


Table 15: Age- and ethnicity-standardised income rate ratios (SRR), rate differences (SRD), relative indices of inequality (RII) and slope indices of inequality (SII) of brain cancer, by sex

Age group	Cohort	Males				Females			
		Relative inequalities		Absolute inequalities		Relative inequalities		Absolute inequalities	
		SRR	RII (95% CI)	SRD	SII (95% CI)	SRR	RII (95% CI)	SRD	SII (95% CI)
Brain									
25+ years	1981–1986	0.86	0.8 (0.5–1.3)	-1.3	-2.0 (-4.7–0.1)	0.90	0.7 (0.4–1.3)	-0.5	-2.0 (-4.0–0.6)
	1986–1991	0.86	0.9 (0.6–1.4)	-1.4	-1.0 (-3.4–1.3)	1.43	1.3 (0.8–2.3)	1.7	2.0 (-2.4–5.6)
	1991–1996	1.24	1.4 (0.9–2.2)	2.2	3.0 (-2.6–9.0)	1.12	1.1 (0.7–1.8)	0.9	1.0 (-0.5–1.5)
	1996–2001	1.06	1.0 (0.7–1.5)	0.7	0.0 (-3.0–3.5)	1.13	1.2 (0.7–1.9)	0.8	1.0 (-3.6–5.4)
	2001–2004	0.71	0.6 (0.4–1.0)	-3.8	-5.0 (-9.6– -0.8)	1.16	1.1 (0.6–2.0)	1.1	1.0 (-2.2–3.9)
	P (trend)	0.85	0.50	0.80	0.61	0.78	0.45	0.47	0.58
	Pooled	0.94	1.0 (0.8–1.2)	-0.6	0.0 (-2.6–2.1)	1.13	1.2 (0.9–1.5)	0.8	1.0 (-0.9–3.2)

Notes: 95 percent confidence intervals in brackets. SRRs and SRDs compare low- and high-income tertiles. Age-standardised only rates by quintile of income were used for 1981–1986 due to the instability of age-ethnicity-standardised rates. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

Chapter 6: Breast Cancer (Female)

Breast cancer is the most common cancer among New Zealand women; in 2005 alone there were 2458 new breast cancer diagnoses, and 647 deaths.⁵⁷ Breast cancer also occurs rarely in men (there were 21 cases and five deaths in 2005). Virtually all breast cancers are adenocarcinomas. As in most countries, rates of breast cancer in New Zealand have been increasing: age-standardised rates approximately doubled between 1956 and 1996.³

Breast cancer risk increases substantially with age until about age 50 (around menopause), after which there is a more slowly increasing risk. Family history of breast cancer in a first-degree relative, particularly with early age of onset, is an important risk factor: approximately 5–10 percent of all breast cancers are attributable to inherited mutations. Two breast cancer genes (BRCA1 and 2) have been identified, and mutations on at least one of these genes are thought to account for 2–5 percent of all breast cancers internationally. A history of benign breast disease and having relatively dense breast tissue are also associated with an increased risk of breast cancer.⁶²

Breast cancer is related to oestrogen exposure. Factors that increase a woman's lifetime number of menstrual cycles (such as early menarche, late menopause, and not having or having few children) all increase breast cancer risk. Late age (over 30) at first completed pregnancy increases breast cancer risk independently of the effect of the number of children a woman has. Taking post-menopausal hormone replacement therapy increases breast cancer risk, and taking combined oral contraceptives increases the risk to a much lesser degree for current users only. Prolonged breastfeeding causes a small reduction in the risk of breast cancer.⁶²

The effect of body mass index (BMI) on breast cancer risk varies in relation to menopause; obesity prior to menopause reduces the risk of breast cancer, but increases the risk following menopause. Alcohol use increases the risk of breast cancer: there is a steady increase in risk with increasing alcohol consumption from one drink per day. Exposure to ionising radiation (such as X-rays), particularly prior to puberty, increases the risk of breast cancer. Physical activity is thought to reduce the risk, particularly after menopause.⁶⁰

Population screening for breast cancer using mammography was instituted in New Zealand in 1999 for women aged 50–64, resulting in an increase in breast cancer incidence in this age group in the following year.⁶³ The age range for screening was extended to include women aged 45–69 in 2004.

6.1 Ethnic trends

Incidence rates of breast cancer (for those aged 25+) increased steadily over time for all ethnic groups in the period surveyed (by 71 percent, 25 percent, 49 percent, and 80 percent for Māori, Pacific, European/Other, and Asian respectively; p for trend <0.01, 0.38, <0.01 and 0.04, respectively; Figure 10 and Table 81 in Appendix 1). These percentage increases were greatest in the 45–64 year age range (Figure 11).

Pooled over time for those aged 25+ years, Māori had 1.17 (95 percent confidence interval 1.11–1.22) times the breast cancer rate of European/Other, Pacific 0.90 (0.82–0.98) and Asian 0.70 (0.63–0.79) (Table 16). The rate ratio for Māori compared with European/Other did increase over time from 1.07 to 1.23, but not in a monotonic manner, meaning that the trend was not statistically significant (p for trend 0.15). Any trend in the rates ratios for Pacific and Asian compared to European/Other was even less evident.

However, there was a four-fold widening in *absolute* inequalities between Māori and European/Other over the time period, the SRD increasing from 8.4 per 100,000 (-9.2–26) to 39 per 100,000 (23–56; p for trend 0.06; Table 17).

There was no variation by age group in relative inequalities between Māori and European/Other (Table 16). However, relative inequalities for both Pacific and Asian, compared to European/Other, did appear to vary by age group. Pooled across time, the Pacific rate ratio was 1.16 (1.01–1.35) for 25–44 year-olds, 0.94 (0.82–1.07) for 45–64 year-olds and 0.77 (0.62–0.96) for 65+ year-olds. That is, there was a possible trend for Pacific breast cancer rates being greater than European/Other rates at younger ages, and less than European/Other rates at older ages. (This requires further analysis, beyond the scope of this report.) A similar diminishing rate ratio with age occurred for Asian people, but confidence intervals were wider and Asian rates were less than European/Other rates in all three age groups.

Figure 10: Standardised rates of breast cancer for 25+ year-olds, by ethnicity

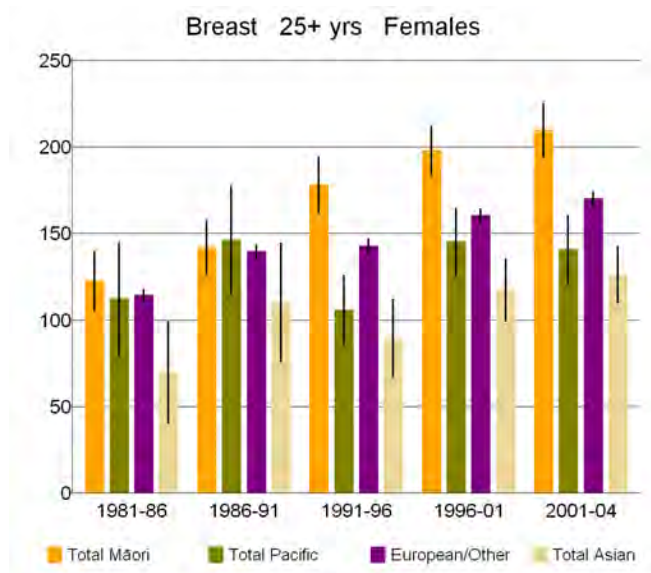


Figure 11: Standardised rates of breast cancer, by ethnicity by age group

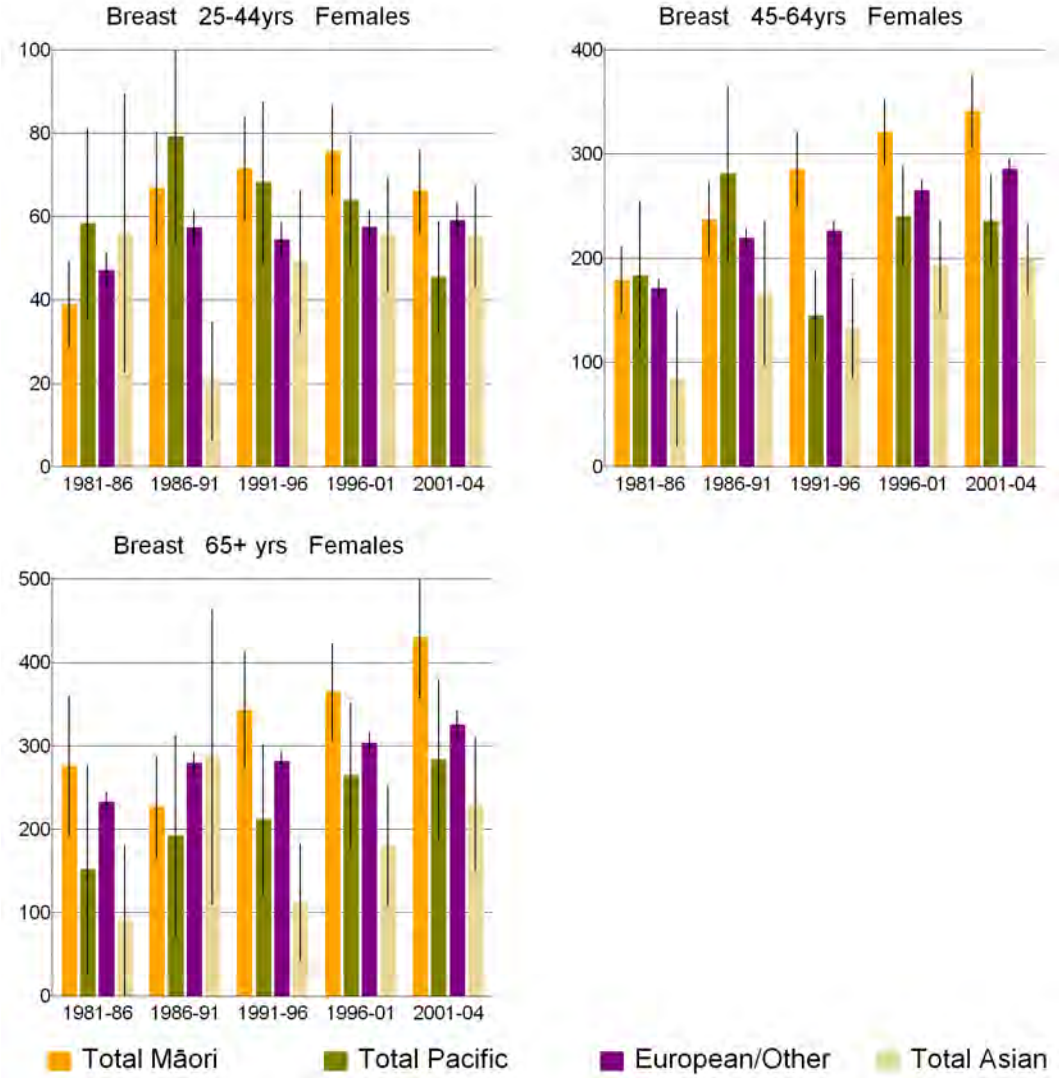


Table 16: Age-standardised rate ratios (SRR) of breast cancer, for Māori, Pacific and Asian compared to European/Other

Exposure Breast females Total ethnicity	Cohort	25+ years SRR (95% CI)	25–44 years SRR (95% CI)	45–64 years SRR (95% CI)	65+ years SRR (95% CI)
Total Māori vs European	1981–1986	1.07 (0.93–1.24)	0.83 (0.62–1.09)	1.04 (0.87–1.26)	1.19 (0.87–1.62)
	1986–1991	1.02 (0.91–1.14)	1.17 (0.94–1.45)	1.08 (0.93–1.27)	0.81 (0.62–1.06)
	1991–1996	1.25 (1.13–1.37)	1.31 (1.08–1.59)	1.26 (1.11–1.44)	1.22 (0.99–1.50)
	1996–2001	1.23 (1.14–1.33)	1.32 (1.13–1.55)	1.21 (1.09–1.34)	1.20 (1.02–1.42)
	2001–2004	1.23 (1.14–1.33)	1.12 (0.95–1.32)	1.19 (1.07–1.33)	1.32 (1.11–1.58)
	P (trend)	0.15	0.55	0.27	0.24
	Pooled	1.17 (1.11–1.22)	1.16 (1.06–1.27)	1.17 (1.10–1.24)	1.14 (1.04–1.26)
Total Pacific vs European	1981–1986	0.98 (0.73–1.32)	1.24 (0.83–1.85)	1.07 (0.72–1.59)	0.65 (0.29–1.49)
	1986–1991	1.05 (0.84–1.30)	1.38 (0.99–1.93)	1.28 (0.95–1.74)	0.69 (0.37–1.29)
	1991–1996	0.74 (0.62–0.89)	1.25 (0.94–1.68)	0.64 (0.48–0.87)	0.75 (0.49–1.15)
	1996–2001	0.90 (0.79–1.04)	1.11 (0.86–1.44)	0.91 (0.74–1.11)	0.87 (0.62–1.22)
	2001–2004	0.83 (0.72–0.95)	0.77 (0.57–1.04)	0.83 (0.68–1.00)	0.87 (0.62–1.23)
	P (trend)	0.39	0.07	0.33	0.02
	Pooled	0.90 (0.82–0.98)	1.16 (1.01–1.35)	0.94 (0.82–1.07)	0.77 (0.62–0.96)
Total Asian vs European	1981–1986	0.61 (0.40–0.93)	1.19 (0.65–2.17)	0.49 (0.23–1.07)	0.39 (0.15–1.05)
	1986–1991	0.79 (0.58–1.08)	0.36 (0.18–0.72)	0.76 (0.50–1.15)	1.03 (0.55–1.90)
	1991–1996	0.63 (0.49–0.80)	0.90 (0.63–1.29)	0.59 (0.41–0.84)	0.40 (0.21–0.75)
	1996–2001	0.73 (0.63–0.86)	0.97 (0.75–1.25)	0.73 (0.58–0.91)	0.59 (0.40–0.89)
	2001–2004	0.74 (0.65–0.84)	0.93 (0.74–1.18)	0.70 (0.58–0.83)	0.71 (0.50–1.01)
	P (trend)	0.45	0.93	0.61	0.99
	Pooled	0.70 (0.63–0.79)	0.86 (0.70–1.04)	0.66 (0.56–0.78)	0.63 (0.48–0.83)

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

Table 17: Age-standardised rate differences (SRD) of breast cancer, for Māori, Pacific and Asian compared to European/Other

Exposure Breast females Total ethnicity	Cohort	25+ years SRD (95% CI)	25–44 years SRD (95% CI)	45–64 years SRD (95% CI)	65+ years SRD (95% CI)
Total Māori vs European	1981–1986	8.4 (-9.2–26)	-8.2 (-19–3.0)	7.6 (-25–41)	44 (-41–129)
	1986–1991	2.2 (-14–18)	9.5 (-4.7–24)	18 (-19–55)	-53 (-115–9.1)
	1991–1996	35 (18–52)	17 (3.8–30)	59 (23–96)	61 (-10–133)
	1996–2001	38 (23–52)	18 (6.8–30)	56 (23–89)	62 (2.0–121)
	2001–2004	39 (23–56)	7.1 (-3.8–18)	56 (20–92)	105 (30–180)
	P (trend)	0.06	0.27	0.05	0.20
	Pooled	24 (16–31)	8.8 (3.3–14)	39 (23–54)	41 (8.9–72)
Total Pacific vs European	1981–1986	-2.0 (-35–31)	11 (-12–35)	12 (-60–84)	-80 (-205–45)
	1986–1991	6.6 (-25–38)	22 (-4.0–48)	62 (-23–147)	-87 (-209–34)
	1991–1996	-37 (-57– -17)	14 (-5.9–33)	-81 (-125– -37)	-70 (-160–20)
	1996–2001	-15 (-35–4.7)	6.3 (-9.9–23)	-25 (-73–24)	-39 (-128–49)
	2001–2004	-29 (-50– -9.2)	-14 (-27–0.3)	-50 (-95– -3.6)	-42 (-140–56)
	P (trend)	0.37	0.08	0.47	0.04
	Pooled	-15 (-26– -3.0)	9.0 (-0.3–18)	-14 (-43–14)	-65 (-113– -17)
Total Asian vs European	1981–1986	-44 (-74– -15)	8.9 (-25–43)	-87 (-153– -21)	-141 (-232– -50)
	1986–1991	-29 (-64–5.1)	-37 (-52– -22)	-52 (-122–17)	7.6 (-170–185)
	1991–1996	-53 (-76– -31)	-5.2 (-23–12)	-93 (-141– -45)	-169 (-240– -98)
	1996–2001	-43 (-62– -25)	-1.7 (-16–13)	-72 (-115– -28)	-123 (-196– -50)
	2001–2004	-44 (-61– -27)	-3.9 (-17–8.9)	-86 (-122– -51)	-96 (-178– -14)
	P (trend)	0.89	0.31	0.75	0.68
	Pooled	-43 (-54– -31)	-7.9 (-17–1.3)	-78 (-103– -53)	-105 (-153– -56)

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

6.2 Socioeconomic trends

Incidence rates of breast cancer (in those aged 25+) increased over time by 47–54 percent in all three income tertiles (p for trend less than 0.05 in all instances; Figure 12 and Table 82 in Appendix 1). The percentage increase in rates was most pronounced in the 45–64 and 65–74 year-old age ranges.

Pooled over time for those aged 25+ years, low-income women had about a 10 percent lower rate of breast cancer than high-income women (Table 18). This relative inequality appeared to be greater among younger women. There was no change in relative inequalities over time. Absolute inequalities varied by age group (as expected due to large variation in rates by age), but did not show a systematic trend over time, either in combined or separate age groups.

Figure 12: Standardised rates of breast cancer for 25+ year-olds, by income

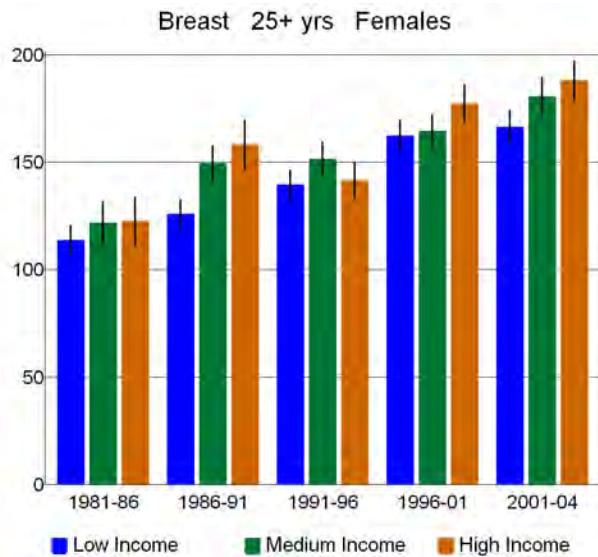


Figure 13: Standardised rates of breast cancer, by income by age group

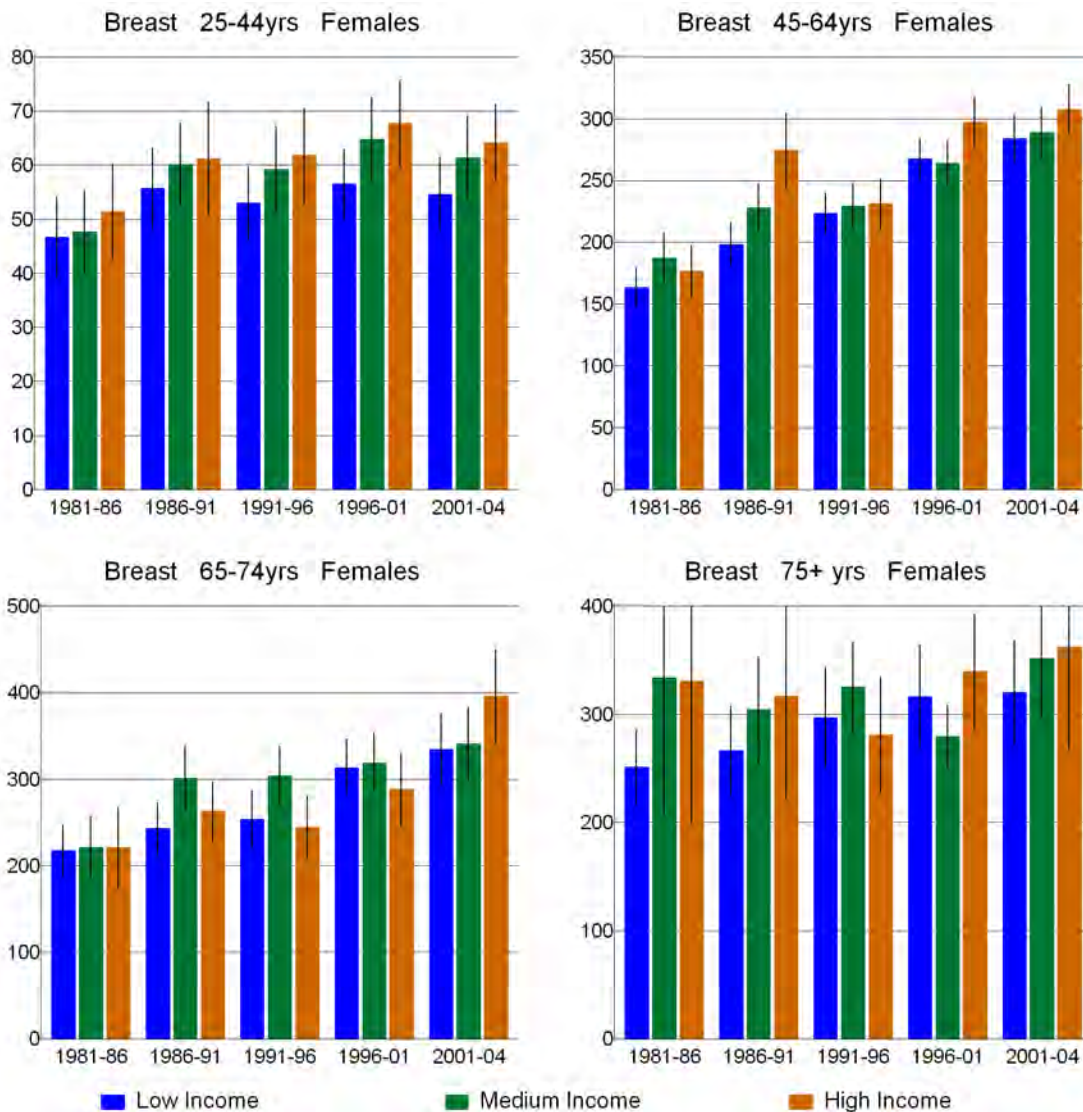


Table 18: Age- and ethnicity-standardised income rate ratios (SRR), rate differences (SRD), relative indices of inequality (RII) and slope indices of inequality (SII) of breast cancer

Age group	Cohort	Females			
		Relative inequalities		Absolute inequalities	
		SRR	RII (95% CI)	SRD	SII (95% CI)
Breast					
25+ years	1981–1986	0.93	0.9 (0.8–1.1)	-8.8	-11 (-20– -2.2)
	1986–1991	0.80	0.7 (0.7–0.8)	-32	-44 (-71– -16)
	1991–1996	0.99	0.9 (0.8–1.1)	-1.9	-8.0 (-31–14)
	1996–2001	0.91	0.9 (0.8–0.9)	-15	-28 (-49– -6.8)
	2001–2004	0.89	0.8 (0.8–0.9)	-22	-33 (-44– -23)
	P (trend)	0.94	0.95	0.83	0.10
	Pooled	0.90	0.9 (0.8–0.9)	-16	-23 (-31– -16)
25–44 years	1981–1986	0.91	0.8 (0.6–1.2)	-4.7	-8.0 (-14– -2.2)
	1986–1991	0.91	0.8 (0.6–1.1)	-5.5	-12 (-29– -5.3)
	1991–1996	0.86	0.8 (0.6–1.1)	-8.8	-13 (-18– -7.3)
	1996–2001	0.84	0.8 (0.6–1.0)	-11	-16 (-26– -5.6)
	2001–2004	0.85	0.8 (0.6–1.0)	-9.5	-15 (-28– -1.8)
	P (trend)	0.05	0.01	0.06	<.01
	Pooled	0.87	0.8 (0.7–0.9)	-7.9	-12 (-19– -4.7)
45–64 years	1981–1986	0.93	1.0 (0.8–1.3)	-13	-1.0 (-23–21)
	1986–1991	0.72	0.7 (0.6–0.8)	-76	-86 (-122– -51)
	1991–1996	0.97	1.0 (0.8–1.2)	-7.8	-4.0 (-42–34)
	1996–2001	0.90	0.8 (0.7–0.9)	-30	-60 (-113– -7.8)
	2001–2004	0.92	0.9 (0.8–1.0)	-23	-45 (-82– -7.1)
	P (trend)	0.64	0.88	0.97	0.46
	Pooled	0.88	0.9 (0.8–0.9)	-30	-37 (-53– -22)
65–74 years	1981–1986	0.99	1.0 (0.7–1.4)	-3.3	-2.0 (-38–34)
	1986–1991	0.92	0.9 (0.7–1.1)	-20	-42 (-185–100)
	1991–1996	1.04	0.8 (0.6–1.1)	9.2	-50 (-180–80)
	1996–2001	1.09	1.0 (0.8–1.3)	25	9.0 (-70–89)
	2001–2004	0.85	0.8 (0.6–1.0)	-61	-95 (-179– -11)
	P (trend)	0.79	0.61	0.82	0.22
	Pooled	0.97	0.9 (0.8–1.0)	-7.4	-29 (-91–33)
75+ years	1981–1986	0.76	0.6 (0.3–1.1)	-80	-157 (-348–34)
	1986–1991	0.84	0.8 (0.5–1.3)	-51	-63 (-198–71)
	1991–1996	1.06	0.9 (0.7–1.3)	16	-29 (-121–63)
	1996–2001	0.93	0.9 (0.7–1.2)	-23	-23 (-97–51)
	2001–2004	0.88	0.9 (0.6–1.3)	-42	-43 (-144–58)
	P (trend)	0.69	0.20	0.69	0.26
	Pooled	0.89	0.8 (0.6–1.0)	-36	-69 (-121– -18)

Notes: 95 percent confidence intervals in brackets. SRRs and SRDs compare low- and high income tertiles. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

Chapter 7: Cervical Cancer

Although one of the leading causes of cancer among women internationally, cervical cancer is a relatively uncommon cancer in New Zealand: in 2005 there were 154 new cases diagnosed and 54 deaths.⁵⁷

The underlying cause of cervical cancer is cervical infection with particular sub-types of human papilloma virus (HPV). A number of factors have been identified which may make HPV infection persistent and progression to cervical cancer more likely. These include cigarette smoking, having a large number of children, long-term oral contraceptive use and possibly co-infection with chlamydia or HIV. The risk of cervical cancer increases markedly with age.⁶⁴

New Zealand's National Cervical Screening Programme (NCSP) was set up in 1990, and recommends three-yearly cervical smears to women aged 20–70. Because screening detects cancer precursors, it reduces cervical cancer incidence as well as mortality. A national programme immunising girls against HPV began in 2008; this is likely to further reduce the incidence of cervical cancer in New Zealand.

7.1 Ethnic trends

Incidence rates of cervical cancer (in those aged 25+) decreased by 58 percent for Māori, 64 percent for Pacific and 40 percent for European/Other over the period surveyed (p for trend <0.01, 0.03 and <0.01 respectively; Figure 14 and Table 83 in Appendix 1). Rates among Asian women remained stable over time.

These percentage reductions in cervical cancer incidence for ethnic groups other than Asian were reasonably consistent across age groups (Figure 15). Among Asian women there was evidence of rates falling among younger women and increasing among older women – however, statistical imprecision precludes a firm interpretation of this data.

Pooled over time for those aged 25+ years, Māori had 2.49 (95 percent confidence interval 2.27–2.73) times the cervical cancer rate of European/Other, and Pacific women 2.05 (1.67–2.52) times that rate (Table 19). However, the rate ratios tended to decrease over time, from 3.04 to 2.11 for Māori compared to European/Other (p for trend 0.11) and from 2.22 to 1.34 for Pacific (p for trend 0.09). Conversely, while rates were similar between Asian and European/Other women aged 25+ in 1981–1986, by 2001–2004 they had diverged such that the Asian rate was 1.60 (1.12–2.28) times the European/Other rate (p for trend 0.04). Allowing for statistical imprecision, there was no strong evidence of further variation of these trends by age.

The reduction in absolute inequalities over time was very large (Table 20). For Māori compared to European/Other, the SRD for those aged 25+ years decreased by two-thirds, from 38 per 100,000 (28–48) in 1981–1986 to 12 per 100,000 (6.9–18; p for trend 0.01). For Pacific compared to European/Other, the same SRD decreased by 80 percent, from 23 per 100,000 (4.2–41) in 1981–1986 to 3.8 per 100,000 (-2.4–10; p for trend 0.06). Conversely, absolute inequalities between Asian and European/Other increased.

Figure 14: Standardised rates of cervical cancer for 25+ year-olds, by ethnicity

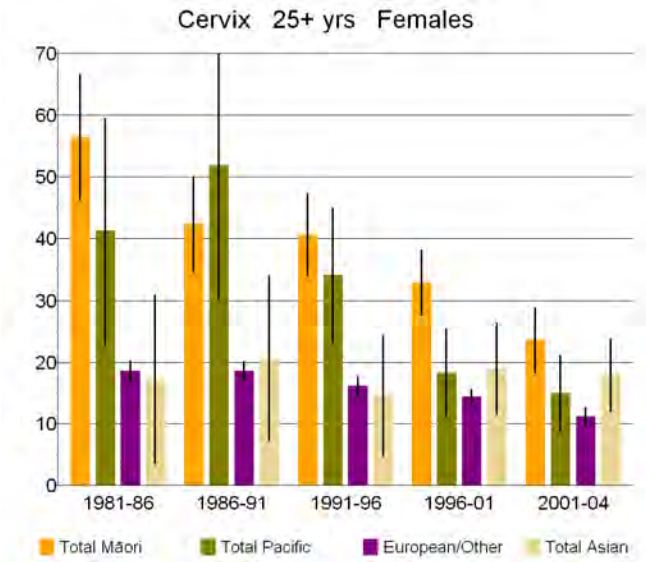


Figure 15: Standardised rates of cervical cancer, by ethnicity by age group

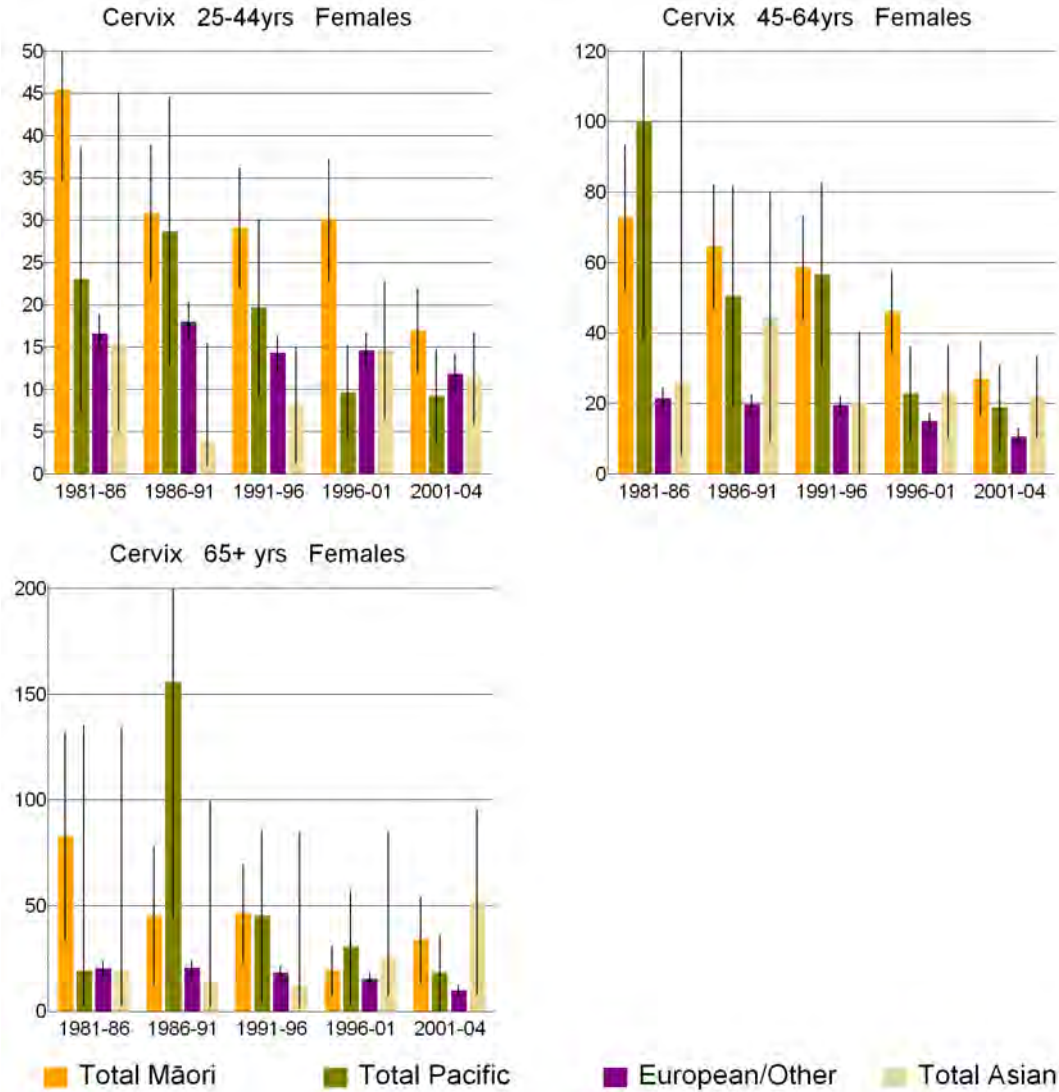


Table 19: Age-standardised rate ratios (SRR) of cervical cancer, for Māori, Pacific and Asian compared to European/Other

Exposure Cervix females Total ethnicity	Cohort	25+ years SRR (95% CI)	25–44 years SRR (95% CI)	45–64 years SRR (95% CI)	65+ years SRR (95% CI)
Total Māori vs European	1981–1986	3.04 (2.48–3.71)	2.73 (2.07–3.60)	3.40 (2.47–4.68)	4.11 (2.21–7.64)
	1986–1991	2.28 (1.87–2.78)	1.71 (1.28–2.29)	3.29 (2.41–4.49)	2.21 (1.05–4.64)
	1991–1996	2.51 (2.09–3.02)	2.04 (1.54–2.71)	3.01 (2.26–4.00)	2.55 (1.51–4.33)
	1996–2001	2.28 (1.89–2.74)	2.05 (1.55–2.72)	3.08 (2.29–4.14)	1.24 (0.66–2.35)
	2001–2004	2.11 (1.62–2.74)	1.43 (1.01–2.04)	2.54 (1.63–3.95)	3.44 (1.76–6.71)
	P (trend)	0.11	0.18	0.04	0.51
	Pooled	2.49 (2.27–2.73)	2.05 (1.79–2.34)	3.14 (2.71–3.64)	2.68 (1.96–3.67)
Total Pacific vs European	1981–1986	2.22 (1.41–3.49)	1.38 (0.69–2.76)	4.67 (2.47–8.84)	0.94 (0.13–6.75)
	1986–1991	2.79 (1.82–4.28)	1.59 (0.90–2.81)	2.57 (1.36–4.87)	7.60 (3.63–15.88)
	1991–1996	2.10 (1.51–2.94)	1.38 (0.80–2.39)	2.91 (1.80–4.70)	2.48 (0.98–6.26)
	1996–2001	1.27 (0.85–1.90)	0.66 (0.36–1.19)	1.52 (0.83–2.79)	1.98 (0.81–4.87)
	2001–2004	1.34 (0.88–2.06)	0.78 (0.41–1.47)	1.77 (0.90–3.48)	1.86 (0.67–5.14)
	P (trend)	0.09	0.09	0.06	0.22
	Pooled	2.05 (1.67–2.52)	1.21 (0.90–1.64)	2.92 (2.12–4.02)	3.23 (1.97–5.29)
Total Asian vs European	1981–1986	0.92 (0.41–2.06)	0.92 (0.31–2.74)	1.22 (0.25–5.95)	0.94 (0.13–6.72)
	1986–1991	1.11 (0.57–2.13)	0.21 (0.05–0.86)	2.27 (1.01–5.09)	0.68 (0.10–4.89)
	1991–1996	0.90 (0.46–1.77)	0.57 (0.24–1.34)	1.04 (0.39–2.81)	0.66 (0.09–4.70)
	1996–2001	1.32 (0.88–1.98)	1.00 (0.56–1.77)	1.55 (0.86–2.80)	1.63 (0.47–5.63)
	2001–2004	1.60 (1.12–2.28)	0.96 (0.57–1.61)	2.06 (1.17–3.64)	5.30 (2.19–12.83)
	P (trend)	0.04	0.37	0.77	0.08
	Pooled	1.11 (0.84–1.46)	0.70 (0.46–1.06)	1.57 (0.99–2.49)	1.34 (0.71–2.52)

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

Table 20: Age-standardised rate differences (SRD) of cervical cancer, for Māori, Pacific and Asian compared to European/Other

Exposure Cervix females Total ethnicity	Cohort	25+ years SRD (95% CI)	25–44 years SRD (95% CI)	45–64 years SRD (95% CI)	65+ years SRD (95% CI)
Total Māori vs European	1981–1986	38 (28–48)	29 (18–40)	51 (30–72)	63 (13–112)
	1986–1991	24 (16–32)	13 (4.4–21)	45 (27–63)	25 (-8.2–58)
	1991–1996	24 (18–31)	15 (7.5–22)	39 (24–54)	28 (4.9–52)
	1996–2001	18 (13–24)	15 (7.9–23)	31 (19–43)	3.7 (-8.2–16)
	2001–2004	12 (6.9–18)	5.1 (-0.4–11)	16 (5.7–27)	24 (3.1–45)
	P (trend)	0.01	0.08	<.01	0.39
	Pooled	24 (20–27)	16 (12–20)	38 (30–45)	29 (15–43)
Total Pacific vs European	1981–1986	23 (4.2–41)	6.4 (-9.3–22)	79 (16–141)	-1.2 (-39–36)
	1986–1991	33 (11–55)	11 (-5.4–27)	31 (-0.6–62)	135 (23–247)
	1991–1996	18 (6.8–29)	5.4 (-5.2–16)	37 (11–63)	27 (-14–68)
	1996–2001	3.9 (-3.4–11)	-5.0 (-11–0.9)	7.8 (-5.7–21)	15 (-12–42)
	2001–2004	3.8 (-2.4–10)	-2.6 (-8.6–3.4)	8.2 (-4.2–21)	8.4 (-9.7–27)
	P (trend)	0.06	0.15	0.09	0.88
	Pooled	17 (10–24)	3.3 (-2.2–8.7)	34 (18–50)	38 (11–65)
Total Asian vs European	1981–1986	-1.4 (-15–12)	-1.3 (-18–15)	4.8 (-37–46)	-1.2 (-39–36)
	1986–1991	2.0 (-12–15)	-14 (-20– -8.4)	25 (-11–61)	-6.5 (-34–21)
	1991–1996	-1.6 (-12–8.2)	-6.1 (-13–1.1)	0.8 (-19–21)	-6.2 (-30–17)
	1996–2001	4.6 (-3.0–12)	0.0 (-8.4–8.4)	8.3 (-5.1–22)	9.6 (-21–40)
	2001–2004	6.7 (0.6–13)	-0.5 (-6.4–5.4)	11 (-0.5–23)	42 (-1.7–86)
	P (trend)	0.06	0.09	0.73	0.16
	Pooled	1.8 (-3.1–6.7)	-4.6 (-9.1– -0.2)	10.0 (-2.7–23)	5.8 (-8.7–20)

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

7.2 Socioeconomic trends

Age- and ethnicity-standardised cervical cancer incidence rates (in those aged 25+) decreased across all income groups; although more so among the low-income (55 percent, p for trend <0.01) than among the high-income group (43 percent, p for trend <0.03) (Figure 16 and Table 84 in Appendix 1). This pattern of percentage reductions was similar across age groups (Figure 17).

Pooled over time for those aged 25+ years, the SRR for the low- to high-income tertile was 1.35 and the RII was 1.7 (Table 21). Relative inequalities in cervical cancer incidence by income appeared to be greater at older ages, but not to vary over time. However, absolute inequalities, as measured by the SRD and SII, decreased over time. For example, the SII for 25+ year-olds decreased from 11 per 100,000 (95 percent confidence interval 0.1–21) to 1.0 per 100,000 (-2.1–5.0). Similar patterns of reduction in absolute inequalities were seen across age groups.

Figure 16: Standardised rates of cervical cancer for 25+ year-olds, by income

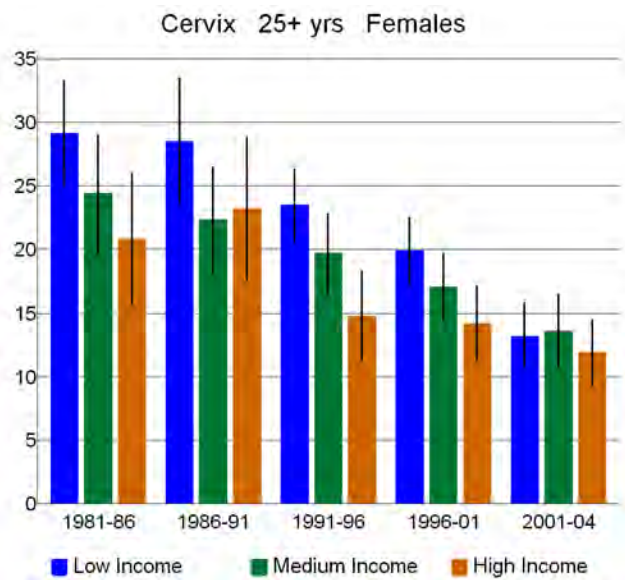


Figure 17: Standardised rates of cervical cancer, by income by age group

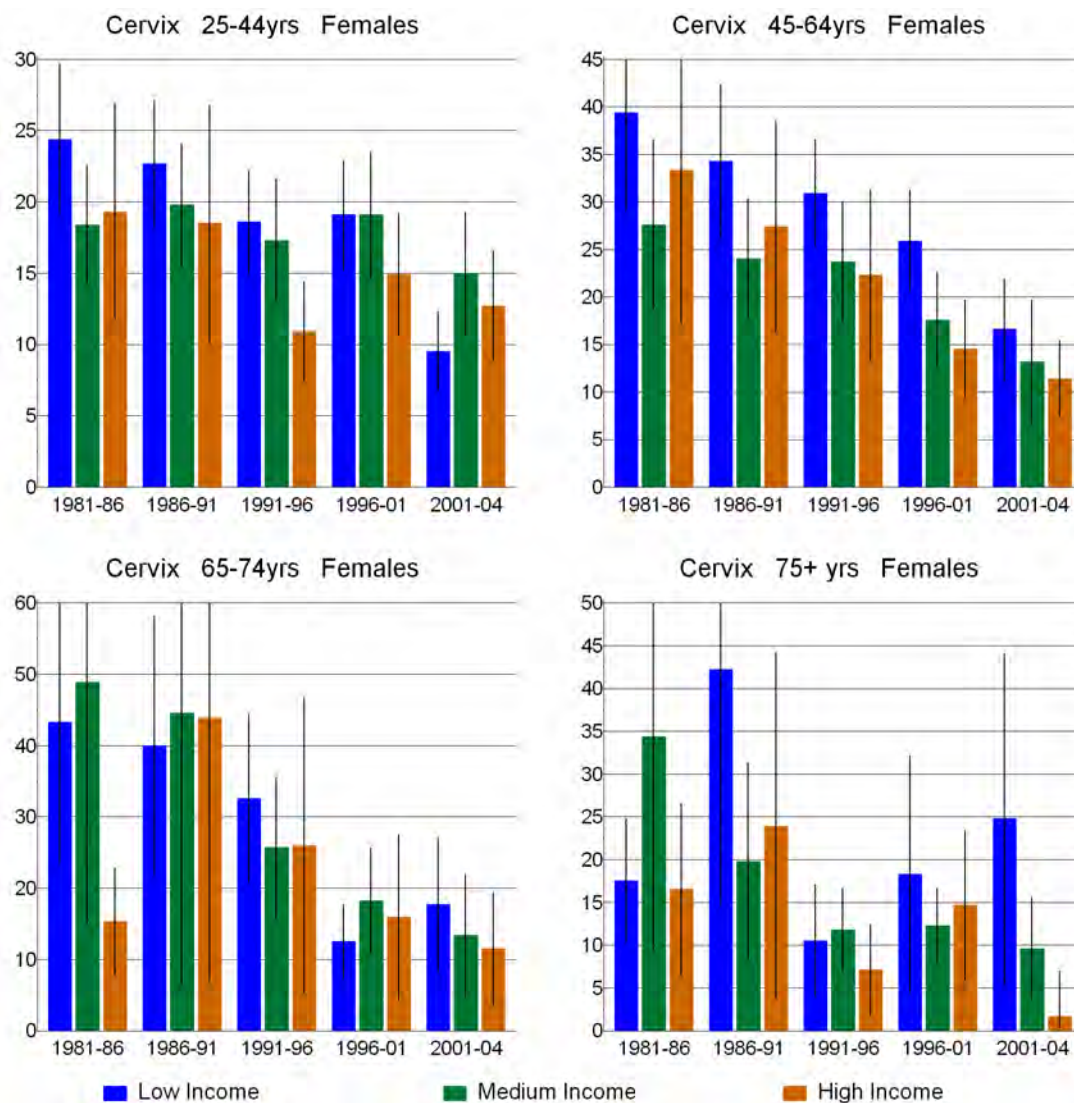


Table 21: Age- and ethnicity-standardised income rate ratios (SRR), rate differences (SRD), relative indices of inequality (RII) and slope indices of inequality (SII) of cervical cancer

Age group	Cohort	Females			
		Relative inequalities		Absolute inequalities	
		SRR	RII (95% CI)	SRD	SII (95% CI)
Cervix					
25+ years	1981–1986	1.40	1.6 (1.0–2.4)	8.3	11 (0.1–21)
	1986–1991	1.23	1.6 (1.0–2.4)	5.3	11 (1.3–20)
	1991–1996	1.59	2.3 (1.5–3.3)	8.7	15 (5.4–24)
	1996–2001	1.40	1.6 (1.1–2.3)	5.7	8.0 (2.0–14)
	2001–2004	1.11	1.1 (0.7–1.7)	1.3	1.0 (-2.1–5.0)
	P (trend)	0.60	0.55	0.11	0.07
	Pooled	1.35	1.7 (1.4–2.0)	6.1	10 (5.0–15)
25–44 years	1981–1986	1.26	1.6 (0.9–2.8)	5.1	9.0 (-0.3–19)
	1986–1991	1.23	1.6 (0.9–2.7)	4.2	9.0 (-1.1–19)
	1991–1996	1.70	2.1 (1.2–3.9)	7.7	11 (2.5–20)
	1996–2001	1.28	1.3 (0.8–2.2)	4.2	5.0 (-0.7–11)
	2001–2004	0.75	0.7 (0.4–1.3)	-3.2	-4.0 (-8.2– -0.4)
	P (trend)	0.45	0.23	0.14	0.05
	Pooled	1.26	1.5 (1.2–2.0)	3.9	7.0 (3.9–10)
45–64 years	1981–1986	1.18	1.5 (0.7–3.0)	6.1	12 (-21–45)
	1986–1991	1.25	2.0 (1.0–3.7)	6.9	18 (-6.2–42)
	1991–1996	1.38	2.1 (1.1–3.9)	8.6	18 (1.1–34)
	1996–2001	1.79	2.5 (1.3–5.1)	11	17 (3.3–30)
	2001–2004	1.45	1.8 (0.7–4.5)	5.2	8.0 (-1.2–17)
	P (trend)	0.19	0.24	0.70	0.16
	Pooled	1.35	2.0 (1.4–2.8)	7.8	16 (1.3–31)
65–74 years	1981–1986	2.83	2.0 (0.5–8.6)	28	25 (-4.8–54)
	1986–1991	0.91	1.1 (0.3–4.8)	-3.9	3.0 (-58–64)
	1991–1996	1.25	1.8 (0.7–4.9)	6.6	15 (-2.3–32)
	1996–2001	0.79	0.9 (0.4–2.4)	-3.4	-2.0 (-9.8–6.7)
	2001–2004	1.54	1.7 (0.4–6.6)	6.2	7.0 (-12–26)
	P (trend)	0.22	0.57	0.27	0.21
	Pooled	1.29	1.5 (0.7–2.9)	6.7	10 (-7.5–28)
75+ years	1981–1986	1.06	0.8 (0.1–14.6)	1.0	-5.0 (-73–64)
	1986–1991	1.76	0.9 (0.1–7.4)	18	-4.0 (-69–61)
	1991–1996	1.48	1.2 (0.4–3.5)	3.4	1.0 (-2.7–5.5)
	1996–2001	1.25	2.2 (0.6–8.4)	3.7	10 (0.8–20)
	2001–2004	14.28	50.6 (0.0–4.0635E14)	23	30 (1.7–58)
	P (trend)	0.34	0.03	0.23	0.01
	Pooled	1.69	1.6 (0.5–5.8)	9.2	9.0 (-7.5–25)

Notes: 95 percent confidence intervals in brackets. SRRs and SRDs compare low- and high-income tertiles. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

Chapter 8: Colorectal Cancer

Colorectal cancer includes cancers of the colon, rectosigmoid junction and rectum. It is the most commonly diagnosed cancer in New Zealand (excluding skin cancers), and the second-most common cause of cancer death: in 2005 there were more than 2600 new cases and 1200 deaths.⁵⁷

Like most cancers, colorectal cancer is more common among older people. Men and women have similar rates of colon cancer, but men have considerably higher rates of rectal cancer. Individuals with a family history of colorectal cancer are at increased risk of the disease; the risk increases with the number of relatives affected, particularly if they were diagnosed at an early age. A small proportion of colorectal cancer is due to inherited familial syndromes such as familial adenomatous polyposis, and hereditary non-polyposis colorectal cancer (Lynch syndrome). Patients with inflammatory bowel disease (such as ulcerative colitis and Crohn's disease) are at increased risk of colorectal cancer.⁶⁵

There is considerable evidence that risk of developing colorectal cancer is related to environmental factors. Diet has been established as an important risk factor for colorectal cancer: risk increases with a diet high in red or processed meats and low in fruit, vegetables and possibly fibre. Dietary calcium may be protective. Alcohol consumption, smoking and obesity have been associated with increased risk, while physical activity is protective. Regular use of aspirin and similar drugs has been found to reduce the risk of colorectal cancer. The removal of adenomatous polyps in the bowel also reduces risk.⁶⁵

8.1 Ethnic trends

Colorectal cancer rates among those aged 25+ years increased among Māori by 73 percent and 32 percent for males and females respectively from 1981–1986 to 2001–2004 (p for trend 0.01 and 0.12; Figure 18 and Table 85 in Appendix 1). Pacific rates increased by 19 percent among males and decreased by 3 percent among females, but were unstable over time and therefore showed no statistically significant trend. European/Other rates increased by 14 percent among males and 7 percent among females (p for trend 0.05 and 0.02), although most of this increase was in the 1980s, after which rates stabilised. Asian rates were unstable over time, showing no clear trend.

The increase in male European/Other colorectal cancer incidence was most apparent among 65+ year-olds. Among 25–64 year-old European/Other males, rates appeared to peak in the late 1980s and early 1990s, and to have decreased by nearly 20 percent since. The increase over time in Māori male rates was apparent at all ages. Less prominently, European/Other female rates among 25–64 year-olds appeared to decrease in later years, whereas rates for those aged ≥65 years continue to increase.

Pooled over time, rates were similar among Māori, Pacific and Asian people for both sexes – with the possible exception of lower rates for Pacific males (the SRR compared to European/Other was 0.44, 95 percent confidence interval 0.36–0.54) compared to Māori (SRR 0.61, 0.56–0.66) and Asian (SRR 0.68, 0.56–0.82). As indicated by the SRRs, rates among European/Other were up to twice those of the three other ethnic groups (Table 22). In terms of changes in these relative inequalities over time, there was evidence of a convergence of Māori and European/Other rates for males (the SRR increasing from 0.48 to 0.73, p for trend 0.04), and there was some evidence of a divergence between Asian and European/Other rates for males (the SRR decreasing from 0.75 to 0.50, p for trend 0.05). Among females, there was also a possible convergence of Māori and European/Other rates among 25–64 year-olds (the SRR increasing from 0.52 to 0.75, p for trend 0.08).

Patterns in absolute inequalities mirrored those of relative inequalities.

Figure 18: Standardised rates of colorectal cancer for 25+ year-olds, by ethnicity by sex

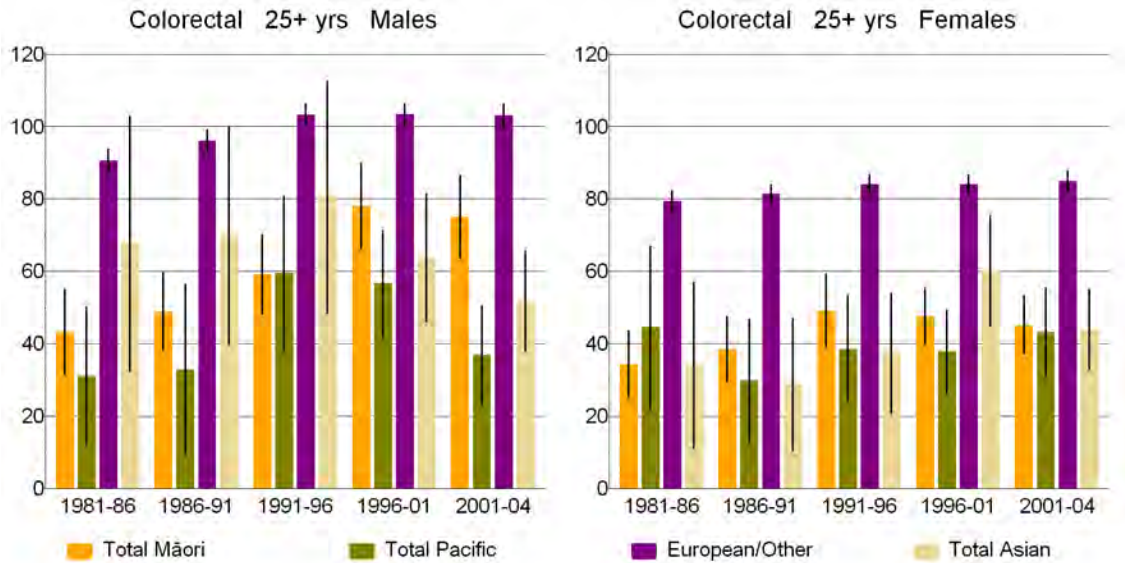


Figure 19: Standardised rates of colorectal cancer, by ethnicity by sex and age group

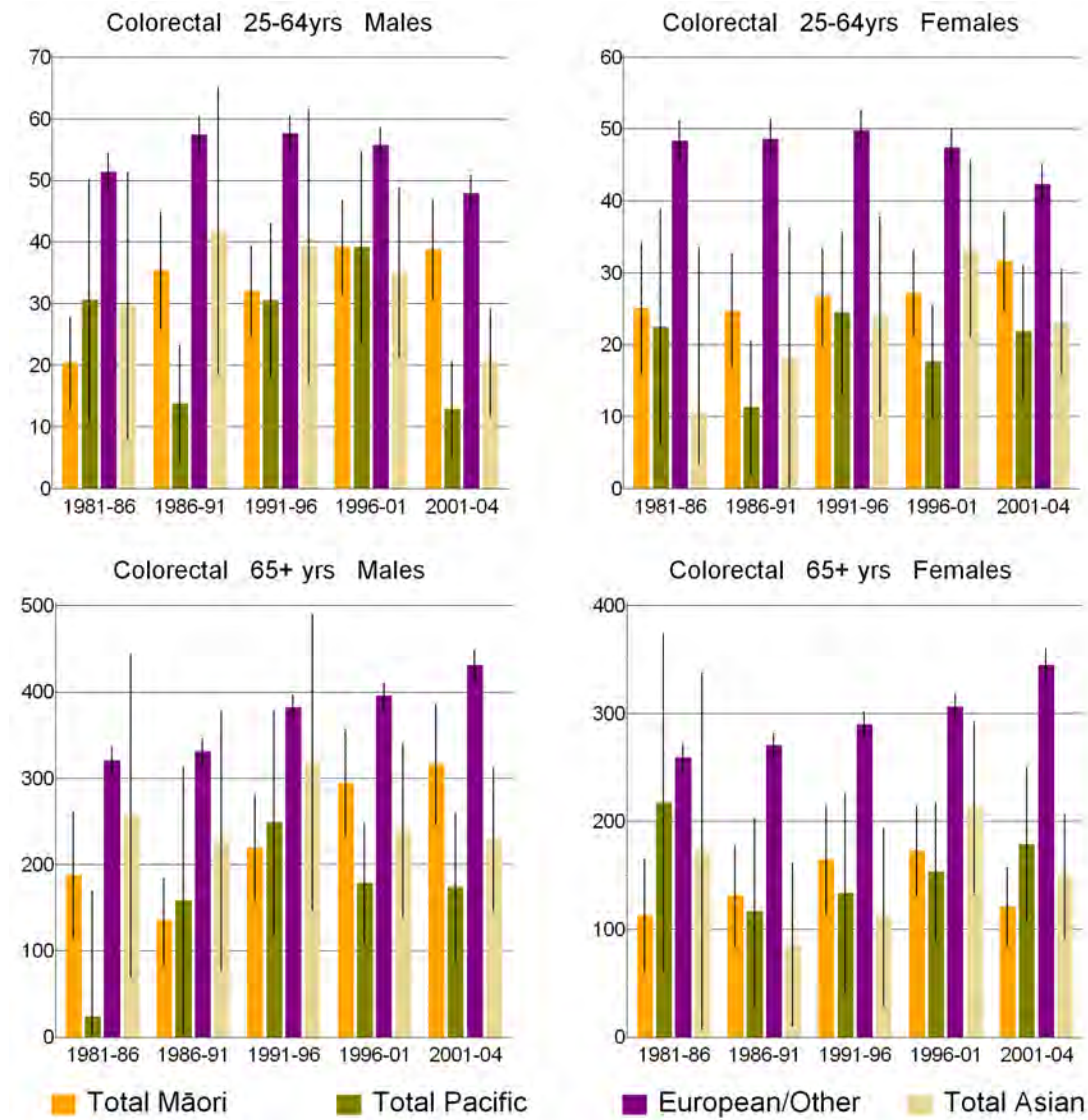


Table 22: Age-standardised rate ratios (SRR) of colorectal cancer, for Māori, Pacific and Asian compared to European/Other, by sex

Exposure Colorectal Total ethnicity	Cohort	25+ years SRR (95% CI)	25–64 years SRR (95% CI)	65+ years SRR (95% CI)
Males				
Total Māori vs European	1981–1986	0.48 (0.36–0.63)	0.40 (0.27–0.58)	0.59 (0.39–0.87)
	1986–1991	0.51 (0.41–0.64)	0.62 (0.47–0.81)	0.41 (0.28–0.59)
	1991–1996	0.57 (0.48–0.69)	0.56 (0.44–0.70)	0.57 (0.43–0.76)
	1996–2001	0.76 (0.65–0.88)	0.70 (0.57–0.86)	0.74 (0.60–0.92)
	2001–2004	0.73 (0.62–0.85)	0.81 (0.65–1.01)	0.74 (0.59–0.92)
	P (trend)	0.04	0.03	0.11
	Pooled	0.61 (0.56–0.66)	0.61 (0.54–0.68)	0.61 (0.54–0.70)
Total Pacific vs European	1981–1986	0.34 (0.19–0.64)	0.60 (0.31–1.14)	0.07 (0.01–0.53)
	1986–1991	0.34 (0.17–0.70)	0.24 (0.12–0.48)	0.48 (0.18–1.28)
	1991–1996	0.58 (0.40–0.83)	0.53 (0.35–0.80)	0.65 (0.39–1.10)
	1996–2001	0.55 (0.42–0.71)	0.70 (0.47–1.05)	0.45 (0.31–0.67)
	2001–2004	0.36 (0.25–0.52)	0.27 (0.15–0.49)	0.40 (0.25–0.66)
	P (trend)	0.97	0.98	0.51
	Pooled	0.44 (0.36–0.54)	0.48 (0.38–0.61)	0.42 (0.31–0.58)
Total Asian vs European	1981–1986	0.75 (0.44–1.26)	0.58 (0.28–1.20)	0.80 (0.39–1.67)
	1986–1991	0.73 (0.47–1.12)	0.73 (0.42–1.27)	0.69 (0.35–1.34)
	1991–1996	0.78 (0.52–1.16)	0.68 (0.39–1.21)	0.83 (0.49–1.43)
	1996–2001	0.62 (0.47–0.82)	0.63 (0.42–0.94)	0.61 (0.40–0.92)
	2001–2004	0.50 (0.38–0.66)	0.43 (0.28–0.65)	0.53 (0.37–0.77)
	P (trend)	0.05	0.19	0.08
	Pooled	0.68 (0.56–0.82)	0.62 (0.48–0.81)	0.69 (0.53–0.90)
Females				
Total Māori vs European	1981–1986	0.43 (0.33–0.57)	0.52 (0.36–0.75)	0.43 (0.27–0.70)
	1986–1991	0.47 (0.37–0.60)	0.51 (0.37–0.70)	0.48 (0.34–0.69)
	1991–1996	0.58 (0.47–0.72)	0.54 (0.41–0.70)	0.57 (0.42–0.77)
	1996–2001	0.57 (0.48–0.67)	0.57 (0.46–0.72)	0.56 (0.44–0.72)
	2001–2004	0.53 (0.45–0.64)	0.75 (0.60–0.94)	0.35 (0.26–0.47)
	P (trend)	0.26	0.08	0.68
	Pooled	0.52 (0.47–0.57)	0.56 (0.50–0.64)	0.48 (0.42–0.56)
Total Pacific vs European	1981–1986	0.56 (0.34–0.93)	0.47 (0.23–0.97)	0.84 (0.41–1.73)
	1986–1991	0.37 (0.21–0.65)	0.23 (0.10–0.53)	0.43 (0.20–0.91)
	1991–1996	0.46 (0.31–0.67)	0.49 (0.31–0.78)	0.46 (0.23–0.92)
	1996–2001	0.45 (0.33–0.61)	0.37 (0.24–0.58)	0.50 (0.33–0.76)
	2001–2004	0.51 (0.38–0.68)	0.51 (0.33–0.79)	0.52 (0.35–0.78)
	P (trend)	0.88	0.62	0.38
	Pooled	0.47 (0.39–0.57)	0.41 (0.31–0.53)	0.55 (0.41–0.73)

Exposure Colorectal Total ethnicity	Cohort	25+ years SRR (95% CI)	25–64 years SRR (95% CI)	65+ years SRR (95% CI)
Total Asian vs European	1981–1986	0.43 (0.22–0.84)	0.22 (0.07–0.70)	0.67 (0.26–1.74)
	1986–1991	0.35 (0.19–0.67)	0.38 (0.14–1.01)	0.32 (0.13–0.77)
	1991–1996	0.44 (0.28–0.69)	0.48 (0.27–0.86)	0.39 (0.18–0.81)
	1996–2001	0.72 (0.55–0.92)	0.70 (0.49–1.02)	0.70 (0.48–1.01)
	2001–2004	0.52 (0.40–0.67)	0.55 (0.40–0.76)	0.43 (0.29–0.64)
	P (trend)	0.58	0.40	0.88
	Pooled	0.49 (0.40–0.60)	0.46 (0.35–0.61)	0.50 (0.37–0.69)

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

Table 23: Age-standardised rate differences (SRD) of colorectal cancer, for Māori, Pacific and Asian compared to European/Other, by sex

Exposure Colorectal Total ethnicity	Cohort	25+ years SRD (95% CI)	25–64 years SRD (95% CI)	65+ years SRD (95% CI)
Males				
Total Māori vs European	1981–1986	-47 (-59– -35)	-31 (-39– -23)	-133 (-208– -58)
	1986–1991	-47 (-58– -36)	-22 (-32– -12)	-196 (-248– -144)
	1991–1996	-44 (-55– -33)	-26 (-34– -18)	-163 (-226– -100)
	1996–2001	-25 (-38– -13)	-17 (-25– -8.3)	-101 (-165– -37)
	2001–2004	-28 (-40– -16)	-9.1 (-18– -0.5)	-114 (-186– -42)
	P (trend)	0.05	0.02	0.27
	Pooled	-39 (-44– -34)	-21 (-25– -18)	-143 (-172– -113)
Total Pacific vs European	1981–1986	-60 (-79– -40)	-21 (-41– -0.9)	-297 (-346– -247)
	1986–1991	-63 (-87– -39)	-44 (-54– -34)	-173 (-329– -17)
	1991–1996	-44 (-65– -22)	-27 (-40– -14)	-133 (-264– -2.3)
	1996–2001	-47 (-62– -32)	-17 (-32– -0.7)	-217 (-288– -146)
	2001–2004	-66 (-80– -52)	-35 (-43– -27)	-257 (-345– -169)
	P (trend)	0.83	0.85	0.33
	Pooled	-55 (-64– -47)	-28 (-35– -22)	-213 (-262– -165)
Total Asian vs European	1981–1986	-23 (-58– 13)	-22 (-44– 0.2)	-63 (-252– 125)
	1986–1991	-26 (-56– 4.2)	-16 (-39– 7.9)	-104 (-256– 49)
	1991–1996	-23 (-55– 9.7)	-18 (-41– 4.2)	-63 (-236– 109)
	1996–2001	-40 (-58– -22)	-21 (-35– -6.4)	-155 (-257– -54)
	2001–2004	-51 (-66– -37)	-27 (-37– -18)	-202 (-287– -117)
	P (trend)	0.02	0.13	0.03
	Pooled	-32 (-44– -19)	-20 (-29– -12)	-113 (-181– -46)
Females				
Total Māori vs European	1981–1986	-45 (-55– -35)	-23 (-33– -14)	-147 (-201– -93)
	1986–1991	-43 (-52– -33)	-24 (-32– -16)	-139 (-188– -91)
	1991–1996	-35 (-45– -25)	-23 (-31– -16)	-125 (-177– -73)
	1996–2001	-36 (-45– -28)	-20 (-27– -14)	-133 (-177– -90)

Exposure Colorectal Total ethnicity	Cohort	25+ years SRD (95% CI)	25–64 years SRD (95% CI)	65+ years SRD (95% CI)
	2001–2004	-40 (-48– -31)	-11 (-18– -3.4)	-224 (-263– -184)
	P (trend)	0.23	0.09	0.23
	Pooled	-40 (-44– -36)	-21 (-24– -17)	-150 (-172– -128)
Total Pacific vs European	1981–1986	-35 (-58– -12)	-26 (-42– -9.2)	-42 (-200–115)
	1986–1991	-52 (-69– -34)	-37 (-47– -28)	-154 (-241– -67)
	1991–1996	-46 (-60– -31)	-25 (-37– -14)	-156 (-249– -63)
	1996–2001	-46 (-58– -34)	-30 (-38– -21)	-153 (-218– -87)
	2001–2004	-42 (-54– -29)	-21 (-30– -11)	-166 (-239– -93)
	P (trend)	0.88	0.25	0.27
	Pooled	-44 (-52– -37)	-28 (-33– -23)	-132 (-179– -86)
Total Asian vs European	1981–1986	-45 (-69– -22)	-38 (-50– -25)	-87 (-252–79)
	1986–1991	-52 (-71– -34)	-30 (-49– -12)	-184 (-261– -108)
	1991–1996	-47 (-64– -30)	-26 (-40– -12)	-178 (-261– -95)
	1996–2001	-24 (-39– -8.4)	-14 (-27– -1.4)	-93 (-173– -12)
	2001–2004	-41 (-52– -30)	-19 (-27– -11)	-196 (-256– -136)
	P (trend)	0.44	0.04	0.75
	Pooled	-42 (-50– -34)	-26 (-32– -19)	-145 (-191– -99)

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

8.2 Socioeconomic trends

Age- and ethnicity-standardised rates of colorectal cancer for 25+ year-olds increased over time in all income tertiles, for both sexes (Figure 20 and Table 86 in Appendix 1). This increase was nearly monotonic over time for low-income males (there was a 28 percent increase, p for trend 0.03). The increase was more modest among medium- and high-income groups, and actually decreased among 45–64 year-old males of low- and middle-income. Rates often peaked in the 1990s, and subsequently reduced in later years. Patterns were similar among females, except that incidence rates among 45–64 year-olds decreased in all income groups from 1991–1996 onwards.

There was no convincing evidence of either absolute or relative inequalities in colorectal cancer incidence, either pooled over time or changing over time.

Figure 20: Standardised rates of colorectal cancer for 25+ year-olds, by income by sex

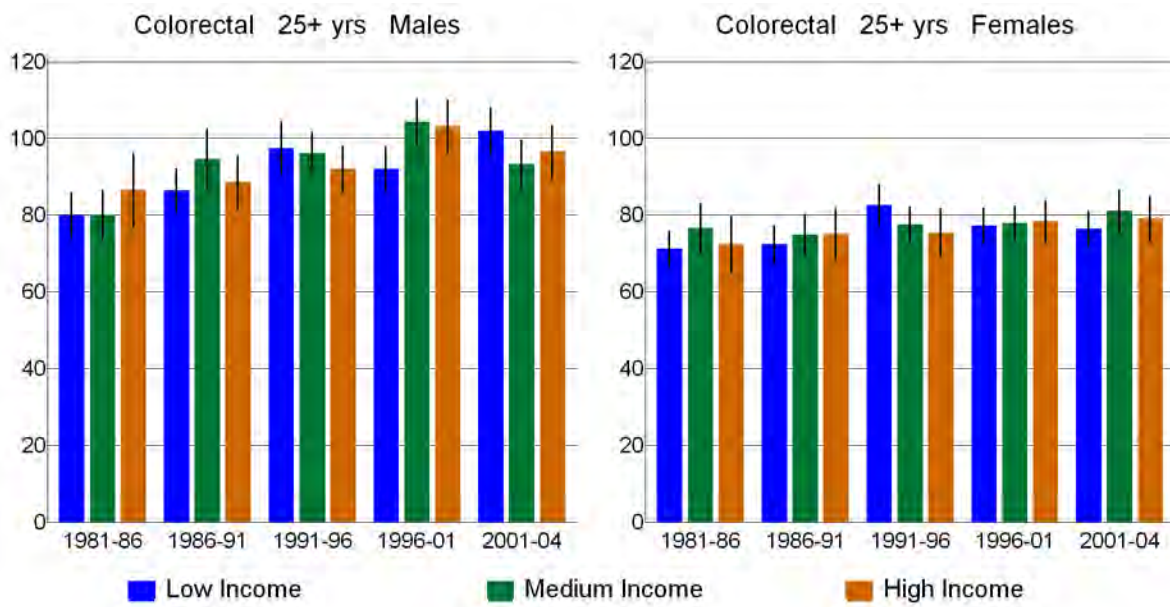


Figure 21: Standardised rates of colorectal cancer, by income by sex and age group

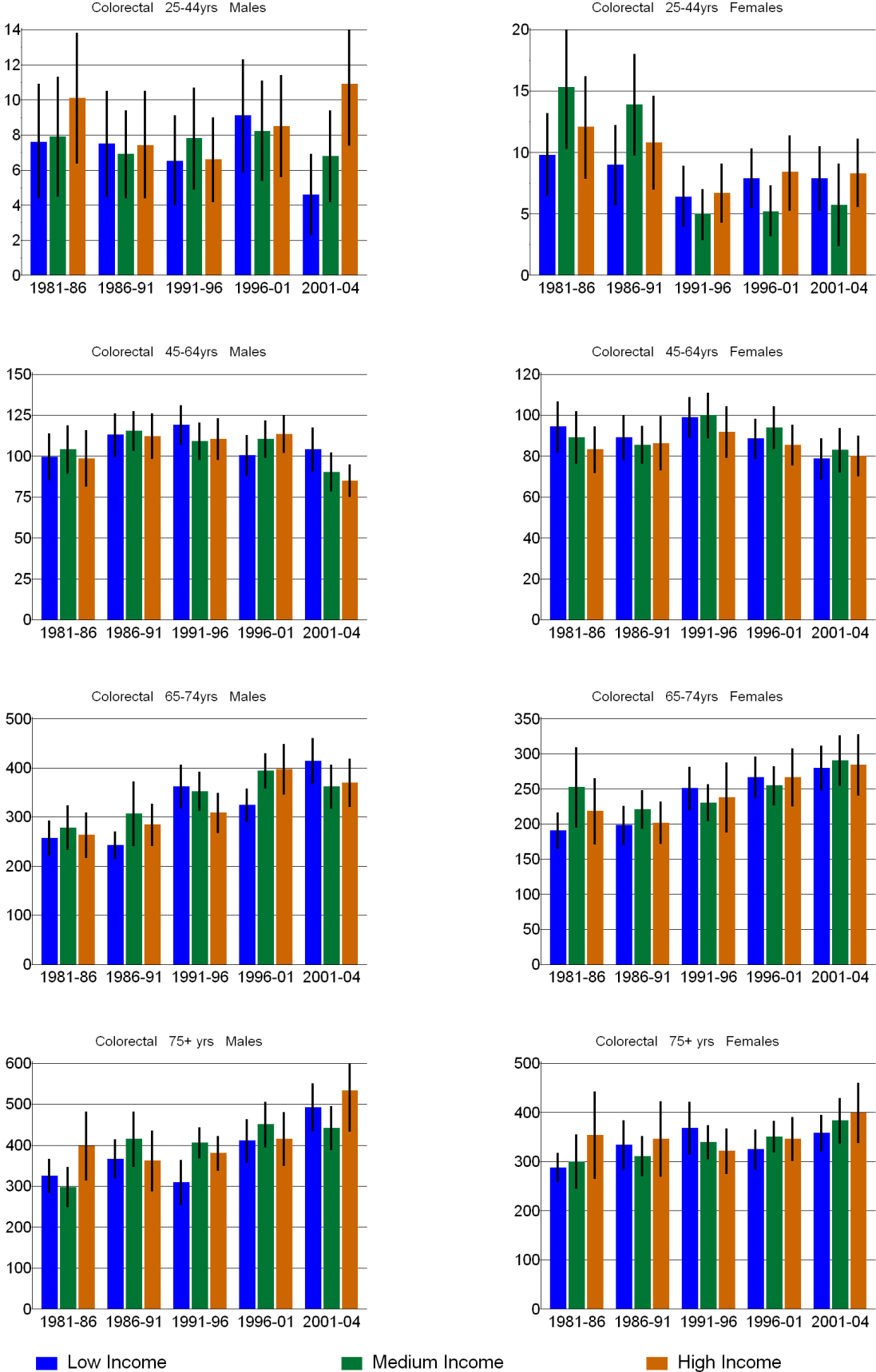


Table 24: Age- and ethnicity-standardised income rate ratios (SRR), rate differences (SRD), relative indices of inequality (RII) and slope indices of inequality (SII) of colorectal cancer, by sex

Age group	Cohort	Males				Females			
		Relative inequalities		Absolute inequalities		Relative inequalities		Absolute inequalities	
		SRR	RII (95% CI)	SRD	SII (95% CI)	SRR	RII (95% CI)	SRD	SII (95% CI)
Colorectal									
25+ years	1981–1986	0.92	0.9 (0.7–1.1)	-6.7	-11 (-30–8.4)	0.98	0.9 (0.8–1.1)	-1.2	-8.0 (-21–5.5)
	1986–1991	0.98	1.0 (0.8–1.1)	-2.2	-4.0 (-21–13)	0.97	1.0 (0.8–1.2)	-2.6	-1.0 (-13–11)
	1991–1996	1.06	1.1 (0.9–1.3)	5.4	10 (2.6–17)	1.09	1.3 (1.0–1.7)	7.1	21 (-17–59)
	1996–2001	0.89	0.8 (0.7–1.0)	-11	-18 (-38–1.0)	0.99	1.0 (0.9–1.1)	-1.1	-1.0 (-24–23)
	2001–2004	1.06	1.1 (0.9–1.2)	5.3	4.0 (-7.6–16)	0.97	0.9 (0.8–1.0)	-2.7	-9.0 (-18–0.7)
	P (trend)	0.65	0.69	0.67	0.80	0.89	0.91	0.86	0.62
	Pooled	0.98	1.0 (0.9–1.0)	-2.2	-5.0 (-10–0.8)	1.00	1.0 (0.9–1.1)	0.0	1.0 (-8.5–11)
25–44 years	1981–1986	0.76	0.9 (0.4–2.0)	-2.5	-1.0 (-6.7–4.2)	0.81	0.7 (0.3–1.4)	-2.2	-5.0 (-22–12)
	1986–1991	1.01	1.2 (0.5–2.5)	0.1	1.0 (-3.0–5.0)	0.83	0.9 (0.5–1.8)	-1.8	-1.0 (-3.5–1.3)
	1991–1996	0.99	1.0 (0.5–2.1)	-0.1	0.0 (-5.2–4.7)	0.96	0.9 (0.4–2.0)	-0.3	-1.0 (-4.7–3.4)
	1996–2001	1.07	0.9 (0.4–1.8)	0.6	-1.0 (-9.9–7.5)	0.94	0.9 (0.4–2.0)	-0.5	-1.0 (-8.1–6.9)
	2001–2004	0.42	0.3 (0.1–0.9)	-6.3	-9.0 (-10– -8.0)	0.94	0.6 (0.3–1.3)	-0.5	-4.0 (-11–2.4)
	P (trend)	0.66	0.30	0.45	0.02	0.07	0.83	0.13	0.28
	Pooled	0.84	0.8 (0.6–1.2)	-1.4	-1.0 (-3.1–0.3)	0.88	0.8 (0.6–1.2)	-1.1	-2.0 (-3.3– -0.4)
45–64 years	1981–1986	1.01	0.9 (0.6–1.4)	1.0	-6.0 (-35–22)	1.13	1.2 (0.9–1.6)	11	16 (-7.3–40)
	1986–1991	1.01	1.0 (0.8–1.2)	0.7	-4.0 (-27–19)	1.03	1.1 (0.8–1.4)	2.8	6.0 (-14–26)
	1991–1996	1.08	1.0 (0.8–1.3)	8.6	4.0 (-11–20)	1.08	1.1 (0.9–1.4)	7.2	11 (-6.8–29)
	1996–2001	0.89	0.8 (0.6–1.0)	-13	-25 (-51–1.7)	1.04	1.0 (0.8–1.3)	3.0	1.0 (-26–28)
	2001–2004	1.23	1.2 (1.0–1.6)	19	18 (-13–50)	0.98	1.0 (0.8–1.3)	-1.5	0.0 (-15–14)
	P (trend)	0.55	0.70	0.60	0.79	0.09	0.05	0.07	0.06
	Pooled	1.02	1.0 (0.9–1.1)	2.5	-4.0 (-18–11)	1.06	1.1 (1.0–1.2)	4.9	7.0 (-6.2–19)

Age group	Cohort	Males				Females			
		Relative inequalities		Absolute inequalities		Relative inequalities		Absolute inequalities	
		SRR	RII (95% CI)	SRD	SII (95% CI)	SRR	RII (95% CI)	SRD	SII (95% CI)
65–74 years	1981–1986	0.98	0.9 (0.7–1.3)	-6.4	-20 (-54–13)	0.87	0.7 (0.4–1.1)	-28	-86 (-127– -45)
	1986–1991	0.85	0.8 (0.6–1.2)	-41	-50 (-206–107)	0.98	1.0 (0.7–1.3)	-3.5	-5.0 (-35–24)
	1991–1996	1.17	1.4 (1.1–1.8)	53	115 (70–160)	1.05	1.1 (0.9–1.5)	13	24 (-69–117)
	1996–2001	0.81	0.8 (0.7–1.1)	-74	-64 (-192–63)	1.00	1.0 (0.8–1.3)	-0.3	-4.0 (-77–69)
	2001–2004	1.12	1.1 (0.9–1.5)	45	47 (-29–123)	0.98	0.9 (0.7–1.1)	-4.9	-45 (-101–12)
	P (trend)	0.72	0.85	0.76	0.30	0.38	0.89	0.37	0.62
	Pooled	0.98	1.0 (0.9–1.2)	-7.1	6.0 (-43–55)	0.98	0.9 (0.8–1.1)	-4.6	-21 (-59–16)
75+ years	1981–1986	0.82	0.8 (0.6–1.1)	-73	-86 (-295–123)	0.81	0.7 (0.5–1.0)	-66	-103 (-158– -48)
	1986–1991	1.01	1.0 (0.8–1.4)	4.6	15 (-256–286)	0.97	0.9 (0.6–1.4)	-12	-33 (-183–117)
	1991–1996	0.81	0.8 (0.6–1.2)	-71	-81 (-219–57)	1.15	1.4 (0.9–2.0)	47	106 (-116–328)
	1996–2001	0.99	0.9 (0.7–1.2)	-4.4	-51 (-206–103)	0.94	1.0 (0.8–1.2)	-21	-9.0 (-181–164)
	2001–2004	0.93	0.9 (0.7–1.2)	-40	-42 (-190–106)	0.90	0.9 (0.7–1.1)	-40	-44 (-197–110)
	P (trend)	0.56	0.76	0.69	0.61	0.97	0.67	0.99	0.21
	Pooled	0.91	0.9 (0.7–1.0)	-37	-54 (-112–4.2)	0.95	1.0 (0.8–1.2)	-17	3.0 (-142–149)

Notes: 95 percent confidence intervals in brackets. SRRs and SRDs compare low- and high-income tertiles. Underlying non-linear trends mean the p for trend value must be interpreted cautiously.

Chapter 9: Endometrial cancer

Endometrial cancer is the fifth most common cancer among New Zealand women: in 2005 there were 388 endometrial cancers diagnosed and 90 deaths.⁵⁷

Incidence of endometrial cancer increases with age, increasing sharply in the five to ten years before menopause and peaking at ages 65–70. A family history of endometrial cancer in a first-degree relative increases the risk of endometrial cancer. Family cancer syndromes, particularly hereditary non-polyposis colorectal cancer syndrome (which predisposes to colorectal and other cancers, including endometrial), account for 2–5 percent of endometrial cancers.⁶⁶

The risk of endometrial cancer is related to unopposed oestrogen exposure: the more menstrual cycles a woman has in her lifetime, the greater the risk. Oestrogen therapy alone for menopausal symptoms also substantially increases the risk (about ten-fold after 10 years' use). Long-term use of combined oral contraceptives (which include progesterone as well as oestrogen), however, reduces the risk of endometrial cancer.⁶⁶

Obesity is an established risk factor for endometrial cancer: this may be related to storage of oestrogen in peripheral body fat. Endometrial cancer is the only cancer for which cigarette smoking has been convincingly shown to be protective.⁶⁶ There is some evidence that physical activity is also protective.⁶⁰

9.1 Ethnic trends

Allowing for statistical imprecision, there was not strong evidence for changing endometrial cancer rates over time among any of the ethnic groups except Pacific women (Figure 22 and Table 87 in Appendix 1). Among 25+ year-old Pacific females, the rate increased by 86 percent, from 37.5 per 100,000 (95 percent confidence interval 17.3–57.6) in 1981–1986 to 69.7 (55.1–84.2) in 2001–2004.

Pooled across time, Māori rates were two-thirds greater than European/Other (with an SRR of 1.66 (1.49–1.85)) and Pacific rates nearly three times greater (Table 25). Because of the large increase in Pacific rates over time, the SRR for Pacific compared to European/Other also increased from 1.96 in 1981–1986 to 3.78 in 2001–2004 (confidence intervals overlapping, p for trend 0.14).

While analysis was based on fewer observations, among 25–44 year-olds, Māori, Pacific and Asian rates were all considerably higher than European/Other rates (the Māori and Asian groups had a pooled SRR greater than 3, and Pacific peoples an SRR greater than 6, all with confidence intervals clearly excluding 1.0; note that full results are not shown). These data will be further analysed and reported elsewhere.