Cancer mortality and incidence trends comparing New Zealand and Australia for the period 2000–2007

Lamees Alafeishat, Mark Elwood, Sally Ioannides

Abstract

Background and aims A previous study showed that cancer mortality in New Zealand in 1996–97 was substantially higher than that expected from Australian rates. This study compared cancer mortality and incidence in New Zealand for 2000–2007 with rates in Australia, to assess if any differences had persisted or changed.

Methods The numbers of cancer deaths in New Zealand, by type of cancer, year, sex, and 5 year age group, were compared to the numbers that would have occurred if NZ rates had been the same as those in Australia. Trends over time, and also cancer incidence, were assessed.

Results From 2000–2007, there were each year an average of 586 (15.1% of the total) more deaths from cancer in New Zealand women than expected from Australian rates; and 197 (4.7%) more deaths in men. There was no significant change over time in these differentials. Higher cancer mortality was seen for most common sites; the greatest excesses were for colorectal cancer in both men and women. Cancer incidence in New Zealand women was 3.3% higher, and incidence in men was 4.7% lower, than in Australia over this period; thus the higher cancer deaths in New Zealand are not due simply to higher incidence. Over this time period, cancer mortality has fallen substantially in both countries; in New Zealand, it fell from 1990 to 2007 by 20% in women and 24% in men.

Conclusion Cancer mortality remains substantially higher in New Zealand than in Australia, especially for women, although mortality has reduced in both countries. While the differences in 2000–07 were slightly smaller than in 1996–97, there has been little change since 2000. The greater differences in deaths than in incidence suggest that patient survival is lower in New Zealand.

In 2002, Skegg and McCreedie published a comparison of cancer mortality and incidence for New Zealand and Australia, using 1996–97 data. They found that at that time New Zealanders of both sexes experienced more deaths from cancer than were expected on the basis of Australian rates, for all cancers combined, and for most of the 10 leading sites for cancer deaths.

They concluded that “considerable scope exists for reducing cancer mortality in New Zealand” but also predicted that “the gap between New Zealand and Australia in controlling cancer is likely to widen during the next few years.”

To see whether the “gap has persisted, we used a similar method to compare the numbers of deaths (mortality) and of new cases (incidence) in New Zealand in each year from 2000 to 2007, for all cancers combined and for the most common cancers, to the numbers that would have occurred in the NZ population on the basis of...
Australian rates. We also assessed whether any ‘gap’ was changing over that time period.

Methods

Information on cancer mortality and incidence from 2000 to 2007, by year, sex, cancer site, and five year age group from 0-4 to 85+, was obtained from official publications of the appropriate national groups in New Zealand and in Australia. In New Zealand, cancer incidence and death data is collated by the Ministry of Health, from the New Zealand Cancer Registry and the mortality collection. Australian data is published by the Australian Institute of Health and Welfare (AIHW), which draws on the Australian cancer database, combining data from each State cancer registry, and from the national mortality database.

Cancer deaths were classified using the International Classification of Diseases version 10 (ICD 10) in both countries. Cancer registrations are recorded by the oncology conversion of the ICD, version ICD-O-2 being used in New Zealand in 2000 to 2002, and version ICD-O-3 from 2003 onwards; ICD-O-3 was used for Australian cancer incidence the whole period. To facilitate comparisons of incidence and mortality data, both countries link the ICD-O codes to ICD 10 codes, following internationally accepted rules. The Australian data give rates for bowel cancer (colon and rectum) and anal cancers separately, which were summed to be equivalent to New Zealand data on colorectal cancer, which includes the anus.

For each sex, year and cancer, the Australian incidence rates for each 5-year age group were applied to New Zealand population data to give ‘expected, E’ numbers of cancers, to be compared to the actual ‘observed, O’ numbers (indirect standardisation), and 95% confidence limits calculated. Results are expressed as the O/E difference as a percentage of the observed New Zealand numbers. To assess trends, the log transform of the O/E ratio was regressed against year.

Results

Mortality and incidence for all cancers combined—Over the 8-year period 2000 to 2007, there were on average each year 7998 deaths from cancer in New Zealand, 3771 in women and 4227 in men.

Applying the Australian death rates to the New Zealand population shows that on average each year there were 586 (15.1%, 95% confidence interval [CI] 11.9 to 18.3) ‘extra’ deaths in New Zealand women, and 197 (4.7%, 95% CI 1.7 to 7.7) ‘extra’ deaths in New Zealand men. The proportions of extra deaths per year were fairly constant over time (Figure 1); statistical analyses showed a small increase over time, but not statistically significant, in both women (P=0.1) and men (P=0.7).

The equivalent analysis for cancer incidence shows an average annual excess in New Zealand women of 287 cases (3.3% of the annual total of 8782, 95% CI 1.2 to 5.4). This excess in New Zealand reduced over time, but the trend was not statistically significant (P=0.09).

In men, the numbers of incident cases were lower than those expected from Australian rates, the average annual difference being 465 (-4.7% of the annual incidence total of 9794, 95% CI -6.7 to -2.7). Comparisons of incidence numbers are greatly influenced by rapid variations in the recorded incidence of prostate cancer. Although over the whole period prostate cancer incidence was similar in the two countries, the incidence fell by 9% in New Zealand between 2000 and 2007, but increased by 10% in Australia.
Thus, for all cancer (including prostate), the incidence in New Zealand compared to Australia reduced over time, but this was only due to the different trends for prostate cancer incidence.

For all cancer sites except prostate, there were overall fewer incident cases in New Zealand compared to Australia, an average 'deficit' of 463 (-6.6% of the annual total of 7038, CI -8.9 to -4.2); and this proportion did not change significantly from 2000 to 2007 (P=0.7).

Figure 1. Excess proportion of cancer deaths in New Zealand, compared to Australian rates, by year, 2000 to 2007. Error bars show 95% confidence limits

Mortality and incidence for major cancer sites—Results for specific cancers are shown in Table 1; the cancers shown are those accounting for the most deaths, plus cervical cancer, included as it has a screening programme. The cancers shown account for 76% of cancer deaths in women, and 70% in men. Leukaemia had to be omitted as the coding systems differ between the two countries. The cancers are ordered in terms of the numbers of annual deaths in New Zealand. For women, for most cancer sites there were more deaths than expected when compared with Australian rates. Colorectal cancer had the highest number and proportion of 'excess' deaths, 204 per year, 35% higher than expected; in contrast, in New Zealand women the incidence of colorectal cancer was substantially (25%) lower) than in Australia.
Table 1. Annual average deaths and incidence cases of cancer in New Zealand, 2000-2007, by sex and site; and differences compared to Australian rates (LL, UL: 95% lower and upper confidence limits)

<table>
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<tr>
<th>Sex</th>
<th>CANCER SITE</th>
<th>MORTALITY</th>
<th>INCIDENCE</th>
<th></th>
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<td></td>
<td>NZ annual deaths</td>
<td>Excess / deficit</td>
<td>% excess / deficit</td>
<td>95% LL</td>
<td>95% UL</td>
<td>NZ annual cases</td>
<td>Excess / deficit</td>
<td>% excess / deficit</td>
<td>95% LL</td>
<td>95% UL</td>
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<td>4.7</td>
<td>1.7</td>
<td>7.7</td>
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<tr>
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<tr>
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<td>11.5</td>
<td>-3.3</td>
<td>28.2</td>
<td>978</td>
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<tr>
<td>Non Hodgkin lymphoma</td>
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<td>7.1</td>
<td>-7.9</td>
<td>23.9</td>
<td>347</td>
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<td>-14.1</td>
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<tr>
<td>Brain</td>
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<td>152</td>
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<td>Oesophagus</td>
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<td>All except prostate</td>
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<td>143</td>
<td>3.9</td>
<td>0.7</td>
<td>7.2</td>
<td>7038</td>
<td>-463</td>
<td>-6.6</td>
<td>-8.9</td>
<td>-4.2</td>
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Substantial excess deaths were also seen in women for breast cancer (120 excess deaths per year, 19%), while incidence was about the same as Australia. For lung cancer, there were also more deaths (120 per year, 20%) compared to Australia, but also 13% higher incidence.

In women, deaths from cancers of the ovary, stomach, uterus, and cervix, and from melanoma, showed lower numbers of excess deaths as these cancers account for fewer deaths in total, but the proportions of excess deaths ranged from 12% to 30%. For cancers of the ovary, and cervix, and for melanoma, incidence was substantially higher in New Zealand. There were fewer deaths but also fewer incident cases of pancreatic cancer in New Zealand; and there was lower incidence of non-Hodgkin lymphoma and brain cancer, although these differences were not statistically significant.

For men, excess numbers of deaths were seen in New Zealand for several cancers. Colorectal cancer showed the greatest numbers of excess deaths, 143 per year, 24% of the total. Stomach cancer deaths were 25% higher in New Zealand, and prostate cancer deaths 9% higher.

Figure 2. Deaths rates for all cancer from 1990, New Zealand and Australia, both age-standardised using the WHO world standard population

For lung cancer, the number of deaths were similar to Australia (2% lower), but incidence was 10% lower. Melanoma, brain cancers, and non-Hodgkin lymphoma also showed higher mortality, although the differences were not statistically significant. For all of these sites, there were no excesses of cancer incidence in New Zealand; indeed, the incidence rates of lung, melanoma and non-Hodgkin lymphoma.
were significantly lower. As in women, both deaths and incidence from pancreatic cancer were lower than expected from Australian rates.

These differences between the countries relate to a period when total cancer death rates adjusted for age decreased substantially in each country (Figure 2). The decrease in New Zealand over 17 years from 1990 to 2007 was about 24% in men, and 20% in women; but throughout this period, the death rates in New Zealand were higher than in Australia, especially in women.

**Discussion**

This study shows that the higher rates of cancer deaths in New Zealand compared with Australia, shown for 1996 to 1997 by Skegg and McCredie, have continued through to 2007 with only a slight change. In 1996-97, there were 17.5% more deaths in New Zealand in women, and 5.6% more in men.

Overall for 2000 to 2007, there were 15.1% more deaths from cancer in women, and 4.7% more deaths in men in New Zealand than would have occurred if age and site-specific death rates had been equivalent to those in Australia. These differences have been reasonably constant over time from 2000 to 2007, not showing the increased mortality differential predicted in the earlier study, but also not showing any decrease. The analysis used adjusts for age differences between the two countries and over time, and also adjusts for the mix of cancer sites.

Over this time, and since around 1990, total cancer death rates adjusted for age have decreased substantially in each country, as shown in Figure 2, so there has been a substantial improvement. In men, cancer mortality rates in New Zealand are similar to those in Australia about 3 years earlier, but in women this time difference is more than 10 years.

The greater number of deaths in women in New Zealand in 2000-07 was produced by higher numbers of deaths from each of the three main causes of cancer death: breast, lung, and colorectal cancer. However, the excesses for ovarian, stomach, endometrial, and cervical cancer and from melanoma, while numerically smaller, ranged from 18 to 30%. For men, the greatest excess was for colorectal cancer, with substantial excesses for prostate and stomach cancer and for melanoma.

The methods of registration and coding of cancers by the cancer registries are essentially the same in the two countries. It would take a major study to assess whether there are systematic differences in clinical diagnostic procedures, the information that is sent to the registries, or in coding and death certification practices.

Any differences in procedures may be more likely to apply to incidence rather than to mortality data, as accurate and complete recording of incidence is more complex. Also, variations in screening and diagnostic procedures can have major effects. Here, the incidence trends were dominated by the rapid variations in prostate cancer; in New Zealand, the age-standardised incidence rate (WHO world standard) per 100,000 fell from 133 in 2000 to 92 in 2007 (a 9% fall), while in Australia it increased from 95 to 135 (a 10% increase) in the same period. Such rapid variations are likely to be due to changes in the use of prostate specific antigen (PSA) testing. No substantial changes in prostate cancer mortality were seen in either country over those years.
Thus, as in the earlier study, these differences were in mortality rather than in incidence. Total cancer incidence for women in these years was only slightly higher in New Zealand than in Australia, and for men, whether including or excluding prostate cancer, it was slightly lower. Thus the substantial excesses in cancer mortality in New Zealand are not explicable by differences in incidence, implying that for the factors which influence the case-fatality of cancer, New Zealand is at a disadvantage. These factors include the process of diagnosis of cancer and as a result the extent of cancer (the stage distribution) at the time of treatment, the treatment given and the efficiency of treatment services, including equity across the population, and the provision of appropriate treatment at the appropriate time. Information on the distribution by stage at diagnosis would be very valuable, but complete and comparable data is not available for the two countries, except on selected series of patients.

Australia has good cancer survival by world standards. In worldwide comparisons of cancer survival, Australia, along with the U.S., Canada and Sweden is usually ranked near the top, above for example the UK. New Zealand has not participated in these major studies of international cancer outcomes, although there is good data on survival within New Zealand, and it will participate in future studies. We are currently doing a comparison of cancer survival rates in Australia and New Zealand.

In 2000–07, the largest differences, both in absolute excess numbers of deaths and in the proportional excess, were in colorectal cancer, where New Zealand mortality was 35% higher than in Australia for women, and 24% higher for men.

Both New Zealand and Australia have high incidence rates by world standards, likely linked to dietary factors. Australia’s approach to this disease has emphasised adherence to national management and treatment guidelines, and early detection, including population based screening.

The Australian national bowel cancer screening programme began in 2006, too recently to influence mortality; however, that was preceded by a pilot program started in 2001, and there was considerable awareness and interest in the earlier diagnosis of bowel cancer in advance of that. In New Zealand, a pilot program in Waitemata started in 2011, with results expected in 2015, so this development is considerably later than that in many other countries.

Deaths from breast cancer in New Zealand were 19% higher than those in Australia. Both countries have population-based screening programs, starting in Australia in 1991 and in New Zealand in 1998, both offering two yearly mammographic screening. It has been estimated in the New Zealand programme, deaths were reduced by as much as 40% in women participating in the screening.

The utilisation of clinical practice guidelines in Australia in 1985 led to increased use of adjuvant radiotherapy, chemotherapy and oral therapy, and the decrease in mortality in Australia has been linked to improvements in adjuvant therapy. Treatment trends in New Zealand may have been similar, but less information is available.

Lung cancer deaths in women were 20% higher in New Zealand compared to Australia. Deaths in men were about the same as in Australia; however lung cancer incidence in men was 10% lower in New Zealand, so this suggests that clinical survival rates are lower in both sexes.
Successful inter-sectoral collaboration on smoking policy is a major reason for the success of preventive actions for lung cancer; both countries have made legislative changes about packaging, advertising, and the sale of tobacco products. The lung cancer mortality rates fell since the 1990s for Australian men and women and New Zealand men, but did not decrease as much in New Zealand women. Smoking is particularly common amongst Maori women in New Zealand.

The one cancer site showing lower mortality in New Zealand than in Australia in both men and women was pancreatic cancer, where both mortality and incidence were lower than in Australia. Early diagnosis of pancreatic cancer is not linked to better survival outcomes, and it has a poor prognosis and is difficult to treat.

Cancer outcomes are influenced not only by specific treatments, but by the effectiveness and efficiency of cancer control programs. The data here suggest that for cancers which can be greatly benefited by early diagnosis and optimum treatment, such as breast and colorectal cancer, mortality outcomes in New Zealand lag behind those of Australia. For pancreatic cancer, for which neither early diagnosis nor recent advances in treatment have much effect, New Zealand does as well or better.

Progress in a systematic approach to cancer control in New Zealand began during the 1990s with an initiative focused on cervical, skin, breast and lung cancers. The New Zealand Cancer Control Trust was set up in 2001, representing non-government agencies in partnership with the Ministry of Health, and produced a New Zealand Cancer Control Strategy in 2003, which set goals for improving access to high quality and timely cancer services.

The focus has been on identifying disparities in cancer outcomes between subgroups of the population. Relatively little effort has been taken to identify international trends or to compare outcomes between New Zealand and other countries. Recent developments have been based on the Regional Cancer Networks set up in 2006–08, and include the development of service standards for 10 major cancers to ensure patients receive timely, good quality care along the cancer management pathway.

The Australian approach has been to build a systematic framework to promote a comprehensive national approach to cancer control, involving all phases along the continuum of care. Cancer was recognised as a National Health Priority Area in 1986, and in 1987 the National Cancer Control Initiative was jointly established by the federal government and voluntary sectors, to identify areas of greatest potential benefit in cancer control and to support their implementation.

A comprehensive nationwide consultation was held to assess priority control measures, and subsequently these identified measures were assessed by cost effectiveness analyses. In addition, much emphasis was given for the development of evidence-based clinical practice guidelines, primarily supported by the Australian Cancer Network, a voluntary association primarily of cancer specialists. These guidelines cover all the most common cancers such as lung, colorectal and prostate cancer. New Zealand experts have frequently been involved in the development of these guidelines, and some are explicitly Australian and New Zealand joint productions, such as the melanoma guidelines.

In Australia, there have been a large number of systematic surveys of the management of cancer, mostly carried out by the voluntary sector Cancer Councils. These have
included national surveys of population-based series of breast and colorectal cancers, and State based surveys of many other cancers. These have identified variations in management, and gaps between optimal management as defined in evidence-based guidelines and actual practice. There has also been systematic assessment of the actual use of radiotherapy compared to the utilisation expected on the basis of guidelines. In New Zealand, there have been some studies of cancer management, and some large databases, for example for breast cancer, but these have been less extensive than the Australian approaches.

The demonstration of international cancer outcome differences has been particularly influential in the UK. The demonstration that survival rates for cancer patients in the UK were lower than those in many other European countries led to a major reorganisation of cancer services in the UK, with clear national leadership. The emphases in these reforms have been on the efficient provision of evidence-based cancer management, with attention being given to reducing barriers and time delays in access to care, effective primary care services, and appropriate referral services including the concentration of services to provide appropriate levels of expertise and workloads.

More general economic issues are also relevant. Comparisons of cancer survival within 19 countries in Europe show strong positive correlations with total per capita expenditure on health and with the number of computer tomography scanners per million population, interpreted as a measure of investment in advanced health care. Figures from the OECD show a modest difference in total health spending per capita between Australia and New Zealand ($US 3800 and $3042 respectively, 2010), but, if the figures are accurate, a very large difference in scanners per million population (Australia 50.6, New Zealand 15.3, 2012).

Internationally there has been much emphasis on making comparisons between countries in regard to cancer outcomes, particularly survival. The demonstration of survival differences has been followed by high-definition studies in which patient management surveys in areas of contrasting cancer outcomes are used to identify reasons for the outcome differences.

The results in the current study suggest that a systematic comparison of the diagnosis and clinical management of common cancers such as colorectal cancer between New Zealand and Australia could show important areas for improvement.

Competing interests: Nil.

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