

Part C: Child and Adolescent Cancers

Chapter 29: Childhood Cancer

Cancer in childhood (ages 0–14 years) is relatively rare. About 40 percent of child cancers are leukaemias (in particular acute lymphoblastic leukaemia), and one-quarter are brain cancers (in particular neuroblastoma), with the remainder composed largely of other germ cell tumours. Given this heterogeneity, trends and inequalities in overall childhood cancer rates should be interpreted with caution.

29.1 Ethnic trends

There was no trend in childhood cancer incidence over time within ethnic groups (Figure 75 and Table 127 in Appendix 1).

Pooled over time, Māori and European/Other rates were similar, but Pacific and Asian rates were elevated compared to those of European/Other, by over one-quarter for both Pacific (1.29, 95 percent confidence interval 1.06–1.57) and Asian (1.22, 0.87–1.73) (Table 71).

There were no discernable trends in ethnic inequalities in childhood cancer incidence over the 1981–2004 period.

Figure 75: Standardised rates of childhood cancer (1–14 year-olds) by ethnicity

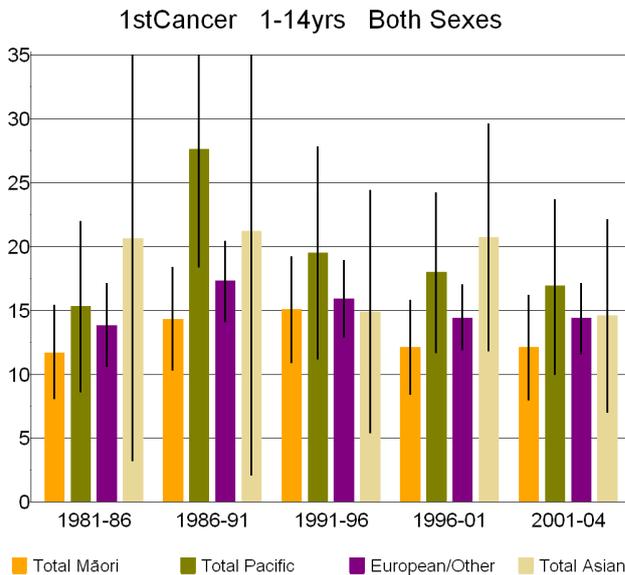


Table 71: Age-standardised rate ratios (SRR) and standardised rate differences (SRD) of childhood cancer, for Māori, Pacific and Asian compared to European/Other

Exposure 1st cancer 1–14 years	Cohort	Both sexes	
		SRR (95% CI)	SRD (95% CI)
Total Māori vs European	1981–1986	0.85 (0.57–1.26)	-2.1 (-7.0–2.8)
	1986–1991	0.83 (0.59–1.16)	-2.9 (-8.1–2.2)
	1991–1996	0.94 (0.68–1.32)	-0.9 (-6.0–4.2)
	1996–2001	0.84 (0.59–1.20)	-2.3 (-6.8–2.2)
	2001–2004	0.84 (0.57–1.24)	-2.3 (-7.2–2.7)
	P (trend)	0.98	0.97
	Pooled	0.86 (0.73–1.01)	-2.1 (-4.3–0.1)
Total Pacific vs European	1981–1986	1.11 (0.67–1.82)	1.5 (-6.0–8.9)
	1986–1991	1.60 (1.09–2.34)	10 (0.6–20)
	1991–1996	1.22 (0.77–1.95)	3.6 (-5.3–12)
	1996–2001	1.25 (0.84–1.84)	3.5 (-3.2–10)
	2001–2004	1.17 (0.75–1.84)	2.5 (-4.9–9.9)
	P (trend)	0.59	0.84
	Pooled	1.29 (1.06–1.57)	4.4 (0.7–8.1)
Total Asian vs European	1981–1986	1.49 (0.62–3.59)	6.8 (-11–25)
	1986–1991	1.23 (0.49–3.08)	3.9 (-15–23)
	1991–1996	0.94 (0.48–1.82)	-1.0 (-11–9.0)
	1996–2001	1.44 (0.90–2.29)	6.3 (-3.0–16)
	2001–2004	1.01 (0.58–1.77)	0.2 (-7.9–8.3)
	P (trend)	0.61	0.62
	Pooled	1.22 (0.87–1.73)	3.4 (-3.0–9.7)

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

29.2 Socioeconomic trends

Rates decreased by 16 percent among the high-income tertile over the period surveyed (p for trend 0.04), but no clear trends were evident in the other tertiles (Figure 76 and Table 128 in Appendix 1).

Pooled over time, children from low-income backgrounds had between one-half and two-thirds the rate of cancer of children from high-income backgrounds (for example, the RII was 0.5, 95 percent confidence interval 0.4–0.7) (Table 72). There was no trend in this inequality over time.

Figure 76: Standardised rates of childhood cancer (1–14 year-olds) by income

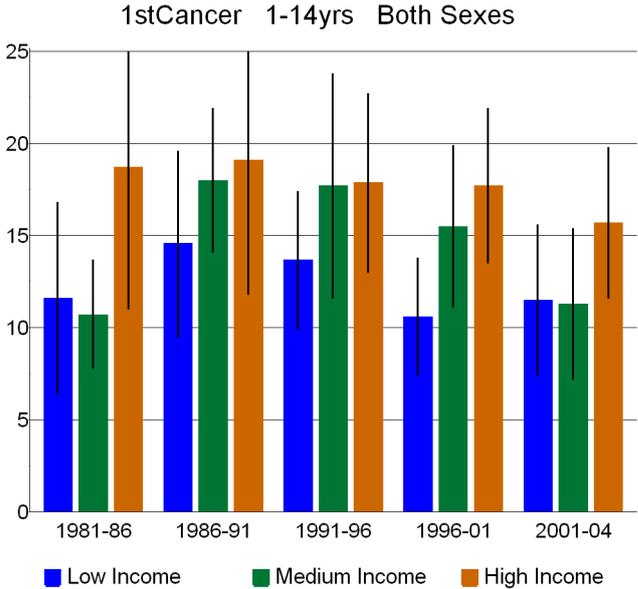


Table 72: Age- and ethnicity-standardised income rate ratios (SRR), rate differences (SRD), relative indices of inequality (RII) and slope indices of inequality (SII) of childhood cancer

Age group	Cohort	Both sexes			
		Relative inequalities		Absolute inequalities	
		SRR	RII (95% CI)	SRD	SII (95% CI)
1st cancer					
1–14 years	1981–1986	0.62	0.5 (0.2–1.2)	-7.1	-9.0 (-16– -2.9)
	1986–1991	0.76	0.6 (0.3–1.1)	-4.5	-9.0 (-18– -0.6)
	1991–1996	0.77	0.7 (0.4–1.4)	-4.2	-5.0 (-14– -4.1)
	1996–2001	0.60	0.4 (0.2–0.8)	-7.1	-13 (-18– -7.8)
	2001–2004	0.73	0.6 (0.3–1.2)	-4.2	-7.0 (-10– -3.1)
	P (trend)	0.92	0.92	0.75	0.78
	Pooled	0.69	0.5 (0.4–0.7)	-5.5	-9.0 (-13– -5.7)

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 30: Adolescent Cancer

About 20 percent of adolescent (here defined as the 15–24 age group) cancers are lymphomas, another 20 percent are germ-cell tumours and approximately 10 percent each are brain cancers, melanomas and leukaemias. Given this heterogeneity, trends and inequalities in overall adolescent cancer rates should be interpreted with caution.

30.1 Ethnic trends

European/Other adolescent cancer rates increased by 37 percent over the period surveyed. Pacific rates decreased by 58 percent, and Asian rates by 37 percent (Figure 77 and Table 129 in Appendix 1).

Pooled over time, Māori rates were 0.79 times those of European/Other (95 percent confidence interval 0.70–0.89), but there was no substantial difference in rates between Pacific, Asian and European/Other. However, due to the above-mentioned divergent trends over time in rates by ethnic group, European rates were about twice Pacific and Asian rates by 2001–2004 (Table 73), although none of the trends in SRR or SRD had p values less than 0.05.

Figure 77: Standardised rates of adolescent cancer (15–24 year-olds) by ethnicity

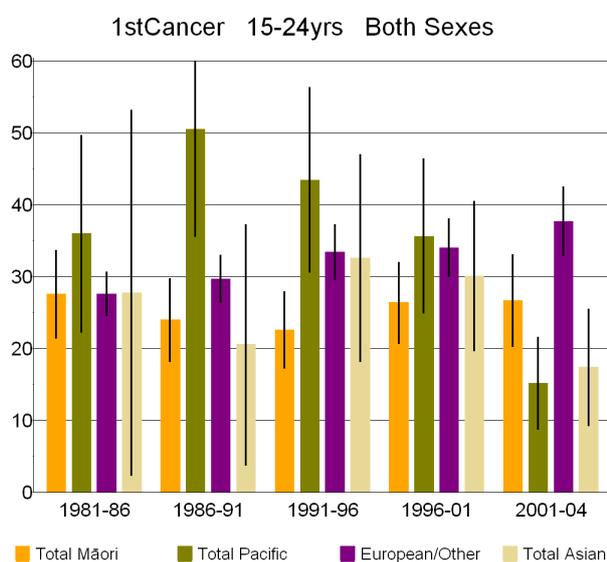


Table 73: Age-standardised rate ratios (SRR) and standardised rate differences (SRD) of adolescent cancer, for Māori, Pacific and Asian compared to European/Other

Exposure 1st cancer 15–24 years	Cohort	Both sexes	
		SRR (95% CI)	SRD (95% CI)
Total Māori vs European	1981–1986	1.00 (0.78–1.28)	-0.1 (-7.0–6.8)
	1986–1991	0.81 (0.62–1.06)	-5.7 (-12–1.0)
	1991–1996	0.68 (0.52–0.88)	-11 (-17– -4.3)
	1996–2001	0.77 (0.61–0.99)	-7.7 (-15– -0.8)
	2001–2004	0.71 (0.54–0.93)	-11 (-19– -3.0)
	P (trend)	0.12	0.09
	Pooled	0.79 (0.70–0.89)	-6.8 (-9.9– -3.7)
Total Pacific vs European	1981–1986	1.30 (0.88–1.93)	8.4 (-5.7–22)
	1986–1991	1.70 (1.24–2.33)	21 (5.5–36)
	1991–1996	1.30 (0.95–1.78)	10 (-3.4–23)
	1996–2001	1.05 (0.76–1.45)	1.6 (-9.9–13)
	2001–2004	0.40 (0.26–0.63)	-23 (-31– -15)
	P (trend)	0.11	0.06
	Pooled	1.15 (0.98–1.35)	5.0 (-0.9–11)
Total Asian vs European	1981–1986	1.01 (0.40–2.52)	0.2 (-25–26)
	1986–1991	0.69 (0.30–1.58)	-9.1 (-26–7.9)
	1991–1996	0.97 (0.62–1.54)	-0.9 (-16–14)
	1996–2001	0.88 (0.61–1.28)	-3.9 (-15–7.2)
	2001–2004	0.46 (0.28–0.75)	-20 (-30– -11)
	P (trend)	0.24	0.17
	Pooled	0.81 (0.61–1.09)	-6.1 (-14–1.6)

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

30.2 Socioeconomic trends

Rates increased in all income groups over the period surveyed, increases ranging from 3 percent in the medium-income tertile to 35 percent in the low-income tertile (Figure 78 and Table 130 in Appendix 1).

Rates of adolescent cancer were about 20 percent to one-third lower in adolescents with low-income backgrounds, with no evidence of change in this inequality over time (Table 74).

Figure 78: Standardised rates of adolescent cancer (15–24 year-olds) by income

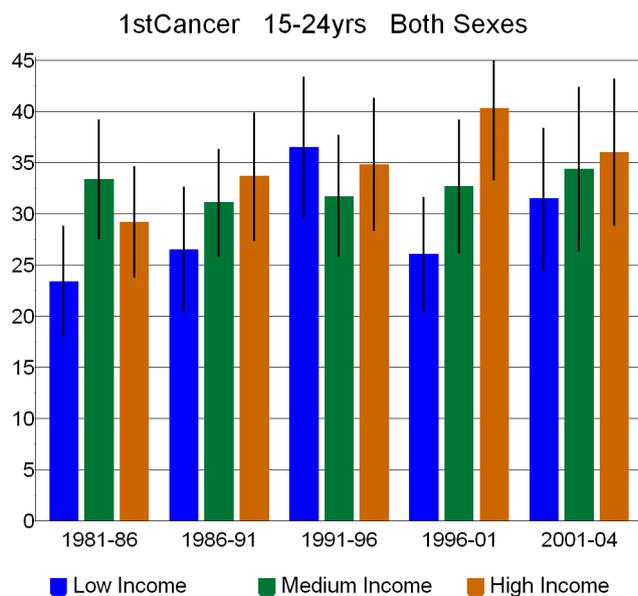


Table 74: Age- and ethnicity-standardised income rate ratios (SRR), rate differences (SRD), relative indices of inequality (RII) and slope indices of inequality (SII) of adolescent cancer

Age group	Cohort	Both sexes			
		Relative inequalities		Absolute inequalities	
		SRR	RII (95% CI)	SRD	SII (95% CI)
1st cancer					
15–24 years	1981–1986	0.80	0.8 (0.6–1.2)	-5.8	-6.0 (-19–7.0)
	1986–1991	0.79	0.7 (0.5–1.0)	-7.2	-11 (-19– -3.4)
	1991–1996	1.05	1.0 (0.7–1.4)	1.7	-1.0 (-19–17)
	1996–2001	0.65	0.5 (0.3–0.8)	-14	-22 (-30– -15)
	2001–2004	0.87	0.9 (0.6–1.3)	-4.6	-5.0 (-17–6.3)
	P (trend)	0.96	0.82	0.81	0.58
	Pooled	0.83	0.7 (0.6–0.9)	-6.1	-10 (-13– -5.7)

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.

Part D: Conclusions

Conclusions

Social inequalities in cancer incidence reflect socially patterned differences in exposure and susceptibility to environmental carcinogens (for example tobacco smoke, some industrial chemicals, ultraviolet radiation, and certain viruses and bacteria) and lifestyles (for example drug use, including alcohol and tobacco, dietary carcinogens, low fruit and vegetable intake, sedentary behaviour, obesity, and sexual and reproductive behaviours). Differences in access to and quality of health services may generate inequalities in cancer survival, but generally not incidence (the major exception is cervical cancer, and to a much lesser extent colorectal and breast cancers, for which screening can detect pre-cancerous lesions, leading to a reduction in cancer incidence).

For this reason differences in cancer incidence between ethnic or income groups largely reflect differences in social conditions and lifestyles, and can be used as an 'integrator' or marker of such differences. So analysis of trends in inequalities in cancer incidence can assist in evaluation of our success in reducing social inequality and in the development of health and broader social policy. Such analyses also provide a planning tool with regard to future development and funding of cancer services – to the extent that past trends can predict future trajectories. Information about trends in risk factors (in the case of those cancers for which risk factors are understood) can also be incorporated into predictive models to improve the accuracy of forecasts.

This section will briefly summarise this report's findings with regard to trends in inequalities in cancer incidence. Lung cancer, as representative of smoking-related cancers, is first reviewed, followed by those non-smoking-related cancers for which this analysis has revealed potentially significant inequalities or trends in inequalities. Finally, implications of these findings for health monitoring and policy are briefly commented on.

It should be noted that the purpose of this report is to provide a broad overview of findings, rather than an in-depth interpretation of patterns for each cancer. Future publications from CancerTrends data will provide more detailed analysis and interpretation for selected cancers of interest.

Figures 79 and 80 summarise at a glance the underlying incidence rates over time for 15 major cancer types, pooling ages and sexes and adjusting for ethnicity as regards the income analyses.

Figure 79: Summary of incidence by ethnicity for main cancers, sexes combined

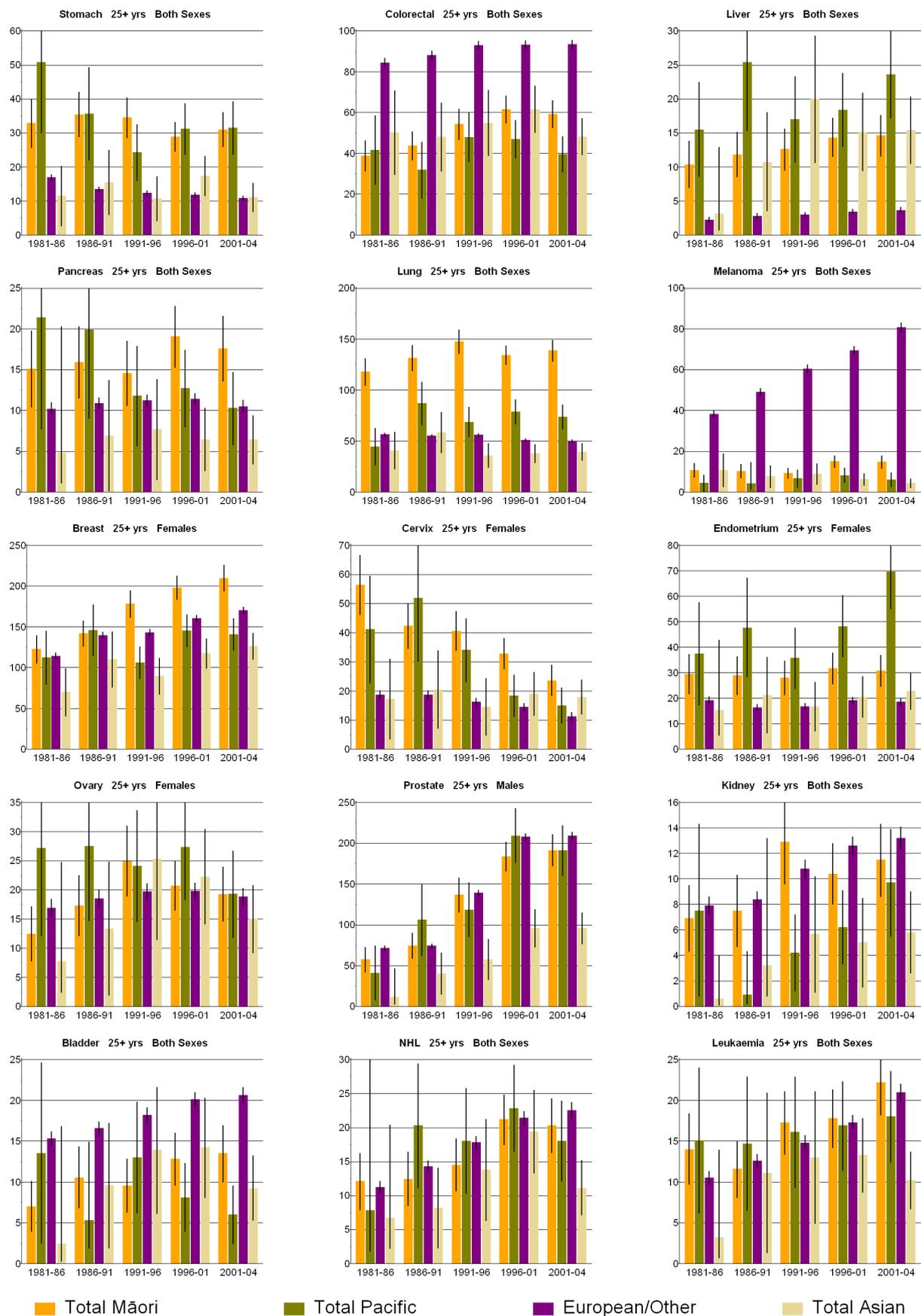
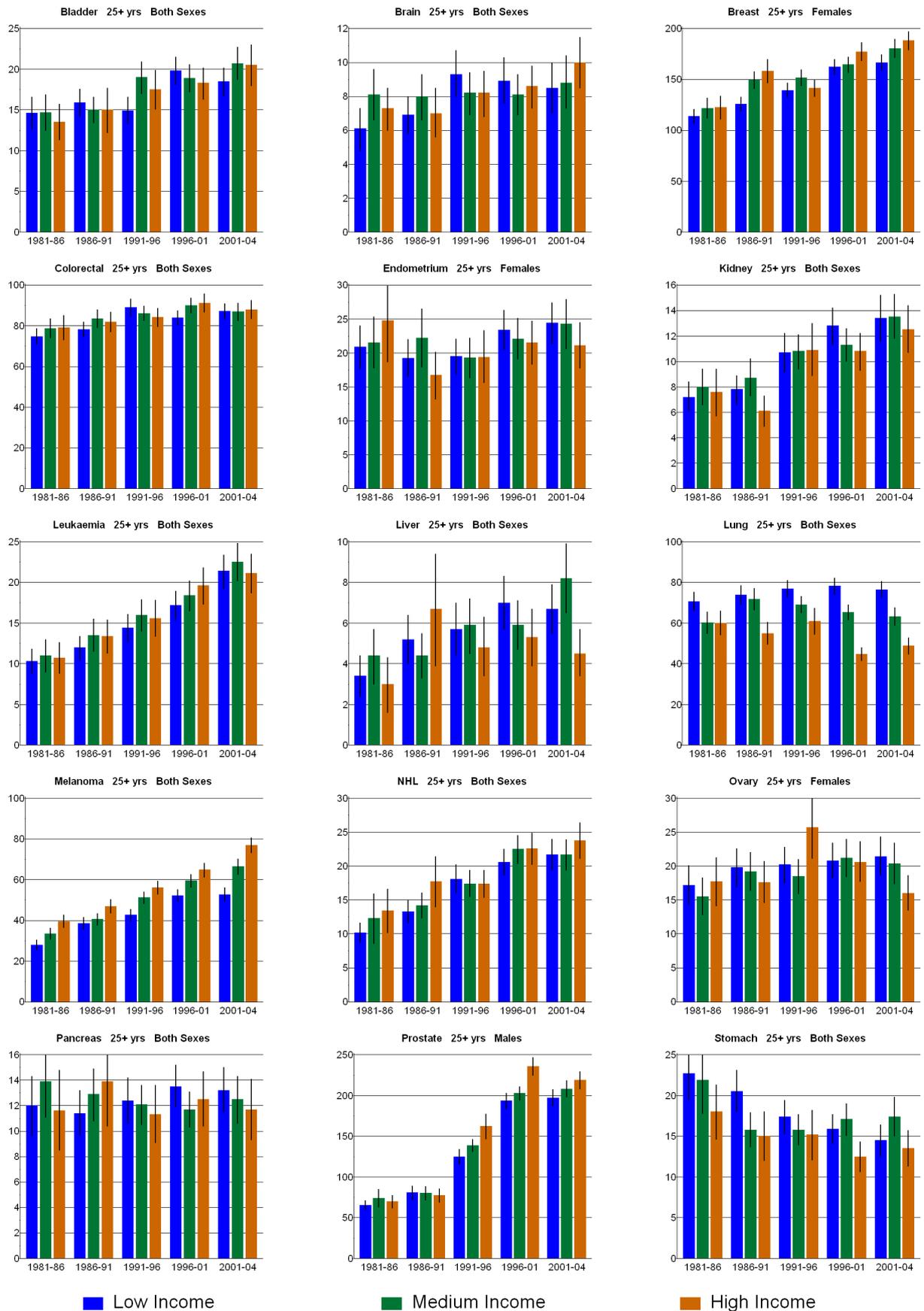


Figure 80: Summary of incidence by income tertile for main cancers, sexes combined



Smoking-related cancers

Smoking-related cancers include the vast majority (more than 80 percent) of lung cancers, but also substantial proportions of upper aerodigestive cancers as well as pancreatic and bladder cancers. Here lung cancer is used to represent the wider group of smoking-related cancers.

Wide ethnic differences and socioeconomic gradients in tobacco use are well recognised in New Zealand,⁹⁰ and are reflected in inequalities in lung cancer incidence. Pooling over time and adjusting for age, Māori were over twice (for males) or three times (for females) as likely to develop lung cancer as European/Other people; moreover, the gap widened over time. Pacific people (of both sexes) were also at higher risk (about 1.5-fold overall), and female (but not male) rates increased over time (Table 103 in Appendix 1), such that inequalities between Pacific and European/Other females tended to widen over time. There was no significant inequality, or any trend, in rates for Asian people (of both sexes).

Unsurprisingly, low-income people (of both sexes) were at least 1½ times as likely to develop lung cancer as high-income counterparts, pooling over age and time and adjusting for differences in ethnic composition. The size of this gap increased over time, especially among females and when measured on an absolute scale, most probably reflecting the differential phasing of the tobacco epidemic by both sex and SEP.

Roughly similar inequalities and trends in inequalities were seen in the other smoking-related cancers, although differences were not always statistically significant. This may reflect the smaller fraction of these cancers (compared to lung cancer) attributable to smoking alone, such that differences in magnitude and timing of the tobacco epidemic between social groups were less clearly reflected in incidence rates. Interestingly, non-European/Other ethnic groups had significantly lower (and stable) incidence rates of bladder cancer than the European/Other group (for which rates increased over time), despite tobacco smoking being an established major risk factor for this cancer; the reasons for this are unclear.

Non-smoking-related cancers

With some exceptions, social inequalities in non-smoking related cancer incidence were smaller than those in smoking-related cancer incidence; often surprisingly so in terms of income inequalities. The following analysis is restricted to 12 cancers for which incidence was sufficient to generate stable group-specific rates for comparison: breast, cervix, colorectal, endometrial, kidney, leukaemia, liver, melanoma, NHL, ovary, prostate and stomach. Less emphasis has been placed on Asian inequalities, as the generally low incidence rates among Asian people are thought to largely reflect a healthy migrant effect (which will wash out over time).

Cancers showing relatively large social inequalities in incidence

Six cancers were found to exhibit large ethnic and/or socioeconomic inequalities in their incidence: cervix, colorectal, endometrial, liver, melanoma and stomach. Note that in the case of several of these cancers (stomach, cervix and colorectal), smoking may in fact make a contribution, albeit minor, to observed inequalities, or trends in inequalities.

Cervix

Pooling over age and time, incidence rates of invasive cervical cancer among Māori and Pacific women were at least twice those of their European/Other counterparts. However, among younger women (aged less than 65 years) at least, the gap has narrowed dramatically and steadily since 1991, coinciding with the introduction of the NCSP. By contrast, an inequality may now be emerging between European/Other and Asian women (who have relatively low rates of participation in screening; coverage rates are also lower for Māori and Pacific than European/Other women, but are improving). Income inequalities are also evident (approximately 1.5 fold-overall), again most probably reflecting differences in participation in screening between income strata. These inequalities were stable over the observation period when measured on a relative scale, yet absolute differences in incidence reduced over time. Given the concern that screening programmes may lead to a widening of inequalities (because disadvantaged groups generally participate to a lesser extent), this finding represents a major public health success; having said this, inequalities in cervical cancer incidence (or participation in screening) are still a long way from being eliminated.

Colorectal

No income gradient is evident in colorectal cancer incidence, but ethnic differences are marked. Māori, Pacific people and Asian people (of both sexes) are only half as likely to develop colorectal cancer as European/Other people, adjusting for age. For Māori, this gap appears to be narrowing, although the trend is statistically significant only for males. Contrary to earlier findings on colorectal cancer mortality,^{40 91} this study found no evidence that inequalities in incidence are narrowing for Pacific people. The reason for the lower incidence of colorectal cancer among Māori and Pacific people is not clear; however, the finding that this differential may be narrowing (at least for Māori) is of concern. The trend appears to be driven by an absolute increase in incidence rates among Māori males, but may also reflect declining rates among younger European/Other males (and females) – possibly resulting from a cohort effect involving the latter ethnic group in particular.⁹²

Endometrial

No consistent income gradient is evident in endometrial cancer incidence, but large ethnic inequalities exist, with Māori rates about one-and-a-half times and Pacific rates nearly twice European/Other rates, pooled over time and adjusting for age. This inequality may have increased over the observation period for Pacific compared to European/Other women, although the trend did not quite reach statistical significance. Obesity is a major risk factor for this cancer, and may explain (part of) the ethnic inequality observed.

Liver

Primary liver cancer is relatively uncommon, so group-specific rates are not particularly stable. Nevertheless, it is clear that moderate income inequalities exist: rates are 20–50 percent higher among low-income compared to high-income groups, pooling over age and time and adjusting for ethnicity. By contrast, ethnic inequalities are large (between three- and eight-fold higher than the European/Other reference group, depending on ethnicity and sex), which is consistent with previous research,^{27 28} although trends in inequalities are unclear. The most likely explanation for this relates to differences in rates of chronic infection with hepatitis B virus between social groups (largely antedating the introduction of immunisation against this infection). If this is the case, it could be that, at some future date, primary liver cancer incidence rates will begin to decline in all ethnic groups, and absolute inequalities will ultimately disappear.

Melanoma

Māori and Pacific people were one-fifth to one-tenth as likely to develop melanoma as European/Other people (pooling over age and time), and trends in these relative inequalities were non-significant. That is, melanoma rates increased similarly in all ethnic groups over time. Rates in low-income strata were about one-quarter lower than in high-income strata, again with similar increases across income groups over time, resulting in essentially stable relative inequalities. Explanations for these inequalities most likely relate to differences in susceptibility (especially by ethnicity) and exposure (especially by socioeconomic group) to episodic ultraviolet radiation.

Stomach

Stomach cancer rates are falling over time, but large ethnic inequalities persist, Māori and Pacific peoples being two to three times as likely to develop this cancer as European/Other people (pooling over age and time). Furthermore, for Māori females (and possibly for Pacific females) this inequality widened over the observation period when measured on a relative scale. Low-income people (of both sexes) had slightly higher rates of stomach cancer than high-income counterparts (of both sexes, pooled over age and time), but for females the inequality narrowed on both absolute and relative scales, driven largely by women older than 65 years. Inequalities, and trends in inequalities, may reflect cohort differences in *Helicobacter pylori* infection rates, among other factors (including tobacco smoking).

Cancers showing relatively small or no social inequalities in incidence

All other non-smoking-related cancers showed small or no ethnic and income inequalities in incidence rates, or exhibited unstable rates (due to small numbers), making inequality analysis difficult. However, given their relatively large numbers, some mention should be made of female breast cancer and prostate cancer.

Breast

Pooling over age and time, Māori women were slightly more likely to be diagnosed with breast cancer than European/Other women (the SRR was 1.17, and the SRD 24 per 100,000). Moreover, Māori rates increased faster than European/Other rates, resulting in widening relative inequalities (an SRR of 1.07–1.23), but did not increase in a monotonic manner, with the result that the trend was not statistically significant (p for trend 0.13). At the same time, Māori women experienced a four-fold increase in absolute inequalities compared to European/Other women (the SRD increasing from 8.4 to 39 per 100,000, p for trend 0.06). By contrast, Pacific women had slightly lower rates (an SRR of 0.90), and there was no trend towards inequality. Asian women experienced moderately lower risk (an SRR of 0.71), which did not vary over time. Low-income women were slightly less likely to develop breast cancer than high-income counterparts (with a pooled of SRR 0.90); this ratio did not vary over time.

Explanations for these ethnic trends are unclear, but most likely are unrelated to differential participation by ethnicity in the BreastScreen Aotearoa programme (which was only introduced recently). It must also be noted that most of what we know about breast cancer risk factors would predict that European/Other breast cancer incidence rates should be higher than the corresponding Māori rates, yet the converse is true. Further research is needed in this respect.

Prostate

Large increases in prostate cancer incidence have occurred among all ethnic and income groups in recent times, probably mostly due to opportunistic PSA testing. Few differences were found in observed prostate cancer incidence rates by ethnicity (adjusting for age and time), except for a lower rate among Asian men. Indeed, the 'step-lock' increases in Māori, Pacific and European/Other prostate cancer incidence rates might be considered surprising, as, although PSA testing rates have so far been lower among Māori and Pacific than European men (by one-half to one-third, depending on age and period),⁹³ no significant trends in ethnic inequalities in prostate cancer incidence have been observed, except for an increasing inequality over time favouring Asian men when measured on an absolute scale.

Low-income men were about 10–20 percent less likely to be diagnosed with this cancer than their high-income counterparts, with little suggestion that the difference has changed over the past quarter-century – again, despite the likelihood that PSA testing rates have thus far been lower among low income than high income men.

Implications for policy

Inequalities in cancer incidence are an important consideration in regard to health policy development, service planning and resource allocation for cancer services. This report indicates that the major driver of inequalities across all cancers is tobacco smoking. This finding reinforces the need to refresh efforts aimed at reducing tobacco consumption by Māori and low-income groups in particular. There are currently also substantial inequalities in the incidence of several cancers unrelated to exposure to tobacco smoke. Some of these cancers, such as endometrial cancer, are linked to obesity, and the observed inequalities reinforce the need to address differential

exposure to the 'obesogenic' environment by ethnicity and SEP.⁹⁴ Inequalities in incidence of other cancers, such as colorectal and primary liver cancer, may reflect strong cohort effects. Incidence of liver cancer in particular should dissipate as birth cohorts immunised against hepatitis B replace earlier non-immunised cohorts with differentially high infection rates by ethnicity and SEP. Inequalities in the incidence of cancers attributable to other infectious agents, such as stomach cancer (*Helicobacter pylori*) and cervical cancer (oncogenic HPV), may also narrow in the future as chronic infection rates reduce overall and simultaneously converge across social groups. This is already happening in the case of cervical cancer, reflecting the success of the National Cervical Screening Programme in enhancing coverage across most social groups (although screening coverage still remains lower among some ethnic groups than among others). A key policy aim for the future should be to mitigate the rising trend in colorectal cancer incidence among Māori – a reduction in ethnic inequality here represents success if it results from falling incidence among Europeans, but failure if it reflects increasing incidence among Māori (which appears to be the case currently).

Implications for monitoring

Inequalities in cancer cannot be interpreted without simultaneous consideration of incidence, survival and mortality (for each major cancer, by age, cohort and period). The NZCMS provides a means of monitoring inequalities in mortality, as previously reported.^{39 40 95} By linking cancer registrations to Census records (anonymously and probabilistically), this report performs the same function for incidence. Unfortunately, time series data for cancer survival, with sufficient information to analyse inequalities directly or (again) by linkage to Census data, have only recently become available from the NZCR. In the near future it will thus be possible to monitor trends in all three epidemiological variables (cancer incidence, survival and mortality) simultaneously, allowing fuller interpretation of the drivers of difference. Greater understanding and more robust measurement of inequalities can help to optimise cancer policy and resource allocation, ensuring better, sooner and more convenient cancer services for all.

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