Getting back the missing men of Aotearoa: declining gender inequality in NZ life expectancy

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ABSTRACT

INTRODUCTION: Men's health is of increasing concern to policy makers worldwide. Although women generally live significantly longer than men, the difference in life expectancy in many countries is now narrowing.

AIM: To document the trend in sex differences in New Zealand (NZ) life expectancy at birth (LEB) over the last decades and to determine disease patterns which account for it.

METHODS: Decomposition of sex differences in LEB by age and cause for the periods 1980–82, 1985–87, 1990–92,1995–97, 2000–02, and 2005–06, using registered deaths and model life tables.

RESULTS: Sex differences in LEB increased from 1951 to peak in 1976 before narrowing again. In 2006 they reached almost exactly the level they were at 55 years earlier. Changes in relative mortality from ischaemic heart disease (IHD) and to a lesser extent accidents, respiratory disease and other circulatory causes, brought about the recent decline in gender survival disparities. IHD continues to be a significant cause of gender inequality, but cancers have now become a major component of the sex difference in LEB.

DISCUSSION: NZ's experience mirrors closely that of other developed countries in pattern, timing and the age–cause composition of the trend in gender survival disparities. Thus differences in the timing of taking up smoking, found to explain a substantial portion of the trend elsewhere, were probably also important in NZ, but improvements in medical outcomes for smokers also must have played a significant role. Primary care practitioners will continue to reduce gender survival disparities by working to ensure a high uptake of services such as screening for colorectal cancer, one of many diseases responsible for lower male life expectancy.

KEYWORDS: Health status disparities; sex factors; health transition; men's health; life expectancy; women's health

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Introduction

A sex differential in life expectancy at birth favouring females is almost universal in developed countries.[1] However, the magnitude of this differential has changed over time. In many developed countries the sex difference in life expectancy began to decline in the latter decades of the twentieth century.[2,3] and a large part of this change has been attributed to differences in uptake and abandonment of smoking between male and female cohorts.[4,5]

This paper examines whether sex differences in life expectancy in New Zealand have experienced a similar decline in recent years. By decomposing these differences into their component causes and ages it aims to reveal which of them have been responsible for the observed trends in gender survival inequality, and makes it possible to compare these with other developed countries where similar analyses have been conducted.

Decomposition of the most recent sex difference in life expectancy provides information on the main causes of death that must be reduced or delayed in order to reduce current sex inequalities in survival. The policy implications of this for primary health care in particular, are discussed.

Methods

Population and cause of death data by age and sex in New Zealand was obtained from the WHO mortality database and from the Ministry of Health. Death rates were calculated at five-year intervals from 1981 through to 2006 by averaging the number of deaths in each age group over the three-year period including the year before and the year after, as well as the year itself for which the sex difference in life expectancy was being calculated. This was done to reduce effects of random variation in numbers of death in any one year. Model life tables for each of the five-year periods were obtained from Statistics New Zealand as were cohort estimates of male and female life expectancy from 1876 to 1933.

Differences in life expectancy between men and women for each of the years were decomposed into age and cause of death components using Arriaga's method as described by Preston et al.[6] This consists of first calculating the contribution of differences in all-cause mortality at various age groups to the overall sex difference in life expectancy and then further decomposing these into the contributions made by specific causes of death. The contribution of age group x to $x + n$ to the overall sex difference in life expectancy, ${}_n\Delta_x$, is given by:

$$ {}_n\Delta_x = \frac{l_x^{male}}{l_0^{male}} \cdot \left(\frac{{}_nL_x^{female}}{l_x^{female}} - \frac{{}_nL_x^{male}}{l_x^{male}} \right) + \frac{T_{x+n}^{female}}{l_0^{male}} \cdot \left(\frac{l_x^{male}}{l_x^{female}} - \frac{l_{x+n}^{male}}{l_{x+n}^{female}} \right) $$

where l_x, ${}_nL_x$ and T_x are conventional life table functions. For calculating the contribution of the open-ended age-group ${}_\infty\Delta_x$ the following formula is used:

$$ {}_\infty\Delta_x = \frac{l_x^{male}}{l_0^{male}} \cdot \left(\frac{T_x^{female}}{l_x^{female}} - \frac{T_x^{male}}{l_x^{male}} \right) $$

WHAT GAP THIS FILLS

What we already know: That, on average, women live significantly longer than men is well known. In some countries though, the 'gender gap' in survival has been declining over the last decade or two, and this is thought to be largely related to changes in the relative prevalence of smoking between men and women.

What this study adds: New Zealand men, like those in several (but not all) developed countries, have been catching up to women in their life expectancy over recent years. The reduction in men's smoking in absolute and relative terms has probably been an important cause of the declining gender gap in life expectancy, but improved treatment of ischaemic heart disease has also played a significant role, along with lower mortality from accidents. Whether New Zealand men's life expectancy will continue increasing more rapidly than women's depends on responses to the growing importance of cancer, especially prostate cancer, in gender disparities in life expectancy.

Table 1. Cause of death groupings and their corresponding ICD codes.

Cause of death	ICD 10	ICD 9	ICD 9 BTL
Infectious and parasitic causes	A0–B99	001–139	01–07
Cancer of the trachea, bronchus and lung	C33,C34	162	101
Breast cancer	C50	174	113
Female genital organ cancer	C51–C58	179–184	120–123
Cancer of the prostate	C61	170–017	124
All other malignant neoplasms	C00–C32, C35–C49, C60, C62–C96	140–161, 170–173, 185–208	08, 09, 100, 109–112, 119, 125–149
Ischemic heart disease, diseases of pulmonary circulation and other heart disease	I20–I52	410–429	27, 28
Other circulatory causes	I05–I15, I60–I99	390–405, 430–459	25, 26, 29, 30
Respiratory diseases	J00–J98	460–519	31, 32
All accidents	V01–X59, Y40–Y86, Y88	E800–E949	E45–E53
Suicide, self-inflicted injury and other external causes	X60–84, Y10–36, Y87, Y89	E950–959, E980–989	E54, E56
All other causes including homicide	D00–H99, K00–R99, X85–Y09	210–389, 520–799, E960–E969	15–24, 33–46, E55

Now the specific contribution to the sex difference in life expectancy of cause i in age group x to $x + n$, under the assumption of a constant distribution of deaths within each age group of the population, is estimated by:

$$ {}_n\Delta_x^i = {}_n\Delta_x \cdot \frac{{}_nR_{xi}^{female} \cdot {}_nm_x^{female} - {}_nR_{xi}^{male} \cdot {}_nm_x^{male}}{{}_nm_x^{female} - {}_nm_x^{male}} $$

where:

${}_nR_{xi}$ is the proportion of all deaths in age group x to $x + n$ caused by i; and

${}_nm_x$ is the all-cause mortality rate in age group x to $x + n$.

Thus the sex difference in life expectancy attributable to cause i in a given age group is calculated as the proportion of the sex difference in life expectancy in that age group of that cause's fraction of sex difference in age-specific mortality rates.

Twelve cause of death groupings were formed which together comprised all causes of death. Individual causes of death responsible for a significant proportion of the sex difference in life expectancy were separated out and those responsible for an insignificant proportion were grouped together in accordance with the standard International Classification of Disease (ICD) groupings. The resulting breakdown is shown Table 1, along with the corresponding ICD 9, ICD 9 Basic Tabulation List and ICD 10 codes. It is important to note that New Zealand adopted the ICD 10 coding system from 2000 and this may have affected how some deaths were classified here, although most causes translate seamlessly from ICD 9 to ICD 10. Pneumonia and bronchopneumonia coding was probably the most affected because changes in coding rules meant that a significant proportion of deaths that would previously have been coded as caused by pneumonia/bronchopneumonia are now coded as caused by other underlying diseases, most notably

Figure 1. Trend in period life expectancy at birth by sex, 1951–2006

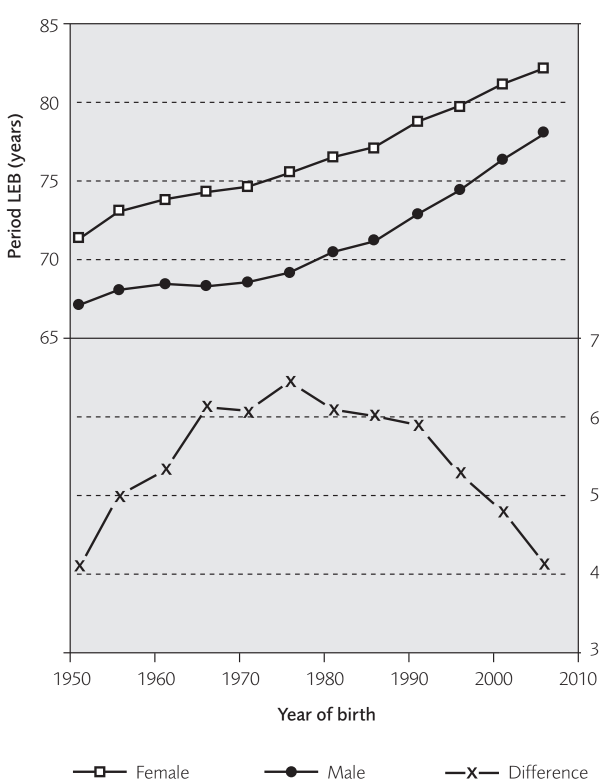
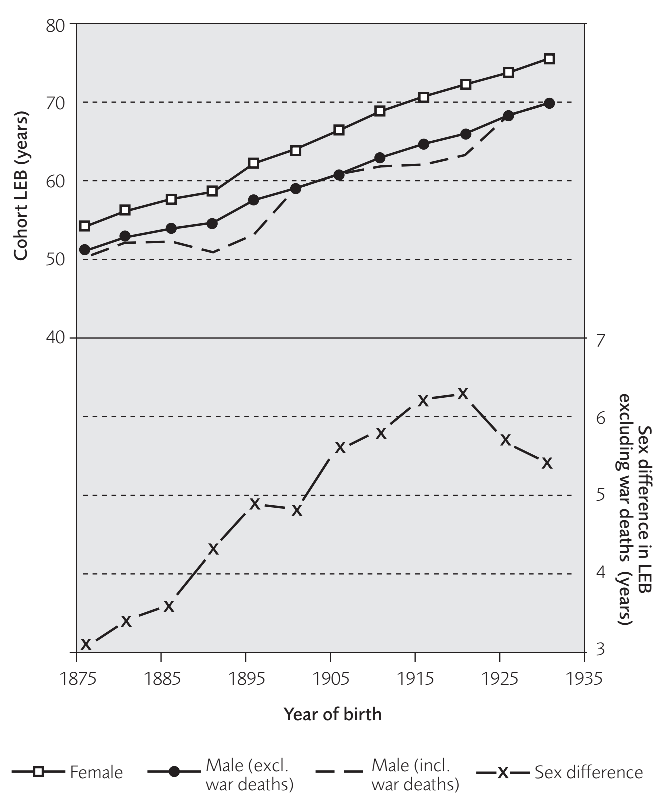


Figure 2. Trend in life expectancy at birth by sex, for birth cohorts from 1876 to 1933



Source: Statistics NZ (2006)[8]

Table 2. The age decomposition of sex-differences in LEB: 1950–52, 1975–77, 2005–06

Age group (years)	Trends in the age composition of sex differences in LEB (years)				
	1950–52	Change (%)	1975–77	Change (%)	2005–06
<1	0.42	-0.07 (-16%)	0.35	-0.25(-73%)	0.09
1–4	0.07	-0.03 (-35%)	0.05	-0.04 (-83%)	0.01
5–14	0.17	-0.08 (-45%)	0.09	-0.06 (-65%)	0.03
15–24	0.42	+0.22 (52%)	0.63	-0.32 (-50%)	0.31
25–34	0.24	+0.04 (16%)	0.28	+0.01 (5%)	0.29
35–44	0.20	+0.06 (32%)	0.26	-0.03 (-13%)	0.23
45–54	0.38	+0.33 (87%)	0.72	-0.42 (-58%)	0.30
55–64	0.89	+0.53 (59%)	1.41	-0.85 (-60%)	0.56
65–74	0.92	+0.74 (81%)	1.66	-0.74 (-45%)	0.92
75+	0.40	+0.59 (146%)	0.99	+0.37 (37%)	1.35
All ages	**4.10**	**+2.34 (57%)**	**6.44**	**-2.33 (-36%)**	**4.11**

heart disease, cerebrovascular disease, malignant neoplasm and chronic lower respiratory disease.[7] This should be borne in mind in interpreting the results presented here, although it does not affect the overall conclusions.

Results

Figure 1 shows the trend in male and female life expectancy at birth (LEB) in New Zealand over the period 1951–2006, along with the difference between the sexes. Evidently there has been a substantial and similar improvement in LEB in both sexes over this period, but the gains were made first by women and then by men. This caused a rise and subsequent fall in the difference in LEB between men and women with the female advantage peaking at 6.44 years in 1976 before falling to almost exactly the 1951 difference in 2006.

A more extended, but less recent picture of the trend in New Zealand male and female life expectancy is provided by data from Statistics New Zealand in Figure 2 which plots cohort rather than period life expectancies.[8] In contrast to period life expectancies, which give the average number of years a person would live if s/he experienced the age-specific mortality rates for that particular time period throughout his or her life, cohort life expectancies estimate the average number of years a person would live if born in a certain year based on the changing age-specific mortality rates. If war deaths are excluded, the magnitude and overall pattern of sex differences in cohort LEB is similar, peaking at over six years for men born in 1916 and 1921 and declining thereafter. For cohorts born from 1926 and 1931, the sex difference in life expectancy has begun to decline.

Decomposition by age reveals that although all age groups contribute to the total male disadvantage in life expectancy, over two-thirds of it now is caused by mortality disparities in people aged 55 years and above, and that over the 55-year period studied, the proportion contributed by the population over 75 years has increased from a tenth to over a third of the total (Table 2). When expressed in terms of the sex difference in LEB, the over-75 age group is the only one that has registered an increase since the early 1980s (from 1.18 years to 1.35) although it peaked in 2000–02 at 1.52 years.

Table 2 also shows the age groups whose mortality changes were responsible for the increase of 2.3 years in the sex difference in LEB between 1950–52 and 1975–77, and those which produced the ‘catch-up’ change of those same 2.3 years over the last three decades. The age groups responsible for widening the sex difference in LEB were 15–24 and those over 45 years, but those responsible for narrowing the difference again were rather different. Men caught up two years

Figure 3. Age–cause decomposition of the reduction in the sex difference in LEB from 1980 to 1996

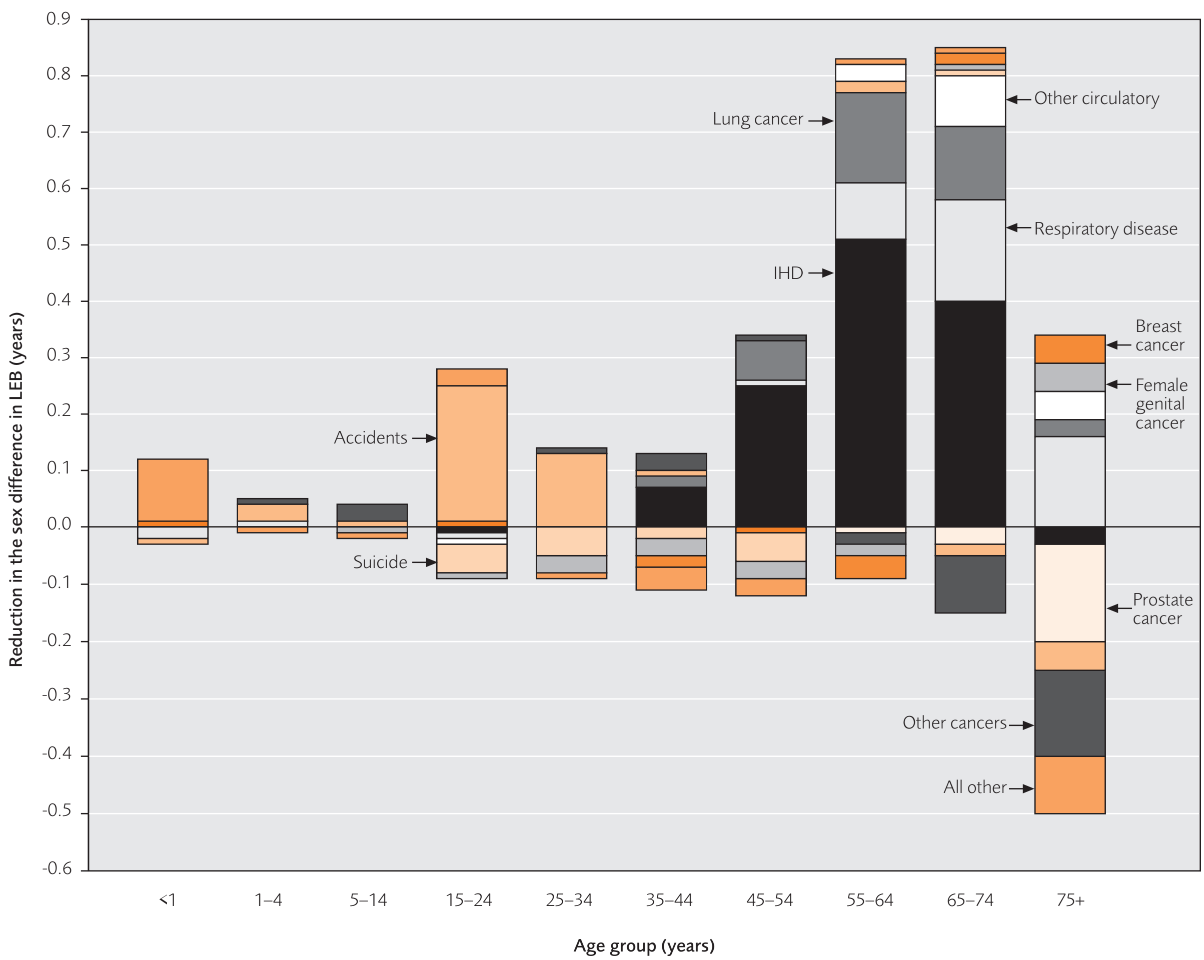


*Table 3. Age–cause decomposition of the 2005–06 sex difference in life expectancy**

	<1	1–4	5–14	15–24	25–34	35–44	45–54	55–64	65–74	75+	All
Infectious and parasitic	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.00	**0.05**
Lung cancer	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	0.04	0.10	0.13	**0.25**
Prostate cancer	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.12	0.31	**0.49**
Breast cancer	0.00	0.00	0.00	0.00	-0.01	-0.06	-0.15	-0.12	-0.12	-0.10	**-0.56**
Female genital organ cancer	0.00	0.00	0.00	0.00	-0.01	-0.02	-0.05	-0.07	-0.08	-0.08	**-0.31**
Other cancers	0.00	-0.01	0.00	0.03	0.02	0.02	0.08	0.20	0.30	0.31	**0.96**
Ischaemic heart disease	0.00	0.00	0.00	0.01	0.02	0.08	0.19	0.30	0.40	0.48	**1.48**
Other circulatory causes	0.00	0.00	0.00	0.00	0.01	-0.01	0.01	0.04	0.04	-0.08	**0.02**
Respiratory diseases	0.01	-0.01	0.01	0.00	0.00	0.00	-0.01	0.00	0.04	0.21	**0.25**
Accidents	0.00	0.01	0.03	0.15	0.12	0.10	0.07	0.03	0.04	0.03	**0.58**
Suicide	0.00	0.00	0.00	0.13	0.10	0.07	0.06	0.03	0.01	0.01	**0.41**
All other causes	0.07	0.01	0.00	0.00	0.03	0.04	0.08	0.06	0.06	0.13	**0.49**
TOTAL	**0.09**	**0.01**	**0.03**	**0.31**	**0.29**	**0.23**	**0.30**	**0.56**	**0.92**	**1.35**	**4.11**

* Cells highlighted in dark orange contribute at least 0.1 years to the sex difference in LEB, those in light grey act to reduce the sex difference by at least 0.1 years, and those in dark grey are causes or age-groups which, in sum, add at least 0.5 years to the sex difference.

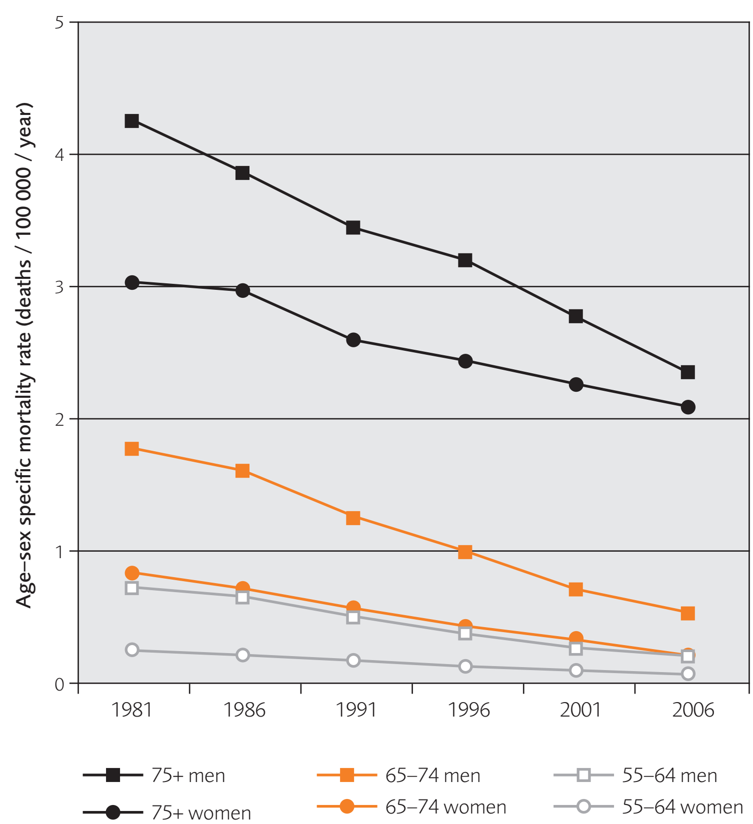
of LEB to women in ages 45–74, and a further 0.31 years from 15–24, but lost significant ground in the 75+ age group which was not quite off-set by an improvement in the survival of boy infants relative to girls.

Figure 3 shows the contribution of specific causes of death in each age group to the overall reduction in the gender survival disparity. Clearly men's catch-up in life expectancy was driven mainly by reductions in deaths from ischaemic heart disease (IHD) in middle-aged men, and by fewer accidental deaths in young adult men. Decreased mortality differences in lung cancer and respiratory disease were also important. On the other hand, prostate and other cancers in older men prevented an even greater reduction in the sex difference in life expectancy. Breast and female reproductive organ cancers had relatively little effect on the change in the sex difference in LEB because their combined large contribution to the overall disparity (almost one year of LEB) has barely changed since the early 1980s.

The most recent age–cause decomposition shown in Table 3 helps to gauge the prospects and priorities for future reductions in gender survival inequality. The highlighted cells show the ages and causes that are the largest sources of gender survival inequality. It is evident from the table that IHD remains the single biggest cause equal to 38% of the total gender gap in life expectancy, 80% of which is from deaths over the age of 55 years. Cancers generally, including prostate and lung, have a major effect on the current sex difference in LEB, especially in the 55+ age groups where two-thirds of the inequalities are concentrated. The figures for breast cancer show that the gender gap would be significantly greater if mortality from this condition falls sharply as it may do. Accidents and suicide are now the two main components in younger age groups.

Fortunately, for most of these age–cause groups there is a declining trend in their contribution to gender inequality in survival (although for some this is a recent phenomenon). However, IHD in people over the age of 75 years is an important exception, being the single biggest contributor to current sex differences in LEB, and one that has not changed significantly since 1981. It is therefore worth examining this group more carefully. Figure 4 shows the trend since 1980–82 in age-specific IHD mortality rates by sex for three different age groups (75+, 65–74 and 55–64). All three age groups have had monotonically falling mortality rates for both sexes with the difference in rates between the sexes dropping steadily in absolute and relative terms for all three age groups. Why then, does the sex difference in life expectancy decline over that period for the 55–64 and the 65–74 year age groups but not for those 75 and over? This is because as men and women live longer, smaller sex differences in mortality rates over the age of 75 will act over longer periods of time and will therefore have a greater impact on the sex difference in LEB than they do at younger ages, and this of course applies to all causes of death for which there is a sex difference in mortality. This is also why the 75+ age group has not seen the same reductions in sex differences in LEB over time as younger age groups.

Figure 4. Trend in IHD age–sex specific mortality rates by year



Discussion

International comparisons

As pointed out above, New Zealand is not the only country to be experiencing a closing of the gender gap in survival. Reductions in the sex mortality ratio for Northern European and other Anglophone countries were noted some time ago.[2,3] The similarity, not just in their pattern, but also in the timing of the rise and fall of sex differences in life expectancy, is quite striking and suggests a common underlying process. Decomposition analyses from Canada and Australia also showed very similar causes of death responsible for narrowing the gap (IHD, accidents and lung cancer) and for stopping it from narrowing further still (other cancers, prostate cancer).[9,10]

Underlying causes of the decline

For a long time, smoking has been highlighted as a key cause of the sex differences in life expectancy[11,12] and one paper as far back as 1983 predicted that the increasing smoking by teenage girls would eventually reduce or eliminate male–female life expectancy differences.[13] When it was later noticed that the gender disparity was indeed declining in some countries, changes in the relative prevalence of smoking between men and women were therefore an obvious explanation. Now actual estimates of the importance of changes in smoking practice on sex differences in mortality suggest that it does explain a large part of the trend.[4,5] However, given that IHD mortality rates among smokers have also declined over time,[14] improvements in the efficacy of health care is also likely to have made a significant contribution to the declining sex differences in LEB.[15,16] Although this study has documented age- and cause-specific components of the trend in sex disparities in LEB, it has not demonstrated specifically the importance of smoking per se. However, if repeated in New Zealand, one would expect such work to broadly confirm the findings of these other studies.

Projecting into the future

What does this mean for the future of gender inequalities in survival in New Zealand? Projections of future mortality changes among men and women that take into account the declining prevalence of smoking suggest that men's life expectancy should continue to catch up somewhat with that of women,[17] although others suggest that for some countries at least, changes in mortality from non-smoking related causes of death will soon outweigh the equalizing effect of declining male smoking relative to female smoking to produce widening gender inequality.[18] In New Zealand there is now no overall gender difference in the prevalence of smoking and the absolute number of tobacco-related deaths is falling,[19] but ongoing improvements in the medical management of cardiovascular disease may continue to reduce gender disparities in survival. Nevertheless, non-tobacco related deaths are likely to become increasingly important as determinants of gender inequalities in health. Other cancers, and in particular future trends in breast and prostate cancer, have the potential to widen or narrow the gender survival gap. If the national screening programme for breast cancer works as intended and reduces mortality significantly, while screening for prostate cancer is put on hold until stronger evidence for its effectiveness emerges, then the gender gap may not close as much or as rapidly as it otherwise would.

Implications for primary health care practitioners

Primary health care practitioners can take much of the credit for the decline in gender inequality in survival. Of fundamental importance has been the part they play in smoking cessation by direct intervention with patients, their advocacy as a group for policies to limit tobacco consumption, and their key role in the increasingly effective treatment of ischaemic heart disease.

However, although primary care professionals were crucial to extending men's life expectancy, they are not necessarily fully cognisant of the changes that are taking place and the implications these have for their practice. Many are probably unaware that men have been catching up to women in life expectancy. There may therefore be a tendency to expect a significantly lower survival in men than that which they will actually experience. Policies and patient management decisions tend to be made on the basis of today's survival rates (in other words period life expectancy), and not on the basis of the actual (cohort) life expectancy of their patients.

This study has brought to light not just the gains that have been made for men in New Zealand, but also the causes of death that have held back men's survival relative to women. Apart from prostate cancer, for which the primary care management is mired in uncertainty and controversy, suicide and 'other cancers' are two major cause of death groups for which the gender survival gap has widened in the last 35 years. The potential of primary practitioners to prevent suicide in men is debatable—most GPs will only have a suicide once every few years in their practice, only about half of them will be visited by the patient in the weeks beforehand, and few will openly express suicidal ideation—so even if effective, their efforts may only have a marginal effect on mortality rates.[20] Brief intervention following parasuicide was effective in preventing suicide in a recent randomised trial, but most of the enrolled subjects were female and the efficacy was not evaluated by sex.[21]

Cancer deaths in men may be more amenable to prevention through primary care interventions. To the extent that early diagnosis and treatment improves survival, finding ways to increase uptake of colorectal cancer screening services, for example, by both men and women would reduce gender survival inequality because the disease lowers life expectancy more for men than women.

Study limitations and areas for future research

An obvious gap in the findings presented here is a decomposition analysis of the trend in gender inequalities among Maori, which do not appear to be declining as they are among non-Maori, perhaps because of a continuing high prevalence of smoking.[22] This is clearly an important area for future research, as is gaining a better understanding of how gender inequalities in survival vary by socioeconomic group. The work has focussed exclusively on mortality, but trends in gender differences in morbidity and disability also merit further investigation. Until men and women can enjoy equal healthy longevity, much remains to be done.

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COMPETING INTERESTS
None declared.