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DO COHORT MORTALITY TRENDS EMIGRATE? INSIGHTS ON THE U.K.'s GOLDEN COHORT FROM A COMPARISON WITH A BRITISH SETTLER COUNTRY

By Alison O'Connell and Kim Dunstan

ABSTRACT

The assumed rate of future mortality improvement has increased over three recent sets of the United Kingdom's national population projections. This optimism has not been so marked in countries which share ancestors with the U.K. population. New Zealand is one such country that provides a data-rich case example in which to investigate the portability of mortality trends.

This paper compares mortality trends in New Zealand with those in England & Wales. Both countries seem to have a 'golden cohort' which enjoys faster improving mortality than people born before or after. The birth of the golden cohort in England & Wales coincided with cohort life expectancy there catching up with New Zealand's.

We show that first generation migrants from the U.K. have better mortality than New Zealand born residents likely to have British ancestry. The advantage lasts into older ages, decades after migration. We hypothesise that migrants from the U.K.'s golden cohort brought with them an early life mortality improvement advantage, and additionally benefited from the healthier environment of New Zealand at middle to older ages. Further, given the recent strong mortality improvement in New Zealand, the U.K.'s assumptions for future mortality look relatively optimistic.

KEYWORDS

Cohort Mortality; Migrant Mortality; Mortality Projections; New Zealand Mortality

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1. Introduction

Demographic literature uses the term 'cohort' to distinguish a group of people formed by a demographic event, most usually being born in the same year.

For example, 'cohort life expectancy' is the expected average length of life for a defined group that was or will be born in a certain year, making assumptions about future mortality rates if needed to complete the cohort's maximum lifespan. In contrast, 'period life expectancy' is calculated using the mortality rates at each age that applied in a specific past period or are assumed to apply in future.

1.1 *Cohort Effects*

The term 'cohort effect' has been used where a specific birth cohort has experienced a noticeably different pattern of mortality rate improvement over time from that of other cohorts. 'Period effects' define where age-specific mortality rates improve at about the same pace over time, and 'age shifting effects' where over time the highest rates of mortality improvement shift from younger to older ages (Andreev & Vaupel, 2005).

By examining Lexis maps[1] of smoothed mortality improvement rates by age and time from the 1950s for various countries, Andreev and Vaupel identified predominantly period effects in the U.S. and Canada, age shifting effects in Australia and New Zealand and a cohort effect superimposed on a predominantly period pattern for England & Wales. Cohort effects were also seen in Austria, France, Denmark, West Germany, Italy, Japan, Netherlands and Switzerland, more strongly in the male population.

1.2 *The U.K.'s Golden Cohort*

The cohort effect in the U.K. has had particular attention. The focus is on what has been called the 'golden cohort': those born around[2] 1931, aged in their late sixties to early eighties in 2009. Mortality rate improvement for this cohort has been consistently more rapid compared to those born earlier or later. The cohort appears to be keeping this advantage as they age (Gallop, 2008; Richards *et al*., 2006; Willets, 2004).

The causes for this phenomenon are not known, but ideas put forward include: low competition for resources at birth in small cohorts, the improved diet and environment for children during World War II compared with before the war, the introduction of the Welfare State in the 1940s, differences in the incidence of smoking between generations, and medical advances increasingly to the benefit of older people (Dunnell, 2008).

The golden cohort may be a fortunate generation that was at the right age to benefit disproportionately from a series of period effects. Another explanation is that this cohort had early life influences that stayed with them, to their mortality advantage, throughout life. The question of these two interpretations has troubled analyses of age-period-cohort data for some time (see for example, Hobcraft *et al*., 1982). As the latter explanation is consistent with what is more generally called the 'cohort effect', in this paper we try not to use that term unless an early life advantage is meant. Instead

[1] A Lexis map plots age and calendar time on two axes, so that a cohort runs along the diagonal.

[2] The cohort was first defined as those born between 1925 and 1945, centred on 1931 (Willets, 2004). In the latest (2006-based) Office for National Statistics U.K. national population projections, it is defined as those born between 1923 and 1940, centred around 1931 (ONS, 2008b).

we seek to observe variations in mortality by cohort and refer to the sustained mortality pattern of a cohort as a cohort trend.

The golden cohort is accepted as such a strong feature of the U.K. mortality experience that it is now given special prominence in national population projections. There has been a rapid increase in the optimism of these projections. The 2002-based principal projection assumed rates of future improvements in the mortality rate would converge at all ages to 1% per annum 25 years hence, and then halve every 25 years. The 2004-based projections assumed those rates would remain constant at 1% per annum in the long-term. In the 2006-based projections, the 1% annual long-term improvement rate is maintained at most ages, but higher rates of improvement are now assumed after 25 years for those born between 1923 and 1940, with a peak at an annual improvement rate of 2.5% for those born in 1931 (ONS, 2006, 2007; Shaw, 2004).

Population projections in Australia, Canada and the U.S. also make assumptions about the future rate of change of mortality rate that vary by age, although none singles out a birth cohort for special treatment. In New Zealand's 2006-base population projections, mortality rates are assumed to decrease at the same rate at all ages. Further, the principal assumption for annual rate of mortality improvement 25 years hence to the end of the projection period in all of these countries is lower than the 1% assumed in the U.K. (ABS, 2008; OCA, 2005; SSA, 2009; Statistics New Zealand, 2007).

The existence of the golden cohort or similar among these British settler countries has not been explored beyond impressions of whole population trends such as those shown by Lexis maps. However, large sections of the populations in each of the countries share ancestors with the U.K. population. The environmental trends proposed for the cause of the golden cohort in the U.K. have also occurred in these countries, with different strengths and timing. Therefore, glimpses of similar cohort trends could perhaps be expected in British settler countries.

Further, if the mortality improvement advantage of the U.K.'s golden cohort came from early life in the U.K., migrants from that cohort could be expected to have a mortality pattern in their new country similar to that of the golden cohort left behind. Or, if the later life environmental influences in the new country proved stronger than the golden cohort's early life advantage, U.K. migrant mortality would be expected to have converged towards that of the population of the new country.

1.3 *Mortality of Migrants*

The mortality of migrants after long duration of residence in their new country has a relatively small literature.

As well as data accuracy issues, there are several confounding factors in analysis of mortality rates by country of birth, which are not yet well understood. Selection effects can arise from health, socio-economic or

marital reasons for migration or return; or from migration making a difference to health risk factors such as moving from a rural to an urban area, or access to health services being made more or less difficult; or from more racial discrimination, or closer family support, in the host compared to birth country (Lassetter & Callister, 2009; Singh & Miller, 2004; Wild *et al.*, 2007).

A critical question is whether mortality rates of long-term migrants converge to that of the host country. This has been suggested for migrants from South Asia to England and Wales (Harding, 2003). However, there is little evidence of this for migrants to Australia after 15 years residence (Young, 1991). Razum & Twardella (2002) suggest that the rate of convergence can be slow if the diseases which differ between birth and host country operate at older ages, for example heart disease.

Although it will be difficult to isolate the causes of any difference in the mortality of migrants from the U.K.'s golden cohort, it is worth seeking the extent of any difference. Often the focus of migrant mortality research has been on the health policy issues of migrants moving to a richer country where the population is in generally better health compared to the source country, rather than on the policy issues from the longevity of migrants from a healthy country. But if migrants from the U.K.'s golden cohort do have a mortality advantage in their new country then, given their current age, they are potentially significant for the costs of public pensions there in the next 10 or 20 years.

1.4 *Research Questions*

The following questions are therefore raised in respect of the countries to which large numbers of British emigrated:

- Are similar improvement patterns to those seen in U.K. mortality rates observed in the countries of U.K. migrants, especially at older ages?
- In particular, did some of the golden cohort emigrate taking their mortality advantage with them, or was the advantage a result only of the U.K. environment?
- What might the analysis to answer these questions illuminate more generally for cohort mortality trends and mortality projections in the countries in question?

This paper chooses one country — New Zealand — in order to focus analysis on the mortality of migrants from the U.K. It follows a suggestion from the Retirement Commissioner (2007) that more analysis is needed on the future life expectancy prospects of superannuitants in New Zealand.

1.5 *About New Zealand*

For one hundred and fifty years, up to the 1950s, the United Kingdom

was the dominant source country for migration to New Zealand (Phillips & Hearn, 2008). The settlers had outnumbered Māori, the first people to live in New Zealand, by around 1860 (Pool & Cheung, 2002). From the 1960s, emigration to New Zealand became more ethnically diverse, with significant inflows from Pacific Island nations. Migration from Asian countries increased from the 1980s. People continue to settle in New Zealand from countries with large populations of European descent, and migration from the U.K. continues.

Ethnic differences in mortality — between Māori and non-Māori — have been studied for most of New Zealand's post-contact history. Māori and Pacific people have a higher relative risk of dying, and Asian residents a lower risk of dying, than the New Zealand population not in those ethnic groups (Jatrana & Blakely, 2008; Statistics New Zealand, 2009). Socio-economic differences appear to account for much of the excess mortality for Māori and Pacific peoples; different rates of smoking and incidence of diabetes are also likely to be important factors. The selection effects at the point of migration may be important for the more recent migrants from Asia. Mortality differentials by European country of birth have not been studied.

Historical trends in New Zealand mortality, including why the life expectancy of New Zealand non-Māori females was the highest in the world from 1875 to 1940 (Oeppen & Vaupel, 2002), have been comprehensively described (Pool, 1982, 1985; Pool & Cheung, 2002).

1.6 *Outline of Paper*

This paper is structured as follows. The next section sets out the data and methods used and addresses concerns that the small size of New Zealand would offer insufficient data for analysis. Three following sections show the results of specific analyses. A final section concludes and discusses the findings of this paper that will be taken up in further study.

2. Methods and Data

This paper compares mortality between the U.K. and New Zealand, with particular reference to migrants from the U.K. to New Zealand, focusing on people currently in their fifties or older. Three approaches were used.

2.1 *New Zealand and England & Wales Mortality Patterns Compared*

Section 3 compares mortality patterns in the New Zealand and England & Wales populations. First, each country's current mortality rates (the probability of dying aged x; in actuarial notation q_x) and expectations of life at age x (e_x) were compared. The most recent complete period life tables were used: the Office for National Statistics (ONS) Interim Life Tables

2005-7 for England & Wales and Statistics New Zealand's New Zealand Life Tables 2005-7, for the total populations of each country.

The United Kingdom comprises three main population data regions: England & Wales, Scotland and Northern Ireland. The total population is currently around 61 million, and nearly 90% of that is in England & Wales. Scotland, with over 8% of the U.K. population has an age-standardised mortality rate around 17% higher than that in the U.K. (GROS, 2008).

Early settlers to New Zealand came from all parts of the U.K. (and Ireland), with Scotland over-represented and England & Wales somewhat under-represented (Phillips & Hearn, 2008). However, in this paper England & Wales will usually be chosen for comparison with New Zealand data rather than the U.K. as a whole. This is because some historical life tables are only available for England & Wales.

A census is taken in the U.K. every ten years, with the latest being in 2001. In New Zealand, a census is taken every five years, with the latest in 2006. Complete 2005-7 period life tables are available for both New Zealand and England & Wales, although they are interim for the latter.

Mortality over time is investigated to see whether New Zealand exhibits similar improvement patterns to those seen in U.K. mortality rates, and in particular whether a golden cohort can be observed in New Zealand. The annual rate of change in the mortality rate:

$$1 - q_{x,t}/q_{x,t-1} \tag{1}$$

for age x at time t is calculated for New Zealand and compared with data from England & Wales.

This measure is used because q_x is the basic unit in mortality analysis, it is the unit of measure that has mostly been used to demonstrate the U.K. golden cohort, and it is available for both countries.

In the section, one demonstration used in the case of England & Wales is updated and extended to New Zealand. This analysis tabulates age specific mortality improvement rates over the last 45 years and seeks to identify a golden cohort by a mixture of simple statistics and observation.

Other methods were considered (for example, Lexis maps) but are not presented as they were found to add little.

2.2 *The Mortality of U.K. Migrants to New Zealand*

Section 4 investigates how the mortality experience and trends of first-generation migrants from the U.K. to New Zealand differs from that of other sub-groups within the New Zealand population.

Standardised Mortality Ratios (SMRs) are calculated for sub-groups of the New Zealand population by birth country. The usually resident populations of New Zealand from censuses 1991 to 2006 are split by birth country, and grouped to isolate the U.K. born. Data on deaths from three

years centred on each census year are similarly identified and death rates computed in 5-year age bands. Country of birth has been included in New Zealand death registrations since 1909.

The U.K. is still the largest single birth country of overseas-born residents in New Zealand. Out of a total population of just over 4 million in 2006, 6% were U.K.-born (Table 1).

The standard population for the SMR analysis is taken as the estimated resident population of New Zealand on 30 June of each census year, rather than the census usually resident population count. The former measure adjusts for census undercount and New Zealand residents temporarily overseas at census date.

As would be expected from a history of long-term settlement, the U.K. born population in New Zealand is generally older than the average population age. At census 2006, the median age of U.K. born residents was 52 years; that of the rest of the population was 35 years. Therefore, the proportion of deaths in New Zealand of people born in the U.K. is higher than the proportion of population count, at 13% of the total deaths of nearly 84,000 in 2005-7 (Table 2).

The all-ages total number of male or female deaths from U.K.-born residents is not less than 5,000 for any of the three year periods analysed and not less than 2,700 for other overseas-born residents. The numbers of deaths for each table of SMR results are shown in the Appendix. Nearly all cells

Table 1. Population of New Zealand by country of birth

	1991	1996	2001	2006
NZ born	84%	82%	81%	77%
U.K. born	7%	6%	6%	6%
Other overseas born	9%	11%	13%	17%
	100%	100%	100%	100%
Total population	3.37 m	3.62 m	3.74 m	4.03 m

Source: Census usually resident population count, Statistics New Zealand.

Table 2. Deaths in New Zealand by country of birth of deceased

	1990-2	1995-7	2000-2	2005-7
NZ born	78%	78%	77%	77%
U.K. born	15%	14%	13%	13%
Other overseas born	8%	8%	10%	11%
	100%	100%	100%	100%
Total deaths	79,906	83,537	82,550	83,801

Source: Statistics New Zealand.

offer reasonably robust numbers compared to similar studies on mortality by country of birth in England & Wales (for example, Wild *et al.*, 2007).

The older U.K.-born residents of New Zealand are of particular interest in this paper, because of the potential link to the U.K.'s golden cohort. If theories of mortality convergence to host country after initial healthy selection for migration hold, then the period of time people in this group have been in New Zealand is important. Nearly all have been settled for over 30 years and most for 40 years or more (Table 3).

Unrestricted access from the U.K. to New Zealand ended in 1974 and assisted passages ended in 1975. Migration from the U.K. for permanent residence in New Zealand generally appears to appeal to young people: a study of applicants for assisted passage in the early 1950s found a mean age of around 25 years (Brown, 1957) and since the late 1970s migrants have been most likely to be aged in the mid to late 20s (Statistics New Zealand, 2008). Many of the older U.K. born New Zealand residents of particular interest in this paper would have migrated in their twenties, probably as part of the assisted passage scheme.

Table 3. Percentage distribution of population born in the U.K. and usually resident in New Zealand, by age and years since arrival in New Zealand, 2006 Census

Age	19 years or less	20-29 years	30-39 years	40 years or more
0-4	100	0	0	0
5-9	100	0	0	0
10-14	100	0	0	0
15-19	100	0	0	0
20-24	86	14	0	0
25-29	77	23	0	0
30-34	71	14	16	0
35-39	62	7	31	0
40-44	56	5	31	8
45-49	45	11	22	22
50-54	30	17	22	32
55-59	16	14	35	35
60-64	10	9	41	39
65-69	8	6	37	50
70-74	7	3	27	63
75-79	7	2	17	74
80-84	7	3	12	78
85+	8	5	11	77
Total	39%	8%	23%	29%

Note: Individual figures may not sum to stated totals due to rounding. The shaded cells represent the U.K.'s 'golden cohort': roughly those born between 1923 and 1940.

Source: 2006 Census, census usually resident population count, Statistics New Zealand.

The SMR analysis seeks to establish whether U.K. born New Zealand residents have different mortality than New Zealand residents born in New Zealand or elsewhere, and so far as is possible, how that varies by age-period-cohort. We then ask how the mortality of U.K. born New Zealand residents compares with that of New Zealand born Māori and non-Māori residents.

Ethnicity is a more fluid concept than birth place. In the New Zealand census, people can choose more than one ethnicity and may choose different ethnicities at different times. The concept is:

> "the ethnic group or groups that people identify with ... a measure of cultural affiliation"
> (Statistics New Zealand definition, in Errington *et al*., 2008).

At the 2006 census, around 80% of the New Zealand population identified with the European ethnic group (Table 4).

The broad 'European' group includes people identifying with 'New Zealand European', 'New Zealander' and, for example, English or Dutch. Most of the European ethnic group have ancestors who settled from Europe, mainly from the U.K. At the 2006 census, around 10% of the European ethnic group also identified with non-European ethnicities such as Māori, Samoan or Chinese.

To compare the mortality of U.K. born New Zealand residents with that of New Zealand born residents of similar ethnic group, population figures and number of deaths were compiled for New Zealand born residents who did not identify with Māori ethnicity.

New Zealand offers a different perspective on ethnicity and migration from the U.K. On ethnicity, the U.K. census uses quite different questions and classifications. In 2001, 92% of the U.K. population was in the 'White' ethnic group and 8% in the heterogeneous 'minority ethnic' group. On migration, compared with New Zealand, a smaller proportion of U.K. residents were born overseas. In 2001, 8% of U.K. residents were born overseas, less than half the New Zealand proportion in Table 1. Around 8%

Table 4. Ethnic groups in New Zealand

	1991	1996	2001	2006
European	83%	83%	80%	79%
Māori	13%	15%	15%	15%
Pacific	5%	6%	6%	7%
Asian	3%	5%	7%	9%
Other	0%	0%	1%	1%

Note: People can identify with more than one ethnic group so figures do not add to 100%.

Source: Census usually resident population count, Statistics New Zealand.

of deaths in the U.K. were from people born overseas, whereas Table 2 shows the equivalent proportion for New Zealand was almost three times that.

Therefore, despite its small total population, New Zealand provides a time series of relatively large samples of both long-term migrants and different ethnic groups. While not without problems of data accuracy or completeness, New Zealand provides a data-rich case example in which to investigate mortality trends by birthplace or ethnicity.

2.3 *Cohort Mortality Trends and Projections*

Further analysis in Section 5 compares cohort expectations of life for the total populations of New Zealand and England & Wales, looking particularly at the implications for population projections.

Both countries produce cohort life tables. The available New Zealand cohort life tables for cohorts born from 1876 (Dunstan *et al*., 2006 and updates) are extended by converting the mortality measures used for the 2006-base national population projections — which are on a period basis — to a cohort basis. Age-specific mortality rates and expectations of life by birth cohort (available from year of birth 1841 to 2056) were also obtained from the Office for National Statistics for England & Wales (2006-based data).

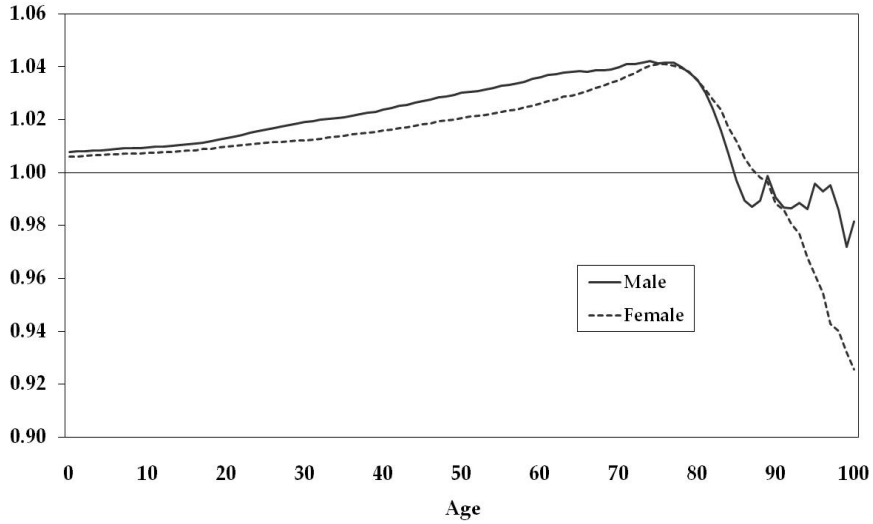
A direct comparison of expectations of life for different birth cohorts in the two countries is made, looking at both historical trends and at the projected trends for the future.

3. New Zealand and England & Wales Mortality Patterns Compared

Current life expectancies (e_x) on a period basis (that is, not assuming any change in mortality beyond the timeframe of the life tables used) are very similar between the two countries at most ages with a slight advantage for New Zealand (Figure 1). At the oldest ages the shape of comparison is erratic, reflecting few deaths and small populations.

Life expectancy at birth from the 2005-7 period life tables is 81.7 years for females in England & Wales and 82.2 for New Zealand. Male figures are respectively 77.4 and 78.0. At age 65, female life expectancy is 20.0 years for England & Wales, and 20.6 for New Zealand; for males, 17.3 and 18.0 years.

This apparent similarity masks larger differences in mortality rates (q_x). New Zealand population mortality rates generally are higher than those for England & Wales up to around age 30 years for males and 45 years for females (Figure 2). After these ages, New Zealand mortality rates are lower, until the rates converge at around age 90 years.



Source: Statistics New Zealand Life Tables 2005-7, Office for National Statistics Interim Life Tables 2005-7

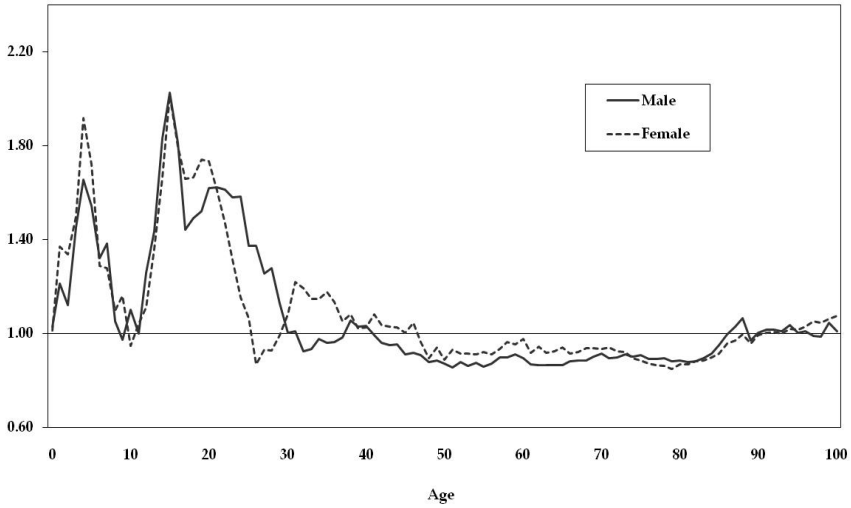
Figure 1. Expectation of life at age x for 2005-7, New Zealand total population as a ratio to England & Wales

The differences are large and irregular at younger ages. The irregularity is partly an artefact of smoothing very low death rates. The maximum difference is at age 15 years when the mortality rate for New Zealand is over twice that for England & Wales for both males and females. At higher ages the differences are smaller, and on average, New Zealand mortality rates between ages 40 and 90 years are 9% lower for males and 6% lower for females.

The shape of the comparison between New Zealand and England & Wales holds when Māori deaths are excluded, although the magnitude of the difference is reduced. The maximum difference is still at age 15 when the mortality rate for New Zealand non-Māori males is 80% higher than that for males in England & Wales.

The significantly higher mortality in New Zealand at younger ages can be explained by deaths by unintentional injury. The mortality rate in New Zealand at ages 15-24 years from this cause has halved in twenty years, but is still roughly double that of England & Wales.[3] The excess mortality at these ages in New Zealand is striking and needs further investigation.

[3] Comparing 2001-4 death rates in New Zealand from Atkinson and Bastiampillai (New Zealand Census-Mortality Study) with 2007 death rates in England & Wales from ONS (2008a).



Source: Statistics New Zealand Life Tables 2005-7, Office for National Statistics Interim Life Tables 2005-7

Figure 2. Probability of death at age x for 2005-7, New Zealand total population as a ratio to England & Wales

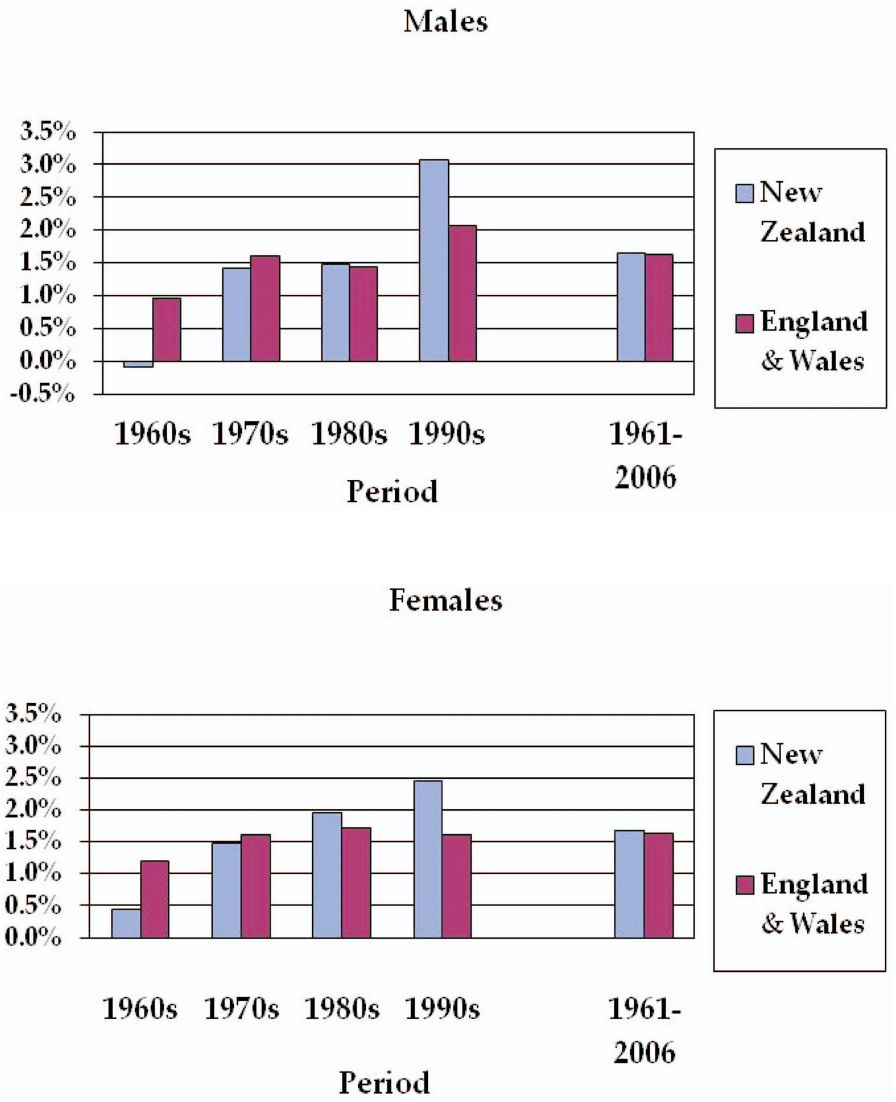
A full explanation of the lower mortality in New Zealand at ages 45-90 years is beyond the scope of this paper, but some indication is given by the World Health Organisation top ten causes of death for each country. New Zealand has a higher proportion of total deaths from the main cause, coronary heart disease: 23% compared to 20% in the U.K. Proportions of death from stroke and the main cancers are the same. The one striking difference between the two countries is that deaths from lower respiratory infections (pneumonia, bronchitis) are 11% of the total in the U.K. but only 2% of the total in New Zealand (WHO, 2006a, b).

If the current levels of mortality at middle to older ages and expectations of life in the two countries appear similar, have they developed over time in a similar way? We now turn to investigations of mortality trends over time which shed light on the golden cohort in the U.K. and in New Zealand.

Table 2 in Gallop (2008) showed annual improvements in age-standardised mortality rates by decade for England & Wales and identified the golden cohort by observation. This investigation updates that table to 2006, and compares with New Zealand data.

Before looking at the age-specific pattern, we first set out the all ages picture by decade, and for the period 1961-2006 (Figure 3).

On average since 1961, the annual rates of mortality improvement have



Source: Simple average of the age-standardised mortality improvement rates for 5 year age groups from 0-4 years to 85-89 years calculated from period q_x from Office of National Statistics and Statistics New Zealand

Figure 3. Average annual rate of all-ages mortality improvement over time

been almost the same for New Zealand and England & Wales: rounding to 1.6% per annum for males in both countries and females in England & Wales. The rate for females in New Zealand rounds slightly higher to 1.7%.

However, there are important differences within each decade. The 1960s in particular were worse years for mortality improvement in New Zealand than England & Wales, with male mortality rates in New Zealand actually increasing. This strong period effect is thought to be attributable largely to smoking and motor vehicle accidents.

New Zealand mortality improvement rates almost caught up in the 1970s, then overtook those in England & Wales in the 1980s. Since the 1990s, mortality improvement has been noticeably faster in New Zealand than in England & Wales for both sexes.

The age breakdown of the same data for each decade is shown in Table 5 (males) and Table 6 (females) with additional data for 1996-2006.

The England & Wales data show a mortality improvement advantage over three decades for the cohort of men and women aged 65-74 years in 1996. This could be described by an age shifting pattern of mortality decline, although the localisation of high rates of improvement suggest somewhat of a cohort effect superimposed on a predominantly period pattern (Andreev & Vaupel, 2005). However, this data provides some evidence for the 'golden cohort' in the U.K.

Andreev and Vaupel characterised New Zealand as having an age shifting pattern. The shading in the New Zealand tables shows a more irregular dispersion of improvement rates compared with England & Wales. This means that there are some high rates of improvement at ages away from the main golden cohort diagonal, for example females aged 20-29 years in the decade beginning 1996, which lessens the strength of some entries on the diagonal.

However, a narrow golden cohort diagonal can be traced for New Zealand males starting at ages 25-34 years in 1961, and stretching across the table to males in their sixties in the decade from 1996. For females, the cohort trend is strongest for the first three decades from 1961 starting at age 25-29 years. It is interrupted in the early 1990s, as another cohort trend appears for females aged 45-54 in 1991. The mortality improvement rate of 3.5% for females starting the decade 1996-2006 aged 55-59 years is very high, but is not shaded as there are even higher rates for females aged 20-29 years in that period.

The weak points of the trend are different in each country. In England & Wales in the 1960s, the shading appears off the diagonal for males and there is no mortality improvement strong enough to be shaded for females. The trend falters for females in New Zealand in the early 1990s.

Therefore, while both countries have seen an age shifting effect, New Zealand's has been more localised around a narrow band of ages. New Zealand can be added to the list of countries with a claim to a golden cohort.

Table 5. Percentage annual rates of mortality improvement, age-standardised, 5 year age groups starting at age shown, males

Age	1961-71	1971-81	1981-91	1991-2001	1996-2006
New Zealand					
0	2.4%	2.9%	2.6%	4.6%	3.2%
5	1.6%	2.7%	2.7%	5.1%	3.7%
10	1.5%	3.4%	−0.1%	3.3%	2.2%
15	−2.7%	1.2%	0.3%	3.5%	4.4%
20	−1.0%	−0.8%	−0.9%	5.0%	3.7%
25	0.2%	−0.9%	−0.3%	2.3%	3.5%
30	0.2%	1.1%	0.0%	1.2%	3.0%
35	−0.4%	2.4%	−0.1%	2.4%	1.0%
40	−0.6%	2.1%	2.2%	1.9%	0.6%
45	0.0%	1.5%	2.7%	2.9%	1.9%
50	−0.4%	2.0%	2.3%	3.6%	3.0%
55	−0.7%	1.5%	2.7%	3.9%	3.8%
60	−0.4%	1.5%	2.8%	3.5%	4.1%
65	−0.5%	1.2%	2.5%	3.3%	4.1%
70	−0.3%	1.0%	2.1%	2.8%	3.8%
75	−0.4%	0.9%	2.0%	2.5%	3.2%
80	−0.1%	0.9%	1.3%	2.4%	2.8%
85	0.2%	0.8%	1.8%	1.0%	1.8%
England & Wales					
0	2.5%	3.9%	3.1%	4.0%	3.4%
5	0.8%	4.6%	2.7%	6.0%	1.4%
10	0.6%	2.5%	2.2%	2.3%	1.9%
15	0.3%	1.3%	1.0%	3.1%	2.7%
20	1.7%	1.2%	−0.7%	1.0%	2.3%
25	1.8%	0.5%	−0.5%	−0.5%	1.5%
30	1.4%	1.4%	−0.7%	−0.8%	0.9%
35	1.3%	2.1%	−0.7%	0.7%	0.5%
40	0.3%	2.1%	1.5%	0.8%	1.2%
45	0.0%	2.1%	2.4%	0.9%	1.2%
50	0.2%	1.5%	2.8%	2.2%	1.2%
55	1.1%	0.8%	3.2%	2.6%	2.4%
60	1.2%	1.2%	2.4%	3.1%	3.0%
65	0.7%	1.4%	1.6%	3.6%	3.7%
70	0.5%	1.1%	1.7%	2.9%	4.0%
75	0.8%	0.7%	1.6%	2.2%	3.2%
80	1.0%	0.3%	1.3%	2.1%	2.6%
85	1.2%	0.2%	1.1%	1.2%	2.4%

Note: Shaded cells represent those where the value is above the average plus one standard deviation for ages 20 years and over in that period.

Source as Figure 3.

Table 6. Percentage annual rates of mortality improvement, age-standardised, 5 year age groups starting at age shown, females

Age	1961-71	1971-81	1981-91	1991-2001	1996-2006
New Zealand					
0	2.3%	2.5%	5.3%	1.6%	2.2%
5	1.4%	3.9%	0.5%	3.7%	3.3%
10	0.9%	2.6%	3.3%	0.9%	3.7%
15	−1.5%	−0.4%	2.0%	3.8%	2.9%
20	−0.3%	−1.3%	1.8%	2.8%	4.1%
25	0.9%	0.7%	1.1%	1.4%	4.9%
30	0.7%	2.0%	1.1%	2.0%	1.5%
35	0.7%	2.7%	1.3%	2.9%	1.1%
40	−0.5%	2.1%	2.1%	3.0%	1.0%
45	−0.6%	0.6%	2.9%	3.3%	2.1%
50	−0.2%	1.3%	1.2%	3.6%	3.3%
55	0.4%	0.6%	1.8%	2.8%	3.5%
60	0.5%	1.2%	1.7%	2.1%	3.2%
65	0.3%	0.7%	2.4%	2.2%	2.9%
70	0.7%	1.3%	1.9%	2.6%	2.6%
75	0.9%	1.9%	1.9%	2.1%	2.5%
80	0.9%	1.8%	1.5%	2.1%	2.1%
85	0.4%	2.4%	1.3%	1.3%	1.5%
England & Wales					
0	2.3%	3.7%	3.3%	3.2%	1.4%
5	1.1%	3.8%	2.0%	2.5%	2.1%
10	0.4%	2.0%	2.6%	3.7%	1.0%
15	0.1%	1.8%	1.2%	1.5%	2.5%
20	1.8%	1.9%	0.5%	1.0%	2.2%
25	1.6%	1.2%	1.7%	0.0%	1.4%
30	1.7%	2.2%	1.3%	0.4%	2.0%
35	1.6%	2.1%	1.2%	0.3%	1.4%
40	0.9%	2.0%	2.6%	0.4%	1.4%
45	0.0%	2.0%	2.3%	1.2%	1.0%
50	0.2%	1.2%	2.6%	1.3%	1.5%
55	0.3%	0.4%	2.4%	2.0%	2.0%
60	1.2%	0.4%	1.3%	2.7%	2.3%
65	1.5%	0.7%	0.7%	2.9%	3.1%
70	1.7%	1.1%	1.0%	2.1%	3.2%
75	1.7%	1.3%	1.3%	1.5%	2.4%
80	1.8%	0.8%	1.5%	1.4%	2.0%
85	1.4%	0.6%	1.5%	0.9%	1.7%

Note: Shaded cells represent those where the value is above the average plus one standard deviation for ages 20 years and over in that period.

Source as Figure 3.

New Zealand's pattern may seem less clear than England & Wales, but neither claim is unequivocal.

These patterns could be a result of different period and age effects that chance dictates reveal themselves as a cohort trend. Period effects are strong in both countries, as Figure 3 shows, and the more irregular changes at younger ages could have some momentum effects at higher ages. However, regardless of what the trends are called, a question is raised for each country, and a comparative question relevant to both.

The first question, for England & Wales, is suggested by the mortality improvement rate being generally slower than New Zealand's since the 1990s, as shown in Figure 3, and particularly so for ages under 30 years and in the range 45-65 years as shown in subsequent tables. Why would this be, and what does it mean for the future longevity of people born after the golden cohort?

The second question, for New Zealand, stems from the large differences in mortality improvement rates by age revealed by this analysis. There appears to be more stability in trends along the diagonal of Table 5 and Table 6 than by row. However, currently population projections are made assuming the same future mortality improvement rate for all ages. How should this evidence of age-related patterns of mortality improvements be taken into account for New Zealand population projections?

The third question comes from observing that assumptions on mortality improvements in population projections in the U.K. have become more optimistic than is the case in New Zealand. Comparing the principal 2006-based projections, England & Wales assumes an average annual mortality reduction rate of over 2% for the next 25 years, converging to 1% (higher for the golden cohort) from 2031, and this improvement is assumed to continue beyond the projection period in the calculation of measures on a cohort basis (ONS, 2007). The New Zealand 2006-base medium projection assumes mortality rates decrease at an average of 1.6% until 2031, then at an average of 0.6% from 2031 to 2061 with no projections beyond that date.

Given the comparison of recent mortality rate improvement, are both sets of long-term assumptions likely to prove accurate? Are U.K. assumptions too optimistic or New Zealand's too pessimistic, or both of these? We return to this question in Section 5.

4. The Mortality of U.K. Migrants to New Zealand

The previous section established that the U.K. (or England & Wales) populations have had similar mortality patterns over time to those of New Zealand, even to the extent of both exhibiting a 'golden cohort'. This suggests that the shared ancestry of many of the peoples of both countries may be a strong factor, despite environmental and other differences between the countries.

Table 7. Standardised Mortality Ratios (SMRs) and Confidence Intervals (CI) for New Zealand residents (all ages) by birthplace

	Males				Females			
	1990-2	1995-7	2000-2	2005-7	1990-2	1995-7	2000-2	2005-7
New Zealand born								
SMR	105	105	106	108	104	104	104	105
CI lower	104	104	105	106	103	103	103	104
CI upper	106	106	107	109	105	105	105	107
United Kingdom born								
SMR	95	93	94	92	94	96	95	95
CI lower	92	91	91	89	92	94	92	92
CI upper	97	96	96	94	97	99	97	97
Other overseas born								
SMR	103	96	97	94	105	96	100	94
CI lower	100	93	94	91	101	93	97	91
CI upper	107	99	100	97	109	100	103	96

Standard population is the estimated resident population of New Zealand on 30 June in mid year of period. Death rates by birthplace use census counts.

This section looks specifically at mortality of first generation migrants from the U.K. to New Zealand. For short-term older age population projections in New Zealand, and the cost of public superannuation, the mortality of the U.K. born will be particularly important. At ages 65 years and above, there are more U.K. born people in New Zealand than all other overseas born combined.

Table 7 shows all-ages SMRs by birthplace for sub-groups of the New Zealand population, with 100 representing the total New Zealand population. 95% confidence intervals are shown. The result is taken as significant if the confidence interval does not include 100.

Numbers of deaths in Table 7, and subsequent tables of SMR analysis, are shown in the Appendix.

U.K. born residents have significantly lower mortality than the New Zealand population. The SMRs vary little since 1991. First generation migrants from the U.K. therefore have a mortality advantage over the New Zealand population as a whole, and over those born in New Zealand.

The changing origins of the overseas born group over time probably explain the more irregular pattern of SMRs. The better mortality in the 2006 data for other overseas born may reflect recent increased Asian migration to New Zealand.

To put these results into context, SMRs for male adults (aged 20 and over) born in East Africa and female adults born in Bangladesh, both resident in England & Wales, are the same order of magnitude higher than the England & Wales population as the SMRs for U.K. born residents of

New Zealand are lower than the New Zealand population (Wild *et al.*, 2007).

Table 8 shows SMRs on the same basis as Table 7, split by age. Confidence intervals have not been shown for simplicity, but SMRs significantly different from 100 are marked. The SMRs for U.K. born New Zealand residents indicate significantly lower mortality than the New Zealand population at ages 35 to 84 years. At ages 85 years and over, there is no significant difference in mortality between those born in the U.K. and the New Zealand population.

The most significant difference is in age group 35-59 years. The mortality advantage U.K. migrants have in this age group may be a healthy migrant selection effect for newcomers. It may also reflect that there are disproportionately more Māori deaths in this age group than in older age groups.

As previously discussed, the majority of migrants from the U.K. aged 60 to 84 years have been resident in New Zealand for 30 years or more. They still have significantly better mortality than New Zealand born residents. The SMRs for both male and female U.K. migrants in this age group reduce over the time period shown, whereas the SMRs in the 35-59 age group are more stable. This may be a consequence of shifts in the make up of the U.K. migrant population over time, or it could be a glimmer of faster-improving mortality in the golden cohort.

Table 9 explores how much the apparent lower mortality of U.K. born New Zealand residents is amplified by the higher mortality of Māori. It shows that there is an all ages mortality advantage for U.K. born New Zealand residents over non-Māori New Zealand born residents, and that advantage continues to the oldest ages. This suggests that the higher mortality of Māori in New Zealand is only part of the reason why U.K. migrants show a mortality advantage relative to the New Zealand total population.

First generation migrants from the U.K. to New Zealand therefore retain a mortality advantage over people born in New Zealand who are likely to have European, mainly British, ancestry. This could be because they brought with them the same mortality improvement advantage as the U.K.'s golden cohort had in early life in the U.K. and it has lasted even after migration; a true 'cohort effect'.

It could also be because a healthy migration selection effect did not wear off even over 30-40 years for this age group. However, a healthy selection effect from a socio-economic bias for migrants is unlikely. There may even be a bias towards manual and unskilled workers. Many migrants are likely to have come to New Zealand on assisted passages; an analysis in the mid-1950s found that the occupations of male applicants were more likely to be manual and unskilled workers than the U.K. population, and female applicants were more likely to be clerical, domestic or hospital workers (Brown, 1957).

Table 8. Standardised Mortality Ratios (SMRs) for New Zealand residents by age and birthplace

		Males				Females			
		1990-2	1995-7	2000-2	2005-7	1990-2	1995-7	2000-2	2005-7
Ages 0-34	New Zealand born	106 *	109 *	110 *	115 *	104	107 *	107 *	112 *
	United Kingdom born	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
	Other overseas born	92	72 *	78 *	64 *	104	79 *	86	61 *
Ages 35-59	New Zealand born	109 *	109 *	109 *	111 *	110 *	110 *	110 *	111 *
	United Kingdom born	73 *	76 *	73 *	76 *	77 *	69 *	73 *	73 *
	Other overseas born	106	101	99	89 *	95	91 *	87 *	85 *
Ages 60-84	New Zealand born	104 *	104 *	105 *	107 *	104 *	104 *	105 *	107 *
	United Kingdom born	96 *	94 *	95 *	91 *	92 *	92 *	90 *	88 *
	Other overseas born	105 *	98	97	99	105	95 *	99	94 *
Ages 85+	New Zealand born	101	104	103	104	101	100	101	102
	United Kingdom born	105	102	102	101	101	106 *	104	104
	Other overseas born	98	94	100	96	110 *	106	111 *	103

Standard population is the estimated resident population of New Zealand on 30 June in mid year of period. Death rates by birthplace use census counts.
* denotes significance at the 95% level.
n/a indicates number of deaths fewer than 100 — see Appendix.

Table 9. Standardised Mortality Ratios (SMRs) for all Māori, all non-Māori, New Zealand born non-Māori and U.K. born New Zealand residents, 2005-7

	Males				Females			
	All Māori	All non-Māori	NZ born non-Māori	U.K. born	All Māori	All non-Māori	NZ born non-Māori	U.K. born
All ages	193 *	94 *	100	92 *	193 *	95 *	100	95 *
0-34	165 *	84 *	95	*n/a*	168 *	81 *	90 *	*n/a*
35-59	233 *	85 *	90 *	76 *	212 *	86 *	94 *	73 *
60-84	196 *	95 *	101	91 *	214 *	94 *	99	88 *
85+	103	100	105 *	101	112	100	102 *	104

Standard population is the estimated resident population of New Zealand on 30 June 2006. Death rates by birthplace use census counts.
* denotes significance at the 95% level
n/a indicates number of deaths fewer than 100 — see Appendix.

Even if migrants were healthier than the remaining U.K. population, the evidence suggests that the advantage stayed with them or even increased during middle to older ages as a result of the even healthier environment in New Zealand. Convergence to the host country was to improve life expectancy, from an already high base.

The golden cohort's advantage may have migrated, but its effect is more difficult to see as the environmental advantages in New Zealand have benefited all age groups (although under age 30 years the accident rate effect dominates). This hypothesis could explain the narrower golden cohort in Table 5 and Table 6, while the wider ranges of ages for which there are large mortality improvement rates support the case for a continued generally healthier environment in New Zealand, especially in the last decade.

If the hypothesis holds, then people in New Zealand currently around the age of eligibility for superannuation who were born in the U.K. have at least as good if not better life expectancy than the U.K. population — for whose longevity there has been such rapidly increasing optimism.

5. Cohort Mortality Trends and Projections

We now switch to using cohort measures of life expectancy (e_x). We look at historic trends and future projections, as these measures effectively summarise the story of past and expected future mortality in both countries.

Figure 4 shows life expectancies at different ages for cohorts by birth year from the beginning of available cohort data to the cohort born in 1941, towards the end of the era of the golden cohort. For males the dip in New Zealand life expectancy at birth (e_0) for cohorts born 1887-97 shows the impact of World War I and the 1918 influenza epidemic. The dip for cohorts 1915-21 shows the impact of World War II.[4]

New Zealand had consistently higher life expectancies at birth (e_0) than England & Wales for both males and females for every cohort born from 1876 to 1937. By age 45 life expectancies are about the same for the two countries, with a small advantage to New Zealand again until the late 1930s. This has been a remarkably consistent pattern, over a long time frame and for both sexes.

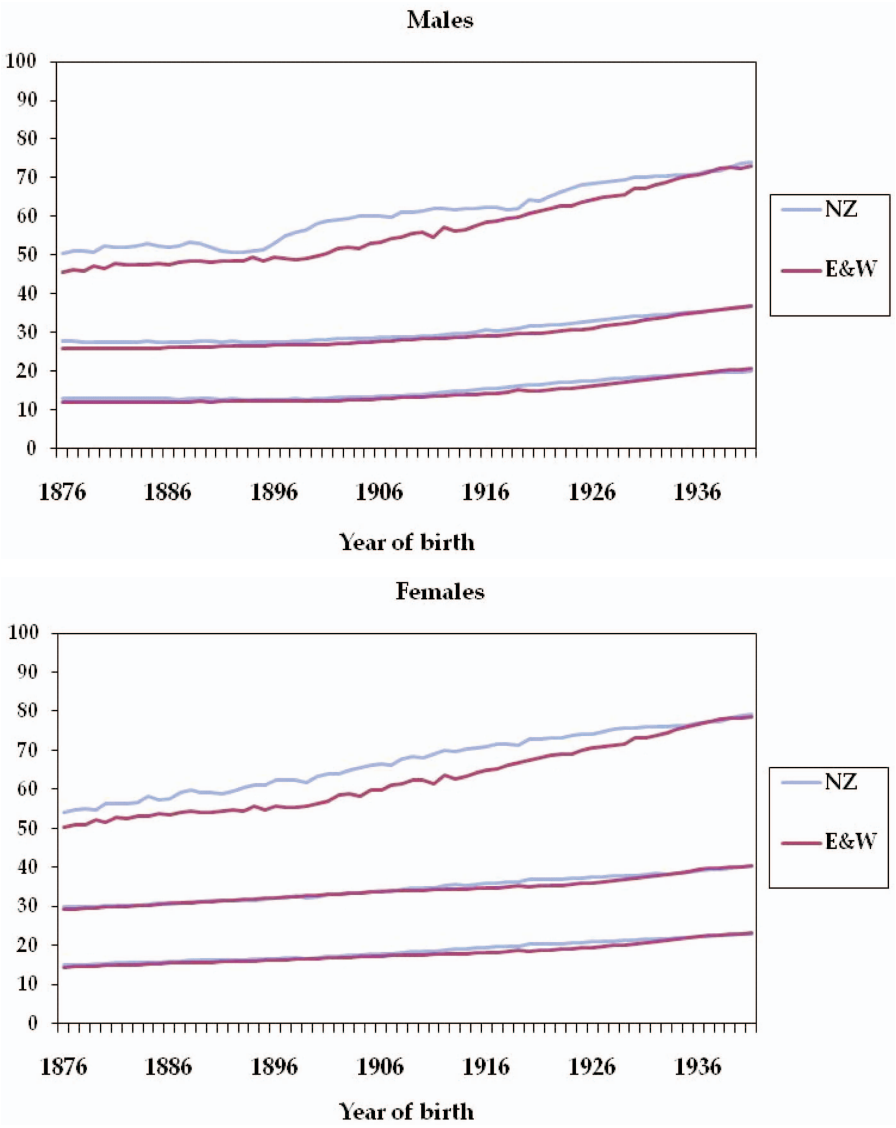
Researchers in the 1940s highlighted that non-Māori in New Zealand had the lowest infant mortality at ages between 4 weeks and under 12 months in the world in the early 1920s to mid-1930s. They pointed to the progressive ante-natal care and infant welfare services in New Zealand, including what is now called the Plunket Society, which had been established in 1907 to provide hospital care for sick children and to give advice and help to expectant and nursing mothers (Lessof, 1949; Peller, 1948).

At most ages at that time, deaths from respiratory causes were an important reason for England & Wales having higher mortality than New Zealand (Lessof, 1949). This was the period when non-Māori females in New Zealand had the highest life expectancy in the world (Oeppen & Vaupel, 2002).

This historical analysis used non-Māori statistics only, whereas this paper uses total population data. Given that Māori mortality has always been higher, it is particularly striking that the New Zealand early mortality advantage now appears on a cohort basis to have been so strong.

Further environmental and man-made reasons for New Zealand's mortality advantage were proposed: lower population density, no city congestion, a healthier climate, and higher economic level; in 1938 New Zealand had the world's highest level of real income per capita (Lessof, 1949). Add to this the early decline in fertility among non-Māori in the last quarter of the 19th century (Pool & Cheung, 2002). The early birth cohorts of the 20th century in

[4] New Zealand's cohort tables include deaths of servicemen abroad, which the England & Wales tables do not.



Source: Statistics New Zealand cohort tables and population projection data; Office of National Statistics q_x database. Cohort life expectancies allow for future mortality improvements in line with the official mortality projections for each country (see Section 1.2)

Figure 4. Cohort life expectancies at age 0, 45 and 65 in England & Wales and New Zealand, for cohorts born in 1876 to 1941

New Zealand had less competition for resources than previous cohorts and people of the same age in other countries.

Therefore, the man-made and environmental disadvantages of the U.K. compared with other countries were understood by the time of the U.K.'s golden cohort's birth and early life. In response, public health issues were addressed. For example, the U.K.'s universal health service was established in 1948, New Zealand's having been set up in 1939. The U.K.'s golden cohort was born at the right time to benefit from the catch up in public health initiatives, especially those around birth and childhood.

Indeed, this was predicted at the time. Lessof noted improved ante-natal care in the U.K. in the late 1930s and suggested that food rationing in the U.K. during World War II would be expected to have had a "beneficial effect on the population, particularly the expectant and nursing mothers and the children'' (1949, p97). Thus, at least part of the U.K.'s golden cohort's advantage may be explained by a true cohort effect from early life.

The story continues with Figure 5, which overlaps from the previous figure by ten years then continues to 1996, the birth year of people reaching superannuation age in New Zealand in 2061, when the current set of population projections end.

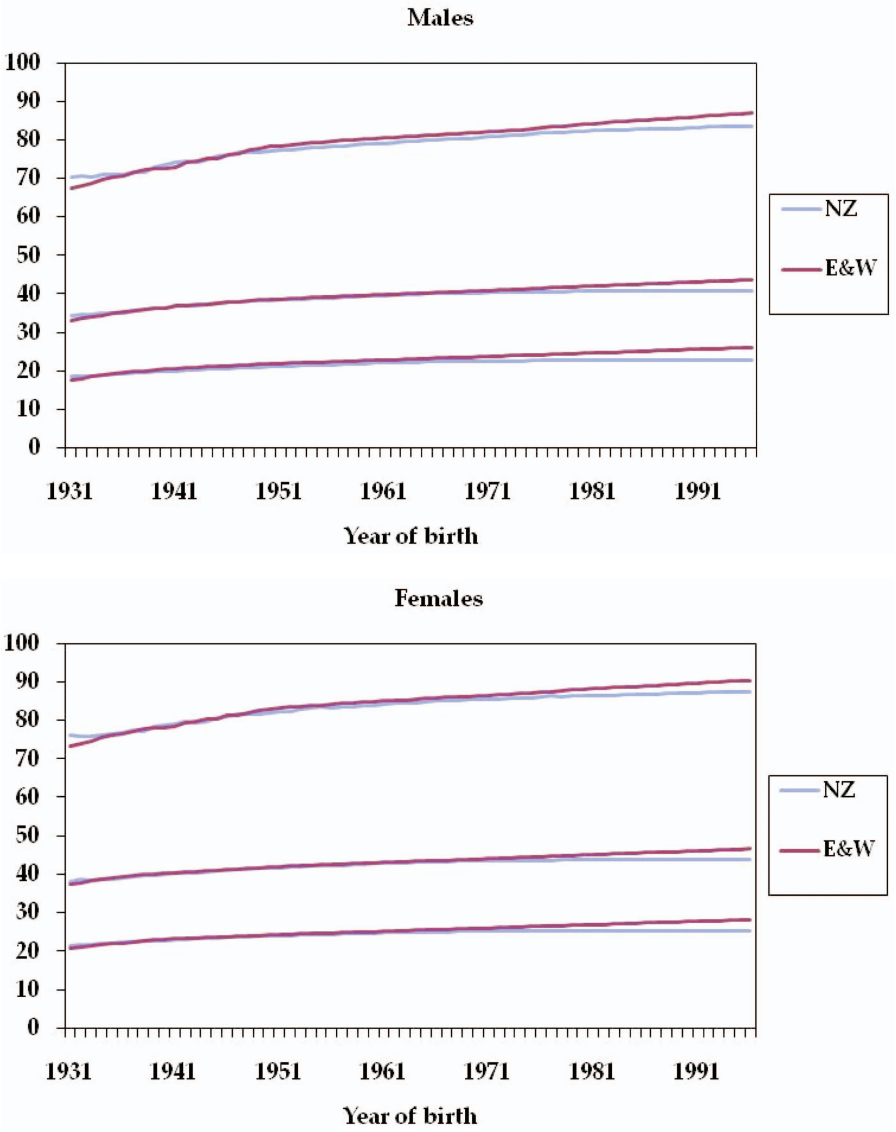
Having caught up with New Zealand's early life mortality, England & Wales life expectancy at birth shows the same remarkable closeness as life expectancies at age 45 and 65 until cohorts born in the 1970s. Then, life expectancies in England & Wales begin to diverge from those of New Zealand, at an increasing amount, with life expectancy at age 65 years being around 10% higher for cohorts born in the 1990s.

Do the actual underlying mortality patterns in each country point to a consistent advantage in future for the U.K., when New Zealand still has many of the environmental advantages of previous times?

One reason for divergence might be the diverse recent migration to New Zealand, and migration to the U.K. may also be important. However, Figure 2 shows that current population mortality rates are lower in New Zealand at most ages after the accident-related deaths up to age 30. Table 5 and Table 6 shows that mortality is improving at a faster pace at most ages in New Zealand compared with England & Wales. This does not suggest a relative worsening of New Zealand's mortality level.

Further, if the New Zealand accident rates at ages under 30 could be addressed there is scope for life expectancy at birth to improve still further.

People born in 1931 were aged 75 years in 2006. Therefore, most of the data in Figure 5 reflects not actual evidence but the assumptions made on future mortality improvement in the 2006-based projections. Therefore, the question remains whether the assumptions on mortality improvement in New Zealand and the U.K. population projections can both hold, or whether they are mutually inconsistent.



Source: Statistics New Zealand cohort tables and population projection data; Office of National Statistics q_x database. Cohort life expectancies allow for future mortality improvements in line with the official mortality projections for each country (see Section 1.2)

Figure 5. Cohort life expectancies at age 0, 45 and 65 in England & Wales and New Zealand, for cohorts born in 1931 to 1996

6. Conclusions and Discussion

This paper uses investigations of the mortality of the U.K. population as a mirror to highlight trends in the less comprehensively researched mortality of the New Zealand population. The interplay between period, age and cohort effects is complicated, but even with summary data some new insights have emerged.

The starting question of whether the populations exhibit similar mortality patterns because of largely shared ancestry is supported by current and historic life expectancies at adult ages, and by similar overall mortality improvement over a period of 45 years.

However, significant differences in period and age effects are also shown. New Zealand has relatively poor mortality improvement rates in the 1960s and 1970s, but recently mortality in the New Zealand population has improved more rapidly. The most obvious current difference between the two countries is the higher accident death rates at young ages in New Zealand.

At middle and older ages, the New Zealand population generally has lower mortality rates, and more recently has had greater mortality improvement rates than England & Wales. This supports the case for a generally healthier environment in New Zealand. There is also some evidence of a narrow golden cohort where people born in a short period in the early 1930s have had relatively faster mortality improvements throughout life than younger or older cohorts in New Zealand.

In England & Wales, the picture is almost reversed: a wider golden cohort, but generally lower recent mortality improvement rates. The emergence of the U.K.'s golden cohort coincided with life expectancy at birth in England & Wales catching up with that of New Zealand, largely for reasons of improving early life conditions. The two country comparison begs the question of why recent mortality improvement in the U.K. seems to be slowing more significantly.

For New Zealand, this analysis reveals past and recent mortality improvement rates that differ by age and cohort. Unlike other countries, New Zealand's population projections up to the 2006-base do not make assumptions of future mortality improvement that differ by age and cohort.

The analysis also shows large recent mortality improvement rates in New Zealand particularly at ages under 30 years and in the range 45-65 years. These rates are higher than those in the U.K., where assumptions of future mortality have become more optimistic on each recent review. This suggests it is unlikely that both the relative pessimism of New Zealand's and the relative optimism of the U.K.'s principal projections turn out to be accurate. It also underscores the importance of users looking beyond just the principal projection.

This paper sheds some new light on the mortality of migrants from the U.K. to New Zealand. Whether or not they had a mortality advantage

relative to their country of birth, they still have an advantage relative to their host country at older ages after decades in New Zealand.

This is consistent with the influence of the host country's mortality: during middle to old age, migrants experienced a healthier environment in New Zealand so their life expectancy improved. The data are also consistent with the U.K. golden cohort's advantage migrating, but its effect may be hard to see because the advantage of that cohort is muted by the general advantages accruing to migrants on residence in New Zealand.

Although not the subject of this paper, the data presented reinforce the mortality disadvantage for Māori in New Zealand. Ethnicity remains an important factor in mortality analysis and public health practice.

This paper suggests that country of birth can be a significant indicator of mortality until advanced ages, even after long-term residence in the host country. Evidence presented shows that mortality is lower for the subgroup of first generation migrants from the U.K. in New Zealand compared with the rest of the New Zealand population. Mortality differentials for other subgroups of migrants are likely in New Zealand and in other countries such as the U.K. with recent large inflows and changes in mix of source countries for migrants. Modelling of population projections by country of birth could add new useful information for health and superannuation policy. Birth country has the advantage over ethnicity, at least for data recording and analysis purposes, of being unique and permanent for each individual.

More research is needed to confirm the hypotheses presented here. For example, what caused the golden cohort in New Zealand? How do the mortality trends in the two countries fit with the trends in causes of death or smoking behaviour or the impact of economic trends? The future prospects for mortality in both countries will depend on socio-economic mix and how disparities in income and other factors influence mortality risk; migration will have an impact on how these factors play out.

The method of analysis in this paper allows the larger body of mortality research in one country — the U.K. — to be focused on exploring insights for another, New Zealand. In turn, some insights and questions for the U.K. experience have been identified. This method of holding up a mirror may provide a useful approach to comparative analysis for other countries that could be expected to have similar historic trends.

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APPENDIX

NUMBERS OF DEATHS IN SMR ANALYSIS TABLES

Numbers of deaths for Table 7:
SMRs for New Zealand residents (all ages) by birthplace

Males				Females			
1990-2	1995-7	2000-2	2005-7	1990-2	1995-7	2000-2	2005-7
New Zealand born							
32,562	33,399	31,986	31,513	29,440	31,568	31,788	32,734
United Kingdom born							
6,099	5,897	5,413	5,230	5,602	5,735	5,313	5,305
Other overseas born							
3,467	3,849	4,357	4,887	2,736	3,089	3,694	4,132
Total							
42,128	43,145	41,756	41,630	37,778	40,392	40,794	42,171

Numbers of deaths for Table 8:
SMRs for New Zealand residents by age and birthplace

		Males				Females			
		1990-2	1995-7	2000-2	2005-7	1990-2	1995-7	2000-2	2005-7
Ages 0-34	New Zealand born	3,487	3,057	2,354	2,134	1,646	1,639	1,280	1,190
	United Kingdom born	83	47	40	38	34	25	14	19
	Other overseas born	235	213	230	229	116	120	125	106
Ages 35-59	New Zealand born	4,861	4,899	4,715	4,864	3,357	3,467	3,363	3,486
	United Kingdom born	546	509	402	395	334	287	258	244
	Other overseas born	685	740	805	904	391	454	517	638

Numbers of deaths for Table 8 continued:
SMRs for New Zealand residents by age and birthplace

		Males				Females		
	1990-2	1995-7	2000-2	2005-7	1990-2	1995-7	2000-2	2005-7
Ages 60-84	New Zealand born							
	20,709	20,579	18,913	17,937	17,193	17,217	15,858	15,199
	United Kingdom born							
	4,254	3,956	3,580	3,255	3,019	2,831	2,461	2,225
	Other overseas born							
	2,162	2,417	2,714	3,037	1,507	1,661	1,964	2,137
Ages 85+	New Zealand born							
	3,505	4,865	6,004	6,578	7,244	9,245	11,287	12,861
	United Kingdom born							
	1,216	1,385	1,391	1,541	2,215	2,592	2,580	2,817
	Other overseas born							
	385	479	607	717	722	854	1,088	1,250

Numbers of deaths for Table 9: SMRs for all Māori, all non-Māori, NZ born non-Māori and U.K. born New Zealand residents, 2005-7

	Males				Females			
	All Māori	All non-Māori	NZ born non-Māori	U.K. born	All Māori	All non-Māori	NZ born non-Māori	U.K. born
All ages	4,661	36,969	26,877	5,230	3,780	38,391	28,981	5,305
0-34	788	1,613	1,351	38	479	836	714	19
35-59	1,472	4,691	3,397	395	997	3,371	2,493	244
60-84	2,241	21,989	15,709	3,255	1,993	17,567	13,215	2,225
85+	160	8,676	6,421	1,541	311	16,617	12,559	2,817

Note: all numbers of deaths are estimated after pro-rating deaths with no country of birth.