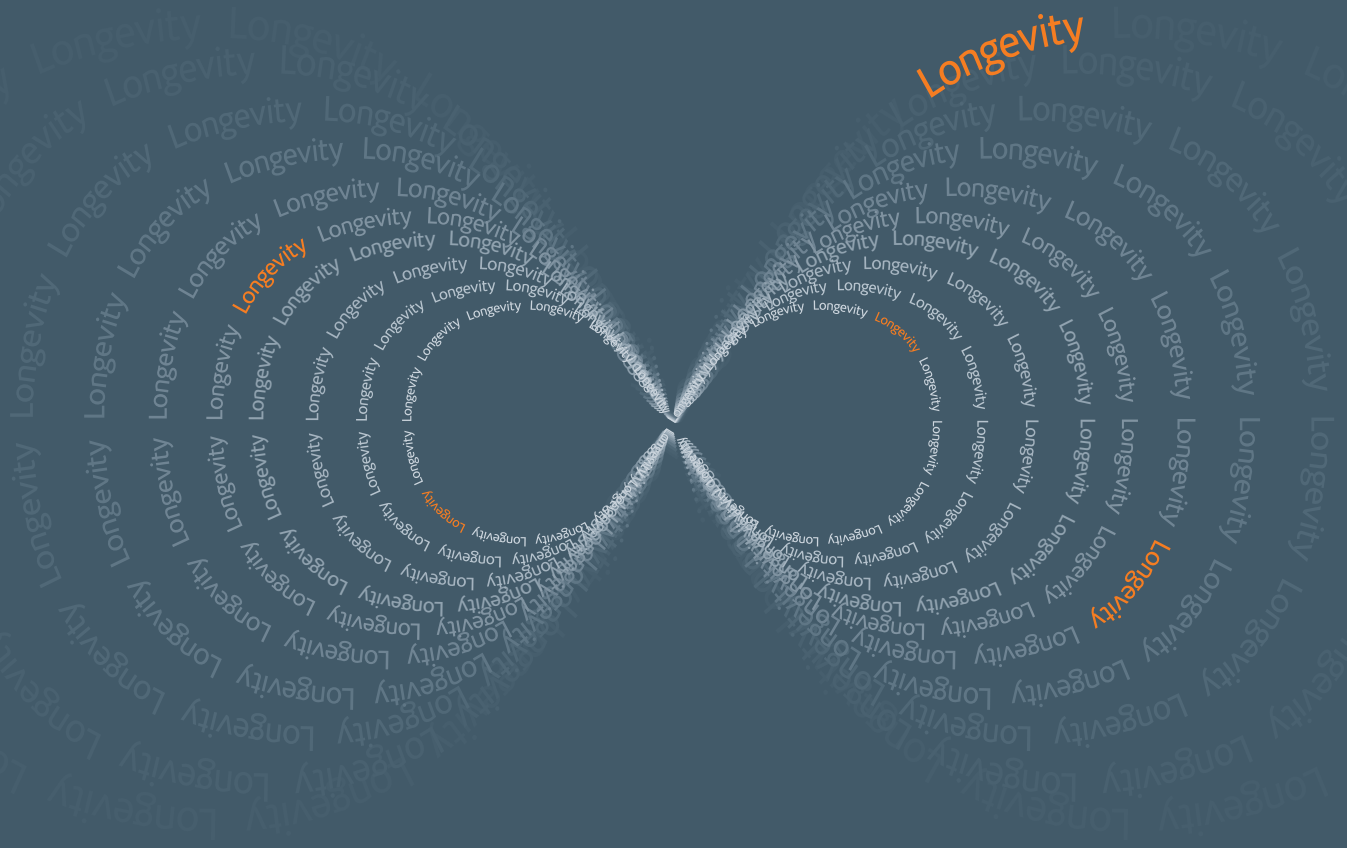
The Actuarial Profession
making financial sense of the future

Longevity Bulletin

From the Institute and Faculty of Actuaries



Issue 01 – May 2011

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Introducing the *Longevity Bulletin*

longevity ***n.***

Pronunciation: /lɒnˈdʒɛvɪti/

Long life; long duration of existence (Oxford English Dictionary)

Most people would rather think about longevity than mortality; about lifespan rather than death. Actuarial calculations are based on the mortality rate, the probability of dying. In most countries mortality rates at all ages are continuing a long history of decline. This means longevity is improving and each generation can expect longer lifespans than their parents and grandparents. This good news can be hidden in forecasts of the growing economic cost of ageing societies. But whether the story has a good or bad news spin, there is uncertainty about the future. There is much we do not know about the impact of factors that may slow down or disrupt the trend towards ever longer lives.

Longevity Bulletin aims to provide a regular guide to the prospects for long lives. It will present and explain actuarial perspectives on population longevity and will look outside the profession for statistics, research and the latest thinking on related subjects. We will consider longevity internationally with a focus on the UK.

We hope the *Bulletin* is read by actuaries, users of actuarial services and anyone with a technical, professional or personal interest in longevity.

Tell us what you think about this *Longevity Bulletin*, and what you would like to see in later editions. Complete the quick survey at **http://www.surveymonkey.com/s/longlife**

2. Focus on:
International forecasts of future longevity

Forecasts of how long the population may live are important because they inform government's long-term forecasts of the cost of public pensions and other planning assumptions for an ageing society. Insurance companies and pension providers also need forecasts of the cost of annuity and other products, based on the population of their policyholders or members. Actuaries are involved in both these areas. This article looks at some national statistics to see what is projected for future longevity in the populations of selected countries.

These projections show that:

- The consensus is that **average lifespans will continue to lengthen** and **females will continue to live longer than males** on average.
- As a result of making different assumptions about the future pace of improvement in mortality, there are **large differences in the estimated future average lifespan across countries.** For example, the estimates of average lifespan for boys born in 2010 range from 82 years in the US to 89 years in the UK, with the more optimistic of the two Australian projections at 92 years.
- **There is great uncertainty about the future course of longevity.** It is unlikely that any of these projections will exactly predict future lifespans.

Here we look at a small number of comparator countries: the United Kingdom (UK), United States of America (US), Canada, Australia and New Zealand. These English-speaking countries have more in common than language and settler history. They all use similar actuarially-based methods to estimate future longevity, actuaries have generally been involved in the forecasting[1], and future longevity is measured in the most informative way using cohort life expectancy.

"Cohort life expectancy" follows the lifecourse to give the best measure of average lifespan. Cohort life expectancy is the average lifespan of a group of people born in the same year, calculated using the average mortality rates that apply for that group at each age in each year of that cohort's life. The calculation of cohort life expectancy uses actual average mortality rates for past years, until the current age of the cohort, but then requires estimates of future mortality at later ages. Period life expectancy is also an average lifespan measure. Period life expectancy uses mortality rates at each age from one point in time, which does not represent how a life is lived. Period life expectancy is often used, incorrectly, as if it were a measure of real lifespans but it is more useful as a summary of a population's mortality at one time.

Chart 1 shows the range of cohort life expectancy for girls and boys born in 2010 in each country, as projected by the national agencies. Chart 2 shows the projected average remaining lifespan for the cohort of women and men aged 65 in 2010 (so born in 1945)[2].

[1] | *The Australian Government Actuary's office produces estimates of future longevity of the Australian population. Estimates of the future longevity of the UK population are produced by the Office for National Statistics, with input from the Government Actuary's Department. The demographers at Statistics New Zealand use similar methods to those in the other countries and produce cohort life expectancies for comparison. The forecasts for the United States and Canada used here are made for the purpose of estimating long-term income and outgo of the national pension or social security program. The forecasts are made by the Office of the Chief Actuary within the Social Security Administration in the US and by the Office of the Chief Actuary within the Office of the Superintendent of Financial Institutions Canada.*

[2] | *Source documents: AGA 2009, OASDI Board of Trustees 2010, OCA 2009, ONS 2009, Statistics New Zealand 2009.*

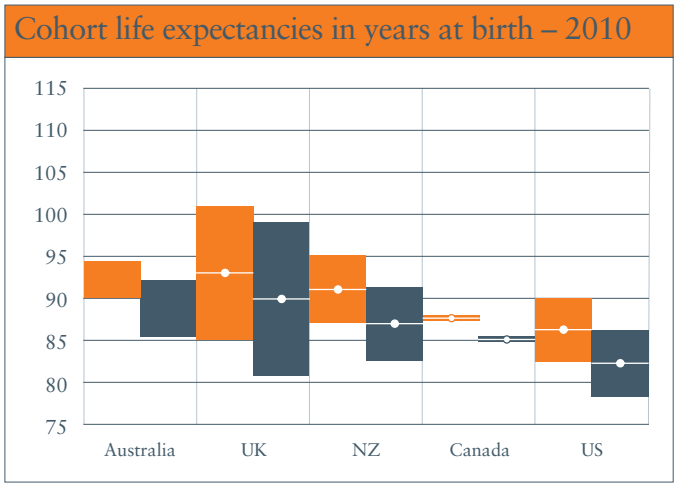

Chart 1

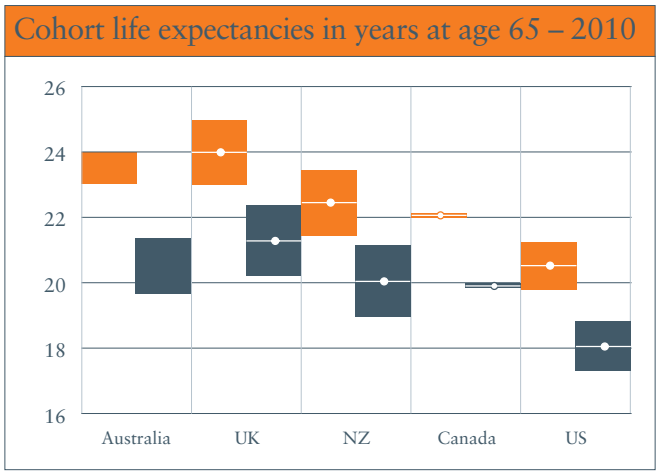

Chart 2

Female Male

This international comparison shows some key themes about future longevity:

- **There is uncertainty about the future course of longevity.** Most countries show a range of projections to illustrate this. Each variant projection is calculated using a different set of assumptions. More detail on assumptions is given later in this article.
- **There are large differences in average lifespan across countries.** The principal estimate for projected average lifespan for boys born in 2010 ranges from 82 years in the US to 89 years in the UK, with the more optimistic of the two Australian projections at 92 years. For women aged 65 in 2010, the principal estimate in the US is 20.4 years and in the UK 23.9 years.
- **Females are expected to continue to live longer than males on average.** The gap is expected to be roughly around 3 to 4 years for complete lifespan, and around 2.5 years for average remaining lifespan at age 65.

Usually, the principal projection is considered the 'best' estimate of the national agency, sometimes with two points either side as high and low variants. However, the statistical agencies who produce these numbers stress that they are sets of *projections* not forecasts or predictions. The projections are what would happen if a certain set of assumptions turn out to happen. They are not like weather forecasts which we understand to be likely to turn out even if not guaranteed. The choice of assumptions underlying each variant projection is usually somewhat arbitrary. The high and low variant projections do not represent comparable boundary lines of what is possible. The UK shows the largest range, and the most optimistic projections for both lifespan at birth and at age 65. This does not mean that the UK will achieve better lifespans than the other countries, or that there is any more uncertainty about longevity in the UK. Each range reflects the choices made by the statistical agency on assumptions for each variant.

Because each projection is a consequence of a different set of assumptions, any user of the projections needs to understand and agree with the choice of assumptions. Similar methods are used for each of the international projections shown here. Briefly, the rate of change in each mortality rate by age and sex is assumed for each future year, based on an analysis of the rates of change that actually occurred in the past. So each set of assumptions reflects the past experience of that country's average mortality rates each year, for each age, for men and women separately. The projections for future longevity differ not only because the past history of mortality rates has been different in each country, but also because of the way it is decided to extrapolate past trends into the future: Which period of the past to extrapolate? Give more weight to recent trends, or look back longer term? Distinguish in detail between ages, or average over broad age groups? Extrapolate improvements forever in a straight line, or tail off gradually?

The calculation for each projection involves a large number of assumptions for each age and sex in each future year. It is not easy to summarise these assumptions, but Table 1 attempts a summary for the constituent countries of the UK. Table 2 summarises still further to draw out a comparison between the assumptions for the annual rate of change in mortality rates used in different countries [3].

This comparison sheds more light on the projection of future longevity:

- **All projections assume continued declines (that is, improvement) in mortality rates.** The exceptions are only for short term worsening at specific ages, for example for Scottish males around age 42 in 2008-9, or for a low variant in the UK which assumes constant mortality after 25 years of improvement. This means that lifespans are assumed to continue to lengthen over time. The issue is the pace of improvement.
- **Countries take different assumptions for future pace of mortality improvement.** This explains why large differences in average projected lifespan across countries persist. In Canada, the US and UK, mortality improvement rates slow down after a period to the order of 0.7 to 1 per cent a year (principal estimates) in the long-term. In Australia and New Zealand, it is assumed that the pace of improvement is sustained at higher rates on average.
- **The projections are illustrative rather than exact.** The assumptions underlying the projections depend on judgements about the rate of reduction in mortality rates, which may be based on just one assumed number. For example, after the first 25 years of the projection period in the UK the annual reduction in mortality rates is assumed to be a constant 0, 1 or 2 per cent for all ages in the long-term, depending on the variant.

It is unlikely that any of these projections will be accurate, in the sense of predicting exactly future lifespans. There are strong arguments in favour of projecting future longevity by extrapolating from past mortality[4], but there always remains the prospect of new medical technology or unforeseen health trends that will change the path. These projections look only at the population average so they would hide any changes in the distribution of lifespans within any population. Looking across national populations shows that there is great uncertainty and differences in judgements about future prospects for longevity.

[3] | *For the full detail for each projection refer to the respective source material in footnote 2.*

[4] | *See for example Wilmoth 1998.*

Table 1:

Summarised assumptions for UK 2008-based national population projections, principal estimate.
Average rate of reduction in age and sex-specific mortality rates between calendar years.

Region	Average annual reduction 2008-2033 Range across ages 0-100 (ages at which minimum and maximum reduction occurs in brackets)		Average annual reduction 2032-33 and later
	Male	Female	
England, Wales & N. Ireland	0.7% - 3.0% (age 14, age 21)	0.9% - 3.4% (age 7/8, age 16)	1.0% for nearly all ages, male and female. Higher for those born during 1923-1940.
Scotland	0.1% - 3.0% (age 36, age 21)	0.7% - 3.4% (age 36, age 16)	As above

Source: *ONS*

Table 2:

Summarised assumptions for the annual rate of reduction (improvement) in mortality rates in population projections of selected countries.

Country	Low variant	Principal estimate	High variant
Australia	1.8% (m) 2.2% (f)	n/a	2.7% (m) 2.2% (f)
UK	Varies by age until reaches 0% by 2032-33. Thereafter, 0%	Varies by age until reaches 1% by 2032-3. Thereafter, 1%. Average 2008-2083: 1.3% (m) 1.4% (f)	Varies by age until reaches 2% by 2032-3. Thereafter, 2%
New Zealand	1% (m) 1.3% (f)	1.6% (m) 1.8% (f)	2.1% (m) 2.4% (f)
Canada	n/a	Varies by age to 2029 then 0.7% for all ages under 85, lower for ages 85 and over	n/a
US	Varies by age to 2034 then 0.5% for all ages under 65, 0.3% for ages 65 and over	Varies by age to 2034 then 1% for all ages under 65, 0.7% for ages 65 and over	Varies by age to 2034 then 1.5% for all ages under 65, 1.2% for ages 65 and over

Note: *The figures shown are generally those given by the statistical agency for the average annual rate of change in mortality rates, averaged over ages and time periods, for the duration of the projection period or part-period as shown. For Australia, averages weighted by population count have been calculated.*

m = male; f=female. The Low and High variants have been named to reflect lower or higher life expectancy (higher or lower mortality). These labels and "principal estimate" may not be those used in original cases. The table summarises a wealth of detail. For the full details of each projection, see the source documents at footnote 2.

3. Longevity research news

This section highlights some recently published research. Each item is selected for its relevance to longevity knowledge and interest to *Bulletin* readers. Check the links and the Sources section at the end of this Bulletin to follow up on a reference.

The British Actuarial Journal (Volume 15, Supplement) has a collection of papers from the multidisciplinary ***Joining Forces on Mortality and Longevity*** conference hosted by the Actuarial Profession in Edinburgh in October 2009. The research reflected in these papers covers three inter-related themes of mortality: the drivers of change; how the mortality of successive cohorts differs and why; and the connections between total population mortality and individual risk characteristics.

The journal ***Annals of Actuarial Science*** is also published for the Institute and Faculty of Actuaries. The latest issues cover technical aspects of actuarial work including mortality data and projections for UK and Ireland.

The August 2010 issue of ***Demography*** focuses on ageing. See the article by Schoeni and Ofstedal for a summary of the **key themes of current research on the demography of ageing** (1) population trends (including mortality) (2) international comparisons (3) the economics of ageing and (4) the dynamics of health in later life.

The Focus article in this edition of *Longevity Bulletin* reflects the first two of these themes, as does an article by the UK's National Statistician in the Winter 2010 issue of ***Population Trends*** (Matheson 2010) which compares a range of demographic measures for the UK with those of other nations. It shows **that mortality improvements in the UK over the last 20 years have been considerable, but have been even larger elsewhere,** including in Australia and New Zealand, Brazil, China and Egypt. Further, **the UK population is ageing, but not as rapidly as some other countries including Germany, Italy and Japan.** It is therefore timely to consider a view on the economics of ageing populations from Lee and Mason (2010): **"population ageing brings economic benefits that may be at least as important as its costs"**. From their modelling of age-specific economic flows in countries with different ageing profiles, Lee and Mason show that the causes of population ageing – low fertility and low mortality – increase the accumulation of physical and human capital which in turn allows income and consumption to increase.

It is well-known that **mortality is linked to socio-economic circumstances.** An article in the Spring 2011 issue of ***Health Statistics Quarterly*** (Johnson 2011), and an accompanying Statistical Bulletin (ONS 2011), give an update on trends in the summary measure of period life expectancy at birth and at age 65 by socio-economic classification in England and Wales. From 1982–86 to 2002–06 those measures improved for both males and females of all classes. Using mortality rates of 2002-6, period life expectancy at birth was estimated at 80.4 years for male "higher managerial and professional" workers and 74.6 years for "routine" workers. For females, the same measure for those classes was 83.9 years and 79.7 years. The gap between these two extremes of socio-economic class appears stable for females over the timeframe of study and for males since 1992, but between 1982 and 1992 the gap for men appeared to widen by about a year.

There is a good deal of ongoing research into how mortality is linked to socio-economic position. One important theory is that **early-life circumstances, childhood health and education all have consequences for adult socio-economic circumstances and adult health and therefore longevity.** Case and Paxton (2010) use data from several British and American longitudinal surveys to suggest pathways from maternal health and behaviour via birth weight and height to childhood height as a marker for better educational, economic, health and cognitive outcomes in adulthood. From a large sample of almost 50,000 Swedish males born during 1949-51, Falkstedt et al (2010) suggest that social, cognitive and behavioural factors evident prior to adulthood may explain more of the association between poor socio-economic circumstances in childhood and increased risk of coronary heart disease in middle-age than previously thought, with socio-economic position in adulthood being overstated as a factor in itself. Insights into which particular facets of childhood circumstances can increase the risk of poor health in later life were presented by Lacey et al (2010). Analysis of a British cohort born in one week of 1958 showed that the degree of parental involvement with their child affected the child's likelihood of smoking in adulthood more than childhood socio-economic position and educational level did.

Finally, an intriguing prospect for predicting survival in later life. By pooling the results of nine cohort studies of community-dwelling Americans aged 65 and over, Studenski et al (2011) confirmed what earlier individual studies had suggested: that there is a significant association of walking speed with the probability of surviving for a further five or ten years. Out of many other possible factors, only **age, sex and walking speed were consistently proven as predicting survival probability,** and these three indicators were as accurate as models using additional health-related data. Walking is thought to be a good test of all-round vitality, so fast speed generally indicates better life expectancy. A slower than average walking speed (around 1 m/s) could be a simple way to help identify older people with an increased risk of early mortality.

4. News from the Profession

Actuarial Profession announces three new mortality and morbidity research projects

(See **Press Release 13 December 2010** for more details.)

The Actuarial Profession has announced that it will be funding three new research projects which will examine mortality and morbidity.

The successful proposals are:

- University of Southampton and Barnett Waddingham LLP – Bayesian modelling of mortality projection uncertainty.
- Heriot-Watt University – Mortality models for multiple populations using covariates.
- King's College London – Genetic risk profiling for common diseases.

CMI report

The Continuous Mortality Investigation (CMI) carries out research into the mortality and morbidity experience of insurance portfolios and pension schemes in the UK market. The collated research is available publicly, along with its mortality and morbidity tables which have been adopted by the UK profession: see the **CMI section** of the Actuarial Profession's website. The latest publication on mortality, in November 2010, was a working paper (WP 49) to accompany the latest version of the CMI mortality projections model 'CMI_2010'.

For your diary:

Emerging trends in mortality and longevity Warwick, 13/14 September 2011

This conference aims to build on the ***Joining Forces on Mortality and Longevity*** conference held in Edinburgh in October 2009 by encouraging collaboration between the actuarial, medical, social science and demographic fields. The Actuarial Profession will host the conference adjacent to the Society of Social Medicine's Annual Scientific Meeting. For more details see **www.actuaries.org.uk/events**

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