Methods used in drawing up mortality projections

Mortality Projections in the United Kingdom

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Abstract

In common with other developed countries the United Kingdom (UK) has experienced a dramatic fall in mortality rates over the course of the 20th century. This paper discusses the key forces likely to influence UK mortality in the 21st century, and describes the methodology and assumptions used in the latest projections of UK mortality. The paper also describes recent tables of mortality rates published by the Continuous Mortality Investigation, based on the experience of people taking out insurance contracts.

Introduction

In common with other developed countries the UK has experienced a dramatic fall in mortality rates over the course of the 20th century. There has been a change from a regime of high infant and child mortality, with a preponderance of acute and infectious diseases, to one in which adult mortality predominates and chronic and degenerative diseases are the most common causes of death.

Key drivers of future mortality in the UK

Some of the key forces thought likely to drive mortality change in the UK in the 21st century are discussed in this section.

The cohort effect

Analyses of historical UK mortality rates suggest patterns in past rates of mortality improvement by year of birth. Figures A1 and A2 in Annex A show the annual rates of improvement in smoothed mortality rates by age and year for males and females.

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The figures exhibit several features. For males, those born in the late 1920s and in the 1930s have consistently exhibited, over a very long period, higher rates of mortality improvement than those born in the years either side. These patterns have been termed "cohort effects". There is evidence that there may be cohort effects arising for those born in later years of birth, with those born around 1945 exhibiting a similar pattern of higher rates of mortality improvement than those born either side whilst those born in the early 1950s and in the early 1960s are experiencing continuing lower rates of mortality improvement, or even worsening, relative to those born in between. As is discussed later, Government Actuary's Department (GAD) projections of mortality have been strongly linked to trends by year of birth for older ages. The female data exhibits similar patterns for similar years of birth, although the differentials in mortality are not currently as high as for males. These effects may be partly due to period effects rather than cohort specific; future developments will be monitored. Cohort effects have also been found for the subgroup of the UK population who buy life insurance or are in pension schemes run by insurance companies.

It is not known for certain what has caused these patterns. Various explanations for these cohort effects have been put forward, including:

- Differences in smoking patterns between generations;
- Better diet during and after the second world war;
- Benefits from the introduction in the late 1940s of state education and the National Health Service (NHS);
- These generations have been the beneficiaries of medical research and advances which have moved on from causes of death affecting children and young adults to those affecting older people.

**The ageing of mortality improvement**

*Figures A1 and A2* show that for the UK population the ages at which the highest rates of improvement have occurred have been increasing over time. This effect is partly tied up with the cohort effects but it encompasses a wider range of ages and years of birth; it is not necessary that rates of improvement follow a cohort effect for an ageing of mortality improvement to be exhibited.

**Smoking trends**

Various studies have suggested that changes in smoking behaviour in the UK have contributed significantly to the decrease in mortality. After a sustained fall in smoking prevalence during the 1980s, levels appear to have stabilised at most ages during the 1990s – this may lead to lower gains in mortality improvement from the effects of smoking behaviour in future years.

**Uncertainty at young ages**

Mortality rates in the 1980s and 1990s increased for young ages as deaths related to AIDS, drug and alcohol abuse and violence more than offset improvements in health-related causes of death. This trend appears to have been reversed in more recent years, but indicates that the future course of mortality rates at young ages is considerably uncertain.
Medical advances

A large element of the current improvements in mortality has been driven by medical advances. There appears to be ongoing public and political support and availability of funding for continuing medical research which would suggest that medical advances will continue to lead to further mortality decline.

Infectious diseases

Whilst recent medical advances and other factors have continued to lead to a regime of increasing life expectancy, factors which could work in the opposite direction, such as the threat from infectious diseases, should not be forgotten.

As well as new infectious diseases, old ones such as tuberculosis have re-emerged, which may prove resistant to existing antibacterial agents. Increased and rapid travel provides the means for infectious diseases to spread quickly around the globe (e.g., SARS). Human behaviour has also helped spread certain diseases, for example, hepatitis C and HIV.

So far, HIV is the only new example which has had a dramatic impact on mortality globally. In general, medical advances, rapid detection and global cooperation have managed to limit the effects of other newly arrived infectious diseases.

As deaths from heart disease and cancers reduce in the future, resistance to antibacterials could mean that deaths from infectious diseases become more common at older ages. Estimating the effects of an epidemic of an infectious disease is particularly difficult; whilst there would be a short term increase in mortality, the longer-term effects on mortality are less predictable. The effect may be simply a relatively short-term shock if those affected are mainly the elderly, causing mainly an advance of a few years of the deaths of those who would most likely have died in the immediate following years. On the other hand, the effects could be longer term if those of working age are particularly affected, leading to possible decreases in economic output in future years.

Obesity

There has been much discussion about the increase in obesity levels and the possible consequential effects on future mortality. Olshansky (2005) has suggested that the current levels of obesity in children and young adults in the United States could lead to reductions in future life expectancy over the next 40 years. Whilst increased obesity levels are likely to lead to increases in future morbidity, it is less clear how future mortality will be affected. If levels of these diseases increase significantly, medical research is likely to be focussed on treating these diseases or the causes of death arising from them, which may well mitigate the effects on mortality. There is considerable debate about the likely effects of increasing obesity on mortality with some suggesting that obesity has less impact on mortality than previously thought (Flegal et al. 2004).

Mortality by social class

Period life expectancy by social class exhibits a gradient both at birth and at older ages, with those in Social Class I living longest and those in Social Class V least, as can be seen from Figure 1.
A partial explanation for the existence of a mortality gradient by social class is that cigarette smoking varies considerably by social class. Other reasons suggested include selection effects, nutrition, environmental conditions and cultural/lifestyle differences (Townsend and Davidson, 1982) and differentials in work-related stress (Marmot et al. 1997). Valkonen (2001) has concluded that explanations for social differentials are likely to differ for different causes of death and by country and time period.

**Figure 1.**  
*Trends in male period life expectancy at age 65, 1972-2001, England & Wales*

![Trends in male period life expectancy at age 65, 1972-2001, England & Wales](image)

**Source:** Office for National Statistics, UK.

**Mortality projections in the UK**

The UK Government Actuary’s Department (GAD) has prepared the official national population projections for the United Kingdom and its constituent countries since 1954. The projections are prepared at the request of the Registrars General of England & Wales, Scotland and Northern Ireland and are usually produced every two years. The assumptions are agreed in consultation with the statistical offices of the four constituent countries. From February 2006 responsibility for producing the official national population projections and also the official life tables was transferred from GAD to the Office for National Statistics Centre for Demography (ONSCD).

The latest published UK population projections are the 2004-based projections. These incorporate different assumptions to those adopted for the 2001-based interim projections, which were reported on at the ISSA conference in Mexico City in September 2003; these changes are detailed later in this paper.

The methodology adopted for producing projections of future mortality rates by age and gender for each year of the period over which the projection is made follows that recommended by a full review of the methodology to be used for projecting mortality rates in the national projections which was carried out as part of a programme of quality assurance of UK National Statistics (2001).

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A new procedure for the 2004-based projections was the setting up of an advisory panel of experts on fertility, mortality and migration. A meeting was held prior to the setting of assumptions of the 2004-based projections to enable an informed discussion about the range of views on possible future trends. On mortality, opinions were sought on two particular questions – what should the target rate of improvement after 25 years be, and should the tailing off improvements thereafter assumed in previous projections be continued. A questionnaire was also provided; on mortality the questions included asking for respondent’s estimates of the average rate of mortality improvement and of expectations of life at birth in 2030, for males and females separately. Minutes of the meeting were made available after publication of the projections.

Current methodology for projecting mortality in UK national projections

The current methodology used for projecting mortality in the national population projections can be broken down into various elements as follows:

Mortality rates and rates of improvement in mortality by age and gender for the first year of the projection are estimated from an analysis of the trends in recent historic data for the United Kingdom. (Figure 2 shows the assumed initial rates of mortality improvement for 2004 used in the 2004-based projections.)

Figure 2. Initial smoothed percentage reductions in death rates by age, United Kingdom 2003-04

Consideration is then given as to how trends might change in the future. Rates of mortality improvement are set for a target year in the projection period (taken as the 25th year of the projection).

The average annualised rate of mortality improvement for the United Kingdom over the period 1961 to 2003 was around 1.4% a year for males and 1.2% a year for females. Whilst the annual rate of improvement over this period was relatively stable for females, the rate of improvement for males over the latter half of this period was much higher than over the first
half. Part of the reason for this is the differential trends in smoking behaviour between males and females, where relatively higher numbers of men have now given up smoking and mortality rates for males at older ages have shown large rates of improvement in recent years.

The average annual rate of improvement over the whole of the 20th century was around 1% for both males and females although the improvement rates vary by age. In particular, as discussed earlier, those born during the period 1925-1945 (centred around the early 1930s) have exhibited greater rates of improvement than those born on either side. As these generations reach older ages, the rates of mortality improvement at these older ages have been increasing, whilst those at younger ages have tended to decline. However, as these older cohorts reach much more advanced ages over the next 25 years, the contribution of their relatively higher rates of improvement to the overall rate of improvement is thought likely to lessen. Hence, other things remaining equal, it might be expected that the overall rate of improvement would decline as these cohorts become very old.

There is considerable debate as to whether the impact of future technical, medical and environmental changes will have a greater or lesser effect on improvements in mortality in the future than they have had over the 20th century. Past official projections in the UK and elsewhere have tended to assume that the high rates of improvement seen over the 20th century were unlikely to be sustained indefinitely. However, life expectancy at birth has continued to rise at relatively constant rates over the last 20 years for both males and females suggesting that, on current trends, past assumptions were too pessimistic. The panel of experts also recommended that there should be no tailing off in the rate of reduction after the target year.

Taking these various factors into consideration, the target rate of improvement for 2029 (the 25th year of the 2004-based projections) was assumed to be 1.0% at all ages (equivalent to the average annual rate of improvement over the whole of the 20th century). This was the same target rate of improvement for the 25th year of the projections as used in the 2002-based projections, but higher than the target rate of 0.75% used in the 2000-based projections. However, the annual rates of mortality improvement are now assumed to remain constant at 1.0% for each future year after the target year, rather than halving over every 25 years thereafter, as was assumed in the 2000- and 2002-based projections.

The transition from current rates of mortality improvement by age and gender, derived from recent trends, to the target rate of 1.0% in 2029 is not assumed to take place linearly, but more rapidly at first for males and less rapidly for females. This partly reflects the fact that males are currently experiencing rather higher rates of mortality improvement than females. In previous projections, this convergence was projected by cohort for those born before 1947, as there is strong evidence of generational effects in the relative rates of mortality improvement for these cohorts. However, there is now growing evidence of similar generational effects for slightly younger cohorts. Thus, in the 2004-based projections, convergence to the target rate of 1.0% has been done by cohort for all those born before 1960. For those born in 1960 and later, for whom there is little evidence of generational effects, the changes in the rates of improvement to the target rate are projected by age.

Taking account of the generally higher rates of improvement assumed prior to 2029, the assumptions produce averaged annualised rates of improvement in age standardised mortality of nearly 1.3% a year for both males and females over the whole 70 year projection period, which rates are slightly higher than those experienced over the past 70 years. As
Table 1 shows, the new projections generally assume slightly higher average rates of improvement for the future than experienced over corresponding periods in the past.

Table 1. Actual and assumed overall average annual rates of mortality improvement – UK

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Past (actual)</td>
<td>Future (assumed)</td>
</tr>
<tr>
<td>Last/next 22 years</td>
<td>2.02%</td>
<td>1.90%</td>
</tr>
<tr>
<td>Last/next 42 years</td>
<td>1.46%</td>
<td>1.47%</td>
</tr>
<tr>
<td>Last/next 72 years</td>
<td>1.17%</td>
<td>1.27%</td>
</tr>
</tbody>
</table>


Figures A3 and A4 show the actual and projected annual rates of mortality improvement using the same type of presentation as for Figures A1 and A2. The figures show the prolongation of the rates of improvement by cohort for those born before 1960 and by age for those born later.

Table 2 shows actual and projected period life expectancies at birth for the UK for selected years. As a comparison, Japan currently has one of the highest period life expectancies at birth for both males and females. Under the UK 2004-based projections, period life expectancy at birth would not reach those experienced in 2003 in Japan (of 78.4 years for males and 85.3 years for females) until 2011 for males and 2034 for females.

Table 2. Actual and projected period expectations of life, United Kingdom 2004-based projections

<table>
<thead>
<tr>
<th>Year</th>
<th>Age 0</th>
<th>Age 65</th>
<th>Age 0</th>
<th>Age 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>70.9*</td>
<td>13.0*</td>
<td>76.9*</td>
<td>16.9*</td>
</tr>
<tr>
<td>1991</td>
<td>73.1*</td>
<td>14.1*</td>
<td>78.6*</td>
<td>17.8*</td>
</tr>
<tr>
<td>2001</td>
<td>75.8*</td>
<td>16.0*</td>
<td>80.5*</td>
<td>19.1*</td>
</tr>
<tr>
<td>2011</td>
<td>78.5</td>
<td>18.2</td>
<td>82.2</td>
<td>20.6</td>
</tr>
<tr>
<td>2021</td>
<td>80.2</td>
<td>19.7</td>
<td>83.9</td>
<td>22.0</td>
</tr>
<tr>
<td>2031</td>
<td>81.4</td>
<td>20.6</td>
<td>85.0</td>
<td>22.9</td>
</tr>
<tr>
<td>2051</td>
<td>83.6</td>
<td>22.2</td>
<td>87.0</td>
<td>24.5</td>
</tr>
</tbody>
</table>

* Actual data

Table 3 gives an indication of the differences in period and cohort life expectancies at birth and at age 65 for 2004 and those projected for 2054.
Table 3. *Period and cohort life expectancies, UK*

<table>
<thead>
<tr>
<th></th>
<th>2004 Period</th>
<th>2004 Cohort</th>
<th>2054 Period</th>
<th>2054 Cohort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life expectancy at birth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>76.7</td>
<td>86.2</td>
<td>83.9</td>
<td>92.4</td>
</tr>
<tr>
<td>Females</td>
<td>81.1</td>
<td>89.8</td>
<td>87.3</td>
<td>95.3</td>
</tr>
<tr>
<td>Life expectancy at age 65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>16.7</td>
<td>19.2</td>
<td>22.4</td>
<td>23.9</td>
</tr>
<tr>
<td>Females</td>
<td>19.6</td>
<td>21.9</td>
<td>24.7</td>
<td>26.3</td>
</tr>
</tbody>
</table>

**Projections for constituent countries of the UK**

The initial analysis of past trends is carried out at the UK level. A comparison of the mortality experience of each country of the UK to that for the UK as a whole is then carried out to ascertain whether there should be any changes to the UK assumptions when applied to the constituent countries. The base mortality rates assumed for each country are derived by comparing recent mortality experience for that country with the UK as a whole.

**Variant projections**

Because of the inherent uncertainty of demographic behaviour, any set of projections is likely to be proved wrong. To help users take into account the consequences of future experience differing from the assumptions made, variant projections are also carried out based on alternative assumptions of mortality (and also fertility and migration). Two standard variant mortality assumptions (labelled high life expectancy and low life expectancy variants) are provided for each set of projections. These are intended to be plausible alternatives to the principal assumptions and not to represent upper and lower limits to future demographic behaviour. At present it is not possible to provide probabilistic interpretations for these variants. However, work on the possible ways of attaching probability levels to mortality variants is being taken forward by ONSCD.

For the 2004-based projections the high life expectancy variant assumes target rates of improvement in 2029 of 2.0% a year and the low life expectancy variant assumes target rates in 2029 of 0% a year for all ages. A ‘no mortality improvement’ special scenario variant was also produced, where it was assumed that future mortality rates will remain constant at the values assumed for the first year of the projections.

**Table 4** shows the resulting expectations of life at birth in 2050 under the principal projection and each of these variants projections.

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Table 4. Principal and variant projections: assumed period expectations of life at birth and at age 65 in 2050 for the United Kingdom

<table>
<thead>
<tr>
<th></th>
<th>Standard variants</th>
<th>Special case scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High variant</td>
<td>Principal projection</td>
</tr>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At birth</td>
<td>87.7</td>
<td>83.5</td>
</tr>
<tr>
<td>At age 65</td>
<td>25.4</td>
<td>22.1</td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At birth</td>
<td>90.2</td>
<td>86.9</td>
</tr>
<tr>
<td>At age 65</td>
<td>27.1</td>
<td>24.4</td>
</tr>
</tbody>
</table>

The effects of the variant mortality projections are seen mainly in the differences in the numbers of people aged 75 and over, with only around 10% of the increase, or decrease, attributable to ages under 60.

The "elderly" support ratio (defined as the ratio of all persons aged 16 to 64 to those aged 65 and over) for the UK was around 4.0 in 2001. Under the principal projection this falls to just over 2.3 in 2050. Under the high life expectancy variant the support ratio would fall to 2.1 and under the low life expectancy to 2.6 years. However, it is worth noting that, in the UK at least, the future fall in the support ratio is a continuation of a past trend: for example, it fell from 6.0 in 1951 to 4.0 in 2001.

**Continuous Mortality Investigation**

The Continuous Mortality Investigation (CMI) is a body funded by the UK life insurance industry, and run by the Faculty of Actuaries and Institute of Actuaries, which collects deaths and in force data by age and gender from participating UK life offices for various population subgroups who have taken out insurance contracts, including annuities.

Data are collected of numbers of claims (or annuities ceasing payment by death) by calendar year, and the numbers of policies in force at the end of each calendar year. For pensions and annuity business, total amounts of annuity are collected as well. Thus, the investigation is of claims, rather than deaths, and various crude adjustments are needed to allow for persons with duplicate policies.

The CMI produces standard mortality tables for use by actuaries in life insurance companies. New standard tables have been produced every 10 years or so, based on mortality experienced over a quadrennium. The latest tables, the “00” Series based on the mortality experience of 1999-2002, were published in September 2006.

The methodology used for graduating the base tables has for some time been based on maximum likelihood fitting of a Gompertz-Makeham family of functions (of the general form “polynomial + exp(polynomial)” to the force of mortality. It is described in detail in Forfar, McCutcheon & Wilkie (1988).

Data for assured lives are collected on a smoker/non-smoker basis and mortality tables are provided for both categories. These illustrate the large differential in mortality between

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smokers and non-smokers with mortality rates for assured lives in the "00" tables for smokers being over twice those for non-smokers for those aged 50 to 70.

Tables for pensioners and annuitants are produced in two stages. First, base tables are prepared, which are straightforward graduations of the data from the quadrennium. Second, the base tables are projected forward to allow for future improvements in longevity. Currently, the projection methodology is attracting much interest, because improving longevity is recognised as a significant factor in capitalising annuity business. Allowance for improvements has been made in past tables; latterly explicit projection formulae were used, which, in the form of reduction factors applied to the base table, resulted in a two-dimensional table indexed by age and calendar year. The "92" Series reduction factors assumed rates of mortality declining exponentially to asymptotic values, the latter chosen to produce greater improvements at younger ages than at older ages.

Mortality tables are produced both for lives and amounts of pension. Lives tables provide mortality rates based on deaths of persons (after adjusting to allow for those with more than one pension). These would typically be applied to numbers of pensioners alive by age to estimate numbers of deaths of pensioners during a year. Amounts tables provide mortality rates per unit of pension; these are applied to amounts of pension by age to estimate amounts of pension ceasing to be paid during a year. In general, mortality rates per unit of pension are lower than those calculated on a lives basis, reflecting the fact that mortality appears to be lower for those with larger amounts of pension. This suggests a correlation between wealth (using higher pension as a proxy for wealth) and higher life expectancy and is one of the factors in the mortality gradient by social class as well as why amounts mortality is lower than lives mortality.

The experience of the 1990s suggested that even these most recent projections underestimated actual improvements in mortality. To some extent this may reflect changes in the population covered by insured pension annuities, as well as the improving mortality in the population at large, with the development of an active market in the UK in impaired lives annuities resulting in the ordinary market becoming more and more select. Further investigation of the assured lives data for males also found cohort effects similar to those in the general population, but based around an earlier year of birth of 1926.

New interim projections were issued in 2002 (CMI Working Paper No. 1) in which the existing reduction factors, based on exponential decline, were adjusted in an ad hoc manner to allow for the main cohort effect. Three possible scenarios were put forward, called short, medium and long cohorts, depending on the period during which the excess rate of improvement enjoyed by the main cohort were supposed to wear off. Previous CMI projections had presented a single scenario.

The Financial Services Authority (the UK insurance regulator) is introducing new rules for capital adequacy based on stochastic evaluations of risk. A working party of the CMI has evaluated recent advances in projection methodologies, with a view to proposing methods suitable for use with the "00" Series tables, and adequate to meet the needs of life insurers under the new regulatory regime being introduced in the UK. Thus, the working party has examined projection methodologies capable of producing quantitative measures of risk as well as sample or central projections. CMI Working Paper No. 3, issued in March 2004, discusses, inter alia, contrasting methodologies such as time-series approaches (typified by the Lee-Carter model in much of the literature) and extrapolation of smoothed regression models; model, parameter and stochastic risk, and the problems of quantifying them; and the

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extent to which measures of uncertainty based on large populations could be applied to
different, smaller populations such as an insurer’s annuitant portfolio.

The CMI is currently evaluating two methodologies for mortality projections – the P-spline
model and the Lee-Carter model (CMI Working Paper No. 15) – and aims to explain the
benefits and shortcomings of each. The CMI is not seeking approval for either methodology
nor does it rule out alternative approaches to projecting mortality. It will be for individual
actuaries to understand the implications of the different methodologies and the
appropriateness of each in any given situation.

The P-spline model fits a surface of mortality rates to historical data and in the region of the
projections and provides estimates of the standard deviation of the log mean values of the
rate of mortality. The degree of smoothing of the past data can be specified as can the
method for projecting forward. Projections can be done on an age-period or age-cohort basis
(the latter provides more emphasis on projecting forward past cohort effects). The method
provides a range of surfaces of projected mortality improvements; these can then be applied
successively to the assumed base mortality rates. Different surfaces can be regarded as
percentiles so it is possible to pick the 50th percentile sheet as the main projection and look
at variations by considering the 97.5th and 2.5th projectiles, for instance.

A Lee-Carter methodology is being developed to produce sample paths of future mortality
improvement based on historical data. Several thousand of these are generated and then
the resulting projected improvement for a given age and year can be ordered and confidence
intervals obtained by comparing the requisite percentiles of the ordered data. One of the
difficulties in adapting Lee-Carter methods to UK data is the existence of cohort effects in
historical UK data. These are not readily picked up by the original Lee-Carter methods,
either in fitting past data or in projecting these effects forward. Adapting the Lee-Carter
model to deal adequately with cohort effects has so far proved problematic.

**Occupational pension scheme mortality – SAPS investigation**

The CMI has recently started to collect and analyse mortality data from a sample of
occupational pension schemes. These data suggest that for ages 65 and over, male
mortality in the sample occupational schemes was higher than the "00" graduations for
2000 for both lives and amounts. Female mortality was higher over the age range 50 to
94 for both lives and amounts except for age 70-74 on a lives basis (female mortality on a
lives basis was generally close to the "00" graduations for 2000 for ages 70-94).

Standard tables for these data are not currently produced; consideration is being given as to
whether standard tables might be issued in the future.

**Comparisons of mortality**

*Tables 5 to 8* show the values of expectations of life on various mortality tables both with
and without the projected improvements associated with each tables. ILT99/01 gives values
from the interim life tables for the United Kingdom based on mortality experienced in
England and Wales the three years 1999-2001. The figures for population mortality are
calculated using the 2004-based UK population projections and are shown for age attained
in 2007. The "00" tables for pensioners in insured pension schemes provide mortality rates
for pensioners taking normal or late retirement, for early retirements (for whom mortality

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rates are in general higher than for normal retirements, since this group includes retirements on ill-health grounds) and the two experiences combined. The figures shown are calculated from mortality rates for the combined group: PCML00 and PCFL00 figures are calculated on a lives basis, the PCMA00 and PCFA00 figures are calculated on an amounts basis.

Table 5. **Expectations of life – Males**

<table>
<thead>
<tr>
<th>Age</th>
<th>ILT 99/01</th>
<th>PCML00</th>
<th>PCMA00</th>
<th>Population mortality 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>With improvement</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>60</td>
<td>19.47</td>
<td>21.17</td>
<td>22.52</td>
<td>21.27</td>
</tr>
<tr>
<td>65</td>
<td>15.67</td>
<td>17.18</td>
<td>18.40</td>
<td>17.38</td>
</tr>
<tr>
<td>70</td>
<td>12.26</td>
<td>13.47</td>
<td>14.50</td>
<td>13.70</td>
</tr>
<tr>
<td>75</td>
<td>9.35</td>
<td>10.27</td>
<td>11.02</td>
<td>10.42</td>
</tr>
<tr>
<td>80</td>
<td>6.96</td>
<td>7.71</td>
<td>8.12</td>
<td>7.73</td>
</tr>
</tbody>
</table>

Table 6. **Values of expectations of life relative to ILT99/01 - Males**

<table>
<thead>
<tr>
<th>Age</th>
<th>ILT 99/01</th>
<th>PCML00</th>
<th>PCMA00</th>
<th>Population mortality 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>With improvement</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
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<tr>
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<td>100</td>
<td>111</td>
<td>117</td>
<td>111</td>
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</tbody>
</table>

Table 7. **Expectations of life – Females**

<table>
<thead>
<tr>
<th>Age</th>
<th>ILT 99/01</th>
<th>PCFL00</th>
<th>PCFA00</th>
<th>Population mortality 2007</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
<td>With improvement</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>No</td>
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<td>8.57</td>
<td>9.23</td>
<td>9.67</td>
<td>8.97</td>
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</tbody>
</table>

Table 8. **Values of expectations of life relative to ILT99/01 - Females**

<table>
<thead>
<tr>
<th>Age</th>
<th>ILT 99/01</th>
<th>PCFL00</th>
<th>PCFA00</th>
<th>Population mortality 2007</th>
</tr>
</thead>
<tbody>
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<td></td>
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<td></td>
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</tbody>
</table>

The tables show a projected increase of over 10% in period expectations of life between 2000 and 2007 for older males in the UK (and 5% for older females). If future mortality
improvements at these ages occur as projected, the cohort expectations of life will be around 13% higher for males aged 60 to 70 in 2007 than would be expected if mortality rates remained in the future at the same level as currently experienced. The tables also show that period expectations of life of people in insured occupational pension schemes in 2000 were higher than for the population in as a whole in 2000 by around 9 to 11% for males and 6 to 8% for females on a lives basis (and even higher if measured in terms of pension amounts rather than lives).

Pensions Commission

A Pensions Commission was appointed in December 2002 with a remit to review the adequacy of private pension saving in the UK and to advise on appropriate policy changes. Whilst acknowledging the difficulties in projecting future mortality rates, the Commission believed that the 2002-based projections assumed too little future mortality improvement. The changes made to the assumptions for the 2004-based projections produced projected cohort life expectancies for males aged 65 which were rather closer to the middle of the Commission’s assessed range of uncertainty for this measure.

On mortality the Commission made a number of recommendations including:

(i) that official publications as far as possible use the cohort approach when describing current and future trends in longevity;
(ii) that official publications which set out estimates of projected life expectancy should ideally provide not only the best estimate but also the range of possible results which could arise from alternative reasonable assumptions; and
(iii) that pensions systems should be resilient in the face not only of rising life expectancy, but also of the large uncertainty of how rapid this rise will be.

Following consultation of the Commissions report and recommendations, the UK government has announced its intention of introducing legislation to raise the state pension age to 68 for males and females by 2046.

References


### Bibliography


___________________________

Adrian Gallop
Annex A

Figure 1. Annual improvement in smoothed mortality rates – males, UK

Figure 2. Annual improvement in smoothed mortality rates – females, UK
Annex B

Figure 3. Actual and projected annual improvement in smoothed mortality rates – females, UK

Figure 4. Actual and projected annual improvement in smoothed mortality rates – females, UK