CIMA

Apocalyptic demography?

Putting longevity risk in perspective

Pensions Institute

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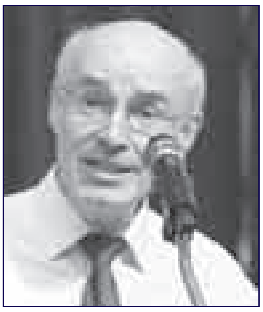
Putting longevity risk in perspective

'...if the life expectancy for a male currently aged 60 is understated by two years ...this could understate the value of his pension by around 5%'

The Pensions Regulator, December 2007

Authors



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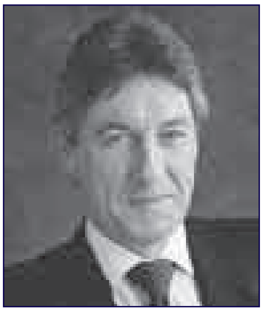

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Executive summary

Life expectancy differs from person to person, population to population and pension scheme to pension scheme. So, your scheme members' mortality experience will be unique. Age is its dominant determinant, but life expectancy is influenced by other factors including gender, geographical location, social class, pension size and occupation.

In order to help you understand the effects that these factors have on your scheme members' mortality, we look at issues that shape the current life expectancy of your members, and then separately, the trends in the rate of improvement in life expectancy.

Current life expectancy depends very much on demographic factors, particularly lifestyle, and varies from scheme to scheme, i.e. it is scheme specific. It is therefore very important that you understand where your scheme sits in the population of pension schemes as far as life expectancy is concerned.

We also look at the improving trend in mortality. UK life expectancy has nearly doubled over the past 150 years, increasing by 2 to 2.5 years a decade on average. These improvements have consistently exceeded official projections.

You need to understand the assumptions underlying your pension scheme's life expectancy projections. To help you, we present a range of views on future life expectancy. This range reflects both the uncertainty of life and the lack of a commonly accepted forecasting model.

Finally, we consider how you might quantify the risk in your mortality assumptions by looking at the impact varying the assumptions has on your scheme liabilities. For example, the Pensions Regulator estimates that two years of extra life could add 5% to the value of a defined benefit plan's liabilities. You need to decide whether the longevity risk in your pension scheme is material to your organisation and, therefore, of strategic importance. To help you, we introduce two categories of longevity risk (idiosyncratic and aggregate, see Section 4.1, pg 31) and discuss their financial implications.

If your scheme's longevity risk is material, you might want to seek specialist advice as to how you might manage it. Options include changing benefits, laying off some of the risks or buying out the pension liabilities.

In a consultation document issued in February 2008, the Pensions Regulator has indicated what it considers good practice when choosing assumptions for defined benefit pension schemes, with a specific focus on mortality, and proposes to exercise greater scrutiny where that is not met.

Inevitably you will need to discuss longevity assumptions with your actuary and to assist you in these discussions we have devised a checklist (see pg 53), focusing on three key areas: current life expectancy, projected life expectancy and longevity risk. The checklist is also available as a separate PDF. Please visit **www.cimaglobal.com/pensions**

Contents

1 **Introduction** 8

2 **Current life expectancy** 10
- 2.1 Gender 11
- 2.2 Geographical location . . . 11
- 2.3 Social class 14
- 2.4 Pension size 16
- 2.5 Industrial sector 18
- 2.6 Summary 18

3 **Projected life expectancy** 19
- 3.1 Trends 20
- 3.2 Biomedical opportunities 24
- 3.3 Projection methods 26
- 3.4 A range of views 27
- 3.5 Summary 29

4 **Longevity risk** 30
- 4.1 Idiosyncratic and aggregate longevity risk 31
- 4.2 The cost of longevity risk 32
- 4.3 A range of views 34
- 4.4 Fan charts 35
- 4.5 Managing longevity risk . . 38
  - 4.5.1 Understanding longevity risk 38
  - 4.5.2 Managing longevity risk 38
- 4.6 Summary 39

5 **Glossary** 40

6 **References** 44

About CIMA and the Pensions Advisory Group 50

About the Pensions Institute 51

Longevity risk checklist 53

Figures

Figure 1 Male life expectancy at birth: by local authority, 2004-06 12
Figure 2 Relationship between pension size and male mortality in self-administered pension schemes (SAPS) – relative to '00' series mortality – 2000-06 16
Figure 3 Life expectancy at age 65 in the UK 20
Figure 4 Record life expectancy from 1840 to 2000 for women 21
Figure 5 Percentage chance of survival to exact age: selected cohorts, males 22
Figure 6 The cohort effect: average annual rate of mortality improvement, England and Wales population, by age group and decade, males 23
Figure 7 Mortality rates in England and Wales for selected disease groups, 1911-2003 24
Figure 8 Accuracy of Office for National Statistics mortality assumptions; actual and projected period life expectancy at birth, UK males, 1966-2031 26
Figure 9 Some recent projections of life expectancy for 65 year old males 27
Figure 10 Variability in longevity for five males and five females, aged 65 31
Figure 11 Comparison of pension deficit using different mortality assumptions 33
Figure 12 Life expectancy assumptions reported in 2006 by FTSE100 companies for 65 year old males 34
Figure 13 Longevity fan chart for 65 year old males in England and Wales 35
Figure 14 Survivor fan chart for 65 year old males in England and Wales 36

Tables

Table 1 UK life expectancy, 2004-06 11
Table 2 Regional life expectancy in England, 2004-06 13
Table 3 Population life expectancy at age 65, by country 13
Table 4 Life expectancy in England and Wales at age 65: by social class and gender, 2002-05 14
Table 5 Definition of social class . . 15
Table 6 Mortality rates and pension size of male pensioners by industry group, 2000-04 18
Table 7 Impact of pension size and lifestyle on life expectancy of 65 year old males and females 29

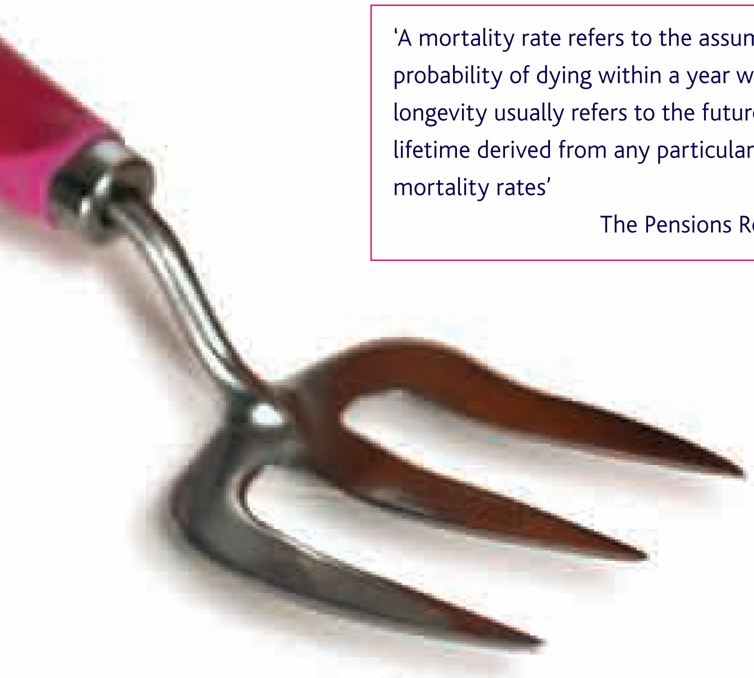
1 Introduction

This document has been prepared for finance directors of organisations with significant defined benefit (DB) pension liabilities. We know that managing DB scheme risks is a challenge high on many of your agendas. In our opinion, longevity risk – the risk that pension scheme members will live materially longer than assumed – is the most topical and challenging of those risks.

Defined benefit schemes are designed on the basis of reasonable assumptions about their members' mortality. But, from a sponsoring company's viewpoint, scheme members are increasingly behaving unreasonably. Human longevity is increasing faster than previously predicted. Could 'apocalyptic demography' undermine the financial viability of your DB scheme?

'A mortality rate refers to the assumed probability of dying within a year whereas longevity usually refers to the future expected lifetime derived from any particular set of mortality rates'

The Pensions Regulator, 2008



Many clever people – doctors, biologists, food scientists, physical fitness instructors, public health campaigners and social scientists – are working hard to extend the human lifespan. You might be unaware of continuing improvements in longevity. You might not know that further, substantial increases in longevity are possible in the foreseeable future.

In Section 2 (pg 10-18), we explore life expectancy based on current mortality experience. We consider different views on future life expectancy and discuss alternative projection methods in Section 3 (pg 19-29). We then discuss longevity risk – the uncertainty attached to estimates of the length of future lifetimes – and its potential financial consequences in Section 4 (pg 30-39). We also list some actions that can be taken to manage longevity risk.

In our report *The pension liability – Managing the corporate risk* (CIMA, 2008), we include a list of questions about longevity risk that we suggest you should ask your pension scheme actuary. We now present an enhanced list of questions in the *Longevity risk checklist* (see pg 53-59). We hope that this report will demonstrate why we consider these questions, and their answers, important, and we hope that it will assist you in explaining and communicating longevity risk to the relevant stakeholders in your organisation's DB scheme. Finally, it should help you to 'position' your scheme's longevity profile in relation to the available benchmarks; and to understand your actuary's reasons for the longevity assumptions chosen.

2 Current life expectancy

Ageing is not a biological necessity. Not all creatures age. The mortality rates of freshwater hydra and sea anemones, for example, do not increase with age (Kirkwood, 1999). So, it is just as well that neither hydras nor sea anemones are members of your pension scheme.

Humans age, but life expectancies differ from person to person, population to population and pension scheme to pension scheme. Your scheme members' life expectancy is unique. Age is the dominant determinant but life expectancy is influenced by many other factors: some genetic; some environmental.

This section looks at life expectancy based on current mortality rates. We explain how life expectancy is affected by such factors as gender, geographical location, social class, pension size and occupation, in addition to age.

All of the tables and figures in this section are based on current, or the most recently available, mortality data (as at April 2008).

2.1 Gender

If mortality rates remain as they were in 2004-06, we can expect 65 year old UK male pensioners to live a further 16.9 years and 65 year old women a further 19.7 years (ONS, 2007b).

Why don't men live as long as women? (It was not always this way; in the 19th century, male life expectancy was little different from that of females.) Possible reasons include higher rates of smoking, greater exposure to occupational hazards, more deaths from accidents and violence, and greater susceptibility to death from heart disease (Tuljapurkar and Boe, 1998).

2.2 Geographical location

Table 1 shows expected future lifetimes in years for males and females at birth and at age 65 for the constituent countries of the UK.

Table 1 UK life expectancy, 2004-06

	At birth		At age 65	
	males	**females**	**males**	**females**
Scotland	74.6	79.6	15.8	18.6
Northern Ireland	76.1	81.0	16.6	19.5
Wales	76.6	80.9	16.7	19.5
England	77.2	81.5	17.1	19.9
United Kingdom	**76.9**	**81.3**	**16.9**	**19.7**

Source: Office for National Statistics (2007b), *Life expectancy continues to rise*

This table demonstrates that, in the UK, life expectancy is highest in England and lowest in Scotland. Females have higher life expectancy than males in all countries.

2 Current life expectancy

Figure 1 Male life expectancy at birth: by local authority, 2004-06

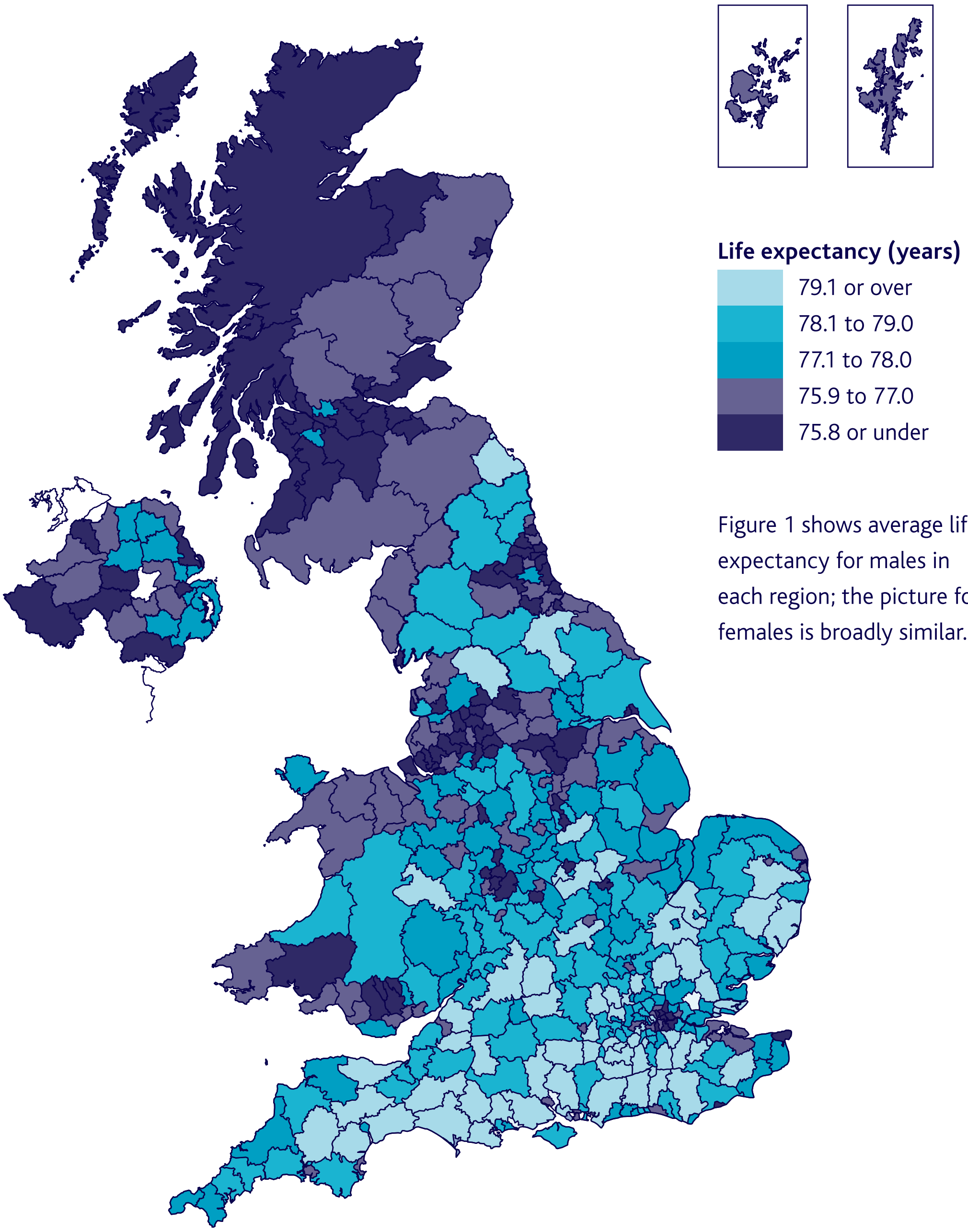


Figure 1 shows average life expectancy for males in each region; the picture for females is broadly similar.

Source: Office for National Statistics, *Subnational life expectancy – life expectancy at birth by local authority, 1992-2005*

Table 2 Regional life expectancy in England, 2004-06

	At birth		At age 65	
	males	females	males	females
North East	75.8	80.1	16.2	18.8
North West	75.7	80.3	16.3	19.1
Yorkshire and The Humber	76.6	81.0	16.8	19.6
East Midlands	77.3	81.3	17.1	19.7
West Midlands	76.6	81.1	16.8	19.7
East of England	78.3	82.3	17.6	20.3
London	77.4	82.0	17.5	20.3
South East	78.5	82.4	17.9	20.5
South West	78.5	82.7	17.9	20.8
England	**77.2**	**81.5**	**17.1**	**19.9**

Source: Office for National Statistics (2007d), *Health Statistics Quarterly*

UK life expectancy also varies by region, as illustrated by Figure 1 and Table 2.

Is there a North/South divide? Almost: as Tables 1 (pg 11) and 2 (pg 13) and Figure 1 (pg 12) show, the lowest life expectancies are found in Scotland and the North East and North West of England. The South East, South West and East of England have the highest life expectancies.

The local authority with the highest male life expectancy at age 65 in 2004-06 was Kensington and Chelsea (22.0 years); 8.2 years more than Glasgow City. Kensington and Chelsea also had the highest life expectancy for 65 year old females (24.8 years); 7.5 years more than Glasgow City (ONS, 2007c).

Table 3 shows that UK life expectancy at age 65 is modest compared to that of the other 'Group of Eight' nations. Willets et al (2004) attribute this mediocre UK performance to high death rates from circulatory disorders, particularly heart disease, and poor cancer survival rates.

Table 3 Population life expectancy at age 65, by country

	At age 65	
	males	females
Japan	18.1	23.1
Canada	17.3	20.6
France	17.1	21.3
Italy	17.1	20.9
UK	16.9	19.7
USA	16.7	19.4
Germany	16.3	19.5
Russia	11.1	15.2

Source: Paternoster (2006) and, for the UK, Office for National Statistics (2007b), *Life expectancy continues to rise*

2.3 Social class

Socioeconomic status has a big influence on life expectancy; Table 4 shows life expectancy at age 65, by social class*, in England and Wales for 2002-05.

Table 4 shows that, for both men and women, there is a social gradient such that those in the unskilled manual class have the lowest life expectancy and those in the professional class the highest.

Social class reflects a person's affluence, education, lifestyle and position in society. Money buys you healthy food, good housing and better medical treatment. Education provides you with knowledge about health risks and healthy behaviour. Social capital helps you when you need information, connections and emotional and practical support (Hoffman, 2005). Such support may be one reason why married people live longer than single people (Tuljapurkar and Boe, 1998).

* For definitions of each class, see Table 5, pg 15

Table 4 Life expectancy in England and Wales at age 65: by social class and gender, 2002-05

Class description		males	females
Non-manual			
I	Professional	18.3	22.0
II	Managerial and technical/intermediate	18.0	21.0
IIIN	Skilled non-manual	17.4	19.9
Manual			
IIIM	Skilled manual	16.3	18.7
IV	Partly skilled	15.7	18.9
V	Unskilled	14.1	17.7
All		**16.6**	**19.4**

Source: Office for National Statistics (2007a), *Variations persist in life expectancy by social class*

Table 5 Definition of social class

Class description		Examples of occupation
Non-manual		
I	Professional	Doctors, chartered accountants, professionally qualified engineers
II	Managerial and technical/intermediate	Managers, school teachers, journalists
IIIN	Skilled non-manual	Clerks, cashiers, retail staff
Manual		
IIIM	Skilled manual	Supervisors of manual workers, plumbers, electricians, goods vehicle drivers
IV	Partly skilled	Warehousemen, security guards, machine tool operators, care assistants, waiters and waitresses
V	Unskilled	Labourers, cleaners and messengers

Source: Office for National Statistics (2007a), *Variations persist in life expectancy by social class*

Those in the lower social classes are more likely to smoke, consume excessive amounts of alcohol, eat unhealthy food and not exercise (Ageaction, 2007). They also participate less in social networks, receive less social support and are more pessimistic (Stansfeld and Marmot, 1992). Yet, the average life expectancy of a female manual worker still exceeds that of the highest status male.

Because people who live in the same residential district tend to come from a similar social class, postcode tends to be a good guide to life expectancy. In recent years, it has become standard practice to use postcodes for pricing bulk annuities and, in November 2007, Legal & General announced that it would use customers' postcodes as an additional risk factor in determining pension annuity income (Legal & General, 2007).

Members of defined benefit pension schemes tend to live longer than other members of the general population (Paternoster, 2007). So, when estimating scheme members' longevity, UK pension actuaries tend to use mortality data collected and published by the Continuous Mortality Investigation (CMI) of The Actuarial Profession (with suitable adjustments to reflect any significant differences in the mortality experience of specific schemes), rather than Office for National Statistics' (ONS) population data.

The most recent CMI actuarial tables are the '00' series. They became effective from 1 September 2006 and are founded on mortality data centred on the year 2000. Based on the mortality rates recorded in the '00' series tables, 65 year old men and women have life expectancies of, respectively, 18.4 years and 20.9 years (CMI, 2007b); right at the top end of UK population life expectancy.

We know that blue collar workers tend to earn less than white collar workers and Table 4 (pg 14) shows that they also have lower life expectancies. It is also true that those with the smallest pensions will be those with the lowest life expectancy; and the pension scheme members of companies with predominantly manual workers, such as those in heavy industries, will have lower life expectancies than those of companies which employ many non-manual workers, such as those in service industries.

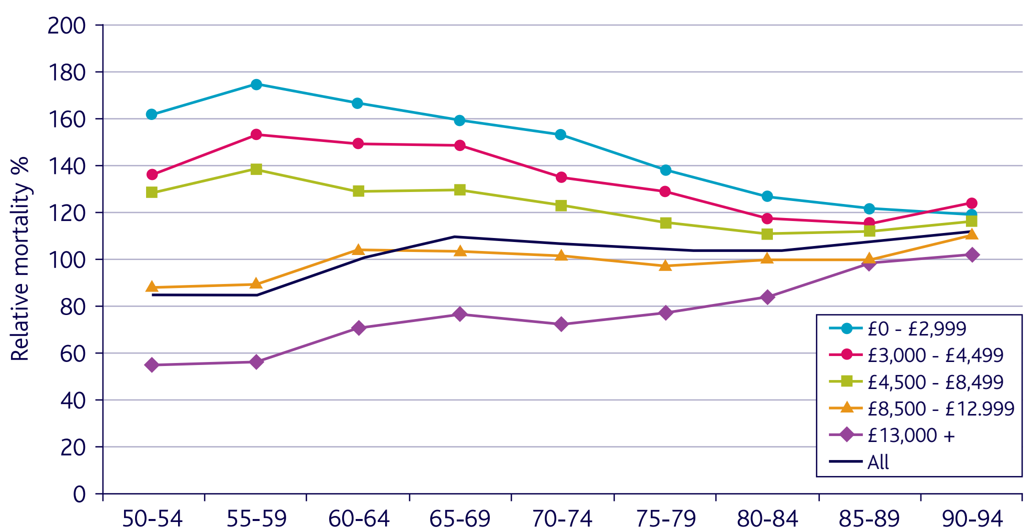
2.4 Pension size

The mortality data in the CMI actuarial tables are collected from life assurance companies, and the pensioner tables used by most pension scheme actuaries record the mortality experience of pensioners in insured group schemes.

The mortality experience of these pensioners, who are generally from the higher socioeconomic groups, differs from that of members of occupational pension schemes. Although, for a long time, this was the only data available and so they were used by pension scheme actuaries to determine mortality assumptions in occupational pension schemes as well.

Recently, however, the CMI has begun a study of the mortality experience in occupational pension schemes. The study is called the 'self-administered pension schemes' or 'SAPS' study. It contains mortality data from a sample of self-administered pension schemes with at least 500 pensioners covering the period 2000-06 (CMI, 2008). In January 2008, the CMI published draft actuarial tables based on the mortality rates of pensioners in the SAPS study.

Figure 2 Relationship between pension size and male mortality in self-administered pension schemes (SAPS) – relative to '00' series mortality – 2000-06



* Relative mortality %: Actual death rate of male pensioners in the SAPS study as a percentage of that expected on the basis of the '00' tables. Note: '00' series mortality set at 100 in each age band. Source: CMI (2008, Chart 11)

The SAPS study provides evidence that life expectancy varies with pension size. Figure 2 (pg 16) compares the actual mortality experience of male pensioners in the SAPS study with that expected on the basis of the mortality data in the '00' series tables, with the '00' series data scaled to be 100. Both the SAPS study data and the '00' series data, underlying Figure 2, were based on amounts of pension paid. The CMI also produces mortality data based on pensioner lives.

The vertical axis in Figure 2 (pg 16) records the actual death rate of male pensioners in the SAPS study as a percentage of that expected on the basis of the '00' tables; and the horizontal axis shows their age band. For example, the mortality rate of males aged 50 to 54 with an annual pension of less than £3,000 was 160% of that expected on the basis of the '00' tables.

Figure 2 (pg 16) reveals that those men in the SAPS study sample who received a pension of less than £8,500 a year experienced higher than average mortality and those receiving more than £13,000 a year experienced lower than average mortality, in comparison with the insured lives underlying the '00' series. The relationship between pension size and mortality is strongest at age 50 to 59 and it diminishes significantly at higher ages. Note that mortality rates are fairly low in absolute terms in the 50 to 59 age band, so the apparently large relative differences in the figures imply only small differences in absolute terms; the opposite holds at higher ages because absolute mortality rates are higher and small relative differences imply big absolute differences.

This effect was also present for female pensioners, although the size of their pensions was smaller.

The SAPS study also reveals that, based on recent mortality rates, the life expectancy of SAPS pensioners is lower than that of pensioners in insured schemes. This can be seen by examining the dark blue line in Figure 2 which rises above the 100 line for ages above 60. As we previously mentioned, this is because there are more blue collar workers in the SAPS sample. It reinforces our earlier point that life expectancy differs from population to population and that your pension scheme members' life expectancy is unique.

2.5 Industrial sector

Table 6 confirms that life expectancy varies by reference to industrial sector. As in Figure 2 (pg 16), the actual mortality ('A') of male pensioners in the SAPS study is compared to that expected ('E') on the basis of the '00' series mortality data, with the '00' series data scaled to be 100%. The data were averaged by amount of pension.

Table 6 also shows average pension size for the different sectors. It reveals a negative relationship between relative mortality and pension size. A regression of the second column on the third column has a statistically significant (at the 10% level) slope coefficient of -0.0016. This suggests that a scheme member with a pension £1000pa higher than that of another member has a mortality rate that is typically 1.6% lower.

Although pension size is a potentially useful indicator of an individual's life expectancy, it can be misleading unless we have complete information about all the pensions that the individual has; many people have pensions from different sources and the CMI studies are not always able to link individuals to all their pension pots. Social class is, therefore, probably a better guide to life expectancy than pension size.

Table 6 Mortality rates and pension size of male pensioners by industry group, 2000-04

Sector	100 A/E '00' series	Average pension size £ per annum
Financials	98	13,471
Miscellaneous	100	5,512
Utilities	109	8,690
Non-cyclical consumer goods	111	6,446
Cyclical consumer goods	113	3,496
IT	114	9,642
General industries	116	4,178
Local authorities	119	5,056
Basic industries	124	5,840
Cyclical services	124	5,649

Source: CMI (2007a, Tables N and P)

2.6 Summary

Life expectancy differs from population to population. Your pension scheme members' life expectancy is influenced by factors such as their age, gender, geographical region, social class, pension size and the industrial sector in which your organisation operates. Age is the dominant determinant of life expectancy, followed by gender and social class.

Some of these factors overlap. For example, both social class and pension size reflect a person's affluence and lifestyle. Official statistics define a person's social class by reference to their occupation which, in turn, is often related to the industrial sector within which they work.

In order to get a deeper understanding of the life expectancies of your pension scheme members, it is useful to quantify these factors – age, gender, geographical region, social class, pension size and industrial sector for your own scheme.

In Section 3 (pg 19-29), Projected life expectancy, we will consider whether these differences in life expectancy are likely to persist throughout your pension scheme members' lifetimes.

3 Projected life expectancy

We explored life expectancy based on current, or recent, mortality rates in Section 2 (pg 10-18). This should have given you an understanding of some of the factors that currently influence life expectancy. However, if mortality rates continue to fall as they have in the past, life expectancy based on current mortality rates will be of limited use to you in estimating your pension scheme's costs and liabilities.

3 Projected life expectancy

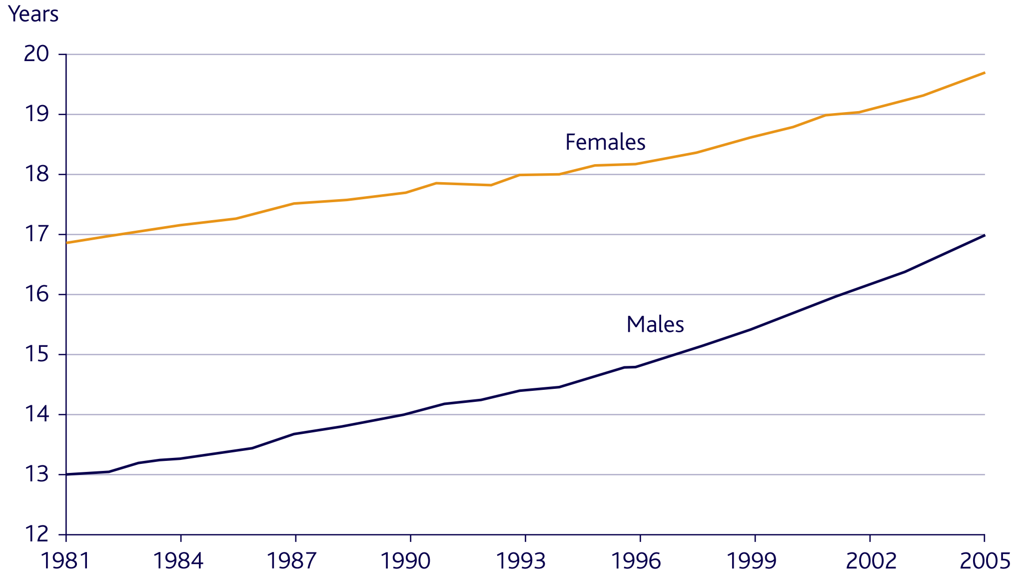
In this section, we review past trends in life expectancy, discuss opportunities for future advances and consider alternative life expectancy projections.

3.1 Trends

Figure 3 reveals that life expectancy at age 65 in the UK has risen steadily since 1981 and is now at its highest level ever for both men and women. If UK mortality rates remain as they were in 2004-06, men aged 65 can expect to live a further 16.9 years and women of that age a further 19.7 years.

Between 1980-82 and 2004-06, life expectancy at age 65 in the UK increased by 4.0 years for men and by 2.8 years for women. Around one-quarter of this increase occurred over the last four years (ONS, 2007b). So, as Figure 3 reveals, the difference between the life expectancies of men and women is narrowing.

Figure 3 Life expectancy at age 65 in the UK



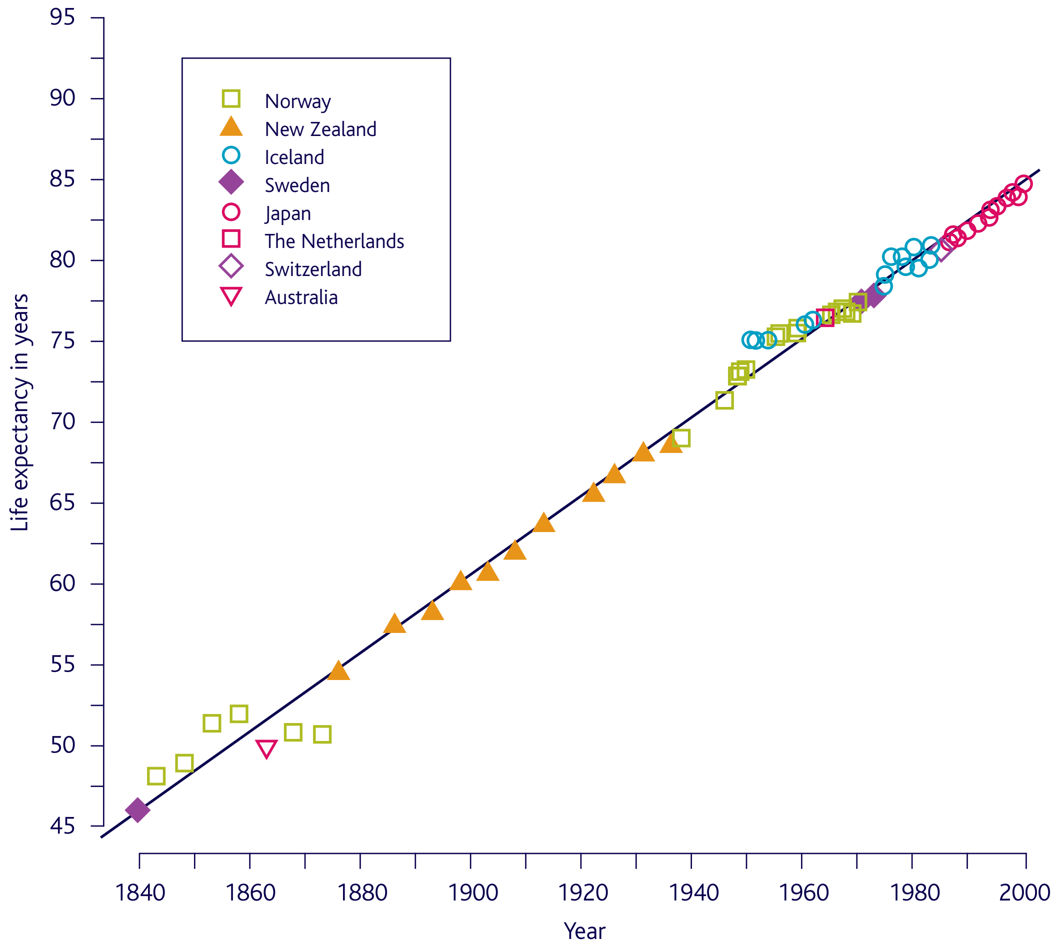
Source: Office for National Statistics (2007b), *Life expectancy continues to rise*

Figure 4 shows that this rising life expectancy trend has persisted for over 150 years, during which time average human life expectancy within industrialised countries has nearly doubled, increasing, on average, by 2.5 years per decade for females and by 2.0 years a decade for males. (For the purpose of Figure 4, life expectancy is the mean age at death under mortality conditions ruling at the time.)

Figure 4 shows the country that had the highest recorded life expectancy for the female population in a particular year. In 1840, for example, Sweden held the highest globally recorded life expectancy for females.

Since about 1840, record life expectancy has risen at an average rate of around three months per year: from 45 years for Swedish women in 1840 to 85 years for Japanese women in 2000.

Figure 4 Record life expectancy from 1840 to 2000 for women

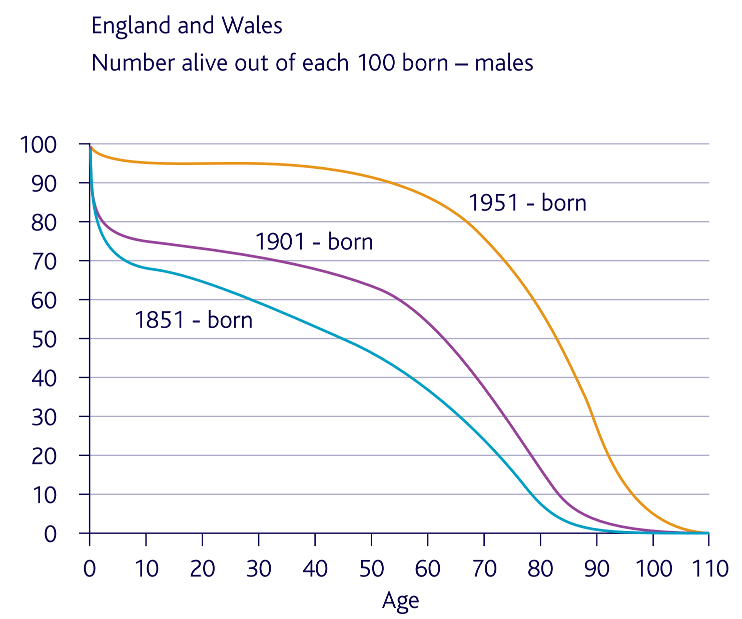


Source: Supplemental material of Oeppen and Vaupel (2002) (R^2 = 99.2%).

3 Projected life expectancy

Rising life expectancy has had a dramatic effect on the cost of pension provision. As Figure 5 demonstrates, only about 35% of those born in England and Wales in 1851 reached retirement age; whereas over 80% of those born in 1951 can expect to pick up their pensions. Some experts are now predicting that as many as 50% of today's 30 year olds could live to age 100 (Paternoster, 2007).

Figure 5 Percentage chance of survival to exact age: selected cohorts, males



Source: Office for National Statistics (2005, page 86; 1951 cohort includes a projection beyond current age of 54 in 2005), *Focus on people and migration*

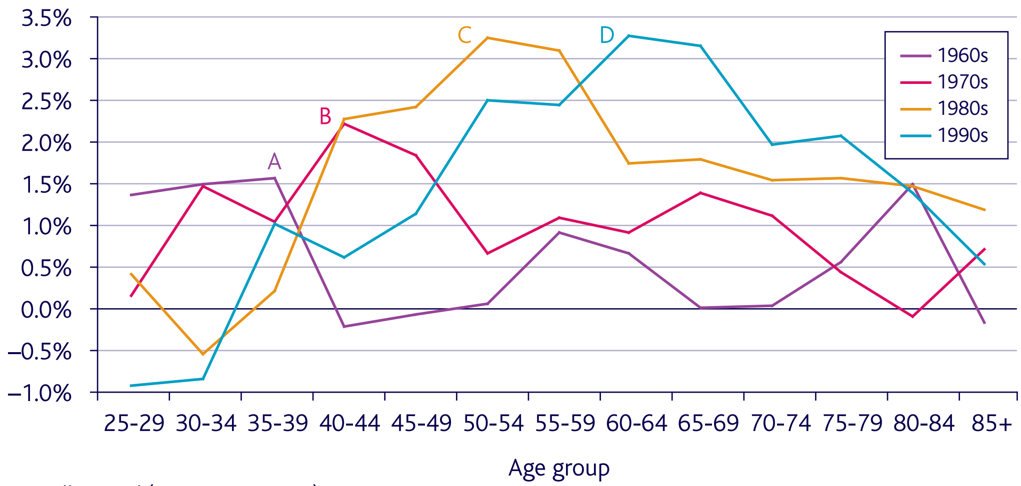
Figure 5 shows that the increase in life expectancy was originally, to a large extent, due to a reduction in infant and child mortality; the 1951 cohort does not exhibit the drop in the survival curve between age 0 and 16 experienced by the 1851 and 1901 cohorts. Infant mortality rates at the beginning of the 20th century were nearly 30 times higher than those at the end; and childhood mortality rates were over 50 times higher (Griffiths and Brock, 2003).

In the second half of the century, there was a decline in mortality among middle-aged and older people; so, the survival curve for the 1951 cohort is more 'rectangular' than the other curves. The increasing 'rectangularisation' of survival curves over time suggests that many more people will live to very old age in the future but then will die off in a narrow age band.

The mortality rates of UK pensioners declined rapidly in the last quarter of the century; between 1979 and 2003, death rates fell by 41% for men aged 65 to 84 and by almost a third for women of that age (ONS, 2006a).

A feature of the increase in UK life expectancy has been, what the ONS and the CMI term, the 'cohort effect': a higher than average rate of improvement in mortality rates for generations born in the UK between 1925 and 1945, centred on the generation born in 1931 (GAD, 2001). Figure 6 (pg 23) illustrates the cohort effect by showing the generations that have experienced the greatest improvements in mortality over the last four decades of the 20th century.

Figure 6 The cohort effect: average annual rate of mortality improvement, England and Wales population, by age group and decade, males



Source: Willets et al (2004, Figure 2.15a)

In Figure 6, each decade (1960s-1990s), as represented by each coloured line on the graph, is shown against the average annualised mortality improvement rates in five year age bands.

In the 1960s, men in England and Wales in their 30s saw the biggest mortality improvement rates (A), in the 1970s this same cohort, now in its 40s, again saw the biggest improvement (B). This continued in the 1980s (C) and 1990s (D), making this generation of men born in the 1930s the 'golden cohort', living longer than those cohorts born before or after. Figure 6 therefore shows that this cohort experienced the biggest mortality improvements, compared with younger and older generations.

This cohort has reached what has been 'old age' in unprecedented good health: '70 is the new 50'. Old age is undergoing a profound transformation, despite the higher prevalence of age-associated conditions such as Alzheimer's disease and osteoporosis. So, ageing seems to be malleable (Kirkwood, 2007).

3.2 Biomedical opportunities

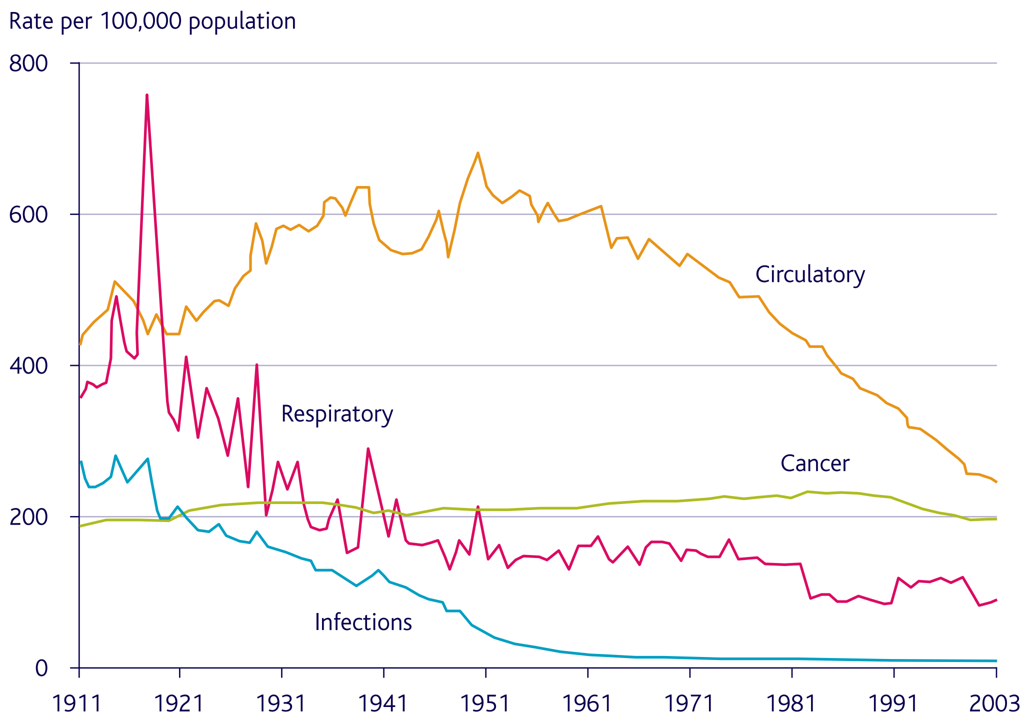
If it is malleable, we should be able to further delay ageing. Biologists have successfully extended the life span of yeast, nematode worms, fruit flies and mice. Now they want to do the same for us.

The consensus is that ageing is due to the lifelong, gradual accumulation of a variety of molecular faults in the cells and organs of our bodies. About a quarter of the variation in lifespan is attributable to genetic differences (Hershkind et al., 1996). But there is no death gene. Genes do not control clock-like timing mechanisms. Rather, they influence the activity of cellular maintenance systems, such as DNA repair and antioxidant defence (Kirkwood, 2007).

Another quarter of the difference in life expectancy is thought to be due to non-genetic factors that are fixed by the age of 30, with the other half due to environmental factors occurring thereafter (Vaupel et al., 1998). Social scientists want to better understand how they can reduce this part of the variation in life span attributable to non-genetic causes. They believe that the factors influencing longevity include nutrition, lifestyle (including exercise), education, housing, employment and the nature of work (Kirkwood, 2007).

Figure 7 shows the four disease groups with the highest mortality rates.

Figure 7 Mortality rates in England and Wales for selected disease groups, 1911-2003



Source: Office for National Statistics (2006b, pg 14), *Focus on health*

Scientists believe that ageing can, to an extent, be counteracted by 'maintenance and repair factors' that slow down the rate at which tissues and organs deteriorate and keep the body healthy. Even if risk factors are present, boosting maintenance factors may render a person less likely to develop an age-related disease. Conversely, if a person is exposed to adverse factors that exacerbate the accumulation of cellular damage, such as poor nutrition and stress, then the early onset of age-related diseases is more probable.

Figure 7 (pg 24) highlights the success the scientific and medical professions enjoyed in reducing deaths from infections.

Today, circulatory diseases (which include heart disease and strokes), respiratory diseases and cancer remain the most common causes of death in the UK. There is a gradient of increasing mortality from these causes between unskilled manual workers and professionals (ONS, 2006b). Progress in curing these diseases has been greatest for the circulatory diseases, followed by the respiratory diseases, with little sign of a cure for cancer on the horizon. Since we have to die of something, it is most likely to be cancer for the foreseeable future.

Research on fruit flies shows that the likelihood of dying decreases at very old age. If applicable to humans, this suggests that there might be a specified age, perhaps around 65 to 75, during which we are particularly vulnerable to fatal diseases. If we can survive this 'bottleneck', we are likely to experience a reduction in mortality rates (Friedland, 1998). This might be nothing more than the 'rectangularisation' of the survivor curve, discussed previously, but it could lead to an increase in the human lifespan.

According to Willets et al (2004), developments such as the decoding of the human genome and stem cell research have the potential to yield increasingly more significant gains in life expectancy. Some scientists claim that we will see the fruits of their anti-ageing research within just a few decades. So, some experts think it highly probable that, within this timescale, life expectancy at retirement will actually surge upwards (Willets et al, 2004, paragraph 6.1.2).

It is impossible to know how biomedical advances might affect the different factors that influence life expectancy, but their effects might be significant. We know that the main factors affecting longevity are environmental, rather than genetic. We also know that the medical profession and social scientists are actively trying to remedy those environmental factors that they believe contribute to the comparatively high UK mortality rates. Reducing inequalities in health between the social classes is a government priority. Specific targets have included reducing mortality rates in people under the age of 75, by 2010: from heart disease by at least 40% and from cancer by at least 20% (Department of Health, 2002). So, there must be a good chance that, in the next 25 years or so, the differences in longevity between the sexes and the social classes will narrow.

The introduction of the ban on smoking in pubs, for example, and the implementation of the recent suggestion that all men over 50 should be given a daily dose of the cholesterol-reducing drug 'statins' are likely to have much bigger effects on the mortality rates of male manual workers than on female professionals.

Such developments help demonstrate why projecting life expectancy is so difficult.

3 Projected life expectancy

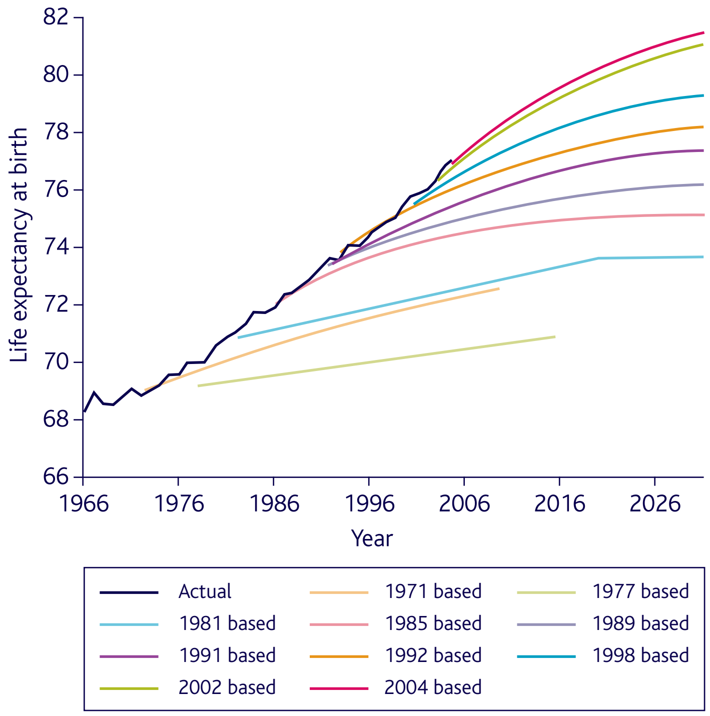
3.3 Projection methods

Life expectancy can be expressed as a mathematical function of mortality rates by age. Indeed, it equals the sum of one minus the mortality rate at each age from the projection age until the maximum death age (usually set at 120).[1] So, the usual way of estimating life expectancy is to project age-specific mortality rates into the future and then use the results to compute life expectancy projections (Wilmoth, 2000).

If, as Figure 4 (pg 21) suggests, the trend is linear, projecting life expectancy should be easy. But, as Figure 8 illustrates, UK life expectancy projections have consistently underestimated future mortality improvements. Indeed, projections were actually reduced in the early 1970s, with the 1977 based projection being the most pessimistic.

The ONS distinguishes 'extrapolative' projection methods from 'process based' and 'explanatory' methods (GAD, 2001).

Figure 8 Accuracy of Office for National Statistics mortality assumptions; actual and projected period life expectancy at birth, UK males, 1966-2031



Source: Shaw (2007, pg 16)

[1] E.g. Life expectancy at 65 = 0.5 + (1-q65) + (1-q65)*(1-q66) + (1-q65)*(1-q66)*(1-q67) + ...+ (1-q65)* ... *(1-q120) and q120 is typically set to unity and q65 is the mortality rate at age 65 etc.

Extrapolative methods project historical mortality trends into the future. There are numerous ways in which this can be done, but all include an element of subjective judgement. Extrapolative methods can be either 'deterministic', meaning that one set of projected rates based on a predetermined set of parameters is produced, or 'stochastic', meaning that the projected rates contain a random or unpredictable element.

Process based methods employ models based on biomedical processes. They are not currently much used, partly because the processes causing death are not well understood and, partly because of difficulties in accurately identifying and recording the correct cause of death (there is often more than one). Scientific and medical advances may increase their relevance.

Explanatory based or 'causal' methods use models based on economic causes of mortality such as social class. Again, they are rarely used in official projections because the economic causes of mortality are not well enough understood or because the underlying data are unreliable.

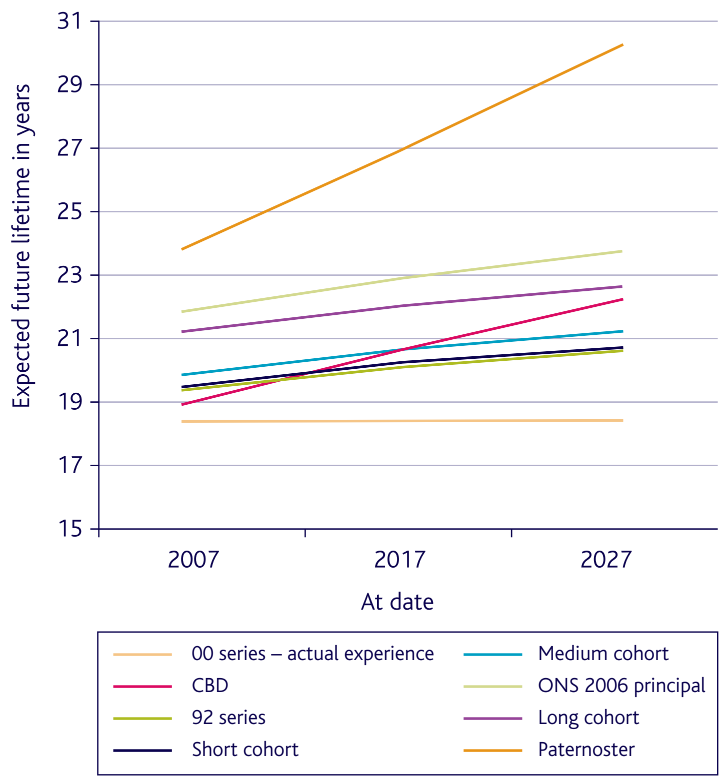
Extrapolative methods will only be reliable if the past trends continue. Advances in medicine or the emergence of new diseases can invalidate extrapolative projections by changing the trend and, as with all extrapolative methods, it takes time for the data to differentiate between a genuine change in trend and a couple of outliers around an otherwise unchanged trend.

3.4 A range of views

Figure 9 draws together some recent projections of life expectancy for 65 year old males.

This range of views reflects both the uncertainty of lifetimes and the lack of an agreed forecasting method. Some of the projections are for populations (of the UK or England and Wales) and some are for pensioners in insured group schemes.

Figure 9 Some recent projections of life expectancy for 65 year old males



Sources: Pensions Institute calculations – data sources: CMI (2007b), Cairns et al. (2006) for the CBD projection, Paternoster (2007) for the Paternoster projection

3 Projected life expectancy

We have used the '00' series actual experience line (male life expectancy of 18.4 years) in Figure 9 (pg 27) to reflect the view, held by demographers such as Olshansky, that life expectancy is about to plateau. And, indeed, US mortality rates do seem as if they might have begun to plateau at higher ages (Willets et al, 2004). Demographers cannot explain this, but, perhaps unsurprisingly, many of those who believe that there are biological limits to the human lifespan live in the US. Obesity may be one explanation for the poor US performance and some commentators believe that increasing obesity, new diseases, global warming, weapons of mass destruction and biological limitations (the human frame just cannot go on forever) will halt increasing longevity.

The CBD projection, in Figure 9 (pg 27), refers to the Cairns-Blake-Dowd stochastic mortality projection model (Cairns, Blake and Dowd, 2006). This uses population mortality data for England and Wales and is based on the observation that, at high ages, the percentage change in mortality rates is linearly increasing with age. It projects one of the sharpest increases in life expectancy because it takes into account in its projection the fact that mortality has been improving more rapidly in recent years.

The '92' series projection, in Figure 9, refers to the single projection of life expectancy incorporated into the '92' series tables. These preceded the '00' series and were based on mortality experience centred on 1992.

To date, partly because of the cohort effect, actual mortality improvements have exceeded those of the '92' series projection. So, in 2002, the CMI published the 'short', 'medium' and 'long' 'interim cohort projections'. These adjust the '92' series projection and reflect three different views about how long the cohort effect will continue. All three projections assume that the cohort effect will start to fade away from 2000; and they assume that it will disappear completely by 2010, 2020 and 2040, respectively.

In consultation documents issued in February 2008, the Pension Protection Fund (PPF) has decided that, in future, its levy should be based on a mortality assumption of medium cohort with a 1% underpin (see Glossary pg 42) and the Pensions Regulator is proposing that recovery plans, based on valuations with effective dates from March 2007, which contain mortality assumptions that are weaker than the long cohort projection, or that assume that the rate of improvement tends towards zero and do not have some form of underpin, will attract further scrutiny (the Pensions Regulator, 2008).

The ONS 2006 principal projection, in Figure 9 (pg 27), refers to the ONS principal longevity projection based on 2006 data for England, Wales and Northern Ireland.

The 'Paternoster' projection reflects a scenario used for capital adequacy modelling purposes in which 50% of today's 30 year olds will live to 100 (Paternoster, 2007).

Richards (2008) has developed a model of life expectancy based on both pension size and lifestyle (where the latter is proxied by postcode). He claims that his model explains socio-economic differences in life expectancy better than models based on pension size or lifestyle alone.

Table 7 shows the combined effect of both pension size and lifestyle on the life expectancy of 65 year old males and females based on the data in a combined portfolio of life-office pensioners and members of defined benefit schemes.

To put the values in Table 7 into context, the equivalent life expectancy using the '00' series tables is 18.4 years for males and 20.9 years for females. Table 7 suggests that the differences in life expectancies are even greater when a more complete range of socio-economic factors are taken into account.

Table 7 Impact of pension size and lifestyle on life expectancy of 65 year old males and females

Gender	Pension size	Lifestyle	Life expectancy (years)
Female	Highest	Upper	22.88
Male	Highest	Upper	20.23
Male	Highest	Lower	18.56
Male	Middle	Lower	17.06
Male	Lowest	Lower	15.62

Source: Richards (2008)

3.5 Summary

UK life expectancy increased steadily during the 20th century and, today, there is a range of views about the likelihood of any future increases. This reflects both the uncertainty of life and the lack of an accepted longevity forecasting model.

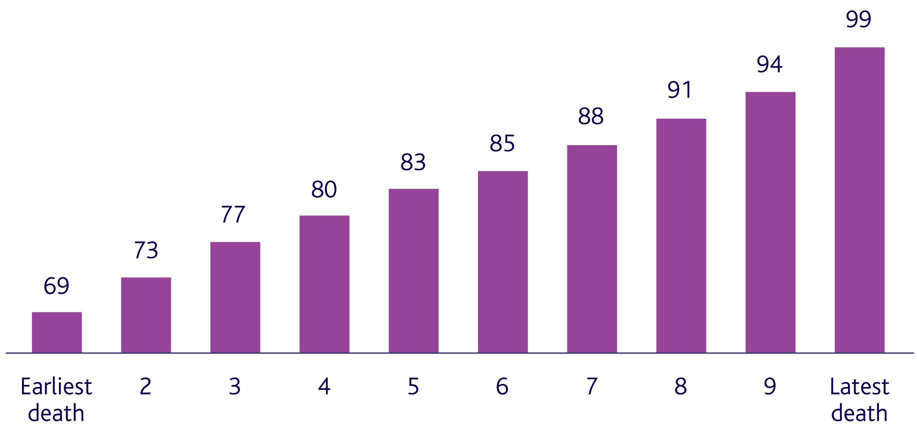
Willets et al (2004) suggest that there is 'clear potential for further significant improvements in longevity' (paragraph 3.6.1) and that it 'is impossible to argue that we are hitting some kind of biological barrier that is going to prevent further improvements. Moreover, the potential for further improvements is greatest for ages 60 to 80', i.e. pensioners; and, they might have added, for those in the lower social classes.

In the next section, we explore what this might mean for your pension scheme's cost.

4 Longevity risk

Increased life expectancy raises the cost of pension provision. However, if the increase is fully anticipated, you can respond by, for example, requiring your scheme members to pay higher contributions when they are in work or to work longer before retiring. They might not like either prospect, but you can use such methods, separately or in combination, to maintain the viability of your pension scheme.

Figure 10 Variability in longevity for five males and five females, aged 65



Source: Benartzi (2007)

4.1 Idiosyncratic and aggregate longevity risk

So it is not the increase in life expectancy per se that threatens the viability of your pension scheme, rather, it is the uncertainty about how long your scheme members are going to live after they retire that is the problem.

Figure 10 shows likely ages at death for a random selection of ten individuals – five men and five women – aged 65 (it is based on US unisex annuity rates). The earliest expected death is at age 69, while the latest is at age 99, thirty years later. Now it is likely that the men will be concentrated amongst the earlier deaths and women will be overrepresented amongst the later deaths, but the figure shows clearly that it is virtually impossible to predict with any accuracy when a particular individual will die; this is what is meant by longevity risk.

We can draw a distinction between 'idiosyncratic' or 'individual' longevity risk and 'aggregate' or 'collective' longevity risk (King, 2004).

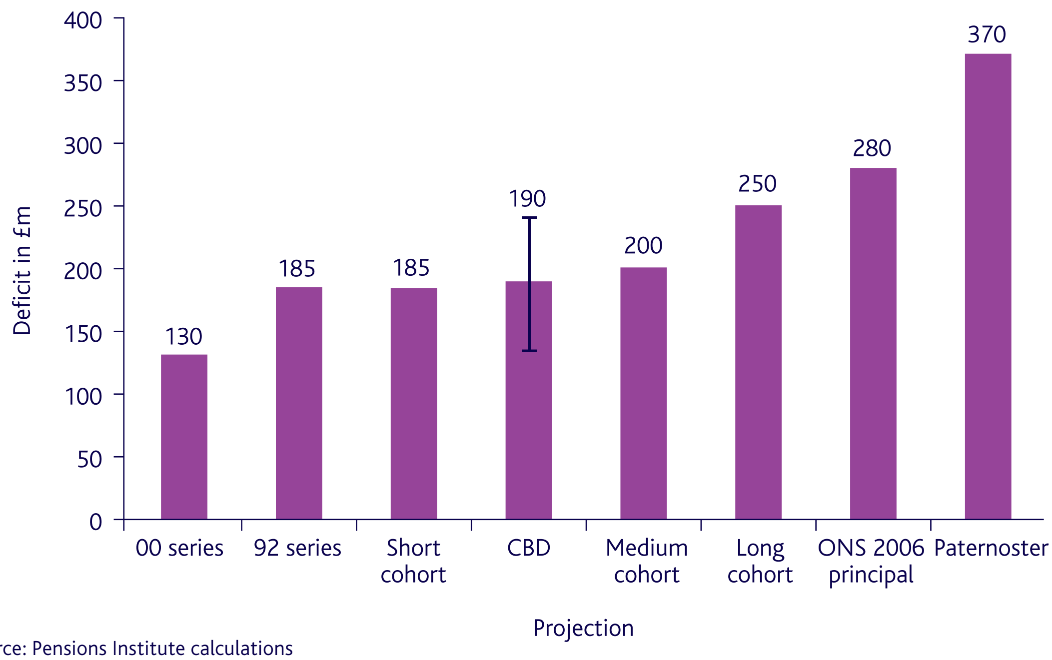
Idiosyncratic longevity risk arises because life expectancy differs from person to person: we do not know at what age any specific individual will die. Figure 10 (pg 31) illustrates idiosyncratic longevity risk – the uncertainty attached to the timing of an individual's death. Idiosyncratic longevity risk is manageable because it can be eliminated by risk pooling, performed by annuity providers. They sell annuities to lots of different people, realising that some annuitants will die early, creating a so-called 'mortality profit' that helps to pay for those who live longer than average. If the ten 65 year olds died precisely at the ages depicted in Figure 10 (pg 31), an annuity provider, such as a life office, could still make a profit from selling annuities even if it did not know in advance which annuitant would die when.

Aggregate longevity risk arises because of the uncertainty surrounding the life expectancy of a whole generation or cohort. Aggregate longevity risk is a problem because it is currently very hard to hedge this risk. It is the difficulty in obtaining aggregate longevity risk insurance that has contributed to the sharp decline in private sector provision of defined benefit pensions (King, 2004).

4.2 The cost of longevity risk

If your organisation has a DB pension scheme, its cost will be highly sensitive to changes in longevity assumptions. We can illustrate the financial consequences of different life expectancy assumptions diagrammatically. Consider a pension scheme with assets of £800 million, liabilities with a present discounted value of £1 billion, calculated using the medium cohort projection, and therefore a deficit of £200 million. Figure 11 (pg 33) shows you what the deficit might be if the liabilities were valued on the basis of the other longevity assumptions shown in Figure 9 (pg 27).

Figure 11 Comparison of pension deficit using different mortality assumptions



Source: Pensions Institute calculations

The calculations which underlie Figure 11 are crude. In particular, they make little allowance for the specific characteristics of a pension plan's membership, but they should give you a feel for the effect of longevity risk. The Pensions Regulator in *The purple book* (2007) estimates that each year of extra life adds about 3% to the value of a defined benefit plan's liabilities; the differences in Figure 11 are broadly consistent with this estimate.

Figure 11 uses best estimate (i.e. most likely) longevity projections to illustrate the potential financial consequences of aggregate longevity risk. The uncertainty surrounding future longevity is now such that the '00' series of actuarial tables does not incorporate any specific projections of future mortality. Pension actuaries are, instead, expected to consider a range of scenarios when estimating life expectancy. To help them, the CMI published a library of mortality projections in November 2007 (CMI, 2007b). The highest projected life expectancies in the draft library are 26.0 years for 65 year old men and 31.8 years for 65 year old women in 2007.

You need a best estimate longevity assumption for accounting and regulatory purposes. For all other purposes, when considering longevity risk, you should take into account a range of possible future life expectancies rather than focus on single number best estimates. Do not think about a pension deficit of £190 million, to take the CBD case in Figure 11; think, instead, of a deficit that might fall within a range of, say, £140 – £245 million, knowing that even this apparently wide range might underestimate the eventual outcome. How do we determine such a range?

4.3 A range of views

One way is to use 'scenario analysis'.

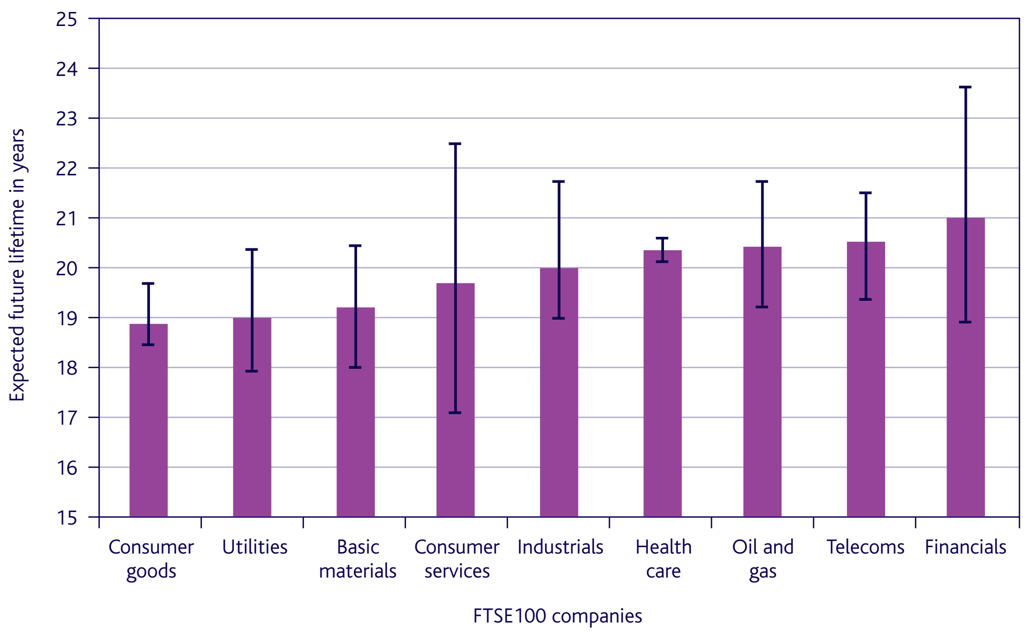
If all your scheme members suddenly adopted a healthy lifestyle, by how much would that increase their average life expectancy? If, on the other hand, they all started eating more junk food, by how much would that reduce life expectancy?

Research is required to answer these questions. The results of relevant controlled experiments are highlighted in medical science literature and many of these studies will have been conducted on individuals from different countries. You could consider the results of these studies in connection with your own scheme but, given this is usually impractical, then you can still conduct 'what if' experiments.

- What would happen to your pension liabilities if mortality rates fell by 1% at each age?
- What would happen if your plan members experience mortality similar to that at the upper end of the range in Figure 9 (pg 27)? Could your company survive apocalyptic demography?

Figure 12 shows the range of life expectancy assumptions made for 65 year old male employees by FTSE100 companies in their 2006 accounts.

Figure 12 Life expectancy assumptions reported in 2006 by FTSE100 companies for 65 year old males



Source: Pensions Institute calculations based on Lane, Clark and Peacock (2007).[2]

[2] The Lane, Clark and Peacock data were for male life expectancy at age 60. We have re-scaled this to age 65 for all sectors on the basis of the relative medium cohort life expectancies at ages 60 and 65 in 2007.

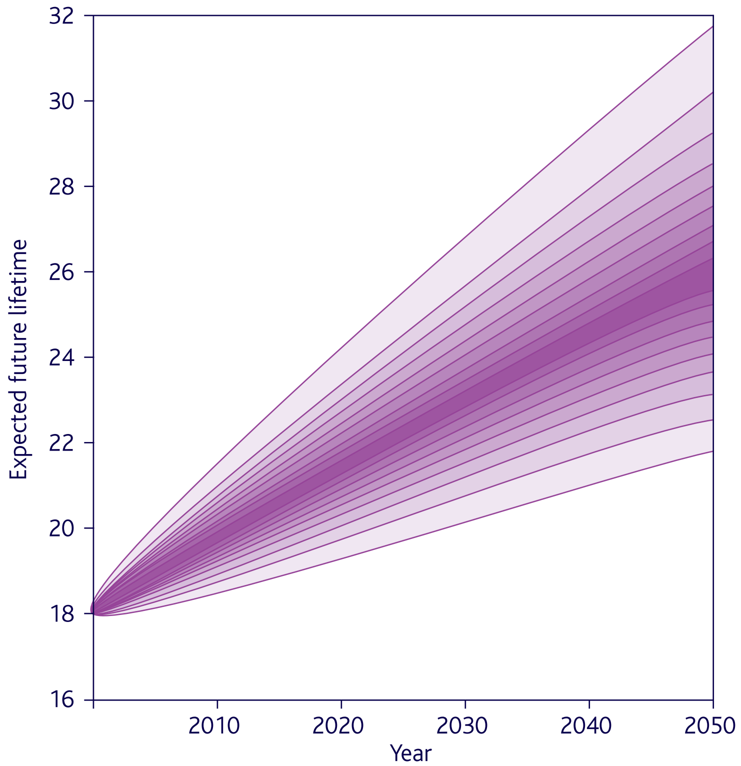
The columns in Figure 12 (pg 34) show the different levels of life expectancy assumptions, across industrial sector. The vertical lines show the extent of the range within each sector, which in turn reflects the number of companies within the sector. The highest assumed life expectancies are found in the financial, telecoms, oil and gas and healthcare sectors (which employ large numbers of white collar workers). The lowest assumed life expectancies are found in the consumer goods, utilities and basic materials sectors (predominantly blue collar industries). There is considerable variation between the assumptions of individual companies within a sector. As previously mentioned, each pension plan member's life expectancy is unique. However, there is clearly a range of different scenarios, albeit unspecified, behind the range of assumed life expectancies shown in Figure 12 (pg 34). That range reflects differences in both current mortality rates and projected reductions in mortality rates.

Figure 9 (pg 27) showed us projected life expectancies for 65 year old males using a number of different projection models. Uncertainty surrounds each of these best estimate projections. Another way of illustrating the range of possible outcomes is to use fan charts.

4.4 Fan charts

Figure 13 is a longevity fan chart. It shows the widening funnel of uncertainty surrounding the CBD projection of life expectancy for 65 year old males shown in Figure 9 (pg 27).

Figure 13 Longevity fan chart for 65 year old males in England and Wales



Source: Dowd et al (2007, Figure 3)

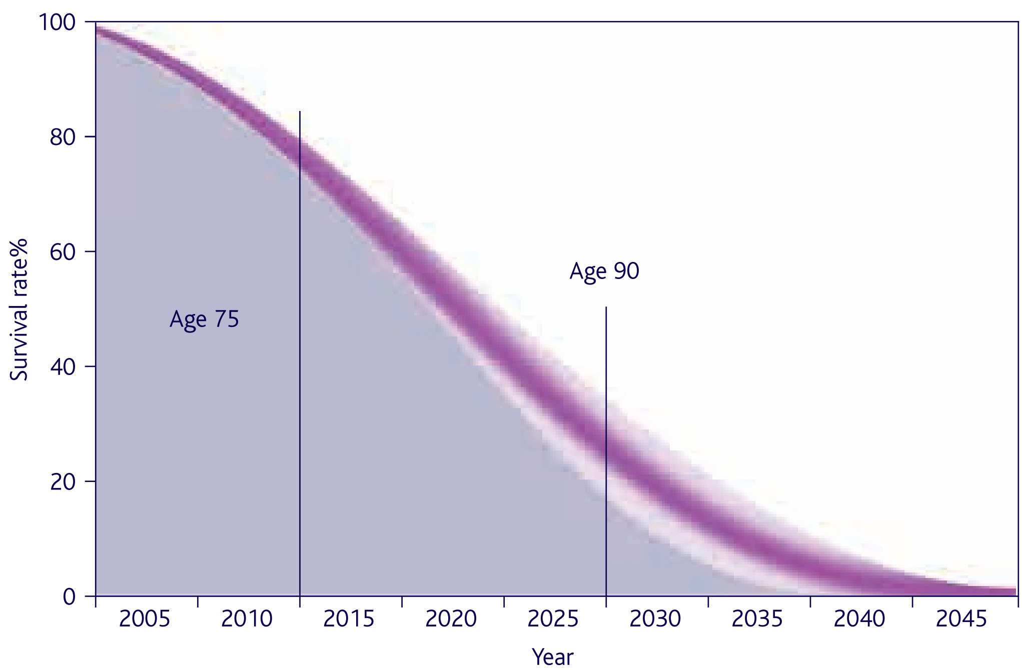
The width of the fan chart in Figure 13 indicates the degree of uncertainty about future life expectancy and different shades indicate different probability bands.

The central projection of life expectancy is the dark band in the middle of the fan chart; the CBD model's best estimate of the life expectancy of a 65 year old man in 2050 is about 26 years, but the degree of confidence in this estimate is less than 10%. Each successive pair of differently shaded purple bands adds another 10% probability. The entire shaded area shows the 90% confidence interval for the forecast range of outcomes. We can be 90% confident that, by 2050, the life expectancy of a 65 year old English or Welsh male will be between 21 and 32 years: a huge range of uncertainty.

With a life expectancy along the upper bound of the fan chart in Figure 13 (pg 35), the CBD deficit in Figure 11 (pg 33) might be £245 million while, with a life expectancy along the lower bound, it might only be £140 million. The vertical lines on the CBD column in Figure 11 (pg 33) indicate this range of possible values within the 90% confidence interval.

In Figure 5 (pg 22) we showed you some cohort survival curves. The 1951 cohort's curve, in Figure 5 (pg 22), was projected beyond the cohort's then current age (54 in 2005). Uncertainty (aggregate longevity risk) surrounds that projection.
Figure 14 presents a survivor fan chart. It shows the 90% confidence interval for the survival rates of English and Welsh males who reached 65 in 2003 as they progress through the remainder of their lifetimes.

Figure 14 Survivor fan chart for 65 year old males in England and Wales



Source: Blake et al (2007, Figure 2)

Figure 14 shows that there is very little survivorship risk before age 75: a fairly reliable estimate is that 25% of this group will have died by age 75. The uncertainty increases rapidly after 75 and reaches a maximum at around age 90 when anywhere between 15% and 35% of the original population will still be alive (with a best estimate of 25%). Think of it: from 100,000 65 year old pensioners today, you might expect 25,000 to be alive in 25 years' time; but you might end up paying pensions to 35,000. This long so-called 'toxic tail' gradually expires some time between 2035 and 2045.

4.5 Managing longevity risk

Funding your pension scheme's toxic tail could be expensive. You might, therefore, want to consider seeking specialist pensions' advice as to how you might be able to manage that cost. Here are some of the things that you might be able to do. It is likely that any benefit changes will apply only to future service.

4.5.1 Understanding longevity risk

- Conduct a survey of the lifestyle habits of your scheme members.
- Conduct a mortality analysis.
- Prepare a longevity fan chart for your scheme.

4.5.2 Managing longevity risk

- As the Pension Commission (2005) suggests, instead of fixing the retirement age in advance, link the future pension age to changes in life expectancy.
- Offer your employees lump sum pension payments instead of annuities, to the extent that this is permissible.
- Index benefits to cohort longevity changes, as they do in Sweden.
- Purchase an annuity at the time of retirement of each pension scheme member (your scheme will still bear longevity risk for current active members and deferred pensioners between now and their retirement dates).
- Offer your employees 'enhanced transfer value payments'; they receive a payment into a defined contribution scheme in return for relinquishing their accrued pension entitlements.
- Close your defined benefit scheme to new members, or to all members, and switch to a defined contribution scheme, or reduce future benefits such as a career-average scheme.
- Sell the liabilities via an insurance or reinsurance contract. This is known as a bulk annuity transfer or a pension fund buy out. It can take a variety of forms. The most common being a full buy out in which a life assurance company takes both the pension liabilities and the scheme assets from the sponsoring company in return for the company making good any difference immediately or for a loan which the company pays off over, say, ten years (or, if the scheme is in surplus, the sponsor receives a payment following the sale). The scheme must be closed to future accrual before this can happen.
- An alternative to a full buy out is a partial buy out or 'de-risking' strategy in which a segment of the liabilities are bought out, such as pensions in payment, or all those over, say, 15 years, or all those belonging to members over the age of 70, or all deferred pension liabilities.
- Manage the risk using mortality-linked instruments. These might be traded contracts (such as longevity bonds) or over-the-counter contracts (such as mortality swaps or forwards). These instruments are still at an early stage of development but, in the near future, we expect a new capital market to develop that will trade financial instruments that can be used to hedge aggregate longevity risk (Blake et al., 2008 and Loeys et al., 2007). In July 2007, JPMorgan announced the launch of a mortality forward contract with the name 'q-forward' (Coughlan et al., 2007). It is a forward contract linked to a future mortality rate: 'q' is standard actuarial notation for a mortality rate. The contract involves the exchange of a realised mortality rate relating to a specified population on the maturity date of the contract in return for a fixed mortality rate agreed at the beginning of the contract.

Taking action to manage longevity risk should increase the security of your scheme members' pension entitlements. But risk protection can be expensive and, clearly, you will have to weight its benefits against its cost.

4.6 Summary

Aggregate longevity risk arises because we do not know the average length of life of a generation or cohort; uncertainty surrounds all life expectancy projections.

We do know that the human lifespan is not pre-programmed; that it can be influenced by lifestyle; that science has slowed the ageing process; and that scientific, medical and social researchers are striving to slow it further. We also know that the cost of pension provision is sensitive to changes in life expectancy assumptions; that it is those pensioners with big pensions who live longest; and that aggregate longevity risk is hard to diversify. So, funding your pension scheme's toxic tail could be expensive. You might, therefore, want to consider seeking specialist pensions' advice as to how you might be able to manage that cost.

We hope that this report and the *Longevity risk checklist* (pg 53-59) will help you, in discussions with your scheme's actuary, to understand the longevity assumptions underlying your organisation's defined benefit pension obligations and their consequences.

5 Glossary

'92' series: life tables produced by the Continuing Mortality Investigation (see CMI) founded on mortality experienced, centred on 1992.

They incorporate an allowance for future improvements. Separate tables are prepared for males and females, and age-specific mortality tables (where the rate at each age is an average weighted by pension amounts). Such tables are known as 'amounts' tables. Tables compiled without such weighting are known as 'lives' tables.

'00' series: life tables produced by the CMI based on observations of life office pensioners centred on 2000. As with the '92' series, separate tables are prepared for males and females and for data averaged by amount of pension and by lives. However, the '00' series tables do not incorporate any projections of future improvement.

Cairns-Blake-Dowd (CBD): a stochastic mortality projection model that has been used to develop a series of longevity, mortality and survivor fan charts. It is built on the observation that, at high ages, the percentage change in mortality rates is linearly increasing with age.

Cohort: a group of people who have an event, attribute or experience in common. For example, a birth-cohort would include all those born within a specified time period (e.g. a year). Other examples would include all those who joined an organisation on the same day.

Cohort effect: a term used by the Office for National Statistics (see ONS) and the Continuing Mortality Investigation (see CMI) to describe a higher than average rate of improvement in mortality rates for generations born in the UK (between 1925 and 1945 in the case of the ONS description, and between 1910 and 1942 in the case of the CMI description) which have more marked reductions in mortality than the generations born before or after. The assumed period of future years over which the cohort effect persists can vary.

- **Short cohort:** the assumed period is until 2010.
- **Medium cohort:** the assumed period is until 2020.
- **Long cohort:** the assumed period is until 2040.

Continuous Mortality Investigation (CMI): a committee of The Actuarial Profession which produces life tables for use by insurers and pension plans.

5 Glossary

Government Actuary's Department (GAD): the body responsible for UK population estimates and projections prior to 31 January 2006.

Life expectancy: the average number of years a person of a given age would live under a given set of mortality conditions. Life expectancy is usually computed on the basis of a life table showing the probability of dying at each age for a given population according to the age-specific death rates prevailing at a given period.

Lifespan: average age at death. Also equal to the sum of life expectancy and current age.

Life table: a rectangular matrix, showing changes in a standard set of functions (columns) across ages (rows). It describes the extent to which a generation of people, or cohort, dies off with age. An example of a life table is set out above.

The central death rate is the proportion of people of that age who die during the year. It differs from the probability of death at age x which is the proportion of people who die at that age. So, a person who reaches 65 in 2007 and dies at that age in 2008 will be included in the probability of death rate in 2007 but will not be counted in the central death rate for 2007.

Because women typically live longer than men, separate life tables are often produced for each gender.

Longevity: How long scheme beneficiaries are expected to live. This refers to the future expected lifetime derived from any particular set of mortality rates.

Interim life table, United Kingdom
Period expectation of life based on data for the years 2003-05

Age			Males		
x	m(x)	q(x)	l(x)	d(x)	e(x)
0	0.005660	0.005644	100000.0	564.4	76.62
65	0.016158	0.016028	83857.9	1344.1	16.63

The column headings are:

m(x) Central death rate at age x
q(x) Probability of death at age x
l(x) Number of survivors to age x
d(x) Death number at age x
e(x) Life expectancy at age x

Mortality rate: a measure of the frequency of occurrence of deaths in a defined population during a specified time interval. It refers to the assumed probability of dying within a year, calculated using historical data.

Mortality improvement: rate of decrease in mortality rate, usually in respect of the progression of time.

Office for National Statistics (ONS): the official agency responsible for producing mortality statistics for England and Wales and population estimates for UK, after 31 January 2006.

Underpin: an adjustment to mortality tables in which future improvement rates are subject to a minimum value. For example, a 1% underpin to the medium cohort projection means that it is assumed that the rate of improvement in mortality declines as per the medium cohort projection until it gets to 1% per annum and then it continues at that rate into the future.

Note: this glossary has been compiled from several sources including Coughlan et al. (2007), the Pensions Regulator (2007 and 2008) and various Office for National Statistics sources.

6 References

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CIMA, the Chartered Institute of Management Accountants, is the only international accountancy body with a sole focus on business. We are a world leading professional institute that offers an internationally recognised qualification in management accountancy, focusing on accounting in business in both the private and public sectors. We are the voice of 164,000 students and members in 161 countries.

CIMA identifies strongly with the challenges faced by management teams in today's fast moving environment. One that is currently high on many finance directors' agendas is how to alert the board to, and help them manage, the risks arising from defined benefit pension schemes.

To discuss these issues a Pensions Advisory Group (PAG) was established by CIMA in May 2006 and its members are as follows:

- Mike Samuel (Chair), Chairman/Trustee, Rank Group/Unilever pension funds
- Professor David Blake, Director, Pensions Institute at Cass Business School
- Ian Bull, Finance Director, Greene King
- Harry Byrne, Chairman, CIMA pension fund and former Chairman of Guinness Ireland Pension Fund
- Andrew Carr-Locke, Former Group Finance Director, George Wimpey plc
- John Coghlan, Past President, CIMA
- Charles Cowling, Managing Director, Pension Capital Strategies
- Dr Rebecca Driver, Chief Economist and Director of Research, ABI
- Douglas Flint, CBE, Group Finance Director, HSBC Holdings plc
- Professor Steven Haberman, Deputy Dean, Cass Business School
- Richard Mallett, Director of Technical Development, CIMA
- John Pickles, Research Fellow, Pensions Institute at Cass Business School
- Charles Tilley, Chief Executive, CIMA
- Kate Wilcox (Secretary), Project and Relationship Management Specialist, CIMA.

In February 2008, CIMA published its revised guidance *The pension liability – Managing the corporate risk*
www.cimaglobal.com/pensions

We are now publishing this executive report on longevity risk, which includes a checklist of questions to consider when meeting your actuary. It has been written by Professor David Blake and John Pickles of the Pensions Institute at Cass Business School with valuable input from Mike Samuel, Richard Mallett and Kate Wilcox. The PAG is grateful for the helpful suggestions and comments received from Richard Willets.

For more information on pensions work by CIMA's Pensions Advisory Group, please contact CIMA via email: innovation.development@cimaglobal.com or telephone +44 (0)20 8849 2275.

About the Pensions Institute

The objectives of the Pensions Institute (**www.pensions-institute.org**) are to undertake high quality research in all fields related to pensions, to communicate the results of that research to the academic and practitioner community, to establish an international network of pensions researchers from a variety of disciplines, and to provide expert independent advice to the pensions industry and government.

We take a fully multidisciplinary approach. For the first time disciplines such as economics, finance, insurance, and actuarial science through to accounting, corporate governance, law and regulation have been brought together in order to enhance strategic thinking, research and teaching in pensions.

As the first and only UK academic research centre focused entirely on pensions, the Pensions Institute unites some of the world's leading experts in these fields in order to offer an integrated approach to the complex problems that arise in this field.

The Pensions Institute undertakes research in a wide range of fields, including:

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Pension fund management and performance
The investment management and investment performance of occupational and personal pension schemes.

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The actuarial and insurance issues related to pension schemes, including risk management, asset liability management, funding, scheme design, annuities, and guarantees.

Pension law and regulation
The legal aspects of pension schemes and pension fund management.

Pension accounting, taxation and administration
The operational aspects of running pension schemes.

Marketing
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The implications of aggregate pension savings and the impact of the size and maturity of pension funds on other sectors of the economy (e.g. corporate, public and international sectors).

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Research disseminated by the Pensions Institute may include views on policy but the Pensions Institute itself takes no institutional policy positions.

Note: This report is for general guidance and is intended to be a useful starting point to be adapted to the individual circumstances of an organisation. It should not be relied upon in any respect without seeking specialist pensions advice. Please note that CIMA, Cass Business School, Pensions Institute and the Pensions Advisory Group do not accept any responsibility to any individual or company who relies on the guidance set out in this report.

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