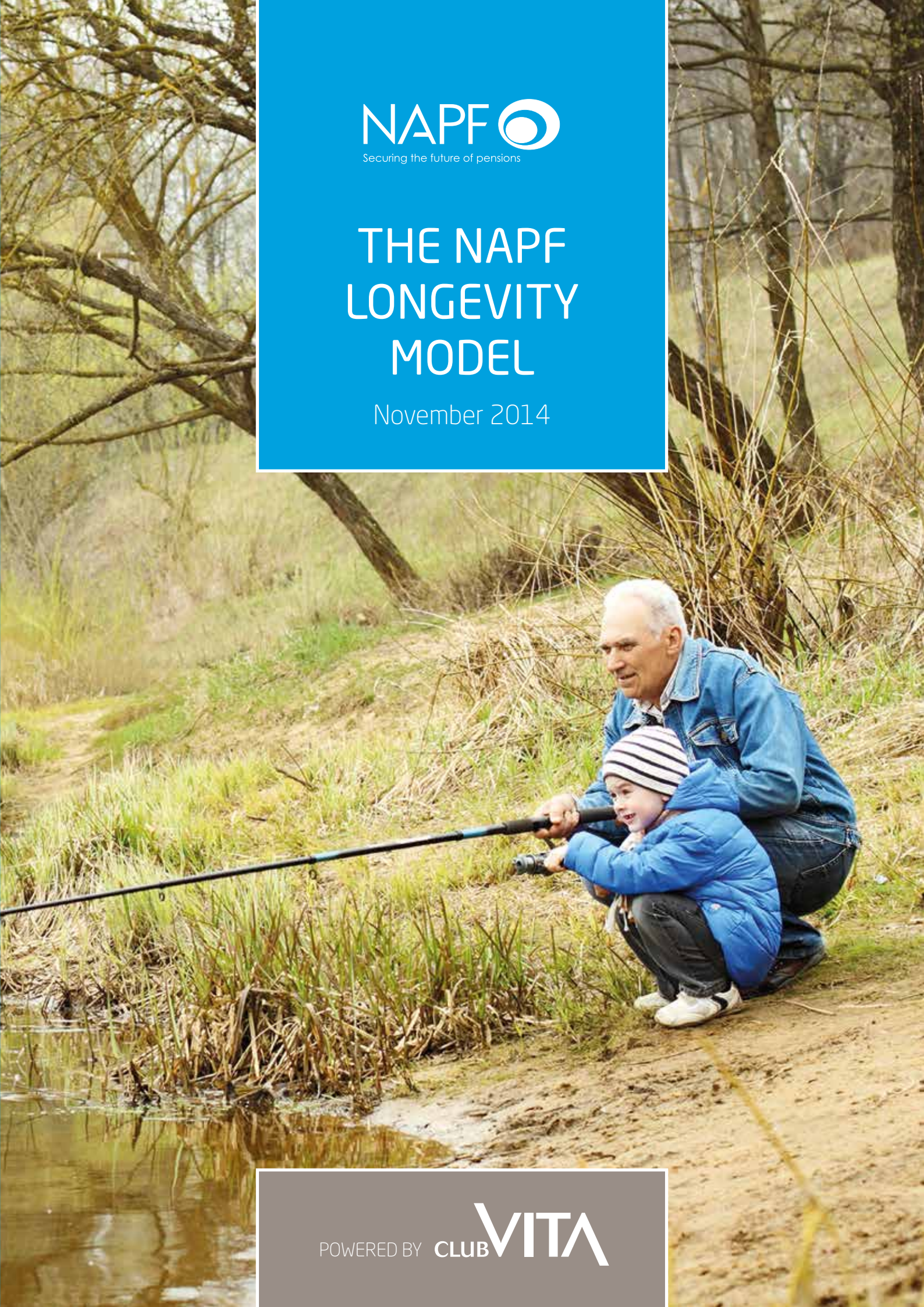
NAPF
Securing the future of pensions

THE NAPF LONGEVITY MODEL

November 2014



POWERED BY CLUB VITA

The NAPF would like to thank Club Vita, and in particular Steve Hood, Steven Baxter, and Matt Fletcher for their time, insight and **considerable commitment to this project.**

Thanks are also due to members of the project steering group, chaired by **Huw Evans, with contributions from:**

- **Tim Gordon, IFoA/CMI**
- **Khurram Khan, Pensions Insurance Corporation**
- **Gemma Tetlow, IFS**
- **Representatives of schemes that provided data to the project.**

Reliances and limitations

The National Association of Pension Funds (NAPF) and Club Vita LLP (CV LLP) have provided to the UK pensions industry both an understanding of how differently longevity has been improving for different groups of DB pensioners (such as those at different ends of the deprivation spectrum) and materials that pension schemes, and their advisors, can use in practice to better inform the assumptions that are adopted for longevity trends (together, the "Research").

The Research is based upon the NAPF and CV LLP's understanding of legislation and events as at November 2014 and therefore may be subject to change. The Research is the NAPF and CV LLP's understanding of how longevity has been improving for different groups of DB pensioners and is not, nor is it intended to be, specific to the circumstances of any particular pension scheme.

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We recommend that you speak with your appointed longevity consultant and/or other professional advisers should you have any queries in relation to the Research. Alternatively please contact Jackie Wells or Helen Forrest of the NAPF at **jackie.wells@napf.co.uk** or **helen.forrest@napf.co.uk** or Steven Hood of Club Vita LLP at **steven.hood@clubvita.co.uk**, who will be pleased to discuss any issue in greater detail.

Foreword

According to ONS, a 65 year old man retiring in 1951 in the UK could expect around 12 further years of life[1]. By 2014 this was expected to have nearly doubled to 22 years and by 2056 to have increased by a further 4 years to 26 years. These improvements should be celebrated.

Yet our industry is one of those for which the incredible advances in medicine and lifestyle that benefit our personal lives also create complexity and cost in our professional lives. For defined benefit pension schemes, accounting for trends in longevity represents a significant challenge.

On top of global or national trends there are considerable local difficulties to consider: How do the members of DB schemes differ from the 'average' person in the UK? How does the membership of one DB scheme differ from another? And how do members within a scheme differ from each other?

We know that DB scheme trustees want to try to make sense of the longevity of their members but, as in many areas of pensions, complete and usable data has been hard to come by.

With this report, the NAPF and Club Vita set out to give trustees access to analysis drawn from data on 2.5 million pensioners from a number of the largest DB schemes across the UK. We seek to understand how people with particular longevity trends can be grouped and how those groups affect liabilities.

The findings confirm that, for DB schemes, average life expectancy of pensioners has improved by 2.3 years during the past 10 years, close to that for the population in general. However, the analysis reveals marked differences between different segments of the DB pensioner population that drive different outcomes for individual schemes, depending on the pensioner profile. The data reveal a narrowing of the gap between more affluent DB pensioners and those living in more hard-pressed regions of the UK. Whereas the more comfortably off male pensioners have experienced an improvement of 1.9 years, more hard-pressed pensioners have seen an improvement of 2.5 years, albeit from a lower starting point.

Establishing how life expectancy has improved in recent years is of course only part of the story. Trustees also have to consider what future trends might emerge. By definition, this requires taking a more subjective view. This report sets out a number of scenarios to answer some of the real 'what ifs' affecting the lives of scheme members and how this could, in turn, alter projected life expectancies and future scheme liabilities. The scenarios reveal the uncertainties that trustees face in adopting future improvement assumptions and, we hope, will provide trustees with information on which to base their debates and discussions with advisers.

We hope that this research will add significantly to the evidence base for longevity assumptions, benefit trustees in understanding their membership and the possibilities for longevity in the future, and that this will help make the challenges of increasing life expectancy a little more manageable for DB schemes.

Joanne Segars

[1] DWP (2011) Cohort Estimates of Life Expectancy at Age 65

Executive summary

The key findings of the NAPF longevity model, powered by Club Vita and based on data from a large sample of DB pensioners:

- Typical assumptions, based on England and Wales (E&W) experience, do not reflect the pace and diversity of longevity trends experienced by DB pensioners.
- The analysis reveals that longevity had changed in different ways for individual DB schemes and for different groups of DB pension scheme members.
- Splitting the DB pensioner population into longevity trend groups that have experienced different changes in longevity reveals that:
  - The longer lived groups (described as 'comfortable' in the model) have tended to see a slower increase in life expectancy (males experienced a 1.9 years increase over the period examined);
  - The shorter lived groups (described as 'hard-pressed') have experienced a faster increase (males experienced a 2.5 years increase over the period);
  - The gap in life expectancy between these groups has narrowed.
- Because each DB scheme will be made up of different combinations of these groups, the impact on liabilities will be unique for each scheme, but will typically be an increase in the region of 1% of liabilities.

As a result of this project, trustees will, for the first time, have credible data on the longevity trend experience of DB pensioners that can be reflected in their longevity assumptions. The information on how longevity has changed in the recent past can also be used to help inform views on how life expectancies of DB pensioners might develop in the future, providing food for thought for trustees and their advisers. Trustees will now have information to hand that will help them consider some of the key 'what if' questions around how longevity might change in the future and be in a position to recognise the associated uncertainty .

Project context

Governments, people planning for retirement and pension schemes all need to understand trends in life expectancy. The increases in life expectancy we have become accustomed to bring both benefits and challenges for each of these groups. For defined benefit (DB) pension schemes in particular, accurately estimating changes in life expectancy is critical to ensuring that pensions are properly financed.

This report describes the findings from a unique analysis of the trends in life expectancy among DB pensioners. In particular, it highlights the differences between different groups of DB pensioners and the implications for the liabilities and funding of DB pension schemes.

The current position

Almost all trustees of UK DB pension schemes make assumptions for how life expectancies will change in the future that are based upon a single common model and approach. These are based upon recent changes in life expectancy in the England & Wales ('E&W') population: they are not calibrated to the experience of DB pensioners who represent a distinct sub-group of the E&W population.

While trustees often make great efforts to identify the range of current life expectancies for their scheme members (eg for poor vs wealthy), their assumptions for future changes to life expectancy do not typically differentiate between groups of members.

The areas of uncertainty

The DB pensioner population largely excludes certain sections of the population (eg long term unemployed). It is therefore reasonable to expect that their life expectancies will change in ways that are different to those of the E&W population.

We know, from data produced by the ONS, that life expectancy has changed differently in different parts of the E&W population, for example by location and socio-demographic group, and that some of these differences have persisted through time. Many experts expect these to continue into the future. This would suggest that it would be appropriate for the current approach (where the same future trend assumption is applied to all) to be reviewed and, if possible, for a new evidence-base to support the differences amongst DB pensioners to be developed.

Our approach

Until now, no-one has been able to collect and analyse sufficient reliable and detailed historic pensioner mortality data to successfully investigate trends in the life expectancy of DB pension scheme members.

The NAPF has worked in collaboration with Club Vita to collect data on almost 2.5m live pensioners and over 1m deaths to make this investigation possible.

The NAPF longevity model, powered by Club Vita

The emerging model confirmed that life expectancy trends were different for different groups of DB pensioners. In particular it identified:

- three distinct groups of male pensioners, and
- two distinct groups of female pensioners

as having experienced different trends in life expectancy. The groups are characterised by differences in socio-economic profile and have been named to reflect these variances.

This model is of direct relevance to trustees and their advisors when considering longevity trend assumptions.

Gender	Life Expectancy trend groups[2]	Observed change in life expectancy as at age 65, over 2000-2010	Expected change in liabilities[3]
Male	Hard-pressed	+ 2.5 years	+2.0%
	Making-do	+ 2.3 years	+1.5%
	Comfortable	+ 1.9 years	+0.5%
Female	Hard-pressed	+ 2.0 years	+0.5%
	Making-do / Comfortable	+ 1.6 years	+1.0%

The table above indicates for each group of DB pensioners:

- the differences in life expectancy trends between the groups, and how
- by applying these differences, instead of the typical longevity trend assumption, the value of liabilities differs.

The increase in liabilities for any particular DB scheme will depend on how the membership is split between the 'hard-pressed, making-do and comfortable' life expectancy trend groups but, looking across all schemes, would be expected to be around 1%.

Alternative futures

The findings described above deliberately focus on an analysis of recent data on changes in DB pensioner life expectancy. The next natural step was to consider what additional steps trustees might take to inform the decisions they have to make about future mortality assumptions.

A series of alternative 'futures' to the one assumed by the majority of pension schemes have been described and modelled to aid the discussions that trustees will have with their advisors.

For each of these 'futures' the different life expectancy trends of DB pensioners are illustrated. Some anticipate a slowing of life expectancy increases and others further or faster increases. We also consider scenarios that are likely to have a different effect on different groups of DB pensioners.

The alternative futures[4] cover scenarios as diverse as a return to the low rates of improvement in life expectancy seen in the 1950s, resource constraints, wide adoption of beneficial health behaviours, medical advances and a extension of life expectancy improvements.

These represent a broad range of possible longevity outcomes, with the results indicating:

- a wide range of potential life expectancies in the 2040s, from a return to life expectancies seen in the late 2000s to life expectancies that would be expected to typically exceed age 90.
- the typical liability effects from these alternative futures ranging from reductions of around 18% through to increases of 10% or more.

Applying the NAPF longevity model to schemes

The NAPF longevity model has been developed using information that will be readily available to you, allowing you easily to place each member into one of the 'hard-pressed', 'making-do' and 'comfortable' groups. This will help you measure how applying this new approach to longevity trend assumptions could change funding positions and your approach to managing liabilities.

We would encourage all schemes to discuss their longevity trend assumptions with their advisers in light of the findings of this unique piece of research.

[2] The longevity trend group names represent a particular type of DB pensioner. The 'hard-pressed' group is generally associated with living in areas assocated with high deprivation and lower levels of retirement income, at the other end of the scale, the 'Comfortable' group is associated with higher levels of retirement income and living in less deprived areas.

[3] The change in liabilities is expressed relative to a longevity trend assumption based on the CMI (2013) model with a 1.5% long-term rate. This is the longevity trend assumption used by the majority of DB schemes in recent valuations.

[4] Note that the alternative 'futures' presented are purely speculative and should be taken purely as 'food for thought'. We do not suggest that one scenario is more likely than another or even that the scenarios we set out represent upper or lower limits on how life expectancy may change in the future.

Introduction

Governments, people planning for retirement and pension schemes all need to understand trends in life expectancy. The increases in life expectancy we have become accustomed to bring both benefits and challenges for each of these groups. For defined benefit (DB) pension schemes in particular, accurately estimating changes in life expectancy is critical to ensuring that pensions are properly financed.

Many trustees and sponsors will have used information on their membership, in particular wealth and lifestyle, and their scheme's own mortality experience when setting assumptions about current longevity. However, until now data has not been available to:

- identify whether trends in longevity are different for the DB pensioners in our data set and the England & Wales (E&W) population (the latter being the starting point for the typical longevity improvement model used currently by most schemes);
- understand how longevity has been changing for different groups of DB pensioners (eg pensioners on high or low incomes);
- use this understanding to set longevity trend assumptions that allow for the unique membership profile of each scheme.

The NAPF Longevity Model, powered by Club Vita, seeks to address these information gaps. The NAPF has worked in collaboration with Club Vita to collect data on almost 2.5m live pensioners and over 1m pensioner deaths so that trends in the life expectancy of DB pension scheme members can be investigated.

This report describes the findings from this unique analysis of the trends in life expectancy among DB pensioners and the implications for the liabilities and funding of DB pension schemes.

The current position

Current practice

In calculating the future liabilities of their DB pension scheme, trustees require two fundamental sets of assumptions about the life expectancy of their members. The first is how long members might be expected to live based on current experience (often referred to as the baseline mortality assumption). The second is how current longevity experience might improve or deteriorate in future years (referred to as the longevity trend assumption). This research focusses on the longevity trend assumption only.

At present almost all UK trustees will use the CMI Mortality Projections Model ('the CMI model') as a base for their longevity trend assumption. The result of this is that many of the decisions trustees make rely upon the CMI model in some way, which makes it important that trustees understand the assumptions they are making when using it.

Reference longevity trend data

The CMI model is pre-populated with information on how longevity has changed for the E&W population. Until now, this dataset has been used as it has been regarded as the only available dataset of sufficient size and credibility to provide information on how longevity has changed over time. This means that, in practice, pension schemes typically base their assumptions on the longevity experience of the E&W population, without necessarily making a conscious decision to do so.

The CMI model does allow the user to input longevity experience data from alternative populations, such as the experience of DB pensioners, although this flexibility is rarely used.

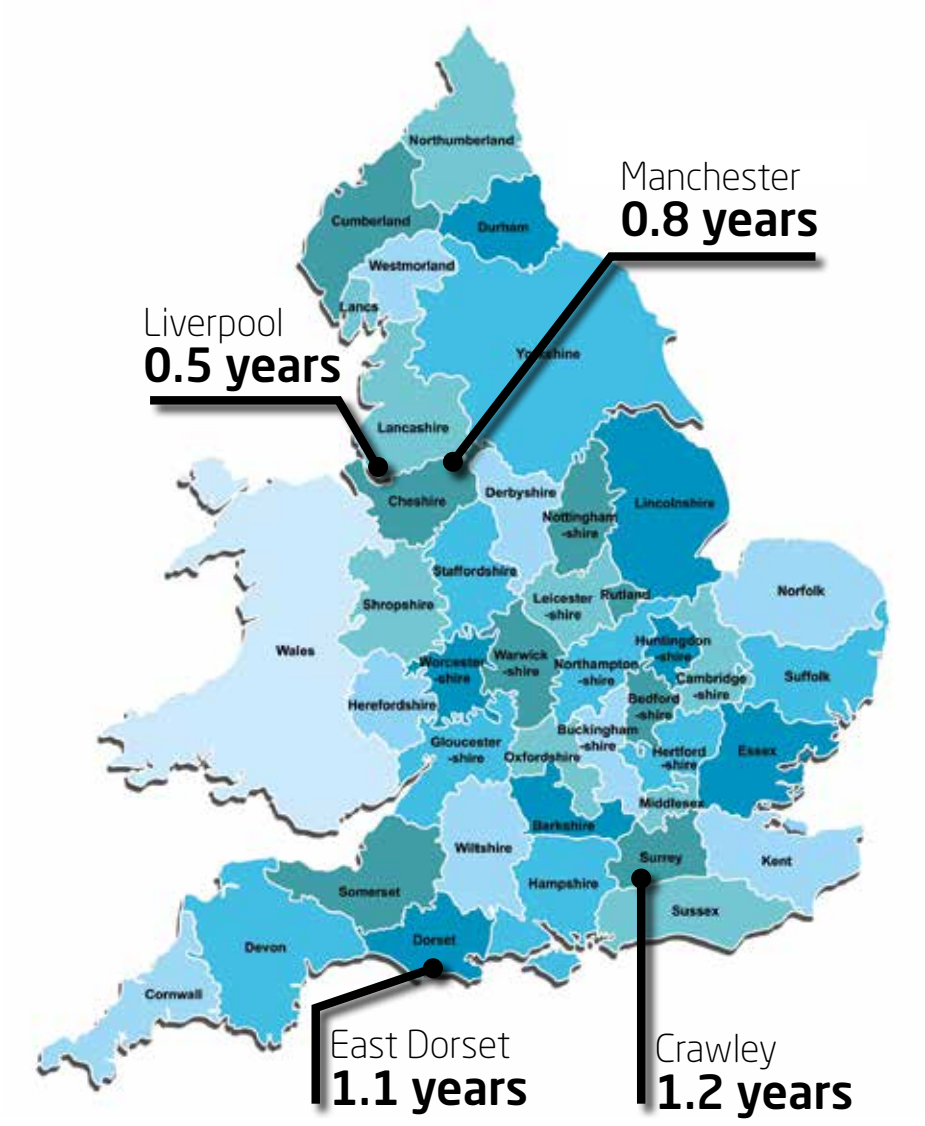
Considering diversity in the E&W population

ONS data demonstrates, very simply, that life expectancies have changed by different amounts for different parts of the E&W population. The map below picks out some parts of the UK and shows the recent increase in life expectancy as observed by the ONS. For example, in only 4 years, life expectancy (at age 65) improved by 1.2 years (from 20.3 to 21.5 years) in Crawley compared to only half a year (from 15.3 to 15.8 years) in Liverpool.

Many users of the CMI model will recognise that location, socio-demography and other factors have influenced the rate at which life expectancies have changed in the past. While the rate of change may differ in future, it seems reasonable to expect the differences in life expectancies for different parts of the population to continue into the future. This would suggest that there may be scope for refining the current approach of adopting the same future trend assumption for all.

Until now the tools and evidence that would allow the differences in the rate of change in life expectancy to be reflected in assumptions for the future have not existed. although some users of the CMI model apply adjustments with a view to recognising these differences.

Increase in life expectancy 2004-06 to 2008-10



Providing information and tools that support trustees in reviewing their current approach, and the decisions they make following that review, are the principal motivations for carrying out this research on longevity trends.

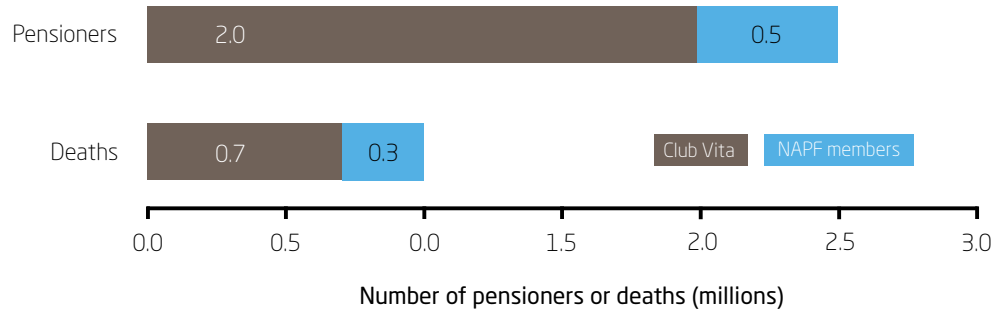
In the next section we highlight the strength of the research dataset before considering the output of our analysis.

Source: ONS

The research dataset

The key to providing analysis on how life expectancies have changed over time, and the characteristics that might help explain those changes, is to use a large amount of reliable (and detailed) data.

Prior to the NAPF collaboration, Club Vita held data on longevity for around 2 million pensioners and 700,000 pensioner deaths and, as importantly, a robust framework for analysing trends in longevity. A number of NAPF member schemes were happy to support this initiative, adding a further 500,000 pensioners and 300,000 deaths to the research dataset.



Before starting work on analysing longevity trends, we asked a series of questions about the research dataset. These questions, and the responses to them, are summarised to the right.

During the data checks we determined that the data we held would allow differences in life expectancy to be investigated over the period 2000 to 2010. The findings we set out in the rest of this paper are in respect of that period though we expect to update these as further longevity experience becomes available.

Question	Response
Is the dataset large enough?	• Yes. The dataset holds information provided by a number of the largest DB schemes in the UK. We did not start analysing longevity trends until we were happy that we had sufficient data to do so.
Have we quality checked the data?	• Absolutely, this is a key step in processing the data from pension schemes. Each member record is checked for consistency and each data item is checked for quality over time. Where a data item is of poor quality it was excluded from our analysis.
Is there enough data stretching back through time to give reliable information on how longevity has changed?	• We have collected data in a way that allows us to confidently show whether or not pensioners are alive for each year of the model . The volume of data we hold has been stable over the period since 2000 and is suitable for analysis of trends in longevity.
Do we hold information on important factors that might shape life expectancy such as affluence and socio-demographics (via postcode)?	• Yes. The dataset has good coverage of both information on when members retired and how long they have lived, as well as occupation, pension amount, salary, postcode, etc
Is each sector or industry fairly represented within the dataset?	• Where there are large schemes or significant industry groupings we have taken the time to ensure that their experience is consistent with that of the rest of the dataset.

As part of the research we have reviewed the variability of individual scheme experience, which is considered in the next section.

Pension schemes: a range of outcomes

A natural question for trustees and schemes to ask is why they should care about tailoring their longevity improvement assumption to their membership.

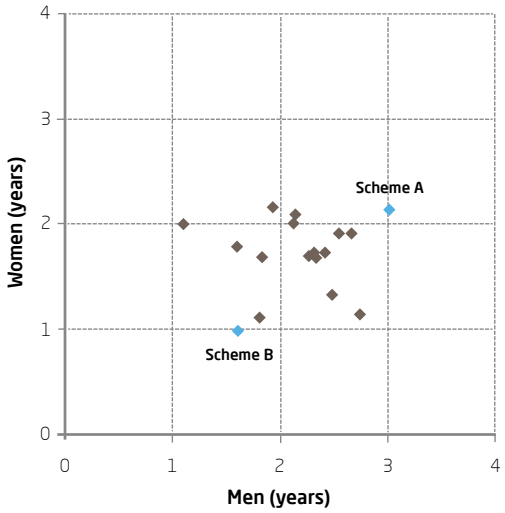
Each pension scheme can be thought of as a unique combination of members. Where groups of members experience different changes in longevity over time, the result is that the average life expectancy for each scheme will change at a different rate.

The chart (below) shows the change in average life expectancy at age 65 over the period 2000-2010 for a number of the largest pension schemes in the research dataset (grey dots). At the higher end, life expectancy for men in Scheme A increased by 3 years over the period (and just over 2 years for women) while men in Scheme B only benefitted from an increase of 1.6 years (and 1 year for women). The net result was that Scheme A's liabilities increased by 5% more than those of Scheme B over the period.

Whilst there are a number of possible explanations for individual schemes' experiencing changes in longevity at different rates, the fact that there are clear differences encouraged us to explore the data further. Certainly it highlights how using a single model for changes in life expectancy leaves considerable uncertainty for individual schemes.

A natural next step, which is considered in the next section, is to dig deeper into the data to understand how longevity trends differ between the different types of pension scheme member.

Increase in life expectancy 2000-2010 measured at age 65



Measures for groupi pensioners

Analysing changes in life expectancy in the research dataset demonstrated that, in DB pension schemes:

- For men, a number of measures could be used to place members into distinct longevity trend groups (see table to right). Factors such as the industry they work in, the type of work they undertake, their levels of pre and post retirement incomes and where they live are all independently associated with differences in life expectancy trends;
- For women, only socio-demographics (measures of lifestyle or deprivation) have been closely correlated to historical longevity trends.The lack of a strong relationship with women's pension amount may be due in part to their income traditionally being secondary within their household.

A key aim of our research is to provide pension schemes with a practical way to place pensioners into longevity trend groups. As such, any factors used for the analysis need to be readily available to all pension schemes and their advisors. This further narrows the list of possible measures to use for grouping pensioners.

The table to the right summarises what we found and concluded. In reading this, the symbols represent:

✓	is used to indicate that there is a clear correlation between a measure and differences in longevity trend for groups of pensioners
?	is used where there is no clear correlation between a measure and differences in longevity trend
×	indicates that a measure is either not generally available (eg many schemes do not hold complete information on member occupation) or is not useable in practice (eg industry can be unclear for some sponsoring companies or schemes)
✓✓	indicates that a measure is both generally available and is useable in practice.

ng

Can this measure be used to form longevity trend groups?			Is this measure available and practical?
	Males	Females	
Industry	✓	?	×
Occupation	✓	?	×
Affluence	✓	?	✓✓ (pension amount)
Socio-demographics (lifestyle/deprivation)	✓	✓	✓✓ (deprivation)

Only two variables passed the test of being relevant, readily available and practical for schemes to adopt: the amount of pension paid by the scheme and a postcode based model of relative deprivation.

To measure the affluence (or the wealth) of a pensioner we had a choice of two measures, either last available salary or last available pension amount. While last available salary is considered to be a better indication of wealth for an individual, the decision to use pension amount was taken for practical purposes. Although pension amount is a weaker measure of wealth, pension schemes hold more complete and accurate information on pension amount than final salary.

However the pension amount does not provide a sufficiently robust measure for women. Therefore the deprivation measure was used in isolation for assessing female pensioner life expectancy trends.

To measure deprivation we have used a UK-wide Index of Multiple Deprivation (IMD). Each country's Index of Multiple Deprivation measures the relative levels of deprivation in small geographical areas and can be attached to postcodes.

Deprivation itself is a measure of the availability of resources and opportunity for individuals living in an area. It takes into account, among other factors, levels of income, employment, crime, training and health.

Based on these findings, we looked at how changes in life expectancy for men differed by measures of affluence and deprivation and for women by a measure of deprivation only. These are outlined in the next section.

Building the model

Using information on pension amount and deprivation we are able to place male pensioners into one of three distinct longevity trend groups. Using only information on deprivation, we are able to place female pensioners into one of two longevity trend groups.

Segmentation of male DB pensioners was achieved by initially allocating each individual into cells, defined by:

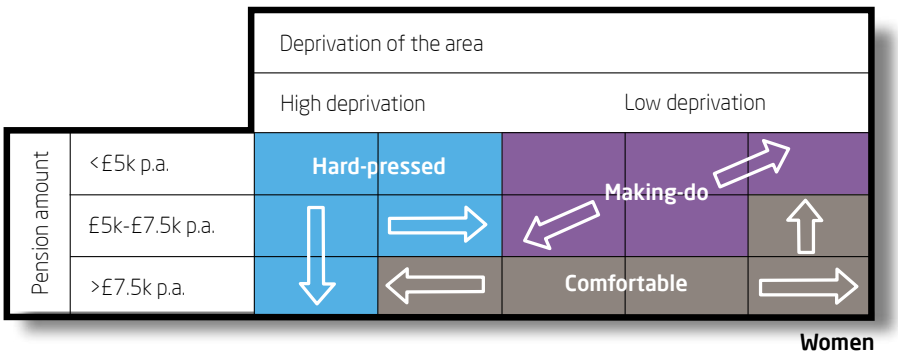
- the last available amount of pension in payment, with pensioners divided by thresholds that placed roughly a third into each pension amount sub-group, and
- a relative measure of the degree of deprivation associated with the area where they live, based on their postcode.

Individuals in the cells were then clustered into three internally consistent longevity trend groups which were named: 'hard-pressed'; 'making -do'; and 'comfortable'. A similar exercise using female DB pensioners segmented on deprivation measures only and resulted in two distinct longevity trend groups named 'hard-pressed' and 'making do / comfortable'.

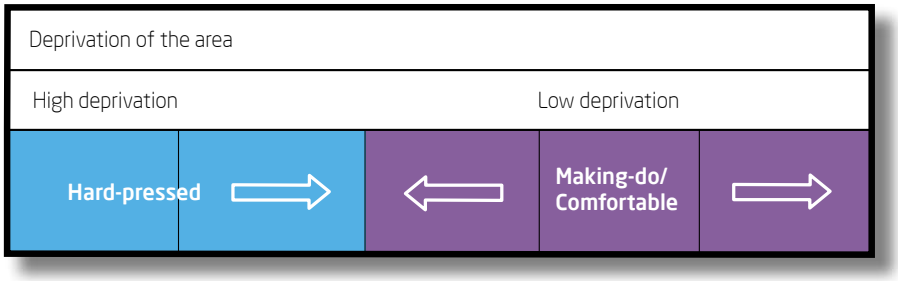
These longevity trend groups, for men and women, are illustrated in the tables below.
In the following pages we set out information on:

- **how life expectancy has changed for each group over the period 2000 to 2010; and**
- **how we might characterise the members of each group.**

Men



Women



Longevity trend groups for men

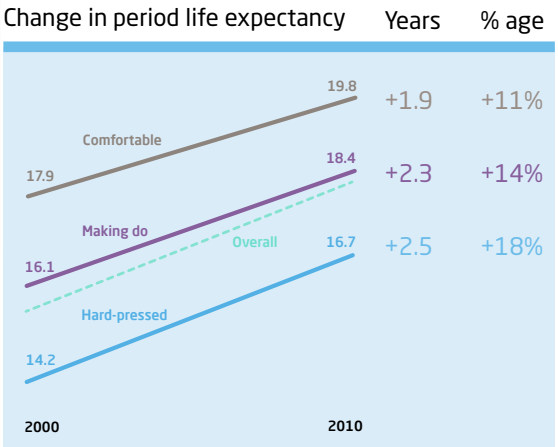
The three longevity trend groups for men can be broadly described as follows:

Group	Characterisation
Hard-pressed	Living in more deprived areas and with lower levels of retirement income.
Making-do	Modest retirement income levels and living in areas of average to low levels of deprivation.
Comfortable	Higher levels of retirement income. This group naturally includes some pensioners with retirement incomes much higher than £7,500 p.a.

While life expectancies (as indicated to the right) have increased for all three male longevity trend groups, there are marked differences in the rate and effect of those increases on the members of each group.

- The increase in life expectancy is the most significant for individuals in the 'hard-pressed' group, both in number of years and as a proportion of starting life expectancy.
- While the 'hard-pressed' and 'making-do' groups have seen life expectancy increase by 2.5 and 2.3 years respectively, these increases represent different relative increases in life expectancy.
- The 'comfortable' group began the period under review with life expectancy of 17.9 years at age 65 and has seen life expectancy increase by around 1.9 years over the decade; a slower rate of increase than other pensioners.
- The result of this is a narrowing of the life expectancy gap between the 'comfortable' and 'hard-pressed' groups of just over half a year over the period.

In future, with additional data, we would like to further segment the 'comfortable' group to explore in more detail the impact of higher pension amounts on trends in life expectancy.



The charts and information on life expectancies for men (above) and women (below) provide credible measures of how longevity has changed for each group. Many other factors will affect the life expectancy of pensioners (eg lifestyle habits (smoking), diet, exercise, weather, illness etc) and we do not seek to capture these here. However, some of these may correlate positively and strongly with variables that are already used in this model.

Longevity trend groups for women

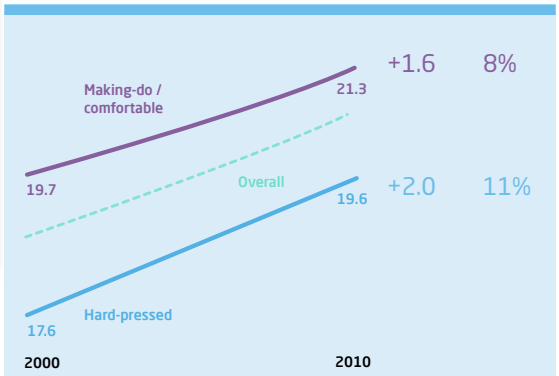
The two longevity trend groups for women can be broadly described as follows:

Group	Characterisation
Hard-pressed	Pensioners generally living in areas associated with higher levels of deprivation
Making-do / Comfortable	Pensioners generally living in areas associated with lower levels of deprivation

While life expectancies (as indicated to the right) have increased for both female longevity trend groups, there are again marked differences in the rate and effect of those increases on the members of each group.

- The 'hard-pressed' group has seen life expectancy increase by 2 years from 17.6 to 19.6 years at age 65. This represents a more significant proportion of starting life expectancy than the less deprived group.
- The 'making-do / comfortable' group have seen life expectancy increase by around 1.6 years, from 19.7 years at age 65, over the decade.
- The results once again highlight a narrowing of the life expectancy gap between the groups. For women the gap narrowed by just over a third of a year.

Change in period life expectancy



Closing the gap

While we have not explored the reasons behind the closing of the gap in life expectancies of the 'hard-pressed' and 'comfortable' pensioners, we would expect that the pattern of later smoking cessation amongst the 'hard-pressed' alongside health initiatives designed to reduce social inequality will have contributed to this effect.

In the next section we consider the approximate impact that our findings would have on the value of pensioner liabilities.

Impact of longevity trend groups

Having identified a number of longevity trend groups, the model can show how pension scheme liabilities would change on moving from a typical longevity trend assumption to assumptions based on the longevity trend groups.

In other words, rather than starting from longevity changes in the E&W population data, the model uses an assumption based on how life expectancy has changed for each trend group.

Both the increases in life expectancy and the effect on liabilities are shown to vary by group. The largest liability increases are for male 'hard-pressed' pensioners where liabilities increase by 2%. Put another way, a scheme that consisted only of 'hard-pressed' pensioners would see its liabilities increase by this amount.

By contrast, male 'comfortable' pensioners see an increase of only 0.5%. For the male and female longevity trend groups, the differences in impact are a reflection of the relative rates at which longevity has been improving for the groups.

The table demonstrates that there is an overall difference in trends in life expectancy between the DB pensioners in our data and the E&W population. The increase in liabilities for any particular scheme will depend on how the membership is split between the 'hard-pressed, making-do and comfortable' life expectancy trend groups but, looking across all schemes, would be expected to be around 1%.

Gender	Life Expectancy trend groups[2]	Observed change in life expectancy as at age 65, over 2000-2010	Expected change in liabilities[3]
Male	Hard-pressed	+ 2.5 years	+2.0%
	Making-do	+ 2.3 years	+1.5%
	Comfortable	+ 1.9 years	+0.5%
Female	Hard-pressed	+ 2.0 years	+0.5%
	Making-do / Comfortable	+ 1.6 years	+1.0%

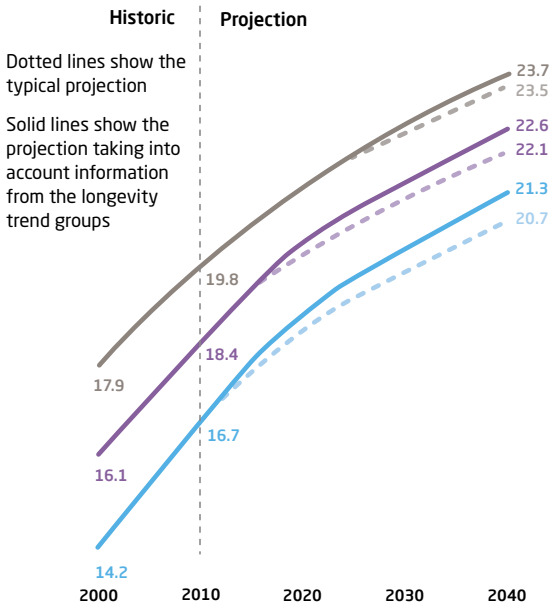
[5] The change in liabilities is expressed relative to a longevity trend assumption based on the CMI (2013) model with a 1.5% long term rate. This is the longevity trend assumption used by the majority of DB schemes in recent valuations.

Illustrating future longevity trends

On the following page we have set out visually how the information we now have on longevity trend groups feeds into the projection of life expectancies.

Changes in life expectancy

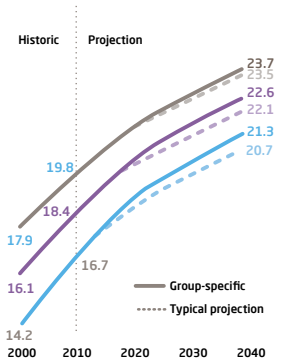
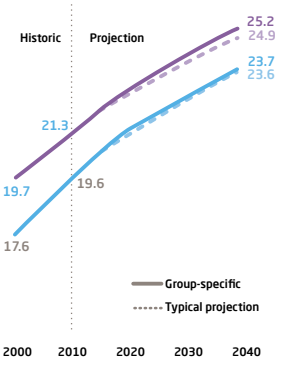
These charts show how life expectancy for a 65-year-old changed over the period 2000-2010 and could change further over the period 2010 to 2040. We are not deviating from the view that is built into the assumption most schemes use. We are just replacing the starting point of the changes in longevity experience of the E&W population with information on longevity changes for our comfortable, making-do and hard-pressed pensioner groups.



The baseline projection illustrated over the page, incorporates into short term projections the differences for the three male and two female groups identified in the NAPF longevity model. The longer term element of the projections reverts back to a long-term improvement rate of 1.5% p.a. It reveals that:

- For 'hard-pressed' male pensioners, age 65 life expectancy could rise from 16.7 years in 2010 to 21.3 by 2040, over half a year more than under typical assumptions.
- Future improvements are less marked for the male 'comfortable' group where life expectancy rises by 2.9 years over the same period.
- The gap between the 'comfortable' and 'hard-pressed' narrows by more than 8 months by 2040.
- A similar but less marked trend is visible among female pensioners.

Longevity trend groups projection

What does this scenario mean?	Men			Women	
	Hard-pressed	Making-do	Comfortable	Hard-pressed	Making-do/ Comfortable
Trends in period life expectancy (LE)*					
Liability impact**	+2%	+1½%	+½%	+½%	+1%

*from age 65 **vs CMI model with CMI starting improvement and 1.5% long-term rate

How can I use this analysis?

This research provides new information based on a unique dataset of DB pensioner longevity experience. For the first time, trustees will have credible data regarding the trends in the life expectancies of DB pensioners and be able to reflect this in their longevity trend assumptions.

While we expect that most DB schemes will see liabilities increase in the region of 1% if longevity trend assumptions are based on the experience of DB pensioners, we note that the result of each scheme will be unique. The impact for each pension scheme will depend on its:

- Age profile
- Mix of men and women
- Affluence and deprivation
- Benefit structure
- Financial assumptions
- Other demographic assumptions

Applying the research in practice

The NAPF Longevity Model[6] has been developed using information that will be readily available for your members, allowing you to place each member into one of the 'hard-pressed', 'making-do' and 'comfortable' groups. This will help you measure how applying this new approach to longevity trend assumptions could change funding positions and your approach to managing liabilities.

When does the difference matter most?

Getting a more detailed picture of the life expectancy trends of scheme members will be of most interest to DB schemes that are, or are seeking to, actively manage their risks.

This group will include:

- schemes that are using assets to match more closely future cashflows from the scheme (via LDI-like strategies) where improved projections of scheme cashflows can help improve the effectiveness of this approach; and
- schemes that are considering, or assessing the value of, a de-risking transaction (longevity swap or buyin/out) where the assumption for longevity trends is an important factor in the decision making process.

In addition, the results of the research are likely to have greatest impact on schemes where members are concentrated in just one of the longevity trend groups. Where this is the case, it is schemes with a larger proportion of 'hard-pressed' members who may see the larger increase in scheme liabilities.

What next?

Some schemes may already have made adjustments to their longevity assumptions for anticipated differences between DB pensioners and the E&W population and/or the uncertainty relating to future longevity trends. These schemes will now be better placed to assess the adequacy of those adjustments.

The technical data provided with this report should allow schemes or their advisers to identify the impact of this analysis on their own pensioner membership by:

[6] Powered by Club Vita

- identifying, for each pensioner, their pension amount and their deprivation level based on postcode;
- placing each member in one of the longevity groups identified;
- attributing different longevity trend assumptions for each pensioner; and
- calculating the impact on scheme liabilities.

Questions schemes may ask their advisers

This is a useful first step for schemes to make. However, we would encourage all schemes to discuss their longevity trend assumptions with their advisers in light of the findings of this unique piece of research. When doing so, it may be useful for trustees/pensions managers to have the following questions in mind.

1. What starting point is being used for the longevity trend assumption? Is the starting point based on E&W population information or adjusted for DB pensioner experience?
2. If we were to use the longevity groups set out in the NAPF Longevity Model, what would be the impact on scheme liabilities?
3. How would our funding and investment strategies change if longevity trends developed in line with one of the scenarios set out in the next section (eg 'cancer revolution') or another plausible scenario?

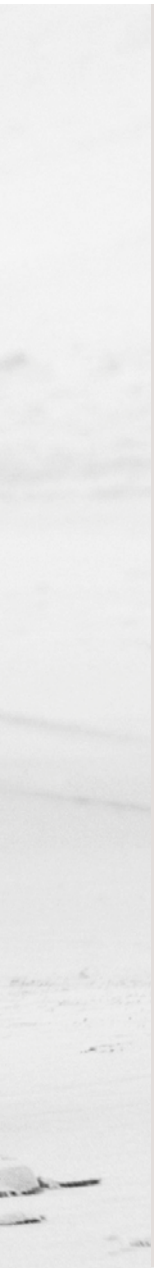
Future scenarios

Having the information on how life expectancy has been changing for different groups of pensioners allows a wider range of possible future outcomes for life expectancy to be explored. This exploration typically involves asking lots of '**what if**...' type questions. For example:

- **What if** life expectancies continue to increase at the current rate, or fall back to the rate of change from 50 years ago?
- **What if** we 'cure' one of the major current causes of premature death, for example, cancer?
- **What if** diseases become increasingly resistant to antibiotics and currently treatable conditions start to become fatal?

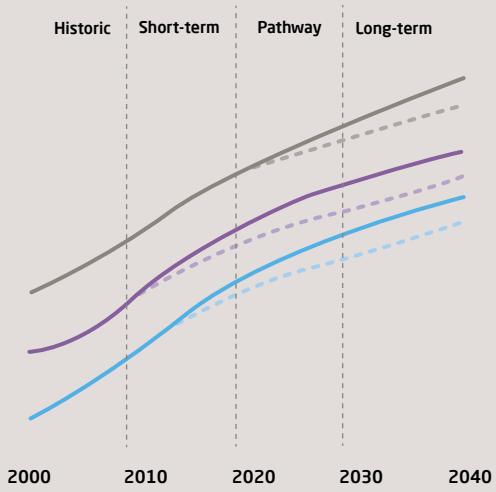
We present a series of possible 'futures' for how the life expectancies of DB pensioners might develop over time. Some will anticipate a slowing of life expectancy increases and others an increase. We also consider scenarios that affect some DB pensioners differently to others.

Note that these alternative futures are presented as purely speculative in nature and should be considered as 'food for thought' for your discussions on future longevity trend assumptions.



Constructing a future life expectancy scenario

For each scenario, we consider three distinct time periods



- The short-term (around 5 years)

Generally a continuation of current trends – but this period can be subject to one-off shocks (eg harsh winters)

- The long-term (20+ years)

As we are looking much further into the future, current trends are less relevant. The assumption for this time period is often based on longer term historic trends and is generally considered to be subjective in nature.

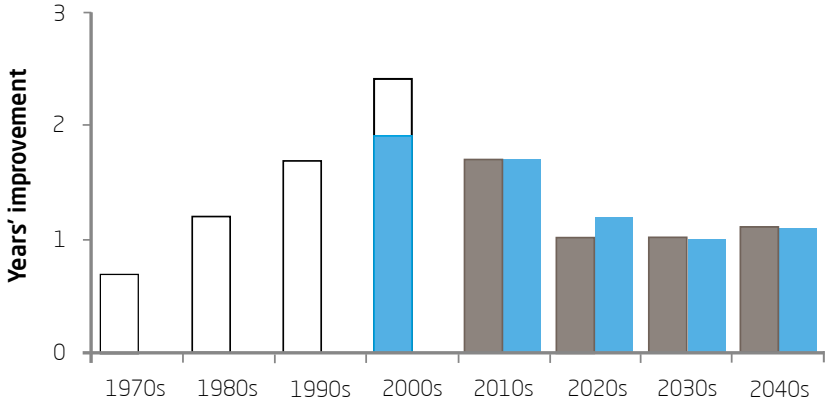
- The pathway between short- and long-term

Typically pension schemes assume that improvements are noticeably lower than current rates in this period, but other external effects, such as smoking cessation patterns, can be modelled here.

Each scenario will be compared to the current typical longevity trend assumption, to help illustrate the impact on life expectancies and liabilities.

Rate of change in life expectancy

For convenience, trends in life expectancy are often expressed in the form 'years of change per decade'. These charts, contained in the scenarios below, illustrate past and future changes in longevity, again at age 65, for each of the longevity trend groups.



Each chart shows four measures of change in life expectancy:

- Historical trends at the national population level (unfilled columns) for 1970 to 2000.
- Changes in life expectancy trends for the subgroup for 2000 to 2010 (2000s blue-shaded column). In this trend group, the improvement was less than the national population.
- Projected trends for the subgroup for 2010s to 2040s under the typical projection (grey-shaded column).
- Projected trends for the subgroup for 2010s to 2040s under the scenario projection (blue-shaded column)

These charts show how the scenario projection compares to both historic trends and the typical projection of longevity.

Overview of scenarios

The following pages introduce six scenarios as food for thought.

These can be considered, broadly speaking, as:

- two central(ish) scenarios,
- one 'plausible' scenario either side of the central scenarios, and
- one scenario at each of the extremes that replicate historically high or low changes in life expectancy repeated in the future.

These represent a broad range of possible longevity outcomes, with the results indicating:

- a wide range of potential life expectancies in the 2040s, from a return to life expectancies seen in the late 2000s to life expectancies that would be expected to typically exceed age 90
- liability effects ranging from reduction of around 18% through to increases of 10% or more for different longevity trend groups and different scheme profiles.

	Low trend scenarios		Central(ish) scenarios		High trend scenarios	
Description	"Back to the Fifties"	"Challenging Times"	"Improvement Decline"	"Health Cascade"	"Cancer Revolution"	"Extended Youth"
Summary narrative	There are multiple negative impacts on life expectancy	NHS funding is severely constrained. Many people cannot afford and/or access necessities	Improvements slow over as the frequency and impact of medical advances diminish. This is coupled with rising obesity and other detrimental lifestyle factors.	Beneficial health behaviours filter through the population. Longest lived are first to adopt positive behaviours with the rest of society adopting these later	Accelerated implementation of cancer therapies, causing cancer mortality reductions of the same magnitude as recently seen for circulatory disease	Increases in life expectancy over the last 10 years continue for many decades
Potential catalysts	Dissolution of NHS, climate change, resource constraints	Severe constraints on NHS funding and consumer spending	Increased funding to cancer research bears little fruit; treatment of other common diseases eg diabetes is neglected; rising obesity	Introduction of plain cigarette packaging. Improvement in eating and drinking behaviours	Earlier diagnosis and much more effective treatment Effective national and genetic screening "Pill" developed to target hard to treat cancers.	Breakthroughs in anti-ageing and dementia treatments Stem cell / gene therapies
Uniform or sequential	Uniform[7]	Sequential[8]	Uniform	Sequential	Uniform	Sequential

What we do not suggest is that some of these scenarios are more likely than others, that they represent a best estimate or even place outer boundaries on what we might experience in the future. The purpose of sharing these scenarios is purely to support more informed discussions between the key stakeholders in managing pension schemes – trustees, sponsoring companies and their advisors and service providers.

7 "Uniform" relates to catalysts expected to have an evenly-distributed impact throughout the population. For example, the introduction of a vaccine via the NHS might be expected to have a relatively uniform effect across all parts of society.

8 "Sequential" relates to catalysts where effects are expected to cascade sequentially through the population. For example, the impact of smoking habits is generally expected to behave in this way.

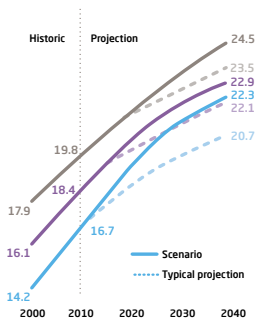
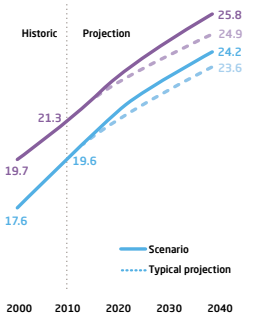
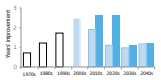
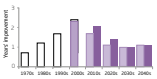
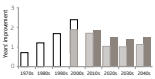
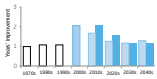
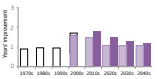
Health Cascade

Recent improvements in life expectancy for the 'golden cohort' (the generation born between two world wars) are believed to be driven by a number of behavioural changes (such as smoking cessation) and medical interventions (including free access to 24/7 medical care via the NHS).

A theory (supported by empirical data from the ONS on smoking cessation) is that uptake of such behaviours and services 'cascades' through society with the most educated (proxied by our 'comfortable' group) adopting the behaviours first and most fully. As the benefits of these behaviours become more evident so they 'cascade' through society.

This 'health cascade' is reflected in this scenario. Specifically the pace of longevity improvements for the 'comfortable' group is assumed to have 'peaked' and hence slows in the short term. In contrast, rapid improvements for the 'hard-pressed' group persist in the medium term as we see the delayed impact of the uptake of healthy behaviours (in particular smoking cessation). The 'making-do' group experiences fast improvements over the short term but these tail off more quickly than the 'hard-pressed' group.

We also reflect that, longer term, new medical therapies / behavioural changes are likely to be accessed by the 'comfortable' group, leading to a slightly faster reduction in their mortality. For women the outcome for the 'making-do / comfortable' group is based on the average of the making-do and comfortable scenarios for men.

What does this scenario mean?	Men			Women	
	Hard-pressed	Making-do	Comfortable	Hard-pressed	Making-do/ Comfortable
Trends in period life expectancy (LE)*					
Pace of improvement					
2015 cohort LE*	20.7	21.8	23.4	23.0	25.0
2030 cohort LE*	23.1	23.7	25.9	25.2	27.0
Liability impact**	+6%	+2 ½%	+3½%	+2%	+3½%

*from age 65 in the year shown. **vs CMI model with CMI starting improvement and 1.5% long-term rate

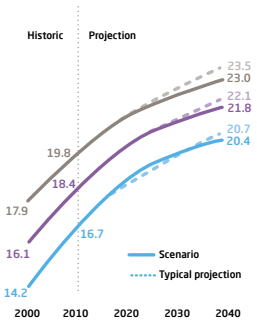
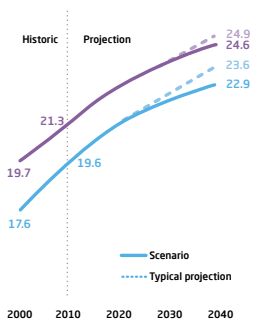
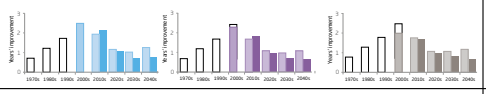
Improvement decline

In this scenario we assume that improvements will diminish over time, as the frequency and impact of medical advances diminish, coupled with rising obesity and other detrimental lifestyle factors. This means that the 'golden cohort' of individuals born between the wars continue to exhibit faster improvements in longevity than those born later.

The benefits of the healthy behaviours (smoking cessation) and introduction of the NHS are inherited by subsequent generations.

However you can only give up smoking once. For subsequent generations, medical advances, and benefits of health interventions such as screening provide a driver for some continued improvements, but the behaviours and lifestyle of younger cohorts throughout their life course result in longevity improvements slowing almost to stagnation.

Specifically, long term improvements for the post WW2 birth generations drop to around 9 months per decade (compared to the long run historical average of 1 year per decade)

What does this scenario mean?	Men			Women	
	Hard-pressed	Making-do	Comfortable	Hard-pressed	Making-do/ Comfortable
Trends in period life expectancy (LE)*					
Pace of improvement					
2015 cohort LE*	19.7	21.2	22.5	22.4	24.3
2030 cohort LE*	20.9	22.3	23.6	23.5	25.3
Liability impact**	-½%	-1%	-2%	-2½%	-1%

*from age 65 in the year shown. **vs CMI model with CMI starting improvement and 1.5% long-term rate

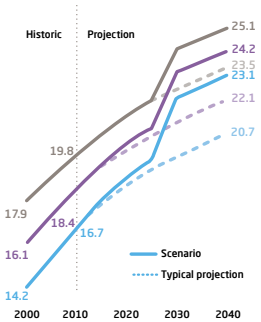
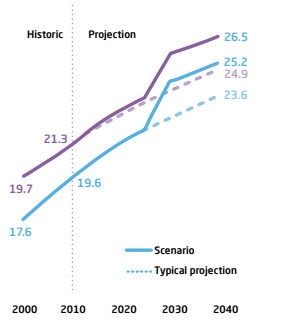
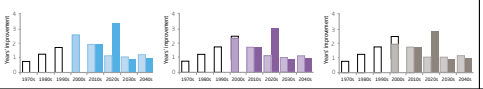
Cancer Revolution

When projecting mortality improvement using scenarios, a common suggestion involves a significant cause of death (typically, but not always, cancer) being eradicated.

Very broadly speaking, in the UK population as a whole cancer accounts for around 20% of deaths below age 55, 40% between ages 55 and 79 and 25% at age 80 and above (which we assume are the same for each of the comfortable, making-do and hard-pressed groups).

In this scenario, we allow for the lead time for drug testing and approval – and so assume that a 'cure for cancer' becomes available in 2025, with full uptake by 2030.

Older individuals are more likely to have multiple diseases - put rather grimly if you did not die of cancer there is something else 'queuing up' to kill you. Consequently, we have assumed that, whilst cancer is eradicated as a cause of death, the reduction in mortality is less than implied by the percentages above because some people who would previously have died of cancer die of another cause relatively soon afterward. We have also assumed that the long-term rate of improvement 'post-cancer' is slightly lower than it would have been 'pre-cancer', as part of the previously assumed long term rate is likely to have been driven by some gradual improvements via cancer interventions.

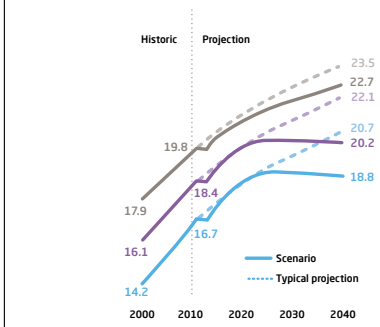
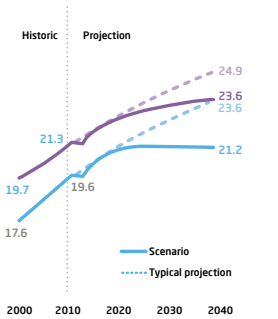
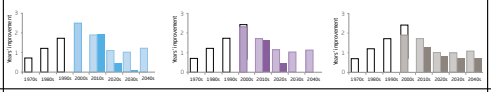
What does this scenario mean?	Men			Women	
	Hard-pressed	Making-do	Comfortable	Hard-pressed	Making-do/ Comfortable
Trends in period life expectancy (LE)*					
Pace of improvement					
2015 cohort LE*	20.8	22.3	23.6	23.5	25.3
2030 cohort LE*	24.0	25.1	26.1	26.3	27.6
Liability impact**	+7%	+5½%	+4%	+4½%	+4½%

*from age 65 in the year shown. **vs CMI model with CMI starting improvement and 1.5% long-term rate

Challenging Times

In this scenario we consider the implications of climate change and finite resources, for example, fossil fuels. We consider the possibility that we have reached 'peak oil flow' and that the availability of oil will become a constraint to economies in the future. A consequence of this could be increasing fuel prices, leading to severe constraints in NHS funding . Alongside this, reduced access / increased cost of imported food stocks could have a detrimental impact on health outcomes through for example, greater difficulty in maintaining healthy fruit and vegetable rich diets throughout the year.

We reflect this by assuming that a significant proportion of the 'hard-pressed' and 'making-do' groups are unable to afford or access their basic needs (heating, fuel, medicine) and that this leads to life expectancy ceasing to improve. In contrast we assume that resource constraint impacts are less severe on average for the 'comfortable' group, meaning that this scenario leads to longevity improvements that are below the long-term trend, but above zero for this group. Further, we have included an impact of two consecutive abnormally harsh winters (leading to no overall improvement for two years) earlier in the scenario, with a relatively high improvement in the third year. For women the outcome for the 'making-do / comfortable' group is based on the average of the 'making-do' and 'comfortable' scenarios for men.

What does this scenario mean?	Men			Women	
	Hard-pressed	Making-do	Comfortable	Hard-pressed	Making-do/ Comfortable
Trends in period life expectancy (LE)*					
Pace of improvement					
2015 cohort LE*	18.6	20.1	22.0	21.1	23.3
2030 cohort LE*	18.9	20.3	23.2	21.3	23.9
Liability impact**	-6½%	-6½%	-3½%	-9%	-5%

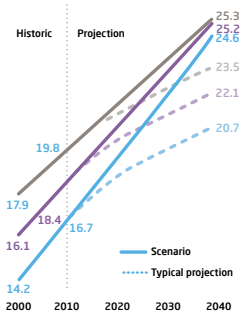
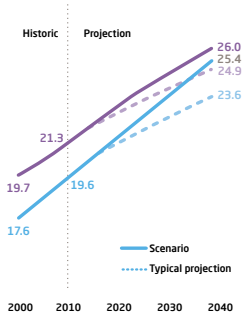
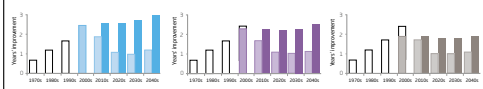
*from age 65 in the year shown. **vs CMI model with CMI starting improvement and 1.5% long-term rate

Extended Youth

Across the whole UK population, improvements in life expectancy for a man aged 65 over the 2000s were 2.4 years. This has increased from 1.7 years in the 1990s, 1.2 years in the 1980s and 0.7 years in the 1970s. For women, the increase in life expectancy over the 2000s was 1.7 years, compared to around 1 year per decade over the 1970s-90s.

However, the experience of each of our subgroups has improved in a different way to the population as a whole, with the 'hard-pressed' male group seeing a 2.5 year improvement over the 2000s, the 'making do' group a 2.3 year improvement and the 'comfortable' group a 1.9 year improvement. For women the 'hard-pressed' group saw an improvement of 2 years, whilst the 'making-do / comfortable' group saw a 1.6 year improvement in life expectancy.

In this scenario we consider the possibility that some combination of factors will lead to these improvements being sustainable over the longer term. Just as it would have been hard to predict the last 40 years of strong improvements back in 1970 - let alone the catalysts - we do not offer a very specific narrative; however possible contributory factors could be a combination of highly successful screening programs, poly-pills, smart pills aimed to improve drug adherence, ageing medicine breakthroughs increasing survivorship from the multiple diseases of later life, increased later life activity and exercise and reduced obesity.

What does this scenario mean?	Men			Women	
	Hard-pressed	Making-do	Comfortable	Hard-pressed	Making-do/ Comfortable
Trends in period life expectancy (LE)*					
Pace of improvement					
2015 cohort LE*	22.5	23.7	24.2	24.2	25.3
2030 cohort LE*	28.2	28.5	27.7	27.9	27.8
Liability impact**	+18%	+14%	+7½%	+9½%	+5½%

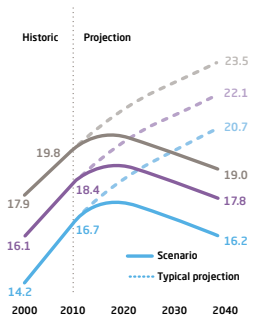
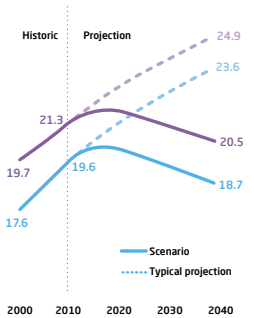
*from age 65 in the year shown. **vs CMI model with CMI starting improvement and 1.5% long-term rate

Back to the Fifties

One of the great success stories of the 20th century has been the rapid improvement in health outcomes and commensurate rise in life expectancy. With modern medicine and technology advances we are naturally inclined to assume life expectancy will continue to rise. However this has not always been the case.

For this scenario we have assumed that mortality rates will rise in the future and so life expectancy will fall, and that this will happen very soon eg by the end of this decade.

Like the continuation of trend scenario, we do not offer a very specific narrative for this scenario, instead suggesting it would involve a combination of a number of societal and health changes, possibly including widespread antibiotic resistance, obesity, severe austerity impacting the NHS (possibly to point of dissolution), severe resource constraints (oil and rare earth metals) impacting heating / access to imported fruit and veg / medical equipment.

What does this scenario mean?	Men			Women	
	Hard-pressed	Making-do	Comfortable	Hard-pressed	Making-do/ Comfortable
Trends in period life expectancy (LE)*					
Pace of improvement					
2015 cohort LE*	17.0	18.5	19.7	19.4	21.1
2030 cohort LE*	16.1	17.6	18.7	18.5	20.2
Liability impact**	-15½%	-15%	-15½%	-18%	-16½%

*from age 65 in the year shown. **vs CMI model with CMI starting improvement and 1.5% long-term rate

Future scenarios – typical impact

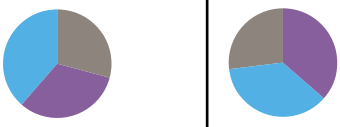
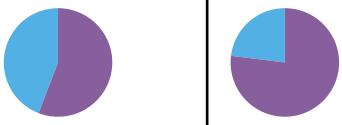
Each DB pension scheme has a unique combination of members and, as a result, a unique combination of life expectancy trend groups.

It follows that the impact for any DB pension scheme of one of these future scenarios will be, at least in part, driven by the characteristics of its membership.

The chart below illustrates, for four different scheme demographics, the implications for scheme liabilities of adopting the different longevity trend assumptions used in the scenarios above. The results illustrate vividly just how variable results can be both between scenarios and between different scheme demographics:

- Some scenarios lead to much lower liabilities (but worse outcomes for scheme members) while others lead to much higher liabilities (but much longer life expectancy for scheme members);
- Some scenarios, such as Health Cascade and Improvement Decline, result in similar outcomes for scheme liabilities;
- Other, more extreme scenarios, result in very different outcomes for schemes, depending on their demographic profile.

Pension schemes could consider consulting their advisors to help them find out their result.

	Example schemes			
	A: Mature, lower socio-economics	**B:** Broadly typical mix	**C:** Broadly typical mix	**D:** Higher socio-economics
Men				
£				
Women				
£				
Estimated Liability Impact				
Health Cascade	3%	3%	3½%	3½%
Improvement Decline	-1%	-1½%	-1%	-1½%
Cancer Revolution	4%	4½%	4%	3½%
Challenging Times	-5½%	-6½%	-5%	-5%
Extended Youth	10½%	10½%	8½%	8%
Back to the Fifties	-14½%	-18%	-16%	-17%

*Note – impact comparison based on schemes using CMI model with CMI starting improvement and 1.5% long-term rate.

Want to read more?

This paper is intended as a high level summary of the results of our Research Project. If you want to know more, including much of the technical detail of the research that we have carried out, you can find this at:

www.napf.co.uk/longevity-model
www.clubvita.co.uk/longevity

The Technical Document is written with an informed audience in mind. This includes actuaries and other pension scheme advisors that want to implement some of our research findings in their advice to you as trustees. However, we would encourage other interested readers not to be put off looking at the Technical Document as we have sought to make it accessible to a wide audience. Requests for printed copies of the technical document and any queries should be addressed to steven.hood@clubvita.co.uk.

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