

# Dorset County Pension Fund

Analysis to support mortality assumptions for the  
2022 valuation

**Barnett Waddingham LLP**

15 August 2022



## Introduction

The life expectancy of a pension fund's membership is one of the more significant assumptions made when valuing its liabilities. It is therefore important that the Fund Actuary has the information needed to make appropriate assumptions about the longevity of the membership in the Fund.

Setting these assumptions is particularly challenging this valuation cycle due to the ongoing COVID-19 pandemic and its effect on both short- and long-term mortality.

The advice in this report is addressed to Dorset Council (the administering authority) of the Dorset County Pension Fund (the Fund). It has been provided as background information to the triennial valuation of the Fund for both the administering authority and Fund Actuary. It contains an analysis of past mortality experience (including the impact of the Covid-19 pandemic) as well as proposed demographic assumptions to be used at the 2022 valuation.

The purpose of this report is to support discussions between the Fund Actuary and the administering authority in selecting appropriate mortality assumptions to use for the actuarial valuation of the Fund as at 31 March 2022 (the 2022 valuation). We emphasise that the final demographic assumptions will be set by the Fund Actuary. We have discussed the proposals in this report with the Fund Actuary.

This advice is not intended to assist any user other than the administering authority in making decisions or for any other purpose and neither I nor Barnett Waddingham LLP accept liability to third parties in relation to this advice.

This advice is subject to and complies with Technical Actuarial Standards (TASs) issued by the Financial Reporting Council (in particular, TAS 100: Principles for Technical Actuarial Work and TAS 300: Pensions).

We would be happy to discuss this paper with you in more detail.

**Jon Palin**  
**Partner, Barnett Waddingham LLP**  
**15 August 2022**

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## Executive summary

### Purpose of the analysis

Gain understanding of Fund's current mortality and longevity risk by assessing two parts:

- 1) The current life expectancies of members
- 2) Future improvements in longevity

### COVID-19

An analysis of the total and relative impact of the COVID-19 pandemic has been carried out.

As deaths during parts of 2020 and 2021 were unusually high due to the pandemic, mortality during 2017-2019 is more representative of future mortality.

### Current mortality assumption

We propose the current pensioner mortality assumptions are based on the S3 tables with a multiplier of 96% for males and 103% for females.

We understand the Fund Actuary may round the multipliers for calculation purposes.

### Future improvements

For future improvements we propose to use the CMI\_2021 model with a long-term improvement of 1.25% p.a., a smoothing parameter of 7.0, an initial addition of 0% p.a. and a weight parameter of 5% for both 2020 and 2021

### Impact on life expectancies

Using these assumptions will lead to an average decrease of the members' life expectancies of 1.5 years for males and 1.0 year for females at age 65, relative to the previous valuation

## Results summary and life expectancies

The proposed best estimate assumptions for current mortality rates and best estimate parameters for future improvement assumptions are summarised in the table below. We have also included the assumptions used at the 2019 valuation. Note that the 2019 current mortality assumptions were rounded to multiples of 5% and we understand the Fund Actuary may again choose to round the multipliers for the 2022 valuation for calculation purposes.

	2019 valuation	2022 valuation
<b>Current mortality rates:</b>		
Pensioners	90% of S3PMA for males 100% of S3PFA for females	96% of S3PMA for males 103% of S3PFA for females
Dependants	95% of S3DMA for males 115% of S3DFA for females	103% of S3DMA for males 102% of S3DFA for females
Actives and deferreds (pre-retirement mortality)	105% of GAD	115% of GAD for males 117% of GAD for females
Actives and deferreds (post-retirement mortality)	As for current pensioner assumptions	As for current pensioner assumptions
<b>Future improvements:</b>		
CMI Model	CMI_2018	CMI_2021
Long-term rate of improvement (p.a.)	1.25%	1.25%
2020 and 2021 weight parameter (new for 2022)	N/A	5%
Initial addition parameter (p.a.)	0.5%	0%
Smoothing parameter	7.5	7.0

## Impact on life expectancy

The changes in current and future improvement assumptions result in the changes in life expectancy as at 31 March 2022 shown in the table below. The three columns show life expectancies for:

- current mortality assumption used in 2019, with CMI\_2018, an initial addition parameter of 0.5% p.a., a smoothing parameter of 7.5 and a long-term improvement rate of 1.25% p.a.;
- best estimate current mortality assumption in 2022, with CMI\_2018, an initial addition parameter of 0.5% p.a., a smoothing parameter of 7.5 and a long-term improvement rate of 1.25% p.a. as an intermediate step; and
- best estimate current mortality assumption in 2022, with CMI\_2021, an initial addition parameter of 0% p.a., a smoothing parameter of 7.0, 5% weighting for 2020/21 data and a long-term improvement rate of 1.25% p.a.

Life expectancy from age 65 (years)	2019 valuation	2022 current mortality, 2019 improvements	2022 current mortality, 2022 improvements	Total change from 2019 to 2022
Male, retiring today, age 65	23.5	23.0 (-2.1%)	22.0 (-4.3%)	-1.5 years (-6.4%)
Female, retiring today, age 65	24.9	24.7 (-0.8%)	23.9 (-3.2%)	-1.0 years (-4.0%)
Male, retiring in 20 years, current age 45	24.9	24.4 (-2.0%)	23.3 (-4.4%)	-1.6 years (-6.4%)
Female, retiring in 20 years, current age 45	26.3	26.1 (-0.8%)	25.4 (-2.6%)	-0.9 years (-3.4%)

The table shows that the change in current mortality assumptions results in a decrease in life expectancies for both males and females. The change in future improvement assumptions, with the change to the initial addition parameter and smoothing parameter in addition to the incorporation of a 5% weighting for 2020 and 2021, further reduces life expectancies for both males and females.

## Approximate impact on funding level and primary rate

We have also considered the approximate impact of moving to the proposed 2022 mortality assumptions on the funding level and primary rate for the Fund in the table below. This analysis uses financial assumptions in line with those set for the 2019 valuation. These figures are for illustration only and the actual impact based on 2022 financial assumptions and full membership data will be different.

	2019 valuation	2022 current mortality, 2019 improvements	2022 current mortality, 2022 improvements	Total change from 2019 to 2022
Impact on funding level	N/A	+0.6%	+2.3%	+2.9%
Impact on primary rate	N/A	-0.1%	-0.5%	-0.6%

The table shows that the change in mortality assumptions is expected to result in an increase in the funding level and a decrease in the primary rate, with the change being driven more by the change in future improvement assumptions than the base table multipliers.

## Background

### Purpose of analysis

The Fund provides pensions and other benefits linked to the lifetime of its members. In order to effectively carry out their role, the administering authority needs to understand how long the Fund members are likely to live, and to update their view from time to time.

A view on the future mortality of members is important for the Fund Actuary to consider when setting contribution rates for the participating employers. Our report is intended to provide information to support the Fund Actuary in setting mortality assumptions for the 2022 valuation of the Fund.

This review also demonstrates good governance by the administering authority which is particularly relevant in light of additional scrutiny from the Government Actuary's Department (GAD) and the Pensions Regulator on governance practices within funds.

A view of future longevity is generally structured in two parts:

- 1) life expectancy of members based on current mortality rates; and**
- 2) an allowance for future improvements in longevity.**

The purpose of analysing the Fund's mortality experience is to gain a better understanding of the Fund's 'current' mortality rates. Typically, this reduces the risk that members of the Fund will live longer than expected, leading to the Fund not holding sufficient funds to cover the cost of members' benefits.

We also comment on how mortality rates may change in the future in the "Future longevity improvements" section of this report and on the impact the COVID-19 pandemic has had on the Fund in the [Choice of years to include in analysis](#) section.

### Method

Our analysis of the current life expectancy is based on an assessment of the mortality rates experienced by the Fund over the three-year period from 1 January 2017 to 31 December 2019 (**experience analysis**) with further analysis of the impact of the COVID-19 pandemic on mortality experience in 2020 and 2021. We have also assessed the profile of the members of the Fund based on their postcodes (**socio-economic analysis**). This allows comparison of the profile of the different membership statuses within the Fund and between funds.

We have also undertaken similar analyses for a number of other LGPS Funds and found that the Dorset Fund exhibited a broadly similar socio-economic profile and actual mortality experience to the Funds of Berkshire, Buckinghamshire, Devon, Essex, Kent, Lincolnshire, Nottinghamshire and Somerset. Throughout this report, we describe this group of Funds as the **2022 Combined Funds**. For membership groups where the experience of the Dorset Fund alone is less credible (due to there being fewer deaths) we have used results for the aggregated 2022 Combined Funds.

A number of assumptions have been made for the socio-economic and experience analysis and the administering authority should be comfortable that they are appropriate. Further details are set out in the remainder of this report.

The assumptions proposed in this report are 'best estimate' assumptions, i.e. the assumptions are intended to result in an equal chance that actual mortality experience will be higher or lower than these assumptions.

The actuarial valuation should use assumptions that are 'prudent'; in other words, the assumptions should provide sufficient margins for adverse deviation consistent with the administering authority's appetite for risk. However, as we understand the Fund Actuary will allow for prudence solely through the discount rate, the longevity assumptions in this report are a best estimate.

## How to determine appropriate assumptions

Setting longevity assumptions for the actuarial valuation has three steps:

- 1) Determine the appropriate base table.
- 2) Adjust the base table to reflect the characteristics of the Fund.
- 3) Make an allowance for future improvements in longevity.

## Lives vs amounts weighted approach

When carrying out longevity analyses, there are two possible approaches to obtaining the results:

- Give equal weighting to each member (**lives-weighted**); or
- Weighting the results based on pension amounts (**amounts-weighted**).

We generally prefer an amounts-weighted analysis, as this more closely reflects the financial impact on the Fund. However, for non-pensioner members, we have carried out a lives-weighted analysis, as their pensions are not yet in payment and pension amount is therefore not an appropriate way to weight the data.

## Data for analysis

Membership data, including membership movements, was provided by the administering authority, in the form of the Universal Data Capture (UDC). More detail about the data used in the analysis can be found in Appendix 3 and Appendix 4.

Data for the 2022 Combined Funds was used in the experience analysis for male dependants and non-pensioners. The table below shows the number of deaths for the Fund between 1 January 2017 and 31 December 2019, with the 2022 Combined Funds shown for comparison. The table shows that pensioners have the highest number of deaths by a significant margin and, although there are also a large number of dependant deaths, the majority of these are for females.

Number of deaths (2017-2019)	Actives	Deferreds	Pensioners	Dependants
Dorset:				
Males	22	28	557	60
Females	25	55	441	297
<b>Total</b>	<b>47</b>	<b>83</b>	<b>998</b>	<b>357</b>
2022 Combined Funds:				
Males	234	382	6,659	961
Females	408	695	6,214	3,543
<b>Total</b>	<b>642</b>	<b>1,077</b>	<b>12,873</b>	<b>4,504</b>

## Choice of years to include in analysis

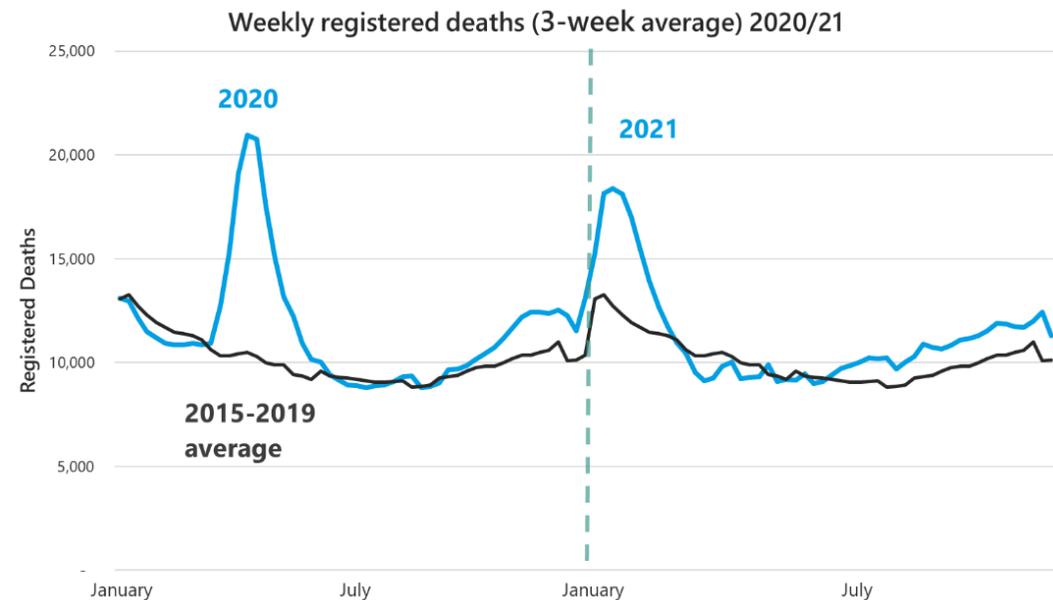
We received data from the administering authority for the five-year period from 1 January 2017 to 31 December 2021. However, mortality in 2020 and 2021 was unusual due to the COVID-19 pandemic and we have chosen not to include them in our analysis of experience and to focus instead on the three-year period from 1 January 2017 to 31 December 2019. In this section, we describe the considerations underlying that decision.

### Impact of the COVID-19 pandemic

The COVID-19 pandemic led to deaths in 2020 and early 2021 being significantly higher than in previous years. This is illustrated by the chart to the right, which shows weekly registered deaths (averaged over three weeks to reduce volatility) in England and Wales since January 2020 (blue line) compared to the average in the preceding five years (black line).

The longer-term impact of the pandemic on mortality is unclear at this stage, as the pandemic is likely to affect mortality in various ways. For example:

- The pandemic could worsen future mortality, directly through COVID-19 itself, because of poorer health due to long-COVID, and the impact of delayed medical screening and treatments.
- But there may be benefits from greater awareness of infectious diseases and advancements in vaccine science.



Further details are provided in our recent briefing note – Covid-19: an uncertain future for mortality.

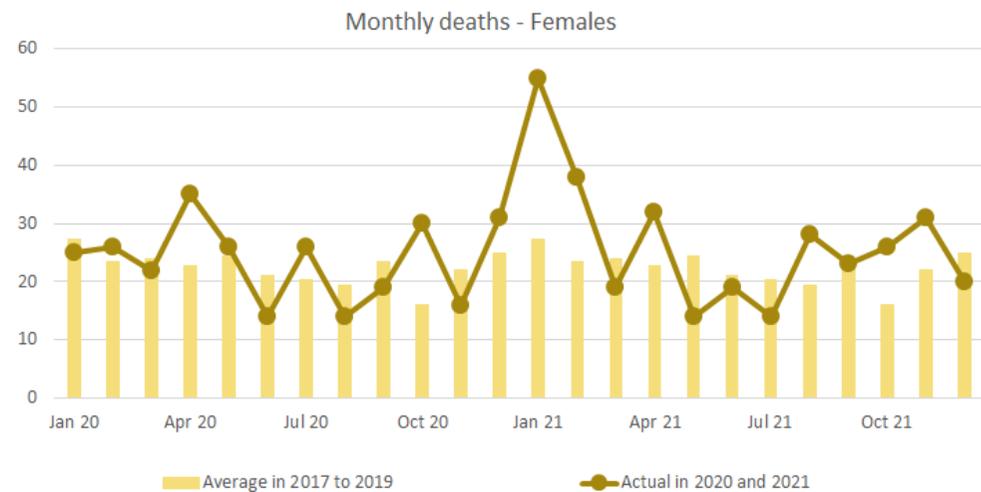
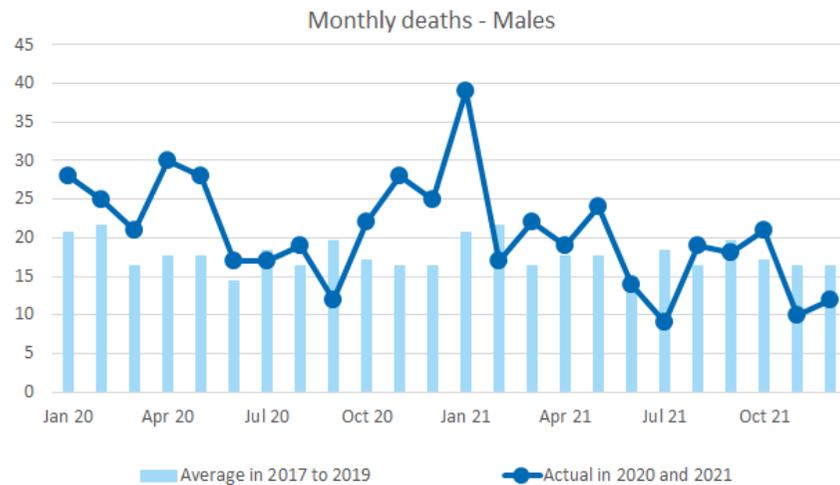
On balance, we would expect the pandemic to lead to a modest reduction in future improvements in life expectancy. This is reflected in our choice of 2020 and 2021 weight parameters, as discussed in the [Future longevity improvements](#) section.

## Impact on deaths in the Fund

The analysis in this report relies on past mortality experience to inform an assumption for the future. As discussed in [Appendix 1](#), a general limitation of mortality analyses is that past experience may not be a good indication of the future. This may be a particular concern due to the pandemic.

To understand the impact that the COVID-19 pandemic has had on the Fund’s members, we have undertaken an analysis of actual member deaths. We have compared deaths in 2020 and 2021 with a “normal” level of deaths experienced before the pandemic, in 2017 to 2019.

The charts below show the average number of deaths of retired members in the Fund by month for the period 1 January 2017 to 31 December 2019 (light blue or yellow bars, with e.g. the January bar representing the average number of deaths in January 2017, January 2018 and January 2019), compared with the number of deaths in 2020 and 2021 (dark blue or yellow line) for males and females separately.



The impact of COVID-19 can be seen in the number of deaths in the Fund. The COVID-19 pandemic led to significantly higher deaths than normal in and around January 2021 and, to a lesser extent, April 2020, for both males and females. Deaths for most other months were similar to the average for 2017 to 2019, although there is some volatility in death figures month-on-month for the Fund, due to its relatively small size compared to the general population.

This analysis gives an indication of how the Fund has been impacted by COVID-19 but it is fairly crude as it does not allow for changes in the size or age of the Fund membership over time.

### Impact on the socio-economic analysis

The socio-economic analysis carried out in this report is based on members' postcodes and pension amounts. CMI research suggests that the pandemic did not materially distort previously observed relative differences in mortality rates for different socio-economic classes. We therefore believe it is reasonable to continue to use socio-economic models that were constructed prior to the pandemic without adjustment to help set the assumptions.

### Late-reported deaths

For the Dorset Fund, the charts on the previous page show the number of deaths falling away slightly towards the end of 2021, but we typically expect more deaths in winter months than in autumn months. While there can be some fluctuation in the number of deaths occurring each month, the slight fall in late 2021 may reflect late-reporting of deaths (i.e. deaths that occurred before the end of 2021 but had not been reported to the administering authority by the time that data was provided to us).

A mortality analysis was also carried out as part of the 2019 valuation of the Fund and there is some overlap in the data underlying that analysis and the data used in this analysis, as both analyses include data for the period 1 January 2017 to 31 December 2018. To further investigate the possibility of late-reporting, we compared our 2019 analysis data with the 2022 analysis data for the overlapping years. For the Dorset Fund, there were a number of additional deaths recorded in the 2022 analysis data, compared to the 2019 analysis data, reflecting some possible late reporting. The majority of these additional deaths related to 2018 and pensioners were affected more than dependants.

We also looked into late-reporting in a number of other LGPS Funds, where we had done a 2019 analysis and found that there was evidence of late-reported deaths for all membership statuses to varying degrees in both 2017 and 2018. This was coupled with several other LGPS Funds showing striking evidence of late-reported deaths in 2021, when looking at the deaths by month as part of the investigation of the impact of COVID-19.

### Conclusion

The combination of the unusual nature of mortality during the pandemic and the evidence of some late-reporting of deaths leads us to focus on the three-year period from 1 January 2017 to 31 December 2019 for our analysis of experience.

## Experience analysis

The first step of the experience analysis is choosing appropriate base tables to be used as the starting point for the analysis. We then adjust the base tables to reflect the characteristics of the Fund or the 2022 Combined Funds, as appropriate. This is an iterative process, as the choice of base table may be revisited if the analysis suggests that our initial choice of base table is not the best fit for the experience of a fund.

### Choice of base table

As the S3 tables are the most up-to-date tables published by the Continuous Mortality Investigation Ltd (CMI), we recommend that they are adopted for post-retirement assumptions for the 2022 valuation. More information about the S3 tables can be found in Appendix 2.

For pensioner members, we believe that the most appropriate base tables are the S3PMA and S3PFA tables, which are based on data for pensioner members of UK pension schemes. We believe that the most appropriate base tables for dependant members are the S3DMA and S3DFA tables, which are based on dependant members of UK pension schemes.

The S3 tables are based on data for post-retirement pension scheme members. For the pre-retirement mortality assumption for non-pensioner members of the 2022 Combined Funds (actives and deferreds) we believe that tables published by GAD for LGPS members are the most appropriate tables as these are based on actual pre-retirement mortality experience of public sector pensioners.

### Adjust the base table to reflect the characteristics of each Fund

The second step is to make an adjustment to the base table. In order to adjust the chosen base table to reflect the characteristics of the Fund or the 2022 Combined Funds, as appropriate, we have analysed mortality experience (i.e. the actual deaths that have occurred relative to a chosen base table) over the period from 1 January 2017 to 31 December 2019. This analysis results in a multiplier being proposed to each table, with a multiplier above 100% meaning that actual deaths have been higher than anticipated by the chosen base table and a multiplier below 100% meaning that deaths have been lower.

A similar analysis was carried out for the 2019 valuation. At that time, analysis for pensioners and female dependants was based on experience of the Dorset Fund alone, while analysis for male dependants and non-pensioners was carried out relative to a group of Funds, the 2019 Combined Funds. The 2019 Combined Funds consisted of Dorset plus the Funds of Bedfordshire, Berkshire, Buckinghamshire, Devon, Essex and Somerset.

## Pensioners

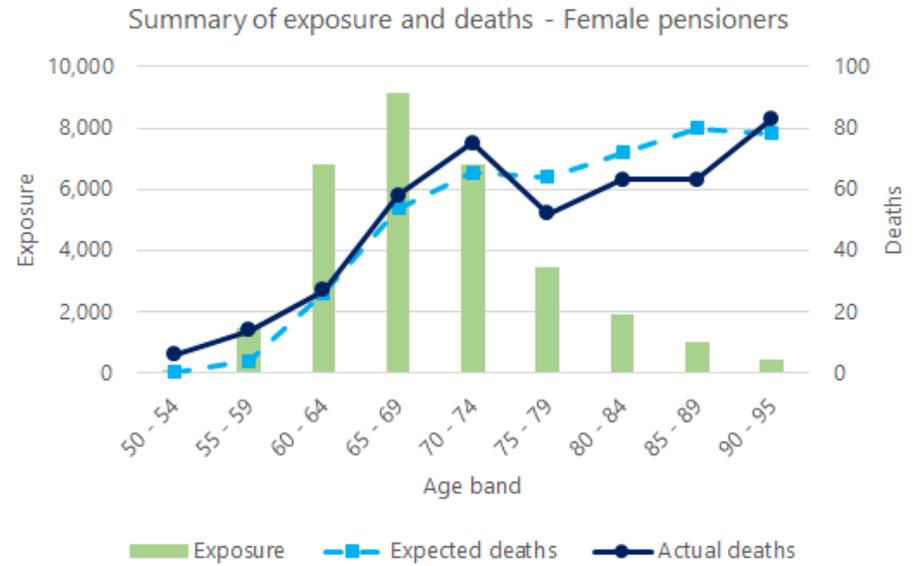
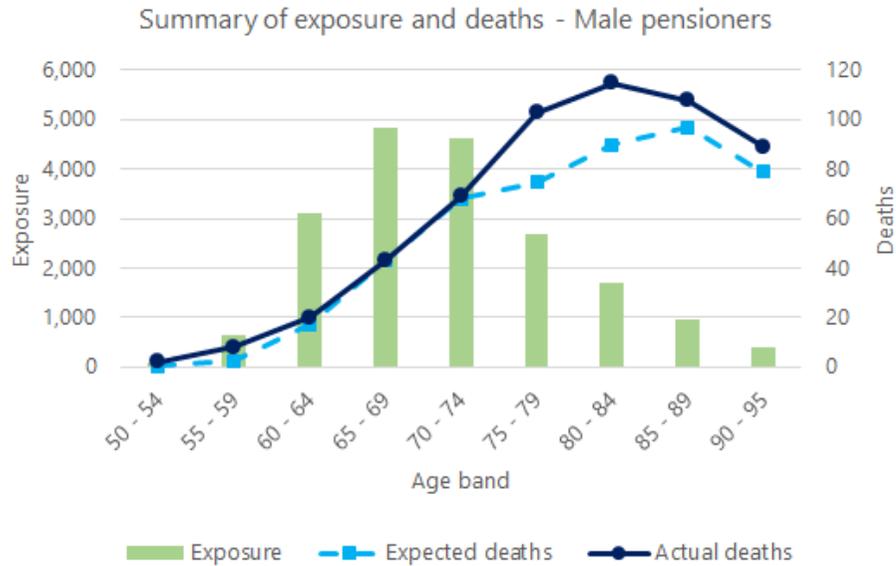
For pensioner members, we have compared actual deaths for the Fund with the number of deaths expected under the S3PMA and S3PFA tables.

These tables have an effective date of January 2013, i.e. the tables reflect mortality rates in 2013. Our analysis data covers a later period, therefore we have used mortality improvements from the CMI Model to allow for changes in mortality between the base table date and the midpoint of our analysis period. This allows for a consistent comparison between the Fund's pensioner experience and the S3 tables. (Specifically, we have used CMI\_2021 with a long term rate of improvement of 1.25% p.a., an initial addition of 0% p.a., a smoothing parameter of 7.0, and a 2020/21 data weighting of 5%).

The experience analysis for the Fund is based on 19,158 members and 50,094 years of exposure (i.e. less than three years of exposure for some members due to retirements and leavers part way through the period). There were 998 deaths during the investigation period – equivalent to about 5% of the pensioner membership.

In order to assess whether it is reasonable to apply a single percentage adjustment to the base table at all ages, we have considered the experience by age band. We have done this on a lives-weighted basis, as this is less volatile than an amounts-weighted basis, although we still set our best estimate assumption based on the amounts-weighted experience as we believe this better reflects the financial impact of mortality on the Fund, as described in the [Background](#) section.

The lines on the charts below compare the actual number of deaths for each age band with the number of deaths expected under the S3PxA tables (before applying a multiplier). The columns show the exposure – the total number of person-years spent in each age band over the investigation period. We show results for males and females separately. Most of the exposure occurred between ages 60 and 74; however, more deaths are expected relative to exposure in higher age bands as mortality rates increase rapidly with age.



The charts show that actual deaths on a lives-weighted basis were generally higher than those expected under S3PMA for males and sometimes higher, sometimes lower than S3PFA for females. The shape of actual deaths compared with expected deaths suggests that S3PxA is a reasonably good fit for the Funds' pensioner membership. **The shape of experience suggests that a flat adjustment to S3PxA is broadly appropriate for pensioners.**

The mortality experience for pensioners (weighted by pension amount) during the investigation period was equivalent to:

- **96% of the S3PMA table for males; and**
- **103% of the S3PFA table for females**

These adjustments mean that, for pensioner members, deaths have been slightly lower than anticipated under S3PMA for males and slightly higher than anticipated under S3PFA for females, on an amounts-weighted basis.

## Dependants and non-pensioner members

We have carried out similar comparisons for dependants and non-pensioner members.

As there are few deaths at younger ages, there is significantly more volatility in the experience of the Fund for non-pensioners than for post-retirement statuses. We have therefore used the experience of actives and deferreds in the 2022 Combined Funds to set a single non-pensioner mortality assumption for the Fund. We believe it is reasonable to do so as the socio-economic profile of the Dorset Fund is similar to those of the other 2022 Combined Funds, as seen in Appendix 4.

Similarly, there are relatively few male dependants, leading to a small number of deaths, so we have set the assumption for male dependants based on experience of the 2022 Combined Funds. For female dependants, we believe there is sufficient data to set the assumption based on experience of the Dorset Fund alone.

For dependants, we have compared actual deaths with those expected under the S3DMA and S3DFA tables, which have an effective date of 1 January 2013. For non-pensioners, we have compared actual deaths with those expected under the GAD death-before-retirement tables and we have assumed these have an effective date of 1 January 2016<sup>1</sup>. We have again used mortality improvements from CMI\_2021 to allow for changes in mortality between the base table date and the midpoint of our analysis period.

The best estimate assumptions for dependants are amounts-weighted, as for pensioners. However, we have used a lives-weighted analysis to determine best estimate assumptions for non-pensioners, as their pensions have not yet come into payment so amounts-weighting would be less reliable.

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<sup>1</sup> The effective date for the GAD tables is not specified. We have assumed an effective date of 1 January 2016 when using these tables as part of the 2019 valuation and have retained that date for this valuation for consistency.

Details of the data underlying the analysis of each membership group can be found in the following table:

	Female Dependants (Dorset Fund)	Male Dependants (2022 Combined Funds)	Non-pensioners (2022 Combined Funds)
Members	2,052	9,303	664,152
Years of exposure	4,884	21,088	1,586,752
Deaths	297	961	1,719
Number of deaths relative to pensioners	14%	10%	0.3%

As for pensioners, we assessed whether to apply a single multiplier at all ages by considering the shape of experience by age band. The results of this assessment are shown in Appendix 5.

Mortality experience for dependants and non-pensioners was equivalent to applying the following adjustments:

Adjustment to base tables	Dependants	Non-pensioners
	<b>103% of the S3DMA table for males</b>	<b>115% of GAD table for males</b>
	<b>102% of the S3DFA table for females</b>	<b>117% of GAD table for females</b>

These adjustments mean that for dependants and non-pensioners, deaths have been:

- Slightly higher than anticipated overall under S3DFA for female dependants of the Dorset Fund on an amounts-weighted basis;
- Slightly higher than anticipated overall under S3DMA for male dependants of the 2022 Combined Funds on an amounts-weighted basis; and
- Higher than anticipated overall under GAD for male and female non-pensioners of the 2022 Combined Funds on a lives-weighted basis.

### Post-retirement assumption for non-pensioner members

It is important to consider whether past experience is an appropriate basis for an assumption regarding future experience; in particular, whether the type of pensioners within the Fund might be changing over time.

The analysis of postcode data by membership status in Appendix 4 suggests that current pensioners are drawn from slightly higher socio-economic groups than current non-pensioners. However, such differences are also evident in population data and assuming a similar socio-economic profile is prudent.

We therefore consider that the experience analysis of current pensioners can be used to set assumptions for future pensioners and, specifically that the assumptions for existing pensioners can also be considered best estimate assumptions of post-retirement mortality for current non-pensioners.

## Future longevity improvements

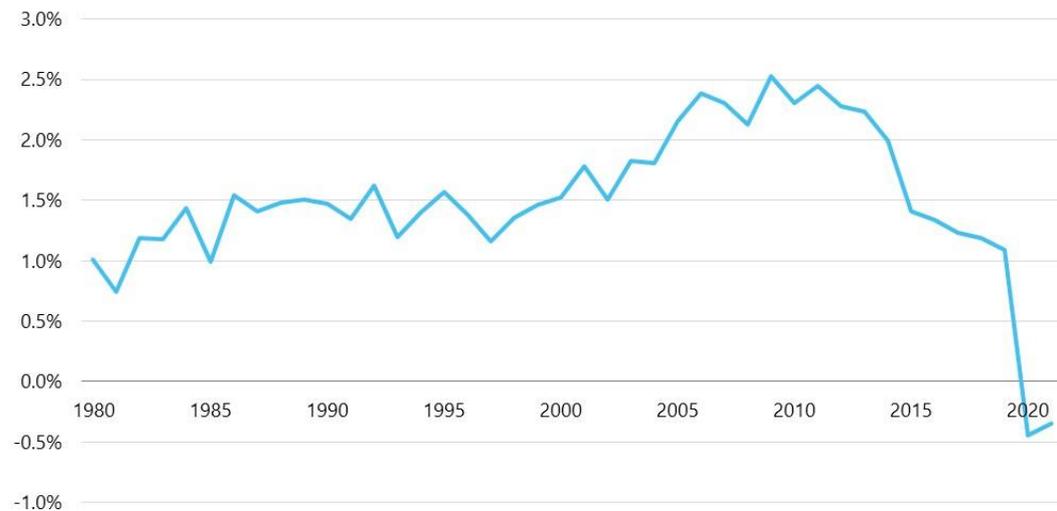
The third step in choosing mortality assumptions is to make an allowance for future improvements in longevity.

### What are “mortality improvement” rates?

The term ‘mortality improvement’ refers to the percentage reduction in the probability of death for a particular age group from one year to the next. The chart to the right shows how mortality improvement rates in England & Wales, averaged across ages 20-100, have changed in recent decades.

Mortality improvements were fairly stable in the 1980s and 1990s but rose in the early 2000s before falling sharply in the 2010s. The largest individual fall was caused by the start of the COVID-19 pandemic in 2020.

England & Wales mortality improvements - rolling 10 year average



### How do we allow for future longevity improvements?

At the previous valuation, allowance was made for mortality to improve in future using the CMI Mortality Projections Model (the “CMI Model”). This assumes that initial mortality improvements, based on historical data, converge to an assumed long-term rate of improvement over a period of up to 40 years.

We propose using the most recent version of the CMI Model, **CMI\_2021**, for this valuation, so that actual improvements since the previous valuation and developments in mortality modelling are allowed for. We note that this relies on population data published by the Office for National Statistics (ONS), which may

be revised following the publication of 2021 census for England & Wales later this year. We will keep abreast of developments as the census results are published and inform you of any results that are likely to have a material impact.

The CMI Model has numerous elements that users can adjust, to make it suitable for their work. We have included further discussion on four elements that we consider are particularly relevant below.

### The long-term rate of improvement

The **long-term rate of improvement** is a particularly subjective assumption as it requires users to make a judgement about what mortality improvements will be further into the future. It is also the one parameter in the CMI Model for which the CMI does not provide a default value.

As part of the 2016 analysis we examined available evidence including long-term trends, the opinions of experts and considering a model projection of future deaths split by cause of death. Our analysis suggested that a long-term rate assumption in the range 1.25% p.a. to 1.75% p.a. would be appropriate.

We do not believe there have been any fundamental changes to the underlying outlook for long-term mortality improvements since the 2016 valuation as, given the long-term nature of this assumption, it takes time for new evidence to emerge. While the COVID-19 pandemic has had a large impact on recent mortality, its impact on long-term improvements is likely to be small. Therefore, we propose that the best estimate range from our previous analyses remains appropriate. We would suggest that the available evidence for setting the long-term rate assumption is revisited as part of the 2025 valuation.

The Fund used an assumption of 1.25% p.a. for the 2019 valuation and we believe, in discussion with your Fund Actuary, that this remains appropriate for the Fund for the 2022 valuation.

### 2020 and 2021 weight parameters

Earlier versions of the core CMI model assumed that recent mortality experience in England and Wales is a good guide to predicting mortality rates in the near future. However, this is unlikely to be true of experience during the COVID-19 pandemic.

The CMI\_2021 model has **weight parameters** that enable the user to vary the weight put on the mortality data for 2020 and 2021. The CMI has set a default of 0% for both the 2020 and 2021 weight parameters. This effectively ignores the pandemic period when determining the initial level of mortality improvements, and assumes that mortality will broadly return to pre-pandemic expectations after the shock of the last few years.

Setting weight parameters higher than 0% would be consistent with a view that mortality rates will be higher (and life expectancy lower) than pre-pandemic expectations.

Our view is that weights for 2020 and 2021 of between 0% and 10% would be reasonable. This would reflect an expectation that mortality rates may continue to be higher than pre-pandemic expectations into the medium-term.

In our calculations we have given a 5% weighting to 2020 and 2021 data within the CMI\_2021 model, which we understand is the assumption that your Fund Actuary will propose for the 2022 valuation of the Fund.

### The initial addition to mortality improvements

The initial mortality improvements in the CMI Model are calibrated to data for the general population of England & Wales. The **initial addition parameter** allows us to adjust the extent to modify the mortality improvements to reflect the socio-economic profile of the Fund. Using a positive initial addition to mortality improvements would imply that the Fund will have higher improvements than the general population.

As part of the 2019 analysis we considered available evidence that suggested that pension schemes and those with higher socio-economic status may have experienced higher mortality improvements than the general population. We also carried out an analysis of the mortality experience of LGPS Funds to investigate whether LGPS members may have experienced higher rates of mortality improvement than the general population. Our analysis suggested that an initial addition of between 0% p.a. and 0.5% p.a. would be appropriate for LGPS Funds. The most recent analysis by the CMI suggests very little difference in mortality improvements between pension schemes and the population. We believe that the range 0% p.a. to 0.5% p.a. remains appropriate for the 2022 valuation but the evidence for a positive initial addition is slightly weaker than at the time of the 2019 valuation, and we would suggest that the evidence is reviewed again at the 2025 valuation.

The Fund used an assumption of 0.5% p.a. for the 2019 valuation but in discussion with your Fund Actuary, we have used an assumption of 0% p.a. for our calculations to reflect the weaker evidence for a positive initial addition for the 2022 valuation, compared with the 2019 valuation.

### The period smoothing parameter

The **period smoothing parameter** allows users to change the relative importance of recent and longer-term data when determining initial mortality improvements. All else being equal, a lower smoothing parameter will place more weight on recent improvements. The impact on life expectancies and liabilities will depend on whether recent improvements have been lower or higher than average. The CMI's default value is 7.0, which it last revised in CMI\_2018.

For the 2019 valuation, the Fund Actuary chose to retain the previous default value of 7.5, rather than moving to 7.0. We were comfortable with this approach at the time.

Analysis by the CMI of CMI\_2021 shows that its results are less sensitive to the choice of smoothing parameter than when the parameter was first introduced for CMI\_2016. This means that changing the smoothing parameter has less impact on liabilities than it would previously have done.

We believe that it would still be appropriate to adopt a smoothing parameter of 7.0 or 7.5 for the 2022 valuation. Following discussion with your Fund Actuary, we have used an assumption of 7.0 in our calculations, in line with the expectation that this assumption will be proposed for the 2022 valuation of the Fund.

## Appendix 1 Limitations of the analysis

It is important to note the potential limitations of these results.

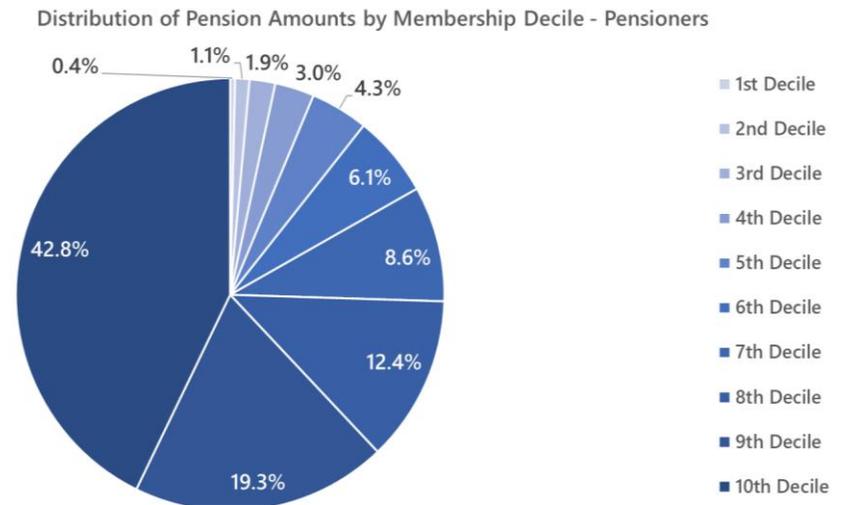
In particular, although there are a large number of pensioners, there will still be some volatility within the experience. Where members hold a large proportion of the total pension in payment within the Fund, experience on an amounts basis is likely to be volatile. As the chart on the right indicates, over 40% of the total pension amount for pensioners in the Fund is in respect of 10% of the pensioner membership. The chart shows that, for the Fund, the data is highly skewed towards members with high pensions.

In addition, using the experience analysis of the 2022 Combined Funds as the basis for setting assumptions for male dependants and non-pensioners implicitly assumes that the past mortality experience of the 2022 Combined Funds is a good guide to the future expected mortality rates of current Fund members. There may be reasons why this is not the case, for example:

- Differences between the characteristics of members of the Fund and of the other members of the 2022 Combined Funds; and
- Changes to the characteristics of the 2022 Combined Funds' members over time or changes in the underlying drivers of mortality.

We have used our socio-economic model (see Appendix 4) to seek to justify this approach but the model assumes that relative mortality rates can be inferred from postcodes.

Finally, our analysis relies on the accuracy and completeness of the data we have used. While we have carried out a number of reasonableness and consistency checks on the data, and believe it to be fit for purpose, we have not carried out full valuation checks. Further commentary on the data can be found in Appendix 3.



## Appendix 2 “S3” series tables

The Institute and Faculty of Actuaries’ Continuous Mortality Investigation (**CMI**) collects data from firms of consultants acting as Scheme Actuary for pension schemes with a minimum of 500 pensioners. The CMI also receives data for public sector schemes, from GAD, and from the Pension Protection Fund.

The “**S3**” **Series** tables were published in December 2018 and are based on data between 2009 and 2016. The “S3” tables are produced using the following subsets of the data:

- The ‘**Ill-health**’ tables are based on data where pensioners were specified to have retired (before their normal retirement date) as a result of ill-health;
- The ‘**Normal Health**’ tables are based on data where pensioners were specified to have retired other than as a result of ill-health;
- The ‘**All pensioner (excluding dependants)**’ tables are based not only on the data in the previous two categories, but also on schemes where data contributors did not differentiate between normal and ill-health retirement; and
- The ‘**Dependants**’ tables are based on data where the beneficiary is not the ex-employee, but their spouse (or other dependant).

Separate tables are available for males and females. In all cases, tables are available on an ‘**amounts-weighted**’ basis, meaning that greater weight is given to those with larger benefits. Tables are also available on a ‘**lives-weighted**’ basis for certain subsets of data.

In several cases, ‘**Very Light**’, ‘**Light**’, ‘**Middle**’ and ‘**Heavy**’ tables are available. The amounts bands used to separate the tables are shown in the following table.

	Heavy	Middle	Light	Very light
Males	£300 - £5,000	£5,000 - £20,000	£20,000+	£40,000+
Females	£0 - £1,000	£1,000 - £8,000	£8,000+	£16,000+

Readers should note that pension amount banded tables are intended to indicate variability of mortality by pension size. However, pension amount is an imperfect indicator of wealth as it reflects length of service as well as earnings. If, for example, a member had a high salary but very short service they would have a low pension that might suggest they belong in the ‘Heavy’ tables when in fact we might expect them to experience light mortality and belong in the ‘Light’ tables.

## Appendix 3 Data

### Data supplied

Membership data, including membership movements, was provided by the administering authority, in the form of the Universal Data Capture (UDC). The membership movement data contains records of the deaths of Fund members and dependants, as well as membership movements due to new joiners, leavers and retirements.

The following points should be noted in relation to this membership data:

- As noted earlier, some deaths may be missing if they are reported after data is provided to us. However, this is unlikely to affect the data for 2017-2019 that we use for the experience analysis.
- If one person had multiple member records relating to several periods of service, we have merged these for the purposes of the experience analysis – to avoid exaggerating the numbers of lives or deaths in the Fund over the investigation period.
- Where members included in the data were found to have died before 1 January 2017, we have excluded these deaths from the analysis as they did not occur in the relevant period for the experience analysis.
- We have excluded child dependants from our analyses, as the mortality experience is unlikely to provide a reliable guide for the assumptions and because this assumption has limited financial materiality.

There were 6,423 members (7.4% of the Fund) with postcodes that were either missing, invalid or from non-UK countries. These members were excluded from the Socio-economic analysis as our model is specifically designed for UK postcodes. A map showing the location of the Fund's members is shown in Appendix 4.

### Data validation

A number of reasonableness checks were performed on the data as part of the analyses, including cross-checking the data with valuation data extracts and reconciling the membership.

While the membership data is still in the process of being checked as part of the wider 2022 valuation process and issues may be queried with the administering authority, we expect that any changes in the data will be minor and are unlikely to impact on the results of this analysis. If there is any significant change to the data that invalidates the results of this analysis then we will discuss this further with the administering authority.

## 2022 Combined Funds' Data

We have done equivalent data checks for each of the 2022 Combined Funds and have no significant concerns about data quality.

## Appendix 4 Socio-economic analysis

### Analysis

Barnett Waddingham have developed a model which looks at the type of neighbourhood that each member lives in, based on their full postcode (UK only). Each member's neighbourhood is assessed using the '**Acorn**' model. This is a demographic classification tool that segments the UK population on a household level. It categorises domestic postcodes in the UK into one of 59 types based on the consumers' demographic and lifestyle characteristics. Each type is given a shorthand name, ranging from 'exclusive enclaves' (type 1) to 'deprived areas and high-rise flats' (type 59).

For Dorset Fund members, the five most common of the 59 Acorn types are shown in the table below.

Rank	Description	Percentage of members
1	Retired and empty nesters	10%
2	Comfortably-off families in modern housing	9%
3	Asset rich families	8%
4	Semi-professional families, owner occupied neighbourhoods	5%
5	Better-off villagers	5%

Our model uses the Acorn types to classify the relative prosperity of the different neighbourhoods according to the Index of Multiple Deprivation (IMD) measure. This is a government classification ranking areas from 1 (most deprived) to 10 (least deprived).

### Data for analysis

The table below shows the number of members, by sex and membership status, with valid UK postcodes, who were included in the postcode analysis. This shows that the Fund's membership is weighted towards females for all membership statuses and that there are only a relatively small number of dependants.

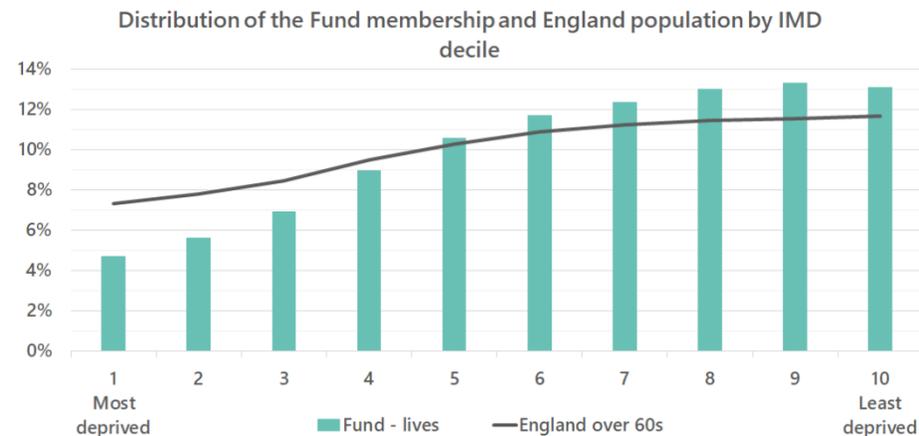
	Active	Deferred	Pensioner	Dependant
Male	9,137	6,007	7,469	775
Female	24,373	17,342	12,902	2,140
<b>Total</b>	<b>33,510</b>	<b>23,349</b>	<b>20,371</b>	<b>2,915</b>

## Results

Comparing the Fund’s members with the general profile of pensioners in England (in the chart below) we can see that the Fund members tend to live in less deprived areas than pensioners in England as a whole. This suggests that the Fund would experience slightly lighter mortality than the population of England as a whole, as people from higher socio-economic groups on average tend to live longer. Members of defined benefit pension schemes are generally drawn from higher socio-economic groups than the general population, so while we expect members of the Dorset Fund to have higher life expectancy than the general population, they may not have higher life expectancy than the population of pension scheme members that underlies the “S3” tables.

The chart to the right considers the membership of the Fund as a whole, however, the majority of deaths in a pension scheme take place at pensioner ages. We therefore show a further breakdown of the Fund’s membership on a lives-weighted basis split by IMD on page 31. These charts suggest males and females have similar socio-economic profiles but that pensioners are drawn from slightly higher socio-economic groups than non-pensioners for both males and females.

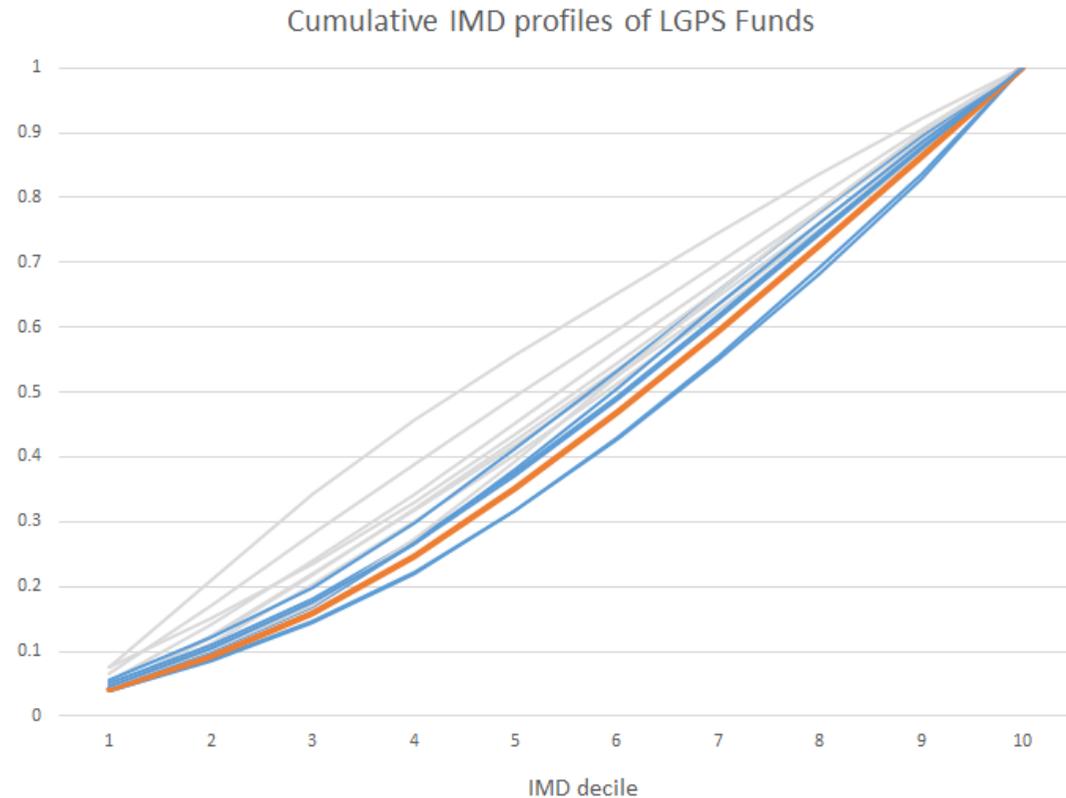
A map of the United Kingdom showing that the Fund’s membership is concentrated in the South West, as we would expect, is also shown on page 32. A detailed map of the South West is shown in the top left corner.



## Comparison with Combined Funds

We have carried out similar analyses for a number of LGPS Funds. The chart to the right compares the IMD profiles of each of these Funds by looking at the cumulative distribution for male and female post-retirement members (pensioners and dependants combined). Dorset is shown in orange with the 2022 Combined Funds in blue and other LGPS Funds in grey.

The chart shows that Dorset and the 2022 Combined Funds all have similar socio-economic profiles, which suggests that using the experience of the 2022 Combined Funds where the experience of Dorset alone is not credible is reasonable.

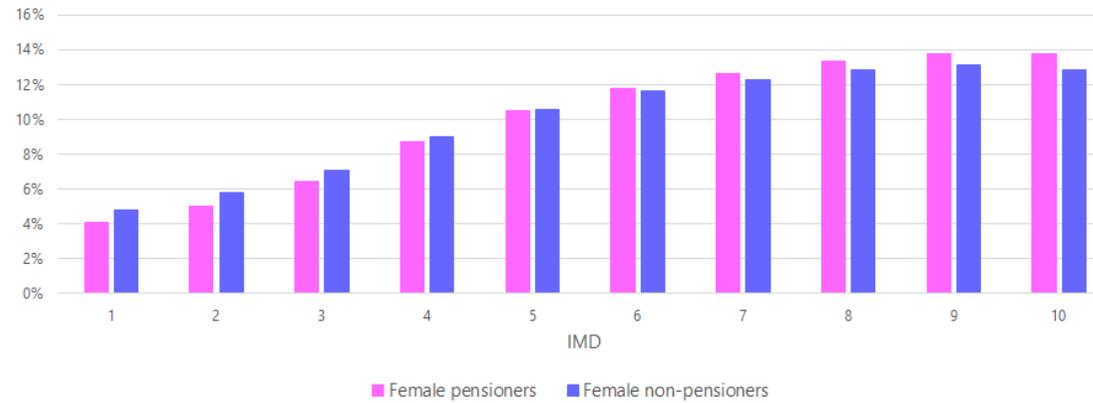


## Fund membership by IMD

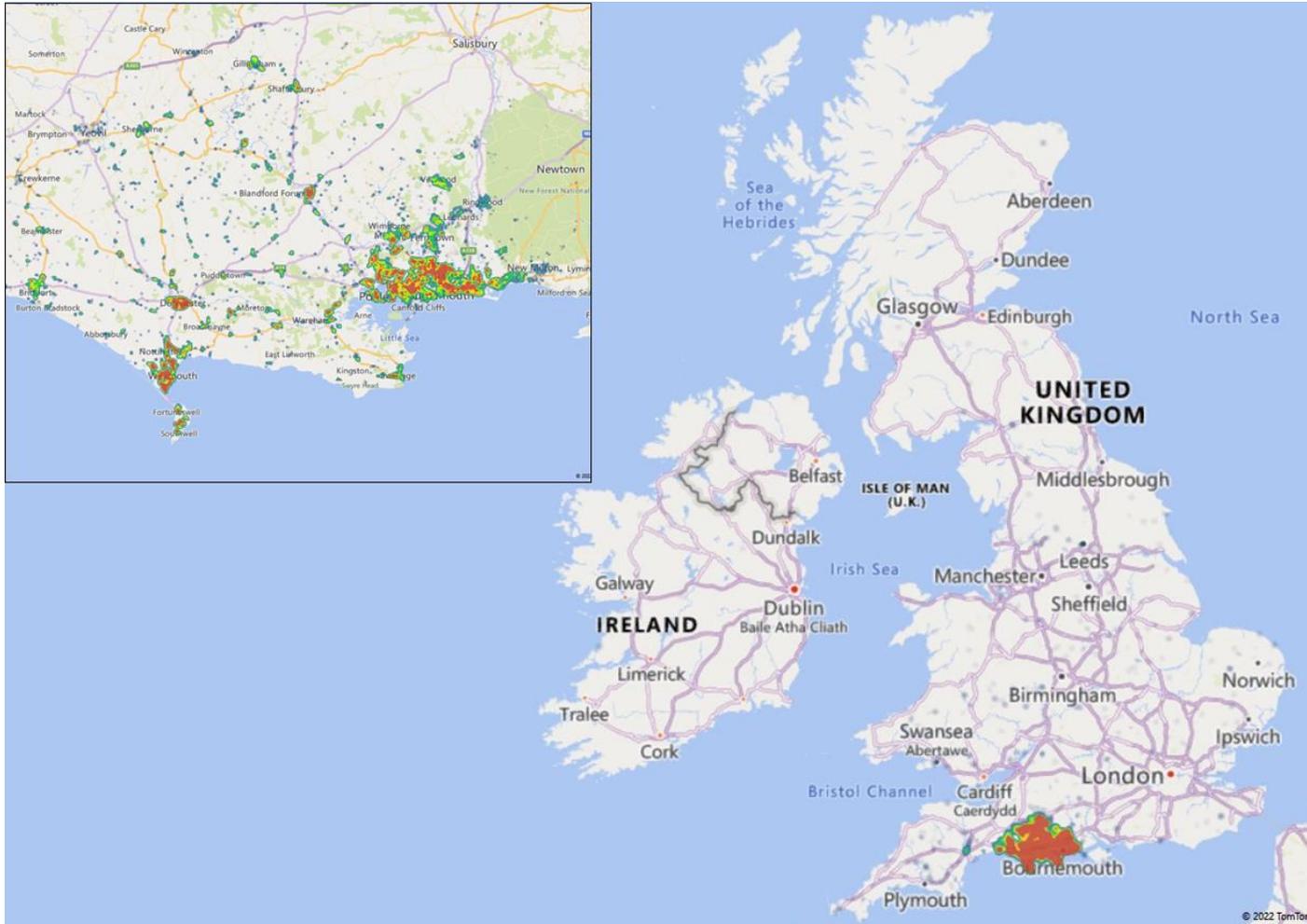
Distribution of IMD: Pensioner vs non-pensioner comparison (males)



Distribution of IMD: Pensioner vs non-pensioner comparison (females)



## Membership location

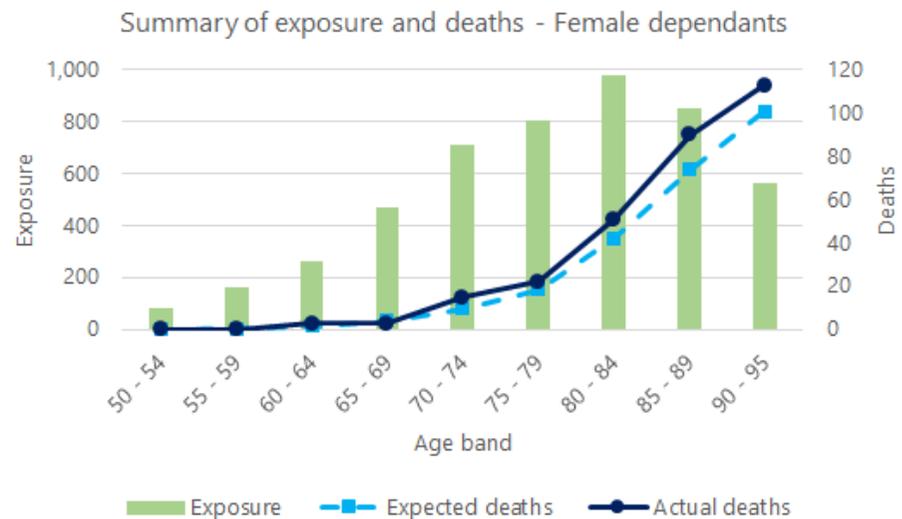
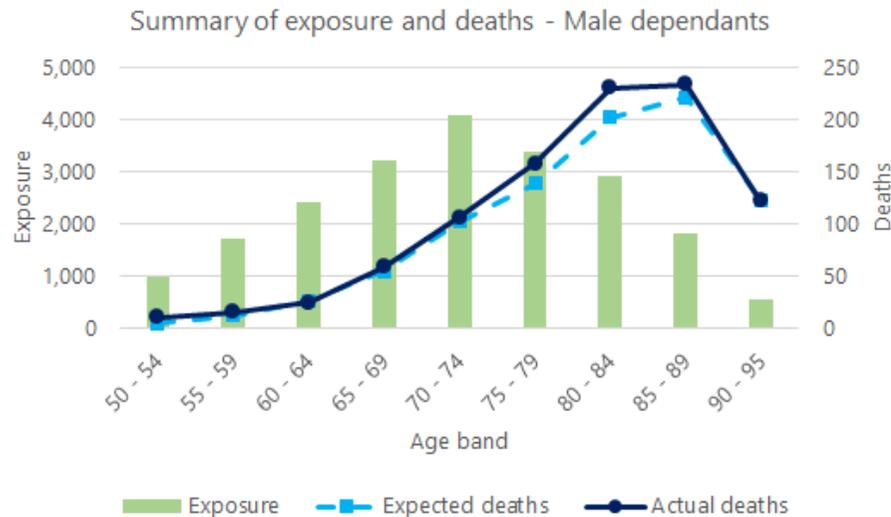


## Appendix 5 Shape of experience analysis results for dependants and non-pensioners

As we did for pensioners, we have considered dependant and non-pensioner experience by age band in order to assess whether it is reasonable to apply a single percentage adjustment to the base table at all ages. The charts show the actual and expected numbers of deaths, under the S3DMA and S3DFA tables (for dependants) and GAD tables (for non-pensioners) before applying a percentage adjustment for each age-group, as well as the exposure (i.e. the total number of lives in each age band in each year over the investigation period) for males and females separately. These charts are again presented on a lives-weighted basis, as this is less volatile than an amounts-weighted basis.

### Dependants

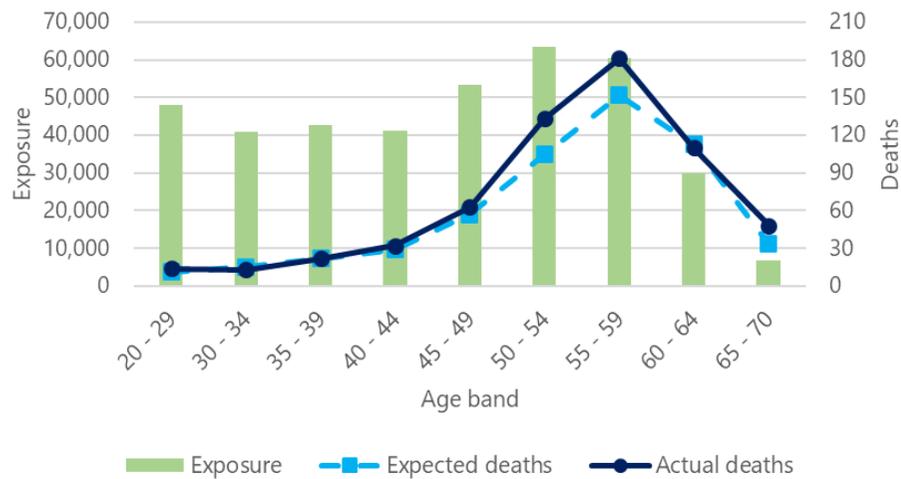
For female dependants in the Dorset Fund, actual deaths are generally a little higher than expected under S3DFA, suggesting that this is a good fit for the Fund's female dependant membership. Actual deaths for male dependants in the 2022 Combined Funds were also generally a little higher than S3DMA, suggesting that it is a good fit for the 2022 Combined Funds' male dependant membership.



## Non-pensioners

For non-pensioners in the 2022 Combined Funds, actual deaths were generally a little higher than those expected under the GAD tables for both males and females. The shapes of actual deaths for non-pensioner members suggest that the GAD tables are a good fit for the non-pensioner members.

Summary of exposure and deaths - Male non-pensioners



Summary of exposure and deaths - Female non-pensioners

